RESTRICTED

GENERAL DESCRIPTION

SECTION 1

TBS SERIES

RADIO TRANSMITTING AND RECEIVING EQUIPMENT

RESTRICTED

RESTRICTED

THEORY
OF OPERATION
SECTION 2

TBS SERIES

RADIO TRANSMITTING AND RECEIVING EQUIPMENT

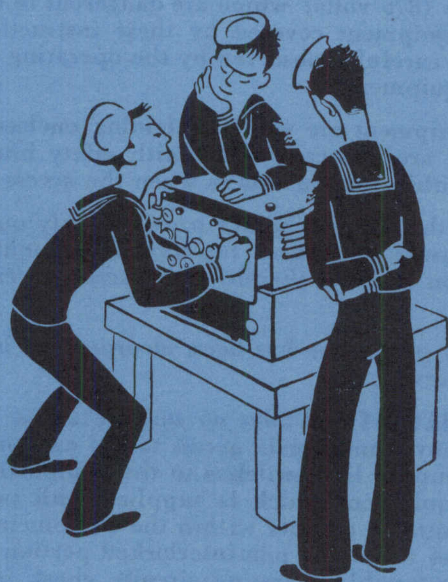
RESTRICTED

RESTRICTED

INSTALLATION

AND INITIAL ADJUSTMENTS

SECTION 3



TBS SERIES

RADIO TRANSMITTING AND RECEIVING EQUIPMENT

RESTRICTED

OPERATION

SECTION 4

TBS SERIES

RADIO TRANSMITTING AND RECEIVING EQUIPMENT

RESTRICTED

OPERATOR'S MAINTENANCE

SECTION 5

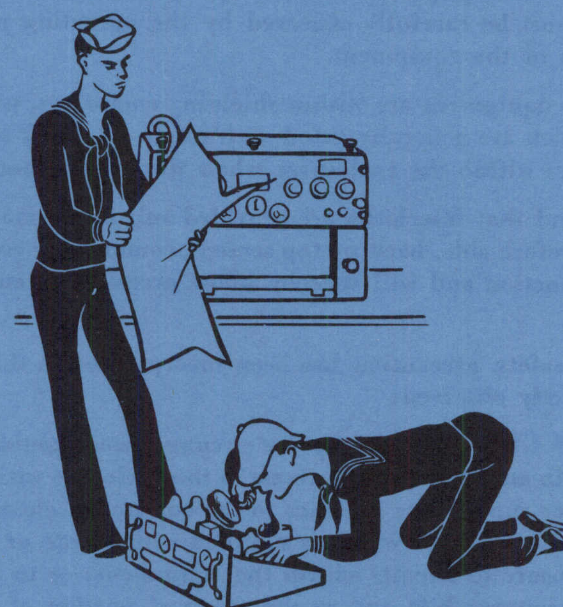
TBS SERIES

RADIO TRANSMITTING AND RECEIVING EQUIPMENT

RESTRICTED

PREVENTIVE MAINTENANCE

SECTION 6



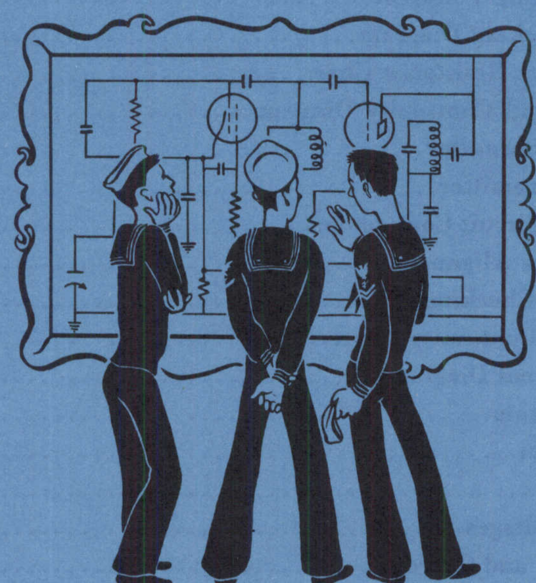
TBS SERIES

RADIO TRANSMITTING AND RECEIVING EQUIPMENT

CORRECTIVE MAINTENANCE

TROUBLE SHOOTING

SECTION 7



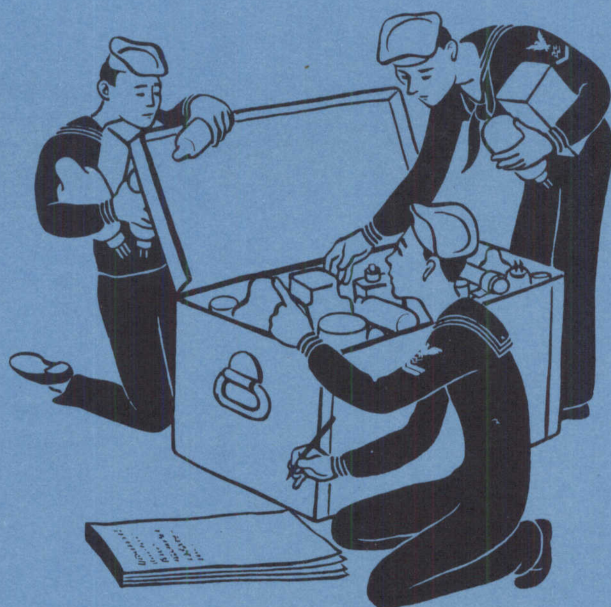
TBS SERIES

RADIO TRANSMITTING AND RECEIVING EQUIPMENT

RESTRICTED

PARTS AND SPARE PARTS

SECTION 8



TBS SERIES

RADIO TRANSMITTING AND RECEIVING EQUIPMENT

RESTRICTED

NAVSHIPS 900,590 RESTRICTED

INSTRUCTION BOOK for TBS SERIES

TBS TO TBS-8 INCLUSIVE

RADIO TRANSMITTING AND RECEIVING EQUIPMENT

NOMINAL POWER OUTPUT
Transmitter 50 Watts
Receiver 2 Watts

TYPE OF EMISSION
Voice
MCW

FREQUENCY RANGE
60 to 80
Megacycles

RCA VICTOR DIVSION
of
RADIO CORPORATION of AMERICA
Camden, New Jersey, U. S. A.

NAVY DEPARTMENT BUREAU OF SHIPS

CONTRACTS NOs-60613
CONTRACTS NOs-70095
CONTRACTS NOs-70095 Sup. B
CONTRACTS NXs-1736
CONTRACTS NXss-17599
CONTRACTS NXss-18747
CONTRACTS NXsr-36725
CONTRACTS NXsr-36725 LOI
CONTRACTS NXsr-38310
CONTRACTS NXsr-51552 LOI

1B-38370

Approved 13 February 1945

SECURITY NOTICE

NOTICE: This document contains information affecting the national defense of the United States within the meaning of the Espionage Act, 50 U.S.C., 31 and 32, as amended. Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law. ARTS. 75½ & 76. U.S.N. REGS.—1920.

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RECORD OF CORRECTIONS MADE

Change No.	Date	Signature of Officer Making Correction

ALL CORRECTIONS LISTED ON THIS PAGE SHALL BE MADE WITH PEN AND INK IN THIS COPY OF NAVSHIPS 900,590.

Page	*Correction*
1–8 and 1–9	In Quick Reference Data, interchange contract numbers for TBS-4 and TBS-5 equipments. Contract for TBS-4 is NXss–17599. Contract for TBS-5 is NXss–18747.
4–15	Caption for figure at bottom of page should read DIAGRAM C—MCW TRANSMISSION.
8–12	Change the Navy Specification Number for C-141 to RE 48A 160 and RE 13A 488
	Add Navy Specification Numbers RE 48A 160 and RE 13A 488 to C-142
8–59	Add Navy Type Number –49328 to X-101
	Add Navy Type Number –49328 and Navy Specification Number RE 49AA 311A to X-102
	Add Navy Type Number –49327 to X-103
	Add Navy Type Number –49327 and Navy Specification Number RE 49AA 311A to X-104
	Add Navy Type Number –49327 and Navy Specification Number RE 49AA 311A to X-105
	Add Navy Type Number –49327 and Navy Specification Number RE 49AA 311A to X-106
	Add Navy Type Number –49327 and Navy Specification Number RE 49AA 311A to X-107
8–60	Add Navy Type Number –49327 and Navy Specification Number RE 49AA 311A to X-108
	Add Navy Type Number –49329 to X-109
	Add Navy Type Number –49329 and Navy Specification Number RE 49AA 311A to X-110
	Add Navy Type Number –49330 to X-111
	Add Navy Type Number –49328 and Navy Specification Number RE 49AA 311A to X-112
8–63 through 8–70	Change the heading in the "QUANTITY" columns to read...............120 V D.C.—230 V D.C.—220/440 V A.C.
8–70	Add Navy Type Number –49328 to X-101, 102, 112
	Add Navy Type Number –49327 to X-103, 104, 105, 106, 107, 108
	Add Navy Type Number –49329 to X-109, 110
	Add Navy Type Number –49330 to X-111
8–71 and 8–72	Change the heading in the "QUANTITY" columns to read ....120 V D.C.—230 V D.C.—220/440 V A.C.
8–98	Delete the quantity (1) from L-108, 109 in the TBS-8 EQUIPMENT column
8–101	Change the Navy Specification Number for C-141, 142 to RE 48A 160 and RE 13A 488
8–106	Add Navy Type Number –49328 to X-101, 102, 112
	Add Navy Type Number –49327 to X-103, 104, 105, 106, 107, 108
	Add Navy Type Number –49329 to X-109, 110
	Add Navy Type Number –49330 to X-111

WHEN THE CORRECTIONS LISTED HAVE BEEN MADE, THIS PAGE MAY BE DESTROYED.

TABLE OF CONTENTS

SECTION 1

GENERAL DESCRIPTION

SECTION 2

THEORY OF OPERATION

TABLE OF CONTENTS

SECTION 3

INSTALLATION AND INITIAL ADJUSTMENTS

SECTION 4

OPERATION

SECTION 5

OPERATOR'S MAINTENANCE

TABLE OF CONTENTS

SECTION 6

PREVENTIVE MAINTENANCE

SECTION 7

CORRECTIVE MAINTENANCE

TABLE OF CONTENTS

SECTION 7—CORRECTIVE MAINTENANCE (Cont'd)

GUARANTEES

GUARANTEE FOR MODELS TBS AND TBS-3

The equipment, including all parts and spare parts, except vacuum tubes, shall be guaranteed for a service period of ONE YEAR with the understanding that, as a condition of this contract, all items found to be defective as to design, material, workmanship or manufacture shall be replaced without delay and at no expense to the Government; provided that such guarantee and agreement shall not obligate the Contractor to make replacement of defective material unless the failure, exclusive of normal shelf life deterioration, occurs within a period of TWO YEARS from the date of delivery of the equipment to and acceptance by the Government, and provided further, that if any part or parts (except vacuum tubes) fail in service or are found defective in ten per cent (10%) or more, but not less than two of the total number of equipments furnished under the contract, such part or parts, whether supplied in the equipment or as spares, shall be conclusively presumed to be of defective design, and as a condition of contract subject to one hundred per cent (100%) replacement of all similar units supplied on subject contract by suitable redesigned replacements. Failure due to poor workmanship, while not necessarily indicating poor design, will be considered in the same category as failure due to poor design. Redesigned replacements which will assure proper operation of the equipment shall be supplied promptly, transportation paid, to the Naval activities using such equipment, upon receipt of proper notice and without cost to the Government. All defective parts originally furnished under contract shall be held subject to rejection and return to the Contractor.

This period of TWO YEARS and the service period of ONE YEAR shall not include any portion of the time that the equipment fails to give satisfactory performance due to defective items and the necessity for replacement thereof, and provided further, that any replacement part shall be guaranteed to give ONE YEAR of satisfactory service.

GUARANTEES FOR MODELS TBS-1 AND TBS-2

The equipment, including all parts and spare parts, except vacuum tubes, is guaranteed for a service period of ONE YEAR with the understanding that, as a condition of this contract, all items found to be defective as to design, material, workmanship or manufacture will be replaced without delay and at no expense to the Government; provided that such guarantee and agreement will not obligate the Contractor to make replacement of defective material unless the failure, exclusive of normal expected shelf life deterioration, occurs within a period of TWO YEARS from the date of delivery of the equipment to and acceptance by the Government, and provided further, that if any part or parts (except vacuum tubes) fail or are found defective to the extent of ten per cent (10%) or more of the total number of similar units furnished under the contract (exclusive of spares), such part or parts, whether supplied in the equipment or as spares, will be conclusively presumed to be of defective design, and as a condition of contract subject to one hundred per cent (100%) replacement by suitable redesigned units.

Failure due to poor workmanship, while not necessarily indicating poor design, will be considered in the same category as failure due to poor design. Redesigned replacements which will assure proper operation of the equipment will be supplied promptly, transportation paid, to the Naval activity using such equipment, upon receipt of proper notice and without cost to the Government.

All such defective parts will be subject to ultimate return to the Contractor. In view of the fact that normal activities of the Naval Service may result in the use of equipment in such remote portions of the world or under such conditions as to preclude the return of the defective item or unit prior to replacement without jeopardizing the integrity of Naval communications, the exigencies of the Service therefore may necessitate expeditious repair of such item or unit in order to prevent extended interruption of communications. In such cases the return of a defective item or unit for examination by the Contractor prior to replacement will not be required. The report of a responsible authority, including details of the conditions surrounding the failure, will be acceptable for effective adjustment under the provisions of this contractual guarantee.

The above period of TWO YEARS and the service period of ONE YEAR will not include any portion of the time that the equipment fails to give satisfactory performance due to defective items and the necessity for replacement thereof. All replacement parts will be guaranteed to give ONE YEAR of satisfactory service.

GUARANTEE FOR MODELS TBS-4 AND TBS-7

All parts and spare parts, except vacuum tubes, of this equipment shall be guaranteed for a service period of one year with the understanding that, as a condition of the contract, all items found to be defective as to design, material, workmanship or manufacture shall be replaced without delay and at no expense to the Government, provided: that such guarantee and agreement shall not obligate the contractor to make replacement of defective material unless the failure occurs within a period of two years from the date of delivery of the equipment to and acceptance by the Government, and provided further, that: if any part or parts (except vacuum tubes) fail in service or are found defective in ten per cent or more of the equipments furnished under contract, such part or parts shall be conclusively presumed to be of defective design, and as a condition of contract subject to one hundred per cent replacement of all similar units supplied on subject contract. Redesigned replacements which will assure proper operation of the equipment shall be supplied promptly, transportation paid, to the Naval activities using such equipment, upon receipt of proper notice and without cost to the Government. All defective parts originally furnished under contract shall be held subject to rejection and return to the contractor.

THIS PERIOD OF TWO YEARS AND THE SERVICE PERIOD OF ONE YEAR SHALL NOT INCLUDE ANY PORTION OF THE TIME THAT THE EQUIPMENT FAILS TO GIVE SATISFACTORY PERFORMANCE DUE TO DEFECTIVE ITEMS AND THE NECESSITY FOR REPLACEMENT THEREOF, AND PROVIDED FURTHER THAT ANY REPLACEMENT PART SHALL BE GUARANTEED TO GIVE TWO YEARS OF SERVICE.

GUARANTEE FOR MODEL TBS-5

The equipment, including all parts and spare parts, except vacuum tubes, batteries, rubber and material normally consumed in operation, is guaranteed for a period of ONE YEAR from the date of delivery of the equipment to and acceptance by the Government with the understanding that all such items found to be defective as to material, workmanship or manufacture will be repaired or replaced f.o.b. any point within the continental limits of the United States designated by the Government without delay and at no expense to the Government; provided that such guarantee will not obligate the Contractor to make repair or replacement of any such defective items unless the defect appears within the aforementioned period and the Contractor is notified thereof in writing within a reasonable time and the defect is not the result of normal expected shelf life deterioration.

To the extent the equipment, including all parts and spare parts, as defined above, is of the Contractor's design or is of a design selected by the Contractor, it is also guaranteed, subject to the foregoing conditions, against defects in design with the understanding that if ten per cent (10%) or more of any such said item, but not less than two of any such item, of the total quantity comprising such item furnished under the contract, are found to be defective as to design, such items will be conclusively presumed to be of defective design and subject to one hundred per cent (100%) correction or replacement by a suitably redesigned item.

All such defective items will be subject to ultimate return to the Contractor. In view of the fact that normal activities of the Naval Service may result in the use of equipment in such remote portions of the world or under such conditions as to preclude the return of the defective items for repair or replacement without jeopardizing the integrity of Naval communications, the exigencies of the Service, therefore, may necessitate expeditious repair of such items in order to prevent extended interruption of communications. In such cases the return of the defective items for examination by the Contractor prior to repair or replacement will not be mandatory. The report of a responsible authority, including details of the conditions surrounding the failure, will be acceptable as a basis for effecting expeditious adjustment under the provisions of this contractual guarantee.

The above one year period will not include any portion of time the equipment fails to perform satisfactorily due to any such defects, and any items repaired or replaced by the Contractor will be guaranteed anew under this provision.

The Contractor construes the obligation to effect repairs and replacements, as set forth in the guarantee clause, to permit Contractor at its option to either repair or replace items found to be defective, in accordance with the clause.

GUARANTEE FOR MODELS TBS-6 AND TBS-8

This guarantee is the same as for MODEL TBS-5, with the omission of the provisions contained in the final paragraph.

INSTALLATION RECORD

Contract No. .... Date of Contract (....................)

Serial Number of equipment ....

Date of acceptance by the Navy ....

Date of delivery to contract destination ....

Date of completion of installation ....

Date placed in service ....

Blank spaces in this book shall be filled in at the time of installation. Operating personnel shall also mark the "date placed in service" on the date plate located below the model nameplate on the equipment, using suitable methods and care to avoid damaging the equipment.

REQUISITIONS FOR REPLACEMENT MATERIAL

All requests or requisitions for replacement material should include complete descriptive data covering the part desired, in the following form:

1. Name of part desired ....
2. Navy Type number (if assigned) (including prefix and suffix as applicable) ....
3. Model designation (including suffix) of equipment in which used ....
4. Navy Type designation (including prefix and suffix where applicable) of major unit in which part is used ....
5. Symbol designation of part ....
6. (a) Navy Drawing Number ....

   (b) Manufacturer's Drawing Number ....
7. Rating or other descriptive data ....
8. Commercial Designation ....

FAILURE REPORTS

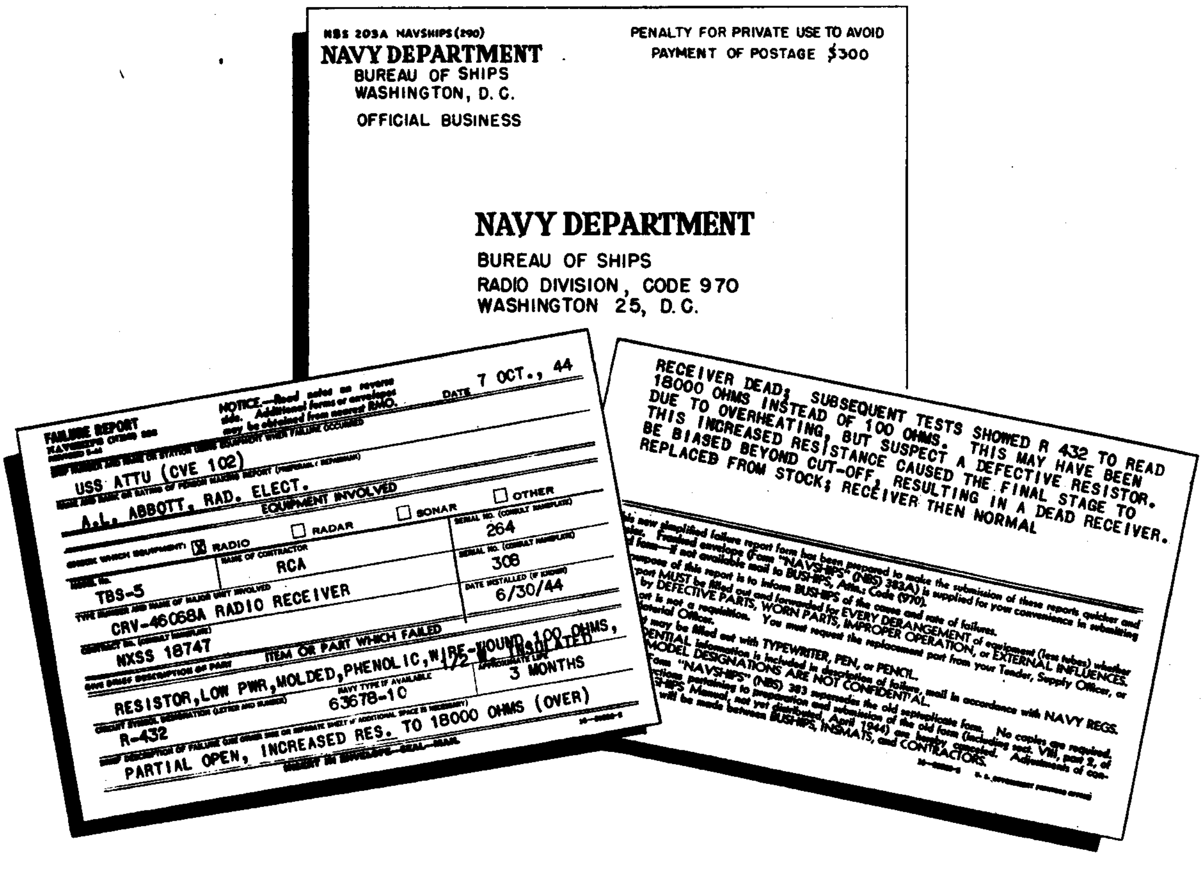
A FAILURE REPORT must be filled out for the failure of any part of the equipment (except tubes) whether caused by defective or worn parts, improper operation, or external influences. It should be made on Failure Report, form NBS-383, which has been designed to simplify this requirement. The card must be filled out and forwarded to BUSHIPS in the franked envelope which is provided. Full instructions are to be found on each card.

Use great care in filling out the card to make certain it carries adequate information. For example, under "Circuit Symbol" use the proper circuit identification taken from the schematic drawings, such as T803, in the case of a transformer, or R207, for a resistor. Do not substitute brevity for clarity. Use the back of the card to completely describe the cause of failure and attach an extra piece of paper if necessary.

The purpose of this report is to inform BUSHIPS of the cause and rate of failures. The information is used by the Bureau in the design of future equipment and in the maintenance of adequate supplies to keep the present equipment going. The cards you send in, together with those from hundreds of other ships, furnish a store of information permitting the Bureau to keep in touch with the performance of the equipment of your ship and all other ships of the Navy.

This report is not a requisition. You must request the replacement of parts through your Officer-in-Charge in the usual manner.

Make certain you have a supply of Failure Report cards and envelopes on board. They may be obtained from any RMO.



SAMPLE FAILURE REPORT CARD FILLED IN

SAFETY

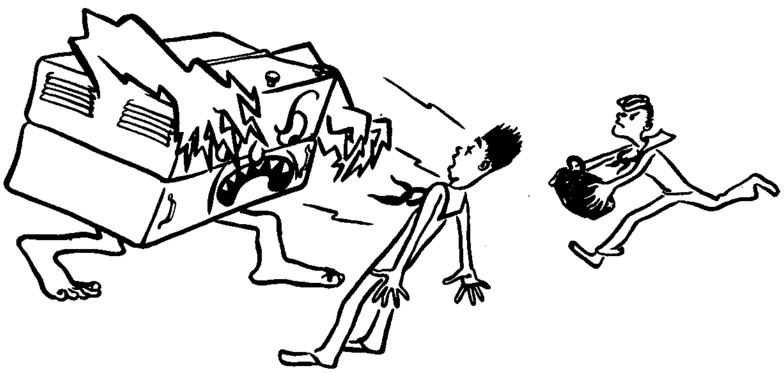
OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES (875 VOLTS) WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION BUT ALWAYS SHUT DOWN MOTOR GENERATOR OR OTHER POWER EQUIPMENT. UNDER CERTAIN CONDITIONS, DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES ALWAYS REMOVE POWER DISCHARGE, AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

Since the use of high voltages (875 volts) which are dangerous to human life is necessary to the successful operation of the equipment covered by these instructions, certain reasonable precautionary measures must be carefully observed by the operating personnel during the adjustment and operation of the equipment.

The major portions of the equipment are within shielding enclosures, provided where necessary with access doors which are generally fitted with safety interlock switches which act to shut off dangerous voltages within the enclosures when the access doors are open.

It should be borne in mind that interlocks are provided only on normal access doors on certain major units and therefore side, back or top screens, commutator covers, if removed, will not cause interlocks to function and will thereby allow access to circuits carrying voltages dangerous to human life.

While every practicable safety precaution has been incorporated in this equipment the following rules must be strictly observed:



KEEP AWAY FROM LIVE CIRCUITS

Under no circumstances should any person be permitted to reach within or in any manner gain access to the enclosure with interlocked gates or doors closed or with power supply line switches to the equipment closed; or to approach or handle any portion of the equipment which is supplied with power, or to connect any apparatus external to the enclosure to circuits within the equipment; or to apply voltages to the equipment for testing purposes while any non-interlocked portion of the shielding or enclosure is removed or open. Wherever feasible in testing circuits, check for continuity and resistances rather than directly checking voltage at various points.

DON'T SERVICE OR ADJUST ALONE

Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS

Under no circumstances should any access gate, door or safety interlock switch be removed, short circuited, or tampered with in any way by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

THE ATTENTION OF OFFICERS AND OPERATING PERSONNEL IS DIRECTED TO CHAPTER 67 OF BUREAU OF SHIPS MANUAL OR SUPERSEDING INSTRUCTIONS ON THE SUBJECT OF "RADIO SAFETY PRECAUTIONS TO BE OBSERVED."

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR AND SONAR ENCLOSURE. POSTER MAY BE OBTAINED ON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

GENERAL DESCRIPTION

TBS SERIES

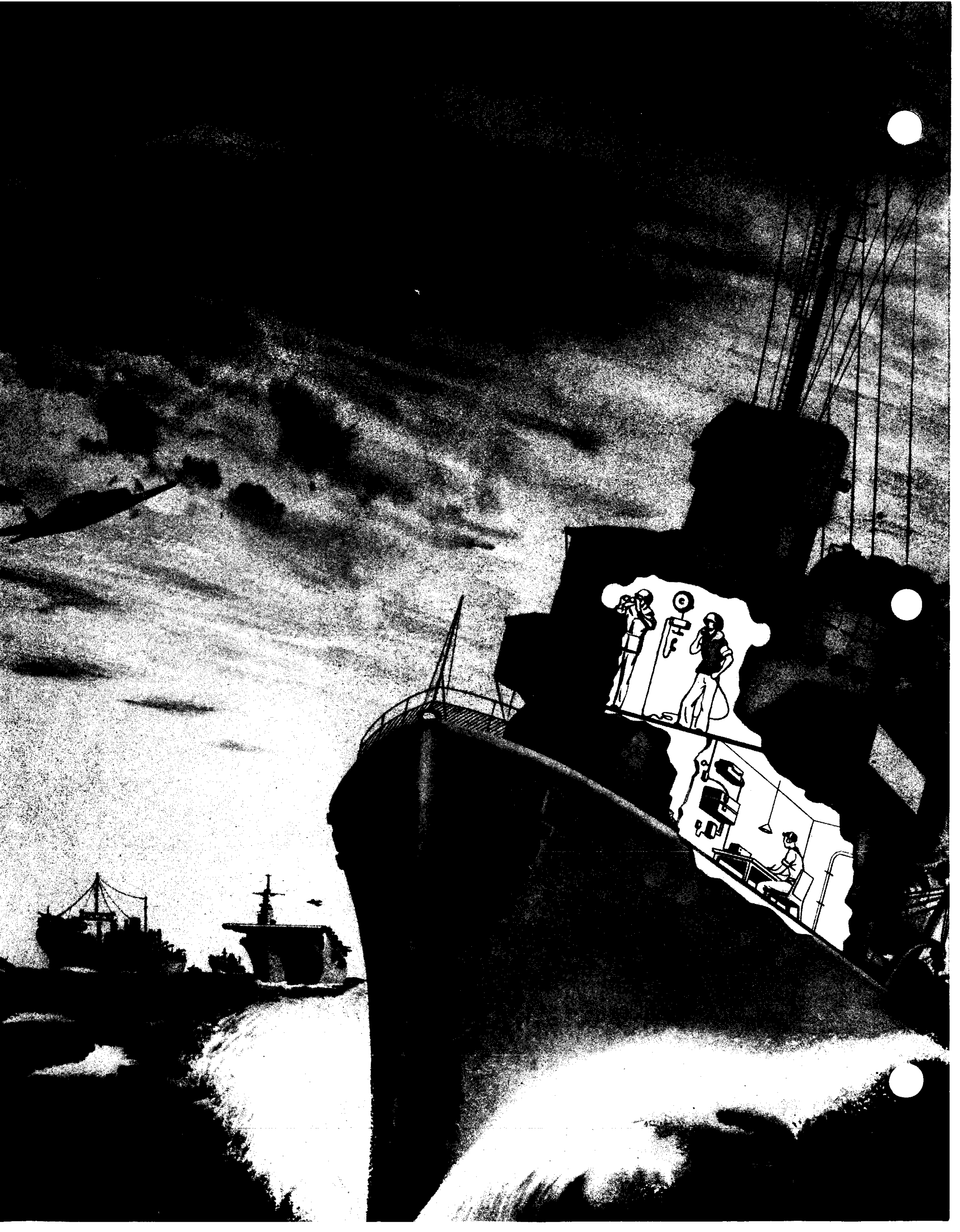
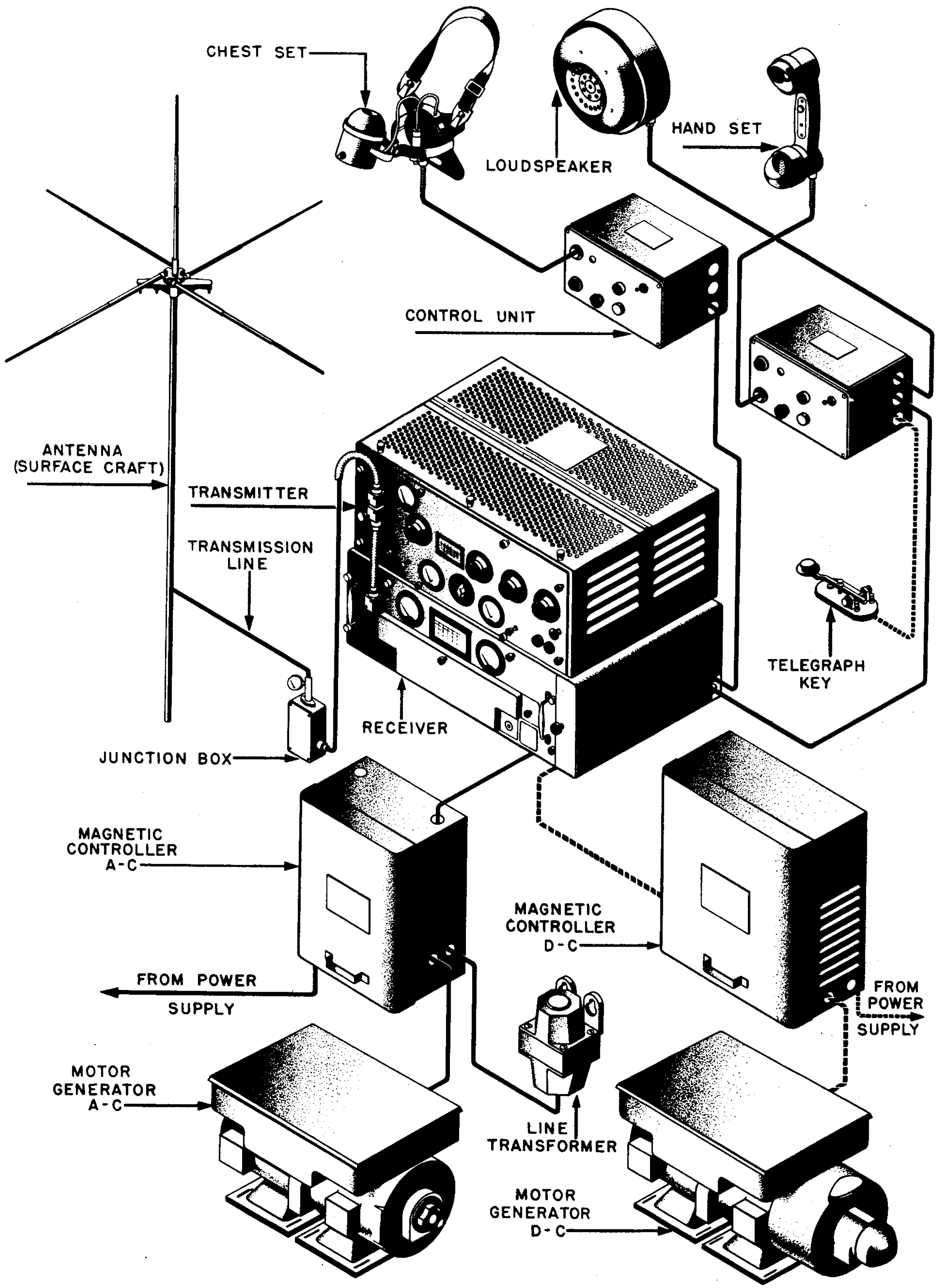


TABLE OF CONTENTS

GENERAL DESCRIPTION

SECTION I

RELATIONSHIP OF TBS UNITS



COMPONENT PARTS OF THE TBS SERIES OF RADIO COMMUNICATION SYSTEMS

The Navy Model TBS Series of Radio Transmitting and Receiving equipment comprising Models TBS, TBS-1, TBS-2, TBS-3, TBS-4, TBS-5, TBS-6 TBS-7 and TBS-8 employed the components pictured on the opposite page to provide reliable radio communication between small surface craft for a distance of approximately ten miles. Communication by voice over this range or telegraphed signals by Modulated Continuous Wave to cover greater distances are available as desired.

The equipment throughout the series has varied but little between the different models except for the motor generators and magnetic controllers. The apparatus may be tuned to operate on any frequency in the 60 to 80 Megacycle range, being fixed tuned and crystal controlled. Full control of transmitter operation is possible from two control units that may be located as desired in the vessel. A chart showing the Navy Model numbers of the components is given on Page 8.

DIMENSIONS OF MAJOR UNITS (UNCRATED)

QUANTITY	NAME OF UNIT	HEIGHT	WIDTH	DEPTH	DIAM.	WEIGHT
1	Radio Transmitter	10½	23½	17¾		75
1	Radio Receiver	8¾	25 13/16	16⅞		45
1	Magnetic Controller d-c	17¼	14½	7¾		45
	Magnetic Controller a-c	15⅛	10⅝	7¼		34
2	Control Unit	5 15/16	10 7/16	7¼		9
1	Loudspeaker	5			11⅛	21
2	Handset					1½
1	Chest Set					1¼
1	Antenna	104				46
1	Transmission Line	1440			⅜	
1	Line Transformer	7⅜	4½	4		16¼

TECHNICAL SUMMARY OF TRANSMITTER & RECEIVER

FUNCTIONAL FACTORS	RADIO TRANSMITTER	RADIO RECEIVER
Frequency Range	60 to 80 MC	60 to 80 MC
Frequency Control	Crystal	Crystal
Frequency Stability	0.025 percent	
Tuning Bands	No. of Crystals furnished and bands covered varies with different models. Inspect nameplates of crystal holders for channel frequencies.	
Output Impedance		600 Ohms
Power Input	1000 watts	110 watts
Power Output	50 watts	2 watts
Type of Modulation	Amplitude	
Method of Modulation	Plate	
Modulation Capability	100%	
Sensitivity (Minimum R-F input for 6 MW output)		5 Microvolts
Crystals	Quartz	Quartz
A-F Input Impedance	600 Ohms	
R-F Input Impedance		70 Ohms
Intermediate Frequency		5.3 MC

ANTENNA

Vertical Type Quarter Wave
Concentric Grounded Stub

Radiation Impedance.........70 ohms
4 Ground plane rods in Destroyer type
2 Ground plane rods in Submarine type

FREQUENCY RANGE—3 BANDS 60 TO 80 MC

Coverage MC	Destroyer	Rod Length	Submarine
60.0-65.0	44	inches	41⅞
64.5-71.5	38⅜	inches	34¾
71.0-80.0	33	inches	28¼

TRANSMISSION LINE

Gas filled Concentric type
5-20 lbs. nitrogen

Line Impedance........................70 ohms
Destroyer type.....................120 ft. long
Submarine........................ 80 ft. long

THE CONTROL UNIT

Two furnished with each installation

Provides full control of transmitter from any two desired points in the vessel.

THE LOUDSPEAKER

Input Impedance.....................600 ohms
Power Capability ....2 watts

THE HANDSET

Two furnished with each installation

Earpiece ....600 ohms
Carbon Button Microphone............. 40 ohms
Press to Talk Switch

THE CHEST SET

Provides chest support for microphone

Carbon Button Microphone.............40 ohms
Press to Talk Switch

LINE TRANSFORMER

Furnished with 440 V. A-C Equipment

Primary wound for 440 volt..............No taps
Secondary wound for 220 volt............No taps

Provides proper voltage for filament transformer in transmitter and operating voltage for magnetic controllers.

POWER SUPPLY UNITS

A motor generator unit is employed as the source of power in the TBS series of radio installations to provide the high voltage current required by the transmitter and serves as well to permit the use of the apparatus on any small surface craft or submarine regardless of the characteristics of the primary power available. Since the current requirements of the radio apparatus are fixed, the output side or generator of motor generator units are practically identical in physical as well as electrical characteristics. The input or motor side of the unit must function on the current available and will vary in mechanical and electrical features.

The chief difference between the various models of the TBS Series lies in the type of motor generator employed. In order to indicate clearly the relationship between line current available and the power supply units furnished with the various models of the TBS Series the chart on the opposite page is provided.

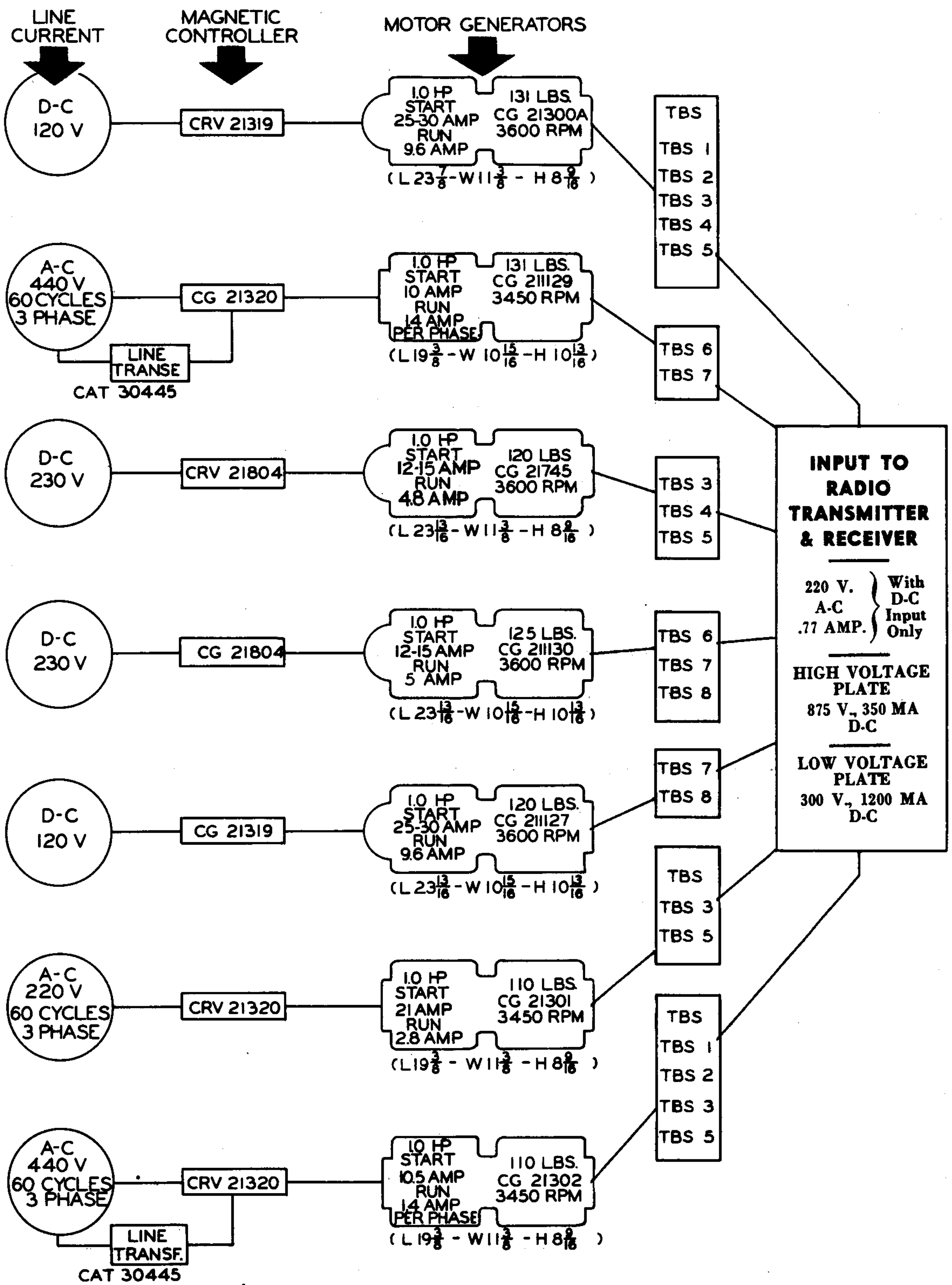
The magnetic controller for remote control of the motor generator will also vary in type depending upon the motor employed. For direct current motors two types are provided, the CRV-21319 and CG-21319 for use with 120 volt motors and the CRV-21804 and CG-21804 for controlling 230 volt motors. Both these controllers employ three steps of resistance change to bring the motor up to speed in starting. The same type controller, CRV-21320 and CG-21320, is used with all types of a-c motors.

Other adaptations are also required in the installation when the line source of power is other than 220 volt a-c. Where 440 volt current is encountered it is necessary to install a line transformer as indicated in the chart. This transformer provides the 220 volt a-c current for the filament transformer in the transmitter.

Where a d-c source is encountered the motor is fitted with an extra winding and slip rings to furnish the necessary 220 volt a-c. A speed regulator is built into the d-c motor generators to provide essentially constant output voltages when input voltage varies ±5 per cent.

Data is also included in the chart to indicate the size and weight of the uncrated units as well as starting and running current required by the different units and their correct speed.

POWER SUPPLY UNITS



NAVY TYPE NUMBERS OF EQUIPMENT FURNISHED WITH TBS SERIES

UNIT	TBS	TBS-1 & TBS-2	TBS-3	TBS-4
Radio Transmitter	CRV-52093	CRV-52093	CRV-52093	CG-52093
Radio Receiver	CRV-46068	CRV-46068	CRV-46068	CG-46068
Motor Generator 120 V. D-C	CG-21300	CG-21300A	CG-21300A	CG-21300A
230 V. D-C			CG-21745	CG-21745
220 V. A-C	CG-21301		CG-21301	CG-21301
440 V. A-C	CG-21302	CG-21302	CG-21302	
Magnetic Controller 120 V. D-C	CRV-21319	CRV-21319	CRV-21319	CG-21319
230 V. D-C			CRV-21804	CG-21804
220-440 V. A-C	CRV-21320	CRV-21320	CRV-21320	
Control Unit	CRV-23135	CRV-23135	CRV-23135	CG-23135
Loudspeaker	CRV-49101	CRV-49101	CRV-49155	CMX-49155
Handset	CRV-51019	CRV-51019	CRV-51019	CYH-51019
Chest Set	CRV-51018	CRV-51018	CRV-51018	CYH-51018
Antenna Surface Type	CRV-66015	CRV-66015	CRV-66015	CPD-66015
Submarine Type	CRV-66016	CRV-66016	CRV-66016	
Line Transformer	CAT-30445	CAT-30445	CAT-30445	
Crystals	*	*	*	*

* No Navy Type Nos. assigned crystals except for nameplate.

QUICK REFERENCE DATA ON TBS SERIES

MODEL	CONTRACT	DATE	CONTRACTOR	INSPECTOR
TBS	NOs-60613	May 16, 1938	RCA	A
TBS-1	NOs-70095	Dec. 18, 1939	RCA	A
TBS-2	NOs-70095 Sup.	Apr. 6, 1941	RCA	A
TBS-3	NOs-1736	Oct. 10, 1942	RCA	A
TBS-4	NXss-18747	Dec. 2, 1942	GE	B

RCA—RCA Victor Division of Radio Corporation of America, Camden, N. J.

GE —General Electric Co., Schenectady, N. Y.

A —Resident Inspector of Navy Material, RCA, Camden, N. J.

B —Resident Inspector of Navy Material, GE, Schenectady, N. Y.

NAVY TYPE NUMBERS OF EQUIPMENT FURNISHED WITH TBS SERIES

UNIT	TBS-5	TBS-6	TBS-7	TBS-8
Radio Transmitter	CRV-52093	CRV-52093	CG-52093	CRV-52093A
Radio Receiver	CRV-46068A	CRV-46068A	CG-46068A	CRV-46068B
Motor Generator 120 V. D-C	CG-21300A		CG-211127	CG-211127
230 V. D-C	CG-21745	CG-211130	CG-211130	CG-211130
440 V. A-C	CG-21302	CG-211129	CG-211129	
Magnetic Controller 120 V. D-C	CRV-21319		CG-21319	CRV-21319
230 V. D-C	CRV-21804	CRV-21804	CG-21804	CRV-21804
440 V. A-C	CRV-21320	CRV-21320	CG-21320	
Control Unit	CRV-23135	CRV-23135	CG-23135	CRV-23135
Loudspeaker	CRV-49155	CMX-49155	CMX-49155	CMX-49155
Handset	CRV-51019	CRV-51019	CYH-51019	CRV-51019A
Chest Set	CRV-51018	CRV-51018	CYH-51018	CRV-51018A
Antenna Destroyer	CRV-66015	CRV-66015	CPD-66015	CRV-66015
Line Transformer	CAT-30445	CAT-30445	CAT-30445	
Crystal	CRV-40062	CRV-40062B	*	CRV-40068B

QUICK REFERENCE DATA ON TBS SERIES

MODEL	CONTRACT	DATE	CONTRACTOR	INSPECTOR
TBS-5	NXss-17599	Aug. 1943	RCA	A
TBS-6	NXsr-36725	Aug. 25, 1943	RCA	A
TBS-7	NXsr-38310	June 1944	GE	B
TBS-8	NXsr-51552	Mar. 11, 1944	RCA	A

RCA—RCA Victor Division of Radio Corporation of America, Camden, N. J.

GE —General Electric Co., Schenectady, N. Y.

A —Resident Inspector of Navy Material, RCA, Camden, N. J.

B —Resident Inspector of Navy Material, GE, Schenectady, N. Y.

ACCESSORIES AND SPARES

1—Junction Box.

1—Line Transformer (440 volt to 220 volt) with 440 volt a-c Installations.

1—Support Stand for mounting radio transmitter and receiver.

2—Stowage Hooks for handset.

1—Transmission Line Kit. This includes gas flask with tank fitting, 0-2000 gauge, micrometer valve and flexible hose. Fitting with gauge for refilling flask from Navy gas cylinders.

Spare tubes for transmitter as ordered.

Spare tubes for receiver as ordered.

1—Box of Spare Parts for radio transmitter, control units, magnetic controller and radio receiver.

1—Box of Spare Parts for power supply unit.

TUBE COMPLEMENT

TRANSMITTER

TUBE	QUANTITY	TYPE No.
Modulation Limiter	1	–84
R-F Oscillator	1	–807
1st Doubler	1	–807
2nd Doubler	1	–808
Power Amplifier	1	–808
Modulator	2	–808
A-F Driver	2	–2A3
A-F Oscillator	1	–6A6
Speech Amplifier	2	–6D6

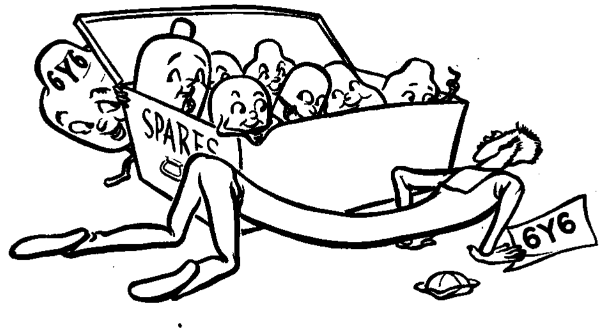
RECEIVER

TUBE	QUANTITY	TYPE No.
R-F Amplifier	1	–956
First Detector	1	–6C6
I-F Amplifier	3	–6D6
Second Detector and Noise Suppressor	1	–75
Automatic Volume Control	1	–6F7
Oscillator and First Doubler	1	–6F8-G
Second Doubler	1	–6J5
TBS-5, TBS-6, and TBS-8 may use	–6J5-G or –6J5-GT	
Output Amplifier	1	–6Y6-G
Rectifier	1	–5Z3
First A-F Amplifier	1	–6C6

EXTRA EQUIPMENT

The following equipment is necessary to make the installation operative but is not furnished.

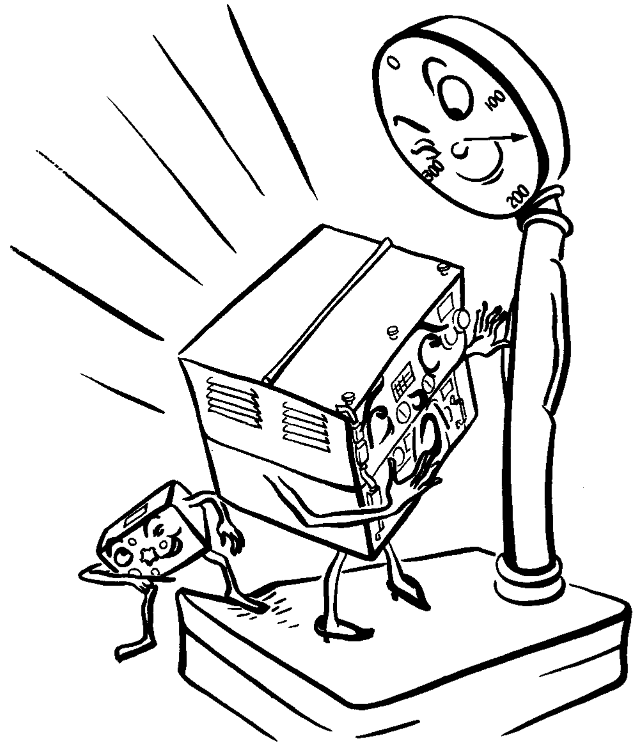
QUANTITY	ITEM
2	Cable for connection between transmitter and control units. (Navy Type MHFA-14.)
1	Cable for connection between transmitter and magnetic controller. (Navy Type MHFA.)
1	Cable for connection between magnetic controller and power supply unit.
1	Set of wiring to line transformer when used. (Navy Type MCS2.)
1	Cable to Loudspeaker. (Navy Type TTHFA-1.)



The following items are necessary or desirable depending upon operating requirements.

1	Telegraph key and flexible leads. (MHFA-2.)
1	Telephone headset (600 ohms).

DATA ON TYPICAL SHIPMENT OF TBS EQUIPMENT



NOTE: Dimensions and weights may vary slightly with mode of packing, type of Power Unit supplied and extra equipment specified.

CASES		DIMENSIONS	NET (LBS.)	GROSS	CU. FT.
1	Transmitter, Receiver and stand	33 x 27 x 30	186	300	15.6
1	Motor Generator	24 x 13 x 12	153	190	3.1
1	Accessories	34½ x 18 x 13	50	82	4.6
2	Tubes	34 x 13½ x 12	8	57	3.9
1	Antenna	67 x 27 x 9	46	120	6.6
1	Transmission Line and Kit	43 x 37 x 7	29	86	4.4
1	Equipment Spares	28 x 29½ x 18	152	212	7.2
1	M. G. Spares	23 x 13 x 12	68	93	2.7
9	TOTALS		692	1140	48.1

RADIO TRANSMITTER AND RECEIVER UNIT FOR TBS SERIES

PH-US197

All models of the TBS Series of radio communication equipment employ the transmitter and receiver assembly shown above. Though it is possible to operate these units when mounted apart, the most satisfactory arrangement is that shown. To permit this compact assembly a support stand is provided with the equipment, which encloses the receiver as shown. This stand is of heavy metal with a black crackle finish and provides at the right of the receiver a small closed compartment for the stowage of charts, log books or other operating records. The receiver is shock mounted in this stand and the chassis may be withdrawn without detaching the receiver cabinet from the stand.

The transmitter is rigidly attached to the top of the support stand and matches it in finish. All connections to the apparatus are made at a terminal board mounted in the rear of the support stand behind the receiver. Leads connect this main terminal board to the connector strip in the rear of the transmitter housing. The receiver requires but two pair of wires, for connection to the terminal strip, the power supply and the audio output leads.

All controls for operating and adjusting the apparatus are mounted on the front panel and since the apparatus is designed for fixed frequency, two-way transmission, means are provided to lock the tuning controls when once set on the desired frequency. To this end, locking thumbnuts are mounted on the tuning dials of the transmitter, while the receiver is fitted with a metal cover that is hinged to swing up and cover the tuning adjustments without interfering with operating controls.

The apparatus is designed and accessories provided to permit the equipment to be fixed tuned to any frequency within the 60 to 80 megacycle frequency range. Remote control units permit the starting of the motor generator and operation of the transmitter from two remote points if desired, but it is necessary to switch the receiver on separately by means of a switch on the receiver panel. Thus the receiver can be kept on continually for standby reception without operating the power supply unit for the transmitter.

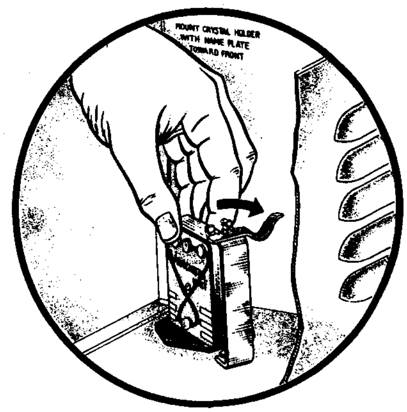
By means of a unique relay system it is possible to use telegraphically keyed modulated continuous waves when conditions demand this form of communication, by providing a telegraph key at either or both points of remote control.

The compactness of the assembly as well as the flexibility of control has made the equipment ideal for smaller surface vessels and submarines where reliable, instantaneous two-way radio communication is required.

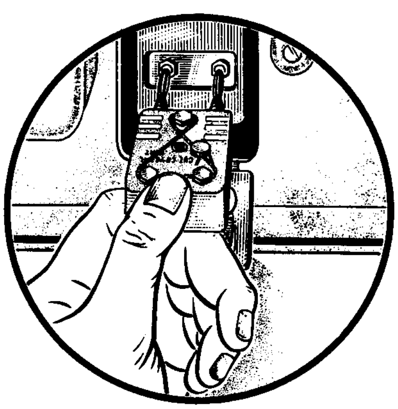
Crystal control on both units assures a minimum of frequency drift, with stable operation within the particular wave band to which the equipment is tuned. To this end a crystal controlled oscillator is the source of oscillations in the transmitter. In the receiver, a crystal is employed to control the basic frequency of the heterodyning currents necessary for superheterodyne operation. A set of crystals is furnished for both transmitter and receiver. The number of crystals per set varies with the different models of the equipment. A spare set is provided that can be stored in the transmitter, a rack being arranged for the purpose in the power amplifier section. These crystals can be readily changed from the front of the panel with a minimum of disturbance to equipment or wiring when it is necessary to change the operating frequency of the apparatus.

THE CRYSTAL OSCILLATOR

Crystal controlled oscillating circuits are employed in both transmitter and receiver of the TBS series to hold the frequency of the radio currents generated in the apparatus within very narrow limits. They consist of thin plates of carefully ground quartz mounted between two flat electrodes and assembled under spring pressure in a rectangular ceramic or moulded case as shown in illustrations below. A set of spring plugs on the end of the ceramic holder makes connections by means of flexible leads to the electrodes. The newer type crystal holders are much smaller and are plugged into an adapter to fit the jacks of the older and larger crystal holder.



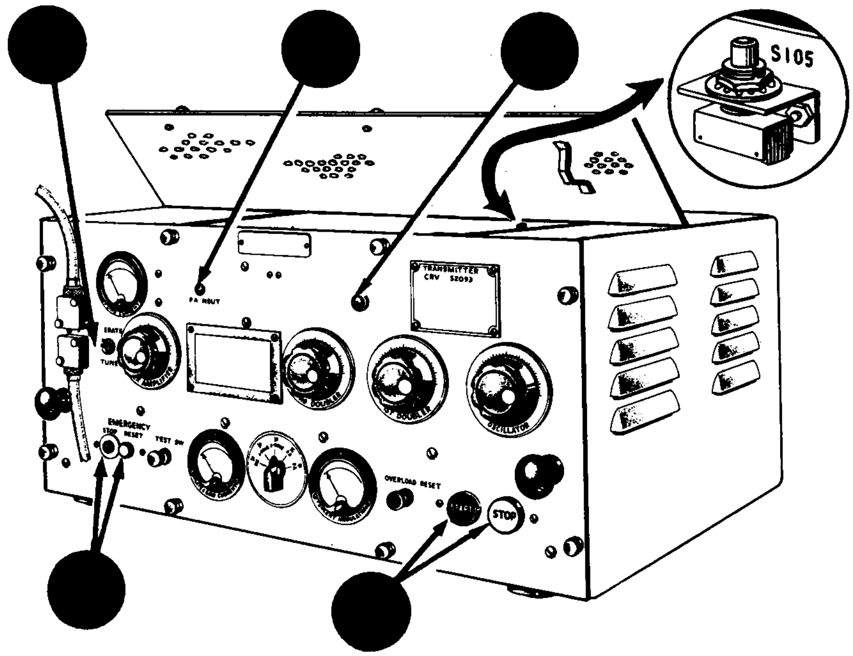
The crystals are connected into the apparatus by simply plugging them into the jacks provided. At the right is shown the crystal holder being plugged into jacks in the transmitter oscillator compartment. The crystal holder is plugged into the receiver as shown at the left. All crystals furnished with TBS equipment are of the third harmonic type, that is, they are ground to operate on the third harmonic of the fundamental frequency of the crystal. The crystal frequency marked on the nameplate is actually the third harmonic frequency and the crystal is used in the circuit in the same manner as a crystal having an equivalent fundamental frequency.



Two types of crystal holders have been furnished with the different models of the TBS series. They differ chiefly in details of the case and spring shapes.

The transmitter and receiver crystal for a given frequency form a set in which the transmitter crystal with the red nameplate in the earlier models has an operating frequency equal to one fourth of the channel or transmitting frequency. The receiver crystal with a blue nameplate in the earlier models has an operating frequency obtained by subtracting 5.3 megacycles from the channel frequency and dividing by four. The latter crystals are used to control the frequency of the heterodyning currents in the receiver. Temperature changes will result in a very slight shift in fundamental frequency of the crystal so the temperature at which the crystal frequency measurements are made is given on the nameplate of the crystal holder.

THE NAVY TYPE TBS TRANSMITTER



NAVY TYPE CRV-52093 CRV-52093A

The transmitter is assembled on a horizontal type chassis properly shielded to prevent interaction between stages of the radio frequency oscillator and radio frequency amplifiers and to isolate the audio frequency section. The whole assembly slides into a black crackle finished case that has the front half of the top hinged as shown in the illustration. An interlocking switch is mounted on the transmitter proper so the opening of this hinged top causes this switch to open the circuit to the magnetic controller and shut down the motor generator. This removes all power from the transmitter and prevents harm to the operator from high voltages. The hinged top is normally held closed by three thumbscrews.

Attached to the chassis of the transmitter is the panel carrying the dials, meters and switches for adjusting and controlling the transmitter. At the upper left hand corner of the panel is mounted the terminal for the flexible lead to the transmission line and antenna, and for the short antenna lead to the receiver below. A relay behind the panel at this point serves to transfer the antenna from the receiver to the transmitter as desired during operation of the equipment.

When necessary, the transmitter may be removed from its housing by disconnecting the flexible antenna lead from the receiver and loosening the eight thumbscrews around the four sides of the transmitter panel when the whole unit may be slid out of the case, confined only by the flexible lead to the junction box. This must be disconnected if the transmitter is to be moved any distance. All connections to the transmitter being made by a series of plugs arranged at the rear of the chassis fitting into jacks mounted in the enclosure case, permit its removal without disconnecting any wires other than the antenna leads to receiver and transmission line.

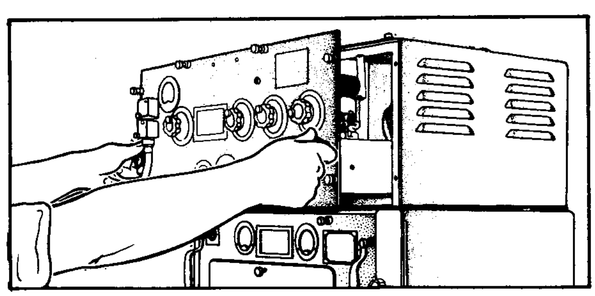
A chart is provided at the left center of the panel to record dial settings for frequencies for which crystals are available. The functions of the various panel controls and fittings are indicated below:

A Tune-Operate switch used to adjust transmitter circuits for tuning when thrown down by connecting a 1000 ohm resistor in the plate return of all r-f tubes and left up during operation of the transmitter.

B Power Amplifier Neutralizer is used to balance feedback from the power amplifier tube. Normally not necessary to adjust.

C Pilot Light to indicate that power is on the apparatus and in condition for operation.

D Emergency Stop and Reset. When an emergency arises all power can be cut off the transmitter with the Stop button and opera-



tion cannot be resumed from remote control boxes till the Reset button is pressed.

E The Start and Stop buttons are provided on the panel for convenience, actual control of starting and stopping usually being done at the control units. These buttons, of the momentary contact type, start and stop the motor generator by actuating the magnetic controller.

F Oscillator. This control tunes the plate circuit of the first oscillating tube. Since the frequency of oscillation is determined by the crystal this control serves to obtain resonance in the plate circuit of the tube.

G First Doubler. This control tunes the plate-tank circuit of the second oscillator to obtain maximum r-f current in that circuit at a frequency twice that of the first oscillator.

H Second Doubler. In turn, maximum r-f current in the plate-tank circuit of the second doubler results at twice the frequency of the first doubler when this dial is set at resonance. This is the final transmitter frequency.

I Power Amplifier. This dial tunes the final output circuit of the transmitter to obtain maximum radiation.

J R-F Line Current. This meter indicates in milliamperes the amount of current being fed into the transmission line to the antenna and is a direct measure of the energy output of the transmitter.

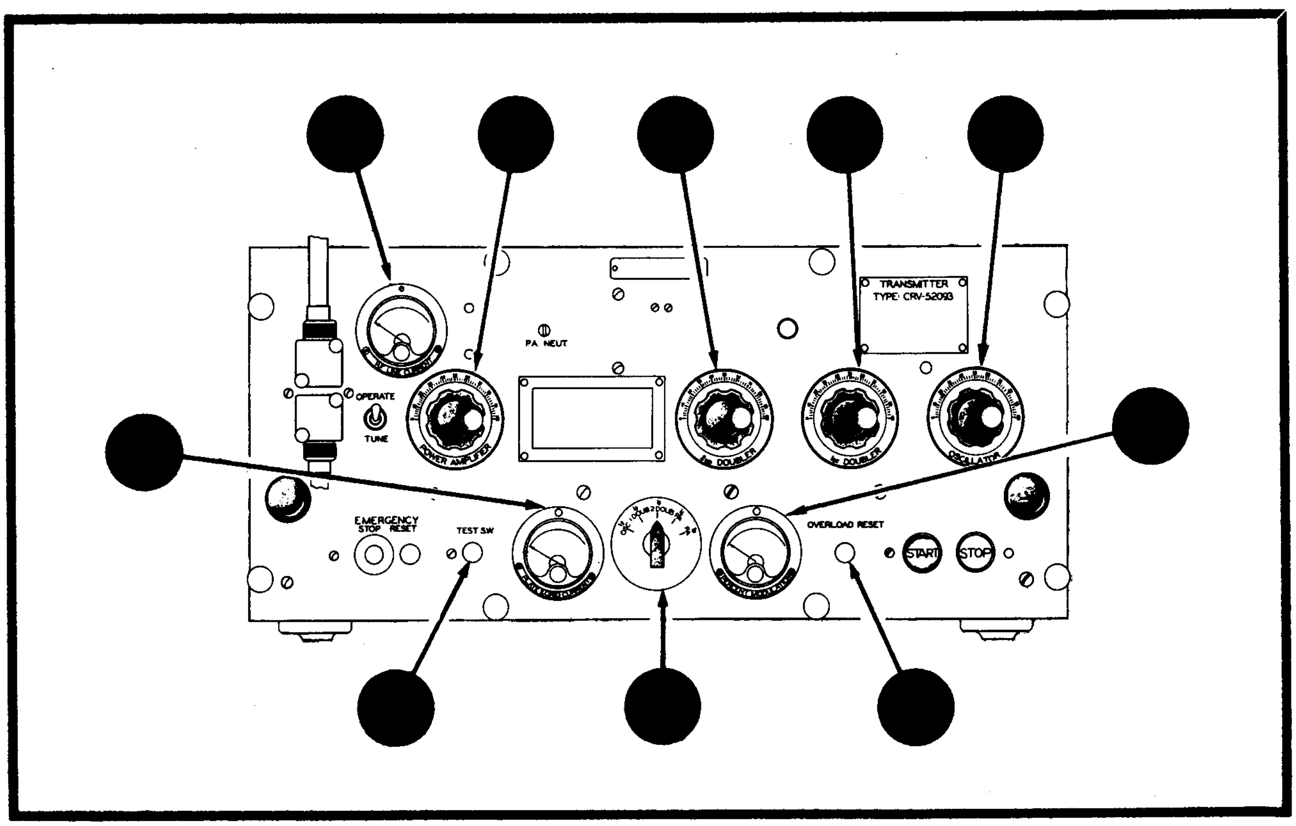
K Plate and Grid Current Meter. Used principally in tuning and adjusting the transmitter, this meter serves to indicate resonance in adjusting the dial controls of the tuning circuits, when switched into the proper circuits by switch K.

L Percent Modulation Meter. Acting as a check on the functioning of the speech amplifier in the transmitter, this meter indicates the approximate modulation being obtained while the transmitter is used for speech transmission.

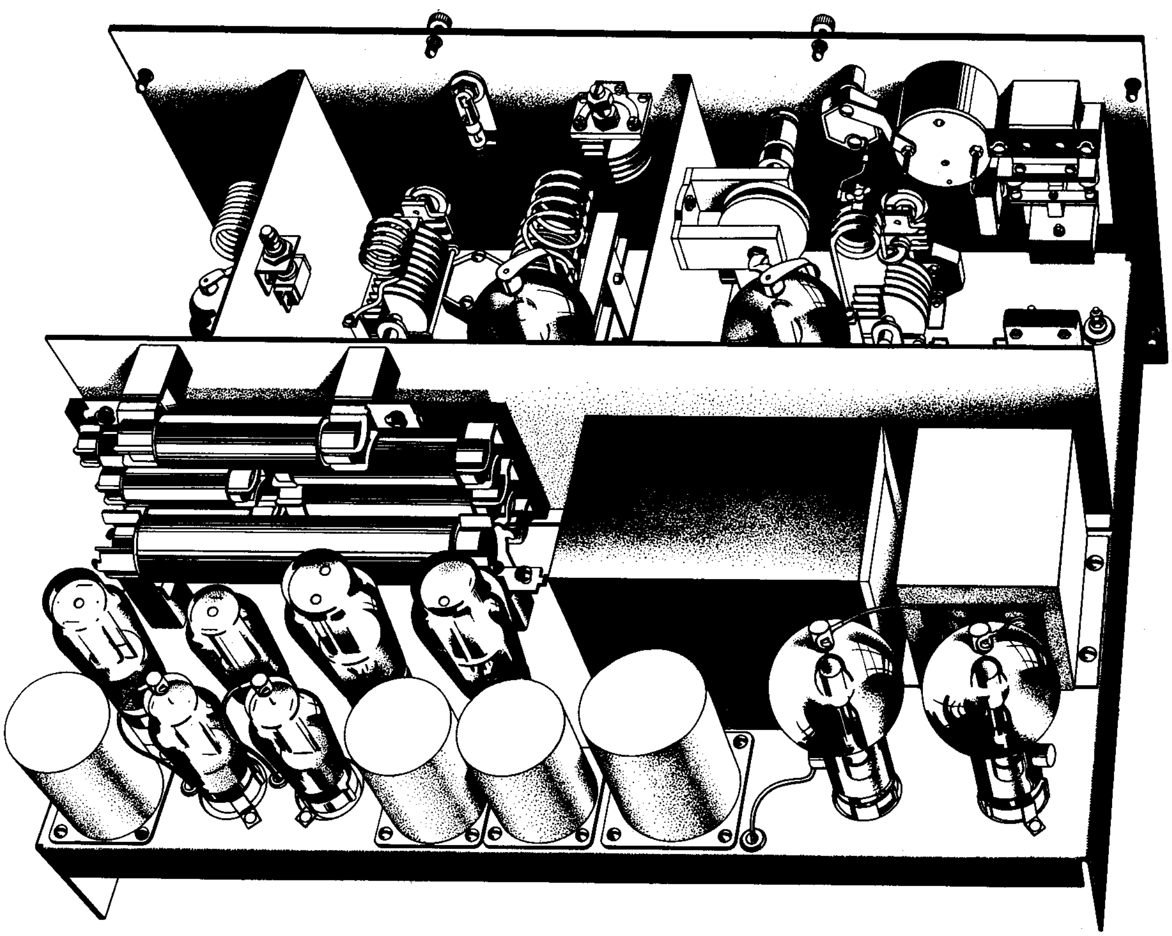
M Test Switch. While tuning or adjusting the transmitter this button is used to control the operation by actuating the relay that switches plate current into the tubes in the transmitter when desired.

N Meter Switch. This is a rotary type, five point switch and is used to switch the Plate and Grid Current Meter F into the grid current of the Power Amplifier and the plate circuits of such tubes as require checking during tuning or operation of the transmitter.

O Overload Reset. Arranged behind the panel, a small overload relay connected into the grid return circuit of the power amplifier that trips open should the current in the circuit exceed 160 milliamperes, due to overloading of this tube, and shuts down the transmitter. This button is used to reset the relay when the trouble is cleared.



THE TOP OF THE TRANSMITTER CHASSIS

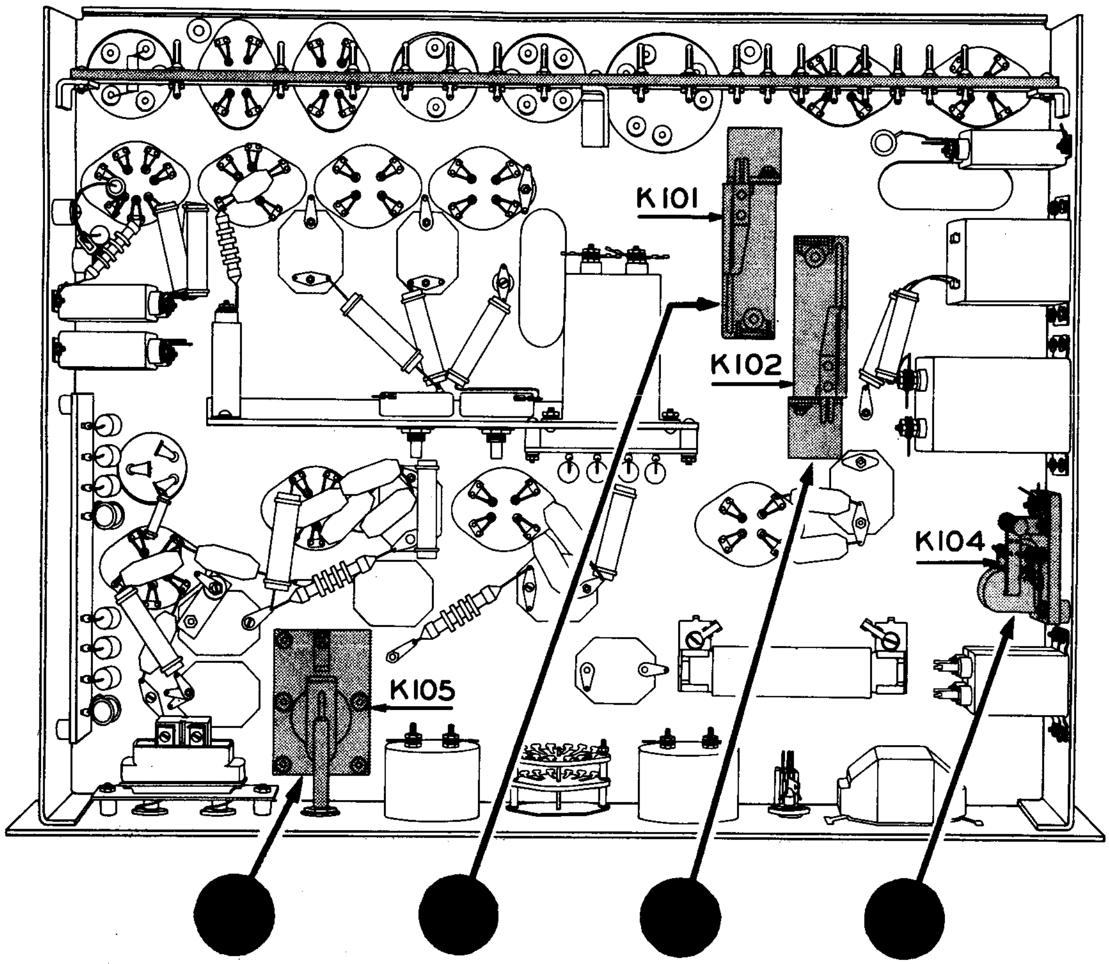


The rear view of the transmitter chassis illustrated above shows the layout of all the apparatus mounted on the chassis top, with the shielding provided to prevent interaction between the various functional parts of the transmitter.

The main shield running the length of the chassis isolates the radio frequency from the audio frequency components of the circuit. The radio frequency elements are likewise divided into oscillator, doubler and power amplifier compartments. The interlocking switch that protects the operator from harm when the transmitter cover is lifted is shown clearly mounted on the shield in the center radio frequency compartment. The rack for holding spare crystals is shown at the right hand end of the center shielding plate in the power amplifier compartment where they are readily accessible from the top of the transmitter.

In the audio frequency compartment mounted on the shield will be seen the voltage dividing resistors that provide the various voltages required for the amplifier tubes and current for such accessories as the microphones in handset and chest set and the relays below the transmitter chassis.

It might be well to mention the tube clamps visible at the tube bases, will be found only on the TBS-8 of the series of TBS equipment.



BENEATH THE TRANSMITTER CHASSIS

Mounted beneath the chassis of the transmitter are the many smaller components such as resistors, capacitors and choke coils as shown in the illustration of the bottom view of the transmitter. Likewise along the lower edge are shown the meters and switches mounted on the lower face of the panel, which arrangement permits compact wiring of the whole apparatus.

To facilitate the connection of the transmitter to the rest of the equipment and still permit its ready removal for inspection or repair, a pin and jack system is employed to make connections between the transmitter chassis and the terminals in the transmitter housing. The insulating strip carrying these pins is shown across the top of the illustration in blue. When the transmitter chassis is slid into its housing these pins make the proper connections by slipping into jacks arranged on the terminal board at the rear of the transmitter cabinet.

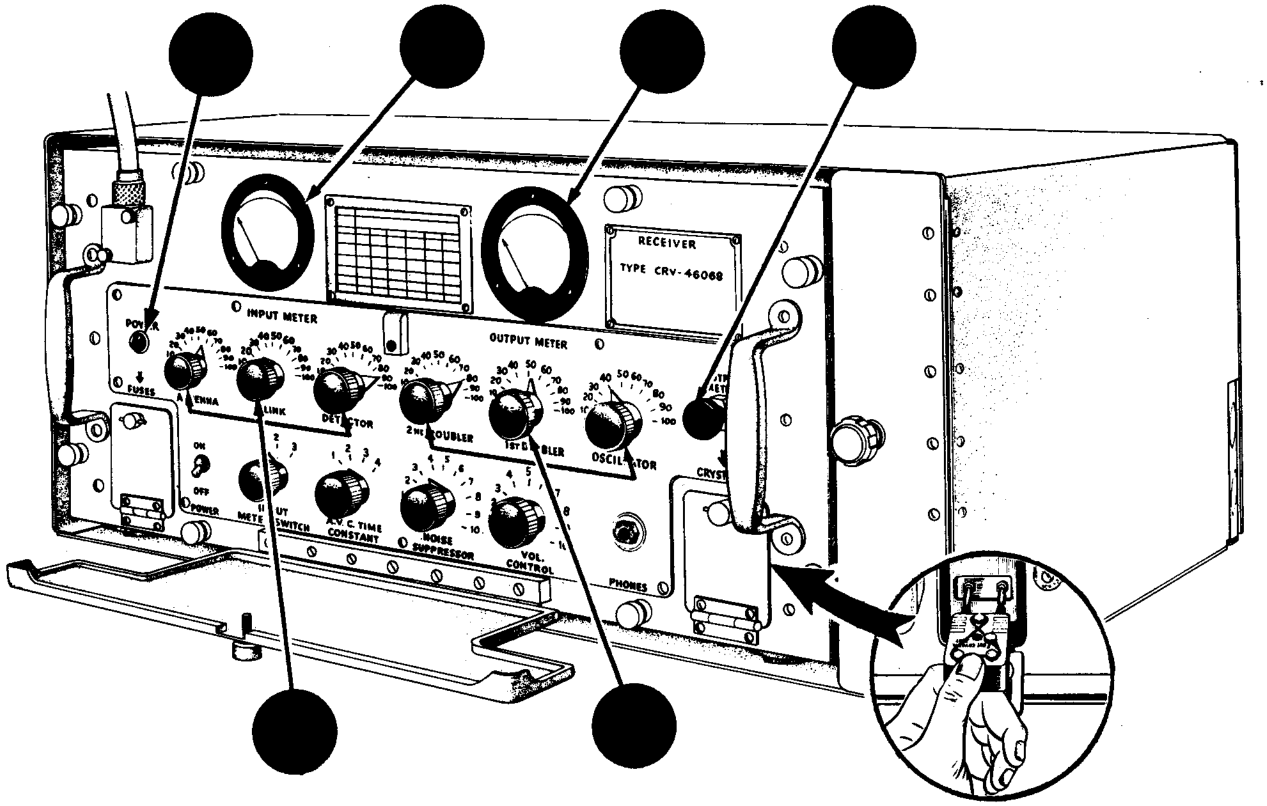
Since the transmitter is remotely controlled its proper functioning depends greatly on a system of relays that are shown in color in the illustration. It is important to know the position and function of these relays should trouble develop.

A—K105—Overload Relay to protect Power Amplifier tube.

B—K104—Low Voltage Plate Voltage Relay.

C—K102—Keying Relay for MCW Transmission.

D—K101—Carrier Delay Relay.



THE NAVY TYPE TBS RADIO RECEIVER

All models of the TBS Series of radio transmitters and receivers have used this receiver with but one slight change in the circuit. Difficulty at times was experienced in the 65 to 69 Megacycle band in the models TBS, TBS-1, TBS-2, and TBS-3. This was found to be due to an absorption circuit formed in the oscillator circuit and was remedied by the inclusion of resistor R-457 in all later models.

In construction this unit consists of a horizon-type chassis to which is attached the front panel. The assembly slides into a crackle finished black case which is shock mounted and fitted into the stand on which the receiver is mounted.

All of the operating and tuning controls are grouped on the panel in such a manner that the adjusting dials may be covered by a hinged plate that swings up to cover them and being clamped in place by a thumbscrew prevents accidental disturbance of the adjustments. At each end of the control panel is a small hinged door, the one at the left permitting access to the fuses in the power input circuit of the receiver, that at the right permitting the changing or replacing of the crystal controlling the frequency of the oscillator.

In the upper left hand corner of the panel is the antenna terminal which is connected by a short flexible concentric conductor to the transmitter terminal of the transmit-receive switch. A chart is provided in the center of the panel to record the dial settings for any frequency band to which the receiver has been tuned so settings may be more readily duplicated.

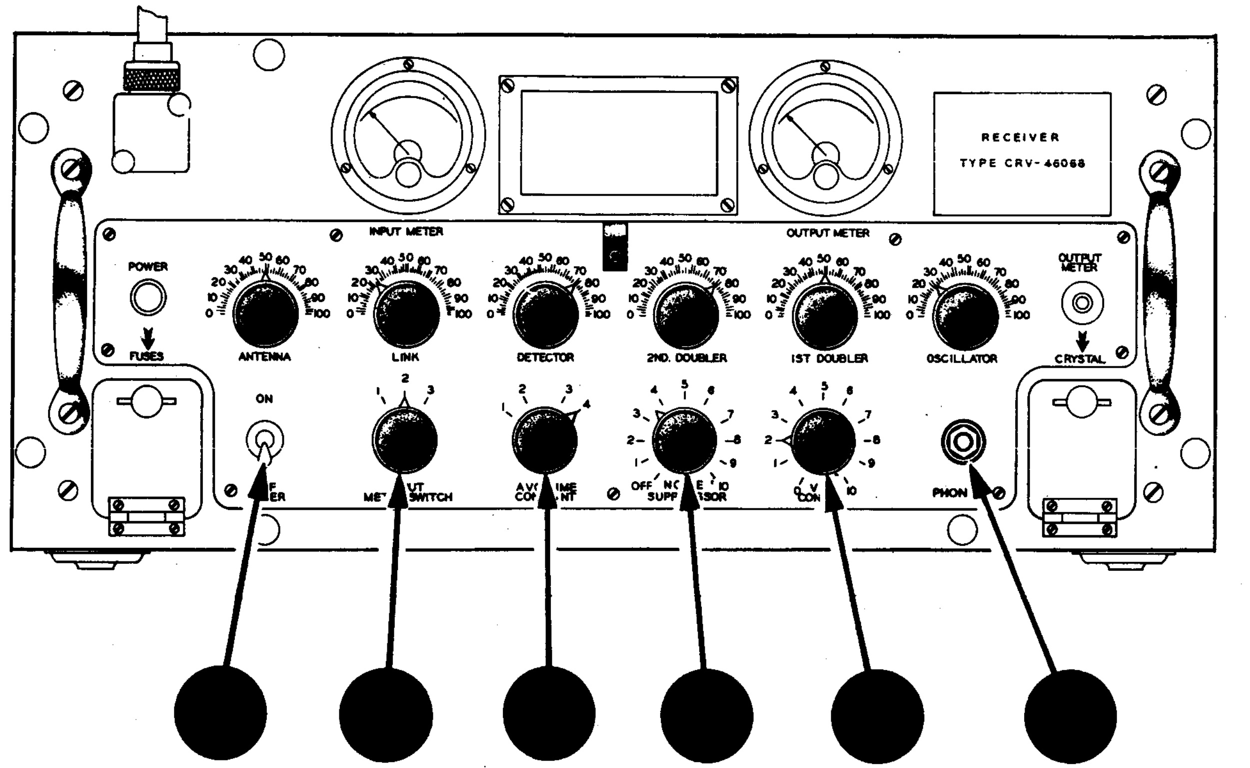
Handles are provided to withdraw the receiver from the case should occasion arise, stops being attached to the chassis to prevent it slipping all the way out. Normally eight thumbscrews on the panel hold it firmly in its case.

Referring to the illustrations we find the following controls and meters mounted on the panel.

A Power. A pilot light to indicate when the receiver is switched on.

B Input Meter. When connected into the proper circuits by means of a switch provided on the panel this meter indicates cathode currents in the r-f amplifier, first detector and oscillator stages. It registers full scale deflection at three milliamperes and is calibrated in decibels with zero deflection at + 120 db. When connected into the r-f amplifier stage the meter indicates the signal input to the receiver in db above 5 microvolts.

C Output Meter. Used for indicating the output level of the receiver when momentarily connected into the circuit by a push-switch. This meter is also calibrated in db with a zero reference corresponding to an output of two watts.



D Output Meter Switch. This switch is employed to connect the output meter into the circuit while a reading is being taken.

E Antenna. This knob tunes the input circuit of the receiver to the desired channel frequency, usually the same frequency as that at which the transmitter has been adjusted to operate.

Link. The plate circuit of the first r-f tube is tuned to resonance with the grid input by means of this knob to obtain high selectivity at the high frequency bands used. The inductance of this tuned circuit is coupled inductively to the input of the next tube but is spaced to obtain a good signal-to-noise ratio.

Detector. Controls the resonance of the grid circuit input to the first detector. This input circuit has its coupling adjusted to obtain good gain and selectivity balance.

F Oscillator. This knob tunes the plate circuit of the oscillator tube activated by the crystal in its grid circuit.

First Doubler. By tuning the plate of the next tube to twice the frequency of the oscillator the frequency of the currents is doubled.

Second Doubler. Here the frequency is again doubled by adjusting the plate circuit with this knob. In this manner the heterodyning frequency is obtained to be mixed with the r-f in the first detector resulting in the intermediate frequency of 5.3 megacycles to which the other transformers in the radio channel are tuned.

G Power Switch. This switch controls the power input to the receiver and switches on all currents to the filaments and plates of the tubes. A transformer and rectifying system takes care of all power demands of the receiver and it is only necessary to connect 110 volt a-c current from the ship supply circuit to the input terminals of the receiver to take care of all its power requirements.

H Input Meter Switch. By means of this switch the input meter may be switched into the cathode circuit of the r-f tube, the first detector and the oscillator tube, respectively, by moving the switch from left to right.

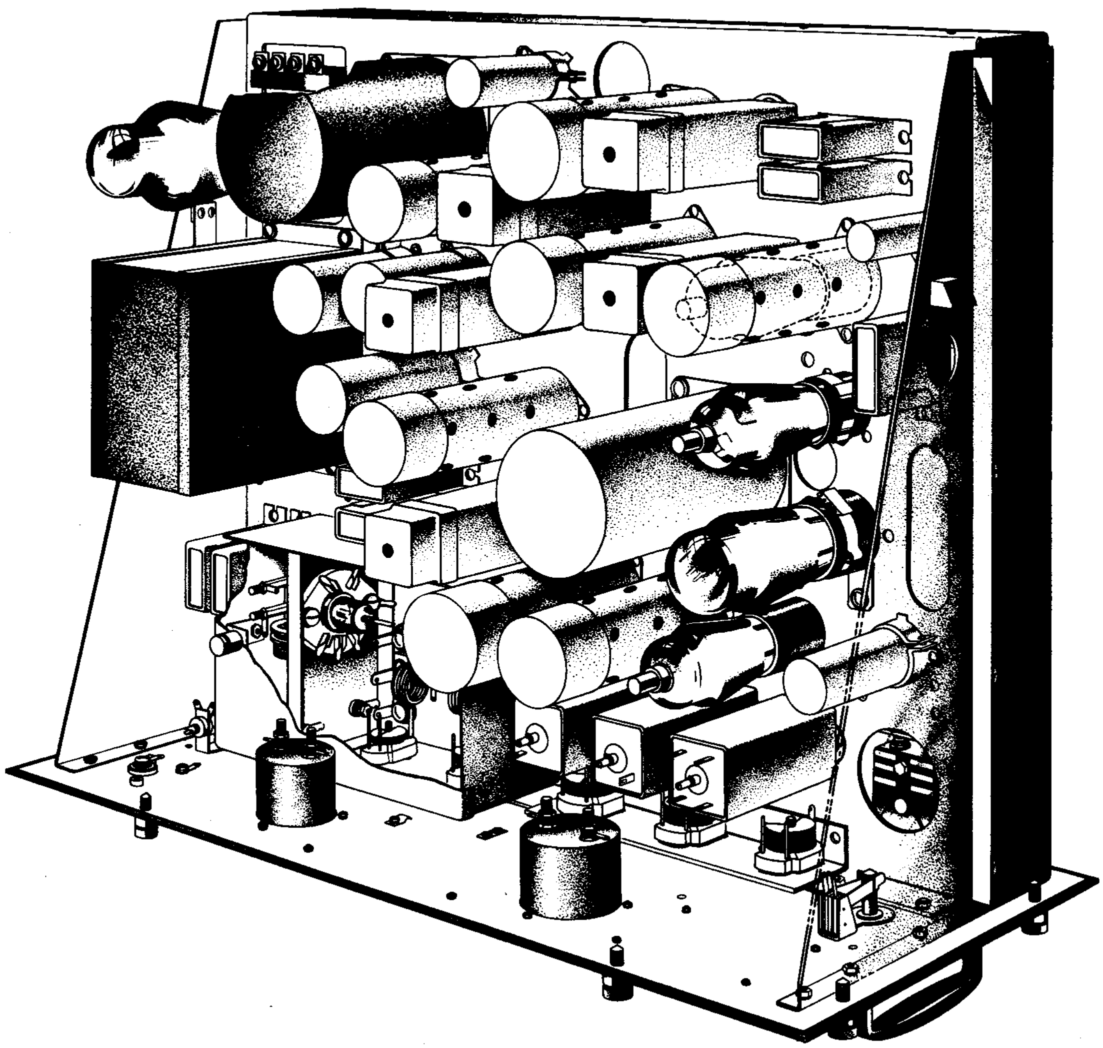
I A.V.C. Time Constant. The purpose of this adjustment is to control the delay in return of sensitivity of the automatic volume control tube in the circuit. This tube responds instantly to check overloading and the length of time the control voltage is retained after removal of the signal can be adjusted by this knob, thus tending to a more level signal intensity.

J Noise Suppressor. This knob adjusts the level at which the noise suppressor circuit starts to function. By rotating the knob all the way to the left a switch is actuated that renders the noise suppressor circuit inoperative.

K Volume Control. Intended to set the receiver for some degree of volume that will operate handsets and loudspeaker satisfactorily under all conditions. Final adjustment of volume control is had at control boxes or loud speaker to suit the individual operating the equipment.

L Phone. A 600 ohm headset may be plugged into this jack to act as a monitor on the operation of the transmitter and for reception.

THE TOP OF THE RECEIVER CHASSIS



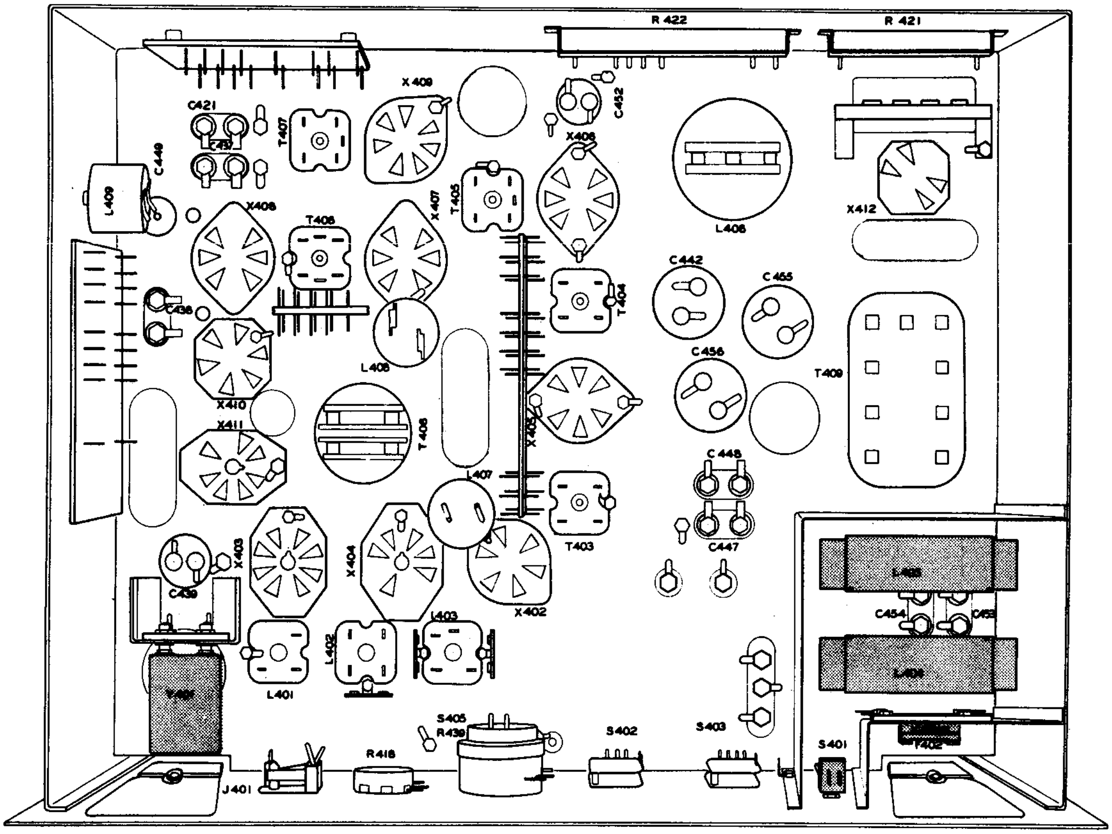
The view of the receiver chassis above shows the assembly of the larger units mounted on the chassis. To obtain stable operation and prevent interaction between the various circuits, all parts subject to such trouble, including most of the tubes, have been shielded by individual metal enclosures. However, the ultra high frequency circuits are enclosed in a square container at the lower left corner, shown with cover removed.

The smaller components of the receiver such as resistors and capacitors have been mounted under the chassis adjacent to the terminals of the circuit elements on top of the chassis with which they are associated.

Terminals for connection to the power supply as well as output terminals are mounted on a small terminal strip at rear of the chassis and shown at the upper left of the illustration. These are the only connections with the exception of the antenna lead that must be made to the receiver. The power transformer furnishing both filament and plate current to the tubes is shown on the left of the chassis at the center.

Despite its apparent complexity the chassis is very systematically arranged in regard to the functions of the circuits involved and can be readily separated for circuit analysis.

BENEATH THE RECEIVER CHASSIS



From the functional analysis of the receiver chassis just completed it should be possible to recognize the terminal side of the components as shown in the illustration of the bottom view of the receiver chassis above. For the sake of clarity the smaller resistors and condensers have not been shown but these necessary circuit components are given in Section 7, identified by their symbol number.

At the lower left of the above illustration is shown the crystal, which determines the frequency of the oscillator, mounted in a jack. The insertion of the crystal is made through the opening with the hinged cover at the right of the receiver panel. The crystal is held securely in place when the hinged cover is closed and latched by means of a rubber knob mounted on the back of the small door.

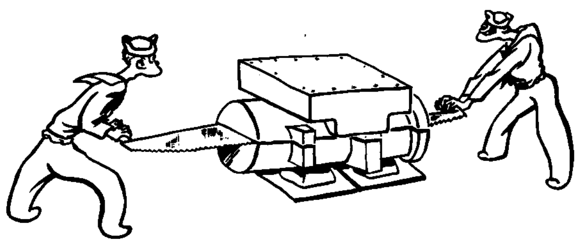
At the lower right is shown the power line filter enclosed in a square shielding container. This portion of the chassis is shown in conjunction with the schematic diagram to show the relationship of the various parts in the circuit.

The power supply terminals on the chassis are connected directly to the switch, so opening this switch cuts all power off the apparatus including the fuses mounted on the interior metal shield facing covered opening in the panel. This makes the fuses readily available for renewal from the covered opening in the panel front.

The filter itself occupies the larger section of the shield and consists of the two inductances L404, L405 connected into the main supply leads as shown. Connected across the feeders are two sets of capacitors with the common lead grounded.

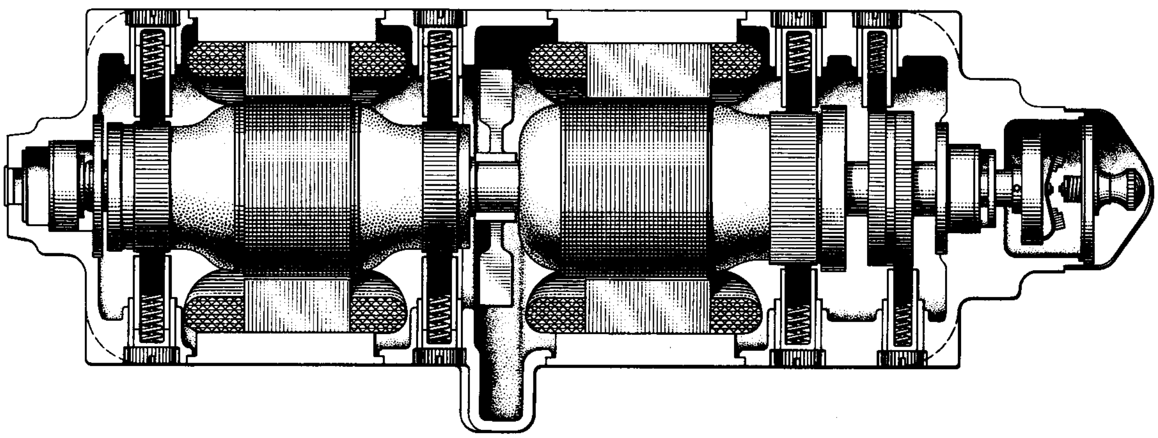
With this arrangement any radio frequency impulses picked up by the supply line to the receiver that may cause interferences are choked back by the impedances and bypassed to ground by the capacitors.

POWER SUPPLY UNITS FOR TBS TRANSMITTER



The power for the operation of all the TBS series of transmitters is obtained from motor generator units. Of necessity these units have varied in constructional and electrical details but fall into two general types. One type employs a direct current motor to drive the generator while the other employs an alternating current motor. In both types the generators are very similar and differ only in minor details of internal wiring.

D-C MOTOR GENERATORS



The illustration shows a horizontal section of the d-c type to show its general internal construction. The motor section occupies the right half of the assembly and consists of the usual shunt wound field structure and d-c armature with commutator shown at A. Since the transmitter requires an a-c input for the tube filament transformer the motor armature carries a special winding connected to the slip rings shown at the right to provide 220 volt a-c current.

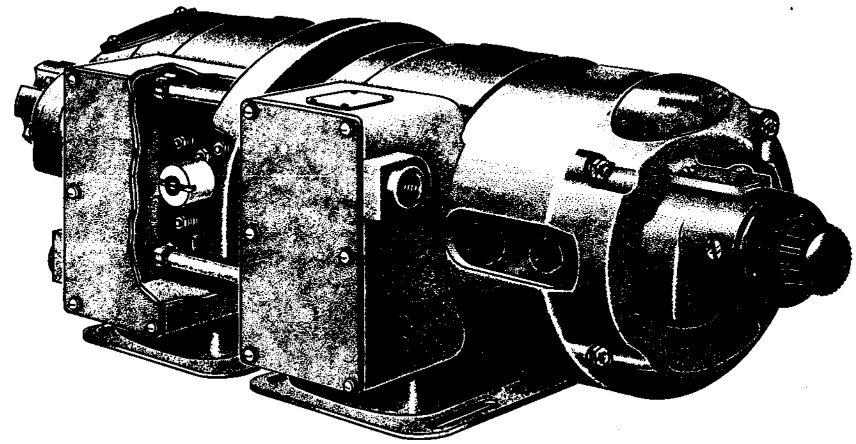
By means of an automatic speed regulator shown on the end of the motor shaft the speed of the motor is held practically constant at 3600 r.p.m. which results in 60 cycle current from the slip rings.

The generator end, at the left, has the armature wound to provide two different voltages and has two commutator and brush assemblies as shown. The commutator to the left provides the 875 volt d-c current for the modulator and power amplifier plate circuits of the transmitter. The other commutator at the right delivers 300 volt d-c for the amplifier tube plate circuits and likewise powers the field windings of the generator.

A fan mounted between the armatures as shown assures proper operating temperatures of the unit by drawing in cooling air at each end of the unit and discharging it through a vent on the side of the machine.

The d-c motor generator units have been built for 120 d-c and for 230 d-c supply voltages. They have also been changed somewhat in physical appearance and in electrical details for the different models of the TBS series of radio communication equipment. The earlier models were furnished with the terminal boxes mounted on the side as shown in the attached illustrations, which show the external appearance of the machines. The power leads in the d-c motors are fitted with a filter circuit to prevent any radio interference that might be caused by sparking of the motor brushes from being carried back over the power lines. For the same reason the speed regulator on the motor of the later model units have a capacitor and resistor connected in series across the contacts to prevent radio disturbance due to the opening and closing of these contacts during operation of the machine.

A portion of the filter circuit to prevent radio interference from the generator section of the unit is also built into the machine, the rest being mounted in the magnetic controller to be described later.

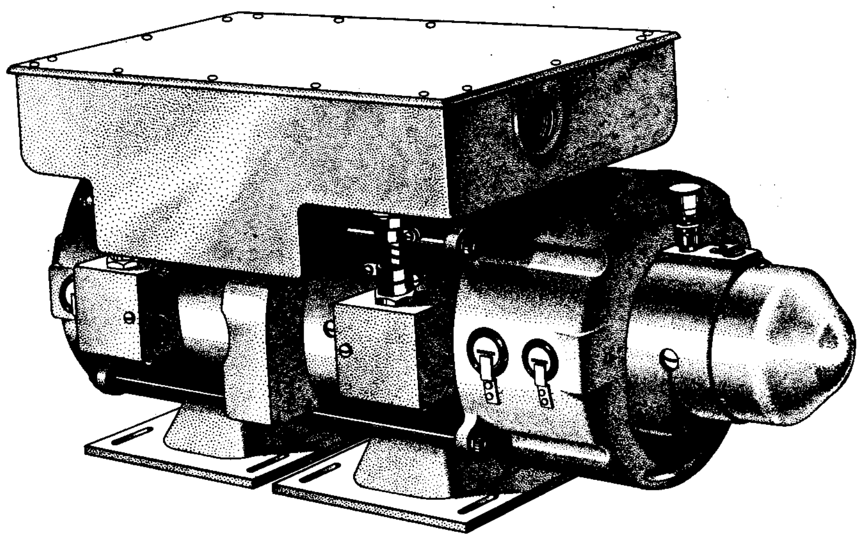


D-C MOTOR GENERATOR

120 volt Navy Type CG-21300—Furnished with TBS.

120 volt Navy Type CG-21300A—Furnished with TBS-1, TBS-2, TBS-3, TBS-4 and TBS-5.

230 volt Navy Type CG-21745--Furnished with TBS-3, TBS-4, and TBS-5.

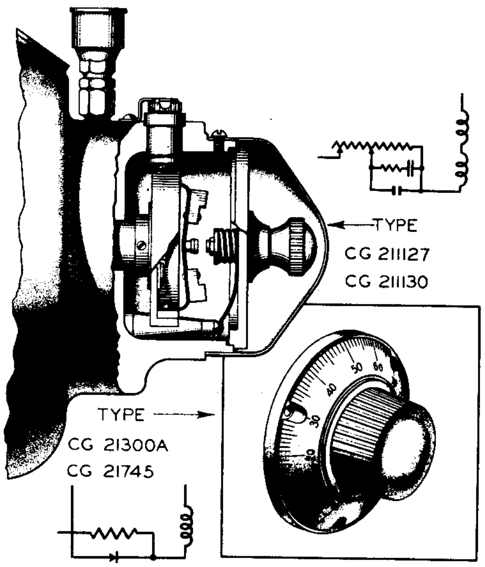


D-C MOTOR GENERATOR

120 volt Navy Type CG-211127—Furnished with TBS-7, TBS-8.

230 volt Navy Type CG-211130—Furnished with TBS-6, TBS-7, TBS-8.

SPEED REGULATOR FOR D-C MOTOR GENERATORS

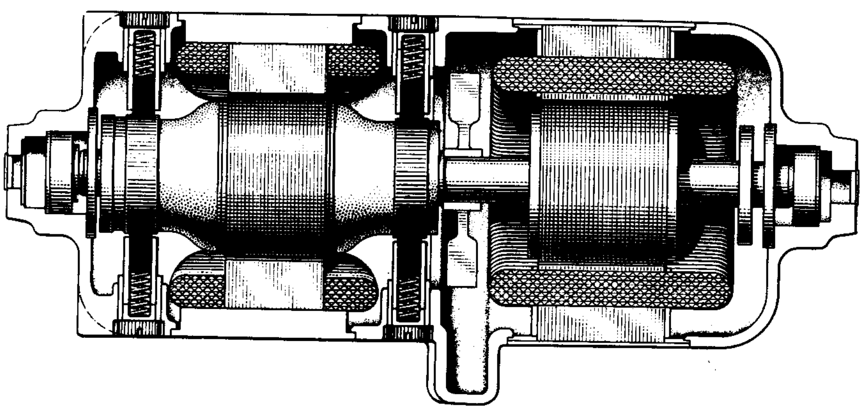


For satisfactory operation of the equipment and maximum tube life the supply voltage and frequency must be kept within certain limits. The d-c motor generators, being subject to speed changes with change in supply voltage, require some form of automatic control to assure correct voltage at generator output and constant frequency at the a-c output from the slip rings on the motor.

The illustration shows a cut-away view of the speed regulator mounted on the end of the shaft of the motor generator. A metal cup-shaped member is attached to the shaft and carries a weight-loaded spring mounting a contact at its center. A brush in the top of the housing makes contact to this rotating device. A contact is arranged on the end of the housing, being adjustable by means of the knob or dial. As shown in the small diagrams, these contacts when closed short out a resistor connected in series with the shunt field of the motor.

The regulator operates in the following manner. When the circuit is first closed to the motor the contacts are open, the resistance reduces the field current and the machine builds up speed. As the speed increases, the weights are forced outward and the contacts approach each other. Should the speed reach a point where the contacts close, the resistor is shorted and the stronger field reduces the motor speed. Thus by properly adjusting the stationary contact the speed of the machine can be held constant within close limits.

A-C MOTOR GENERATORS



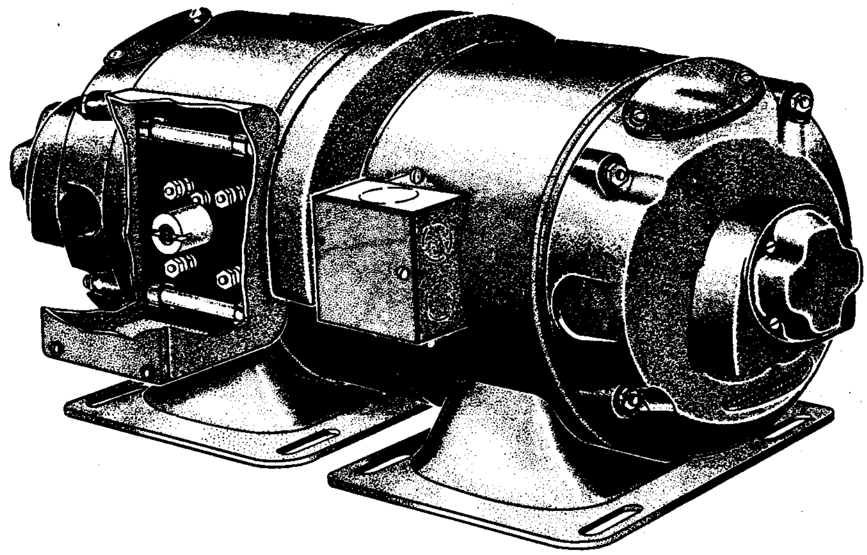
Where the ship supply current is alternating in character the motor end of the Motor Generator must meet this specification, so several types of a-c Motor Generators have been supplied with the various models of the TBS Equipment. Only the motor end differs from the d-c Motor Generators as will be apparent from the attached illustration showing the horizontal section of the a-c equipment.

The construction is much simpler, requiring only the stator windings and the squirrel cage rotor at the motor end. The generator end follows the same construction as the d-c motor generators in having a double wound armature with two commutators.

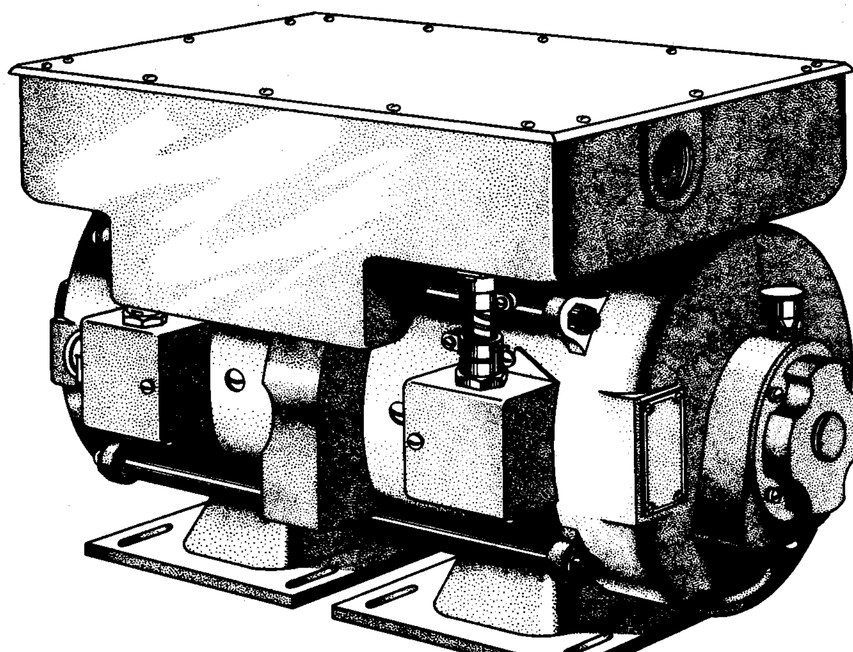
There is no need for a special winding to provide the 220 volt a-c for the transmitter filament transformer, as this current may be obtained from the ship supply lines by the use of a line transformer as described below.

The a-c motor generators have been built in two voltages, namely 220 and 440 volts, three phase 60 cycles, and have changed in physical appearance with different TBS models.

Changes in the wiring between the a-c models have been slight and similar to those made in the d-c units, chiefly changes in wiring to the interpoles. Fuses are provided in all models to protect the generator windings and a partial filter built into the machine. No speed control is necessary with the a-c motor as its speed is determined by the supply current frequency and the a-c machines operate at 3450 r.p.m. with 60 cycle supply current.

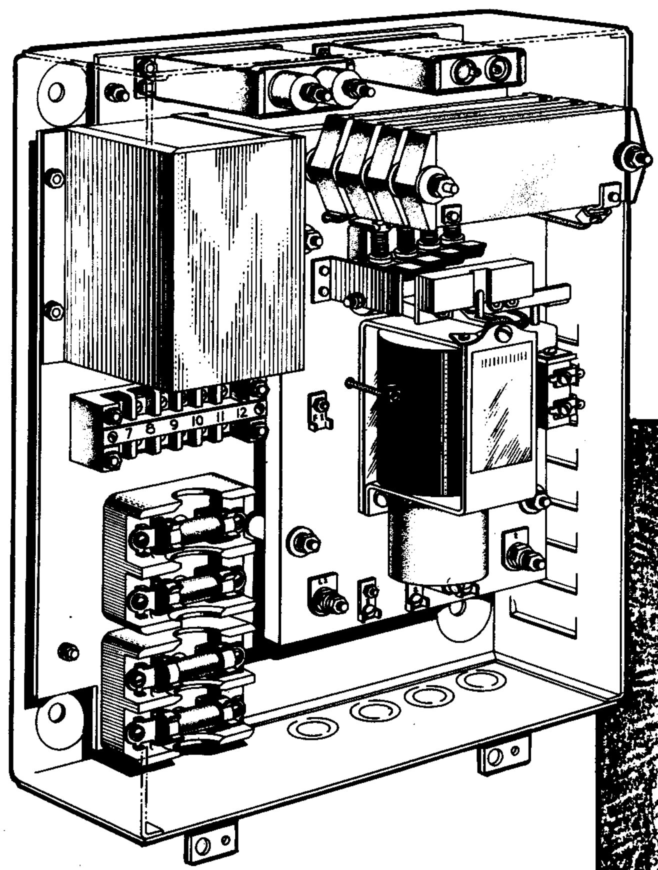


A-C MOTOR GENERATOR — 440 volt Navy Type CG-211129 —Furnished with TBS-6, TBS-7.



A-C MOTOR GENERATOR — 220 volt Navy Type CG-21301—Furnished with TBS, TBS-3, and TBS-5.

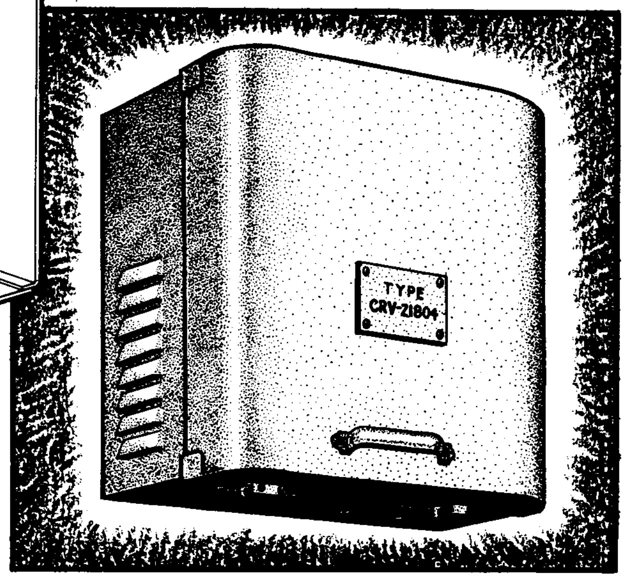
440 volt Navy Type CG-21302—Furnished with TBS, TBS-1, TBS-2, TBS-3, and TBS-5.



NOTE: Direct current magnetic controllers are furnished in two types identical in appearance, operation and wiring, but for different voltages.

120 volt Navy Type CRV-21319 with TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-8.
Navy Type CG-21319 with TBS-4, TBS-7.

230 volt Navy Type CRV-21804 with TBS-3, TBS-5, TBS-6, TBS-8.
Navy Type CG-21804 with TBS-4, TBS-7.



MAGNETIC CONTROLLER FOR D-C MOTOR GENERATORS

To permit remote control of the transmitter an automatic starter or magnetic controller is provided with the power supply units. These are of two types, one for a-c motor and the other for d-c motor generators. While the same controller may be used for 220 or 440 volts in the case of the a-c units, different types are furnished for 120 and 230 volt d-c service.

The d-c controllers are identical in appearance and are mounted in a pressed metal case with removable cover that is normally clamped shut with a screw at the bottom. The external appearance and arrangement of the various units are shown in the illustration herewith.

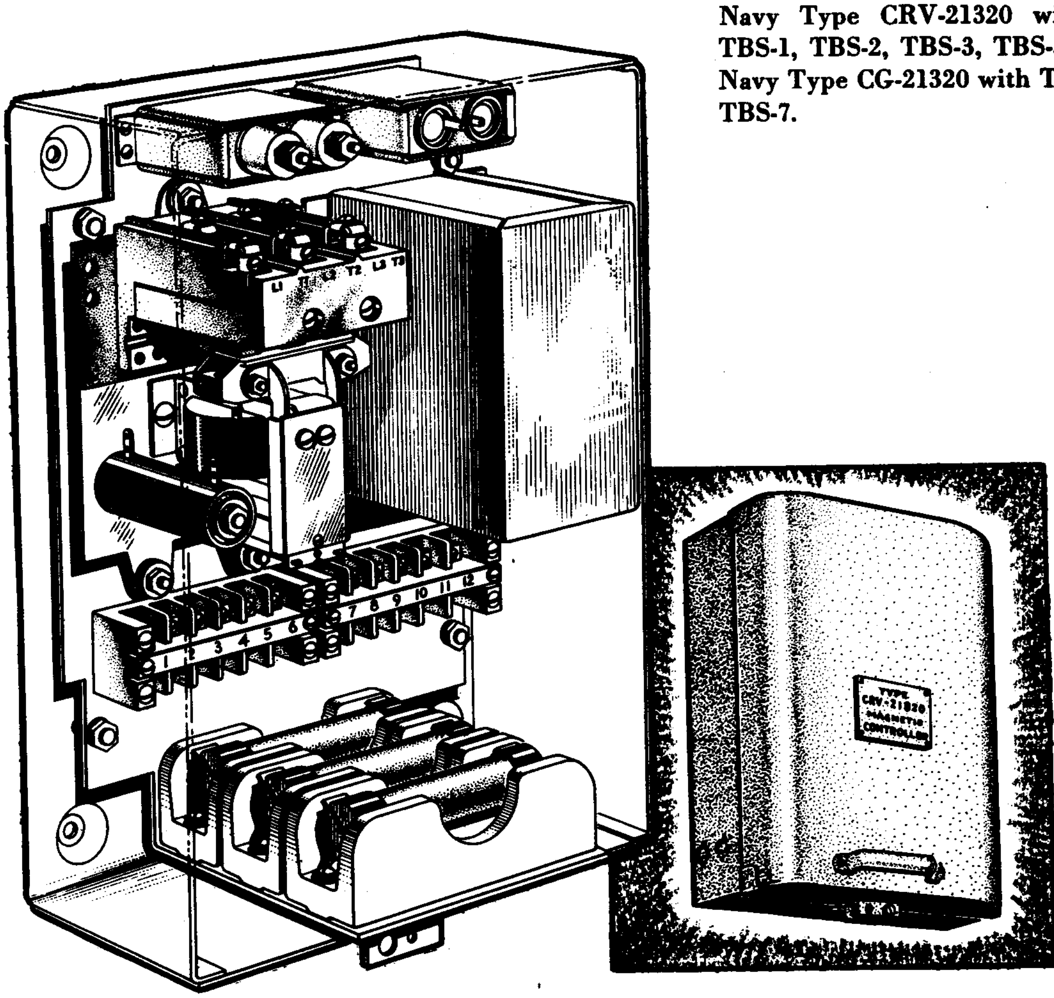
On pressing any of the Start buttons on the transmitter or control boxes the coil of the relay is energized and draws up its armature. Pilot contacts alongside the coil are closed, which keeps the coil energized when the button is released. As the armature rises slowly under control of a dash pot it shorts out resistances in series with the motor in three stages to bring the motor generator up to speed rapidly but without excessive surges of current.

Pressure on one of the Stop buttons shorts the magnet in the controller causing it to drop its armature, opening the circuit and stopping the motor generator. The top door interlocking switch, emergency stop switch and overload relay on the transmitter are connected in series with this magnetic relay so the opening of any of the switches results in stopping the motor generator.

As mentioned previously, the controller case contains a section of a ripple filter for the high voltage output of the generator, this being formed by capacitors mounted at the top of the controller assembly and inductances located in the square can at the upper left.

Two fuseblocks are provided at lower left, the upper pair for the incoming current to the motor, the lower pair being connected in the 220 a-c leads from the motor slip rings, to protect the special winding in the armature of the motor from overload.

NOTE: The same type magnetic controller is used with all a-c motor generator units regardless of voltage. Navy Type CRV-21320 with TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-6. Navy Type CG-21320 with TBS-4 and TBS-7.



MAGNETIC CONTROLLER FOR A-C MOTOR GENERATORS

The magnetic controller furnished for the control of a-c motor generators is shown in the illustration. It resembles in operation the d-c controller with the exception that the full line voltage is thrown directly on the motor on closing of the magnetic switch.

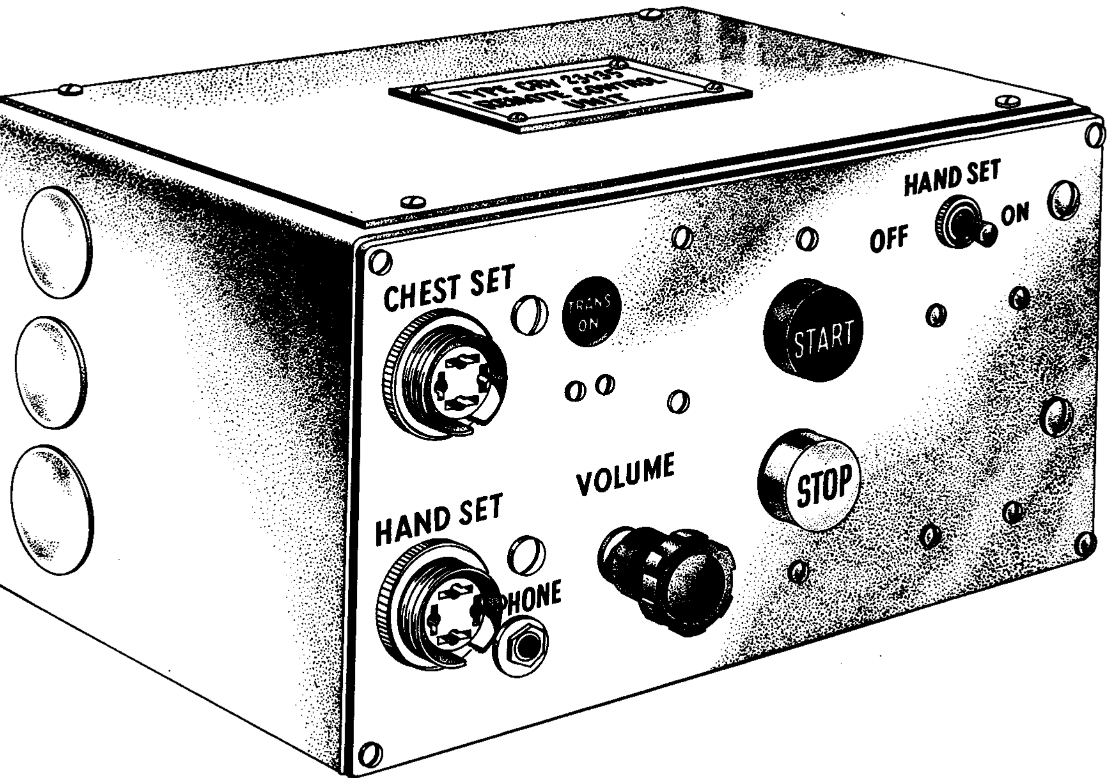
Housed in a pressed metal case with removable cover it mounts the magnetic switch on the left with the can containing the ripple filter inductances to the right of the switch. The two capacitors forming part of the H. V. filter are mounted at the top of the device.

The difference in voltages on which this controller will operate is compensated for by a slight connection change. When used with 440 volt supply, the coil in the magnetic switch is energized from the secondary of the line transformer supplied with 440 volt equipment to provide current for the transmitter filament transformer.

When used with 220 volt supply, the coil is then energized direct from the line current. Terminals are provided at the left of the terminal strip for connecting the primary and secondary of the line transformer.

Mounted on the bottom of the containing case are the fuseblock, to which is connected the three phase supply current, as protection against overload in the equipment.

The operation of the device is similar to that described with the d-c controller. Pushing any of the Start buttons on control units or transmitter panel energizes the magnet in the magnetic controller which closes the circuit to the motor. A pilot contact on the armature serves to keep the magnet energized. Pressure on the Stop button at any control point shorts the magnet coil, permitting the contacts to open and stopping the motor generator.



REMOTE CONTROL UNITS

NAVY TYPE CRV-23135 CG-23135

The two control units furnished with all models of the TBS series are identical in appearance and permit full operation of the equipment, with the exception of the receiver, from any desired remote location within the vessel. Usually one is installed in the radio room and the other on the bridge.

The unit is housed in a cast aluminum case with black crackle finish. They may be installed in any desired location on wall or bulkhead, provision being made on both ends of the case for the entrance of connecting leads from the transmitter and for the attachment of the loudspeaker or key to either unit.

A clamp is provided inside the case to hold the connecting cable while rubber insulating bushings are inserted to pass the wiring to the loudspeaker and telegraph key, although the key is not furnished with the equipment. The top of the case is removable for inspection and ease in repairing.

A fixed terminal board is arranged in the rear of the case for connecting the cable while flexible leads connect the terminal board to the terminals mounted on the panel carrying the control apparatus itself. The front of the panel as shown in the illustration mounts two receptacles at the left for the attachment of a chest set and a handset as indicated.

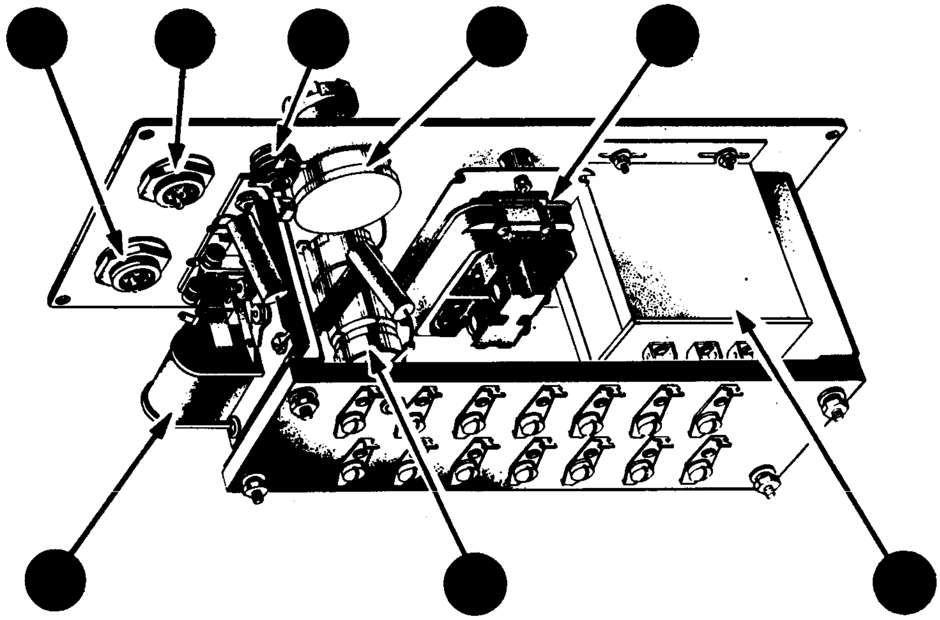
Either unit may be plugged in by fitting the projection on the plug into the slot in the jack collar and slipping the plug on the end of the flexible cord into the jack, and tightening the locking ring to assure rigid connections.

A phone jack is provided to the right of the handset jack if it is desired to monitor at this point, by plugging in a 600 ohm headset. A transparent circular disk to the right of the chest set jack glows red when the transmitter is on.

Since the full output of the receiver is connected to the control unit a volume control is provided on the panel to reduce the volume in the handset to a degree comfortable to the operator.

Two large buttons on the panel control the starting and stopping of the transmitter by actuating the magnetic controller connected to the motor generator set. And finally an on-off switch for cutting the earpiece of the handset out of the circuit, when chest microphone and loudspeaker are being used for communication.

Behind the panel will be found the apparatus shown in the second illustration where a schematic diagram is also given to show the internal wiring of the control unit, similar letters being used to indicate the respective parts of the equipment.

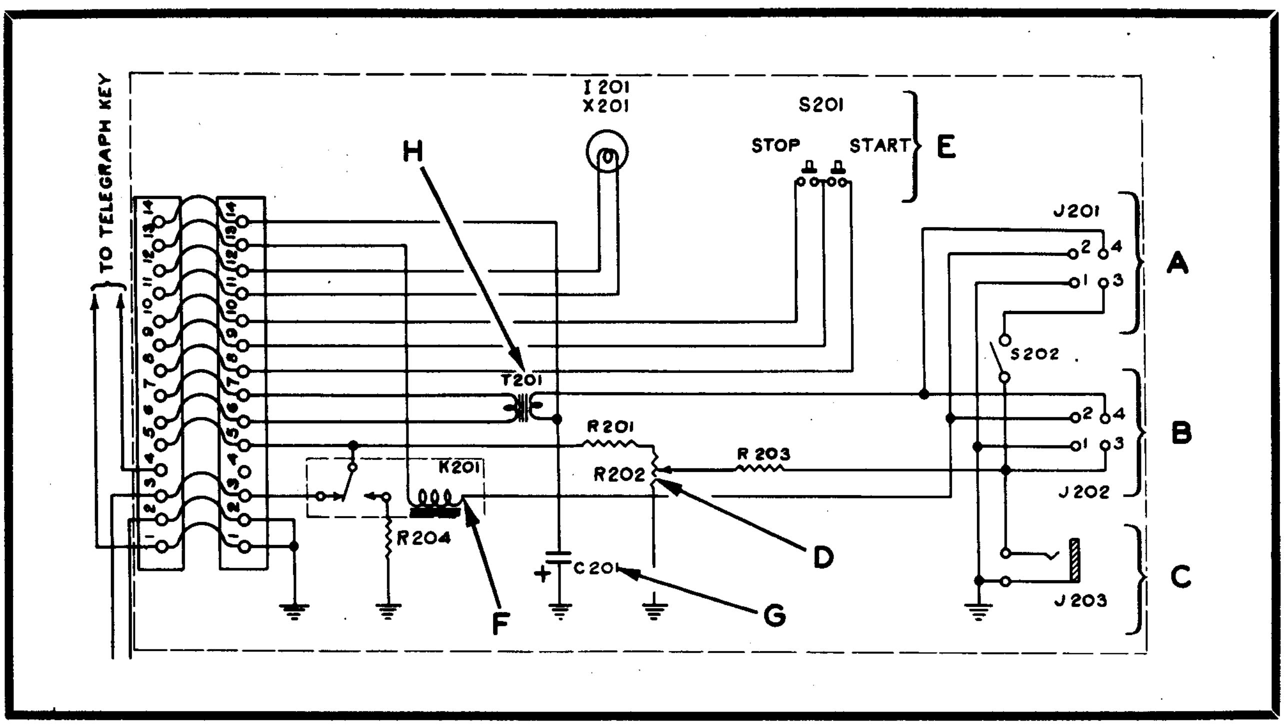


At A and B are shown the handset jack and the chest set jack respectively. No wiring is shown, to prevent confusion. The jack for the headset is indicated by C. The volume control and its position in the circuit is shown by D. The Start and Stop button mechanism and circuit are shown at E.

At F is shown a relay, controlled by the press-to-talk switch on the handset and the button on the chest set microphone when the latter is in use, to cut out the loudspeaker to prevent acoustic reaction between the loudspeaker and the microphone being used for transmission. This relay is in the same circuit as the relay K104 in the transmitter that actuates the transmit-receive relay controlling the antenna connections and the plate voltage to the power amplifier and modulator tubes. When the loudspeaker is cut out of the circuit the output of the receiver is switched into a load resistor R204 by this relay.

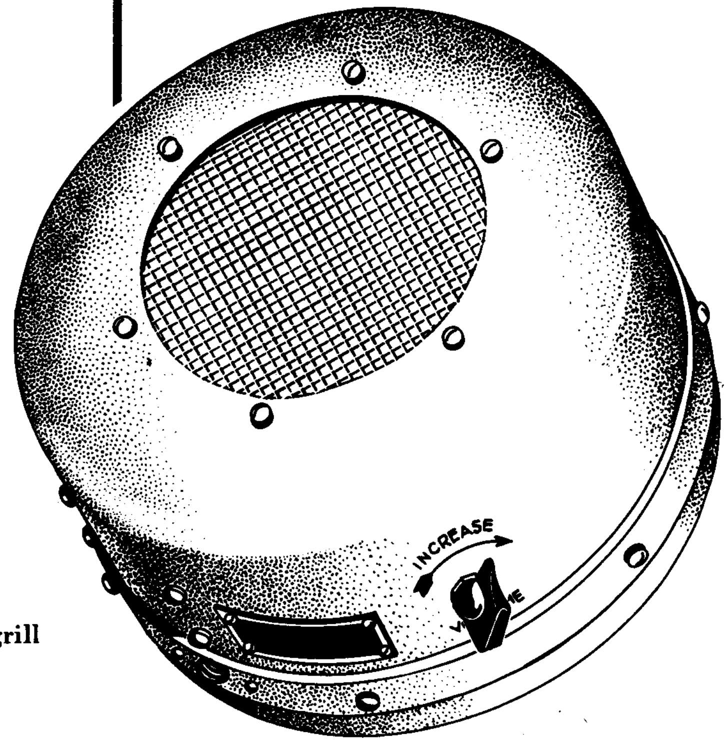
The electrolytic condenser indicated at G is part of the filter supplying current to the microphone, the rest of the filter being located in the transmitter.

The transformer at H is the microphone transformer and is used to match the 35 ohm microphone to the 600 ohm input of the transmitter speech amplifier, it being so designed as to get a perfect match when both control units are wired into the circuit.



LOUDSPEAKER

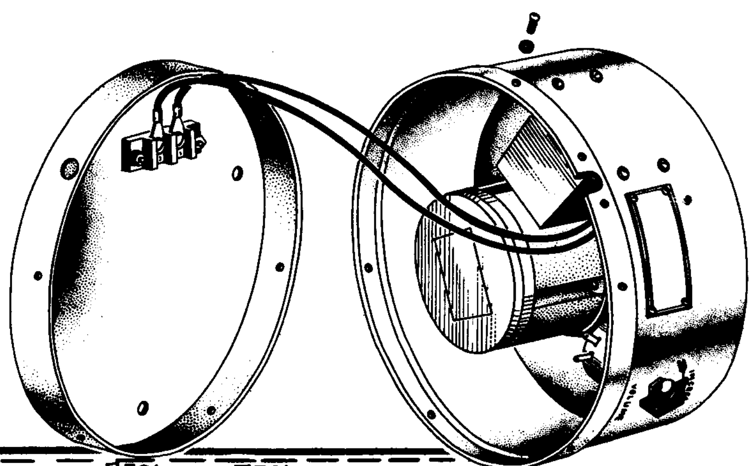
Navy Type CRV-49101.
Furnished with TBS, TBS-1. TBS-2.
Input impedance 600 ohms.
Max. power capability 2 watts.



The loudspeaker shown in the above illustration was supplied with the first three models of the TBS series. It differs somewhat from the later model in appearance, having a wire grill over the diaphragm.

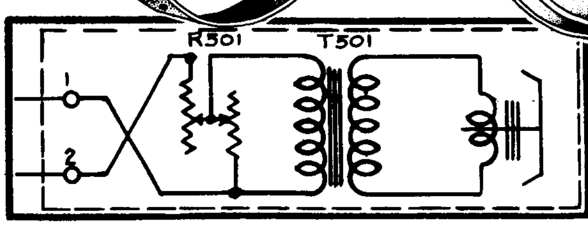
As shown in the lower illustration the permanent magnet type speaker unit is rigidly attached to the rounded metal case by six machine screws. The volume control and impedance matching transformer are attached to the housing, with flexible leads connecting the voice unit to the terminals on the back plate.

The rear section of the speaker is intended to be attached to the wall. After wiring is completed the front section is assembled in place with the volume control knob near the bottom for convenient operation.



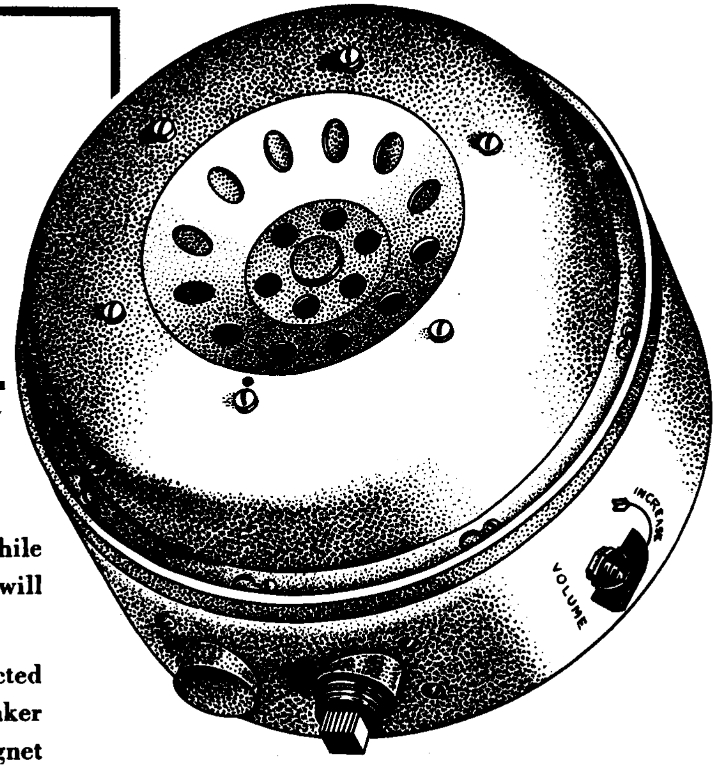
The wiring diagram below shows the circuit inside the speaker where an L pad volume control is connected across the input and permits adjustment of volume at the loudspeaker, reflecting an approximately constant impedance into the line regardless of setting.

The transformer attached to the housing matches the voice coil of the speaker to the line.



LOUDSPEAKER

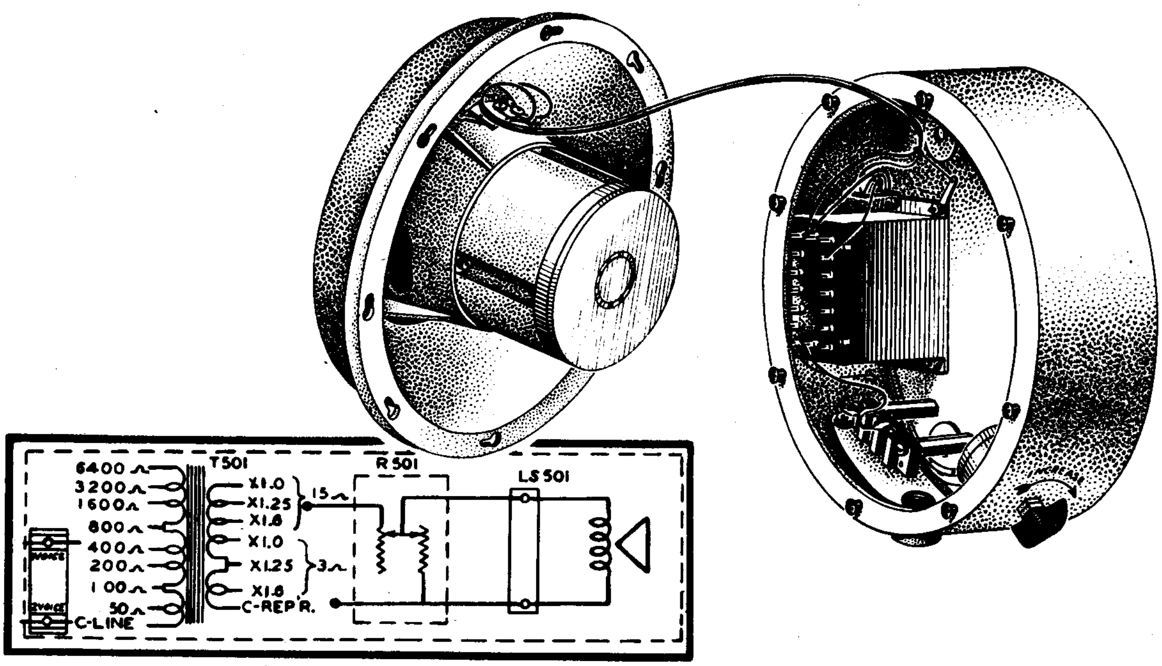
Navy Type CRV-49155.
Furnished with TBS-3, TBS-5 and TBS-8.
Navy Type CMX-49155.
Furnished with TBS-4, TBS-6 and TBS-7.



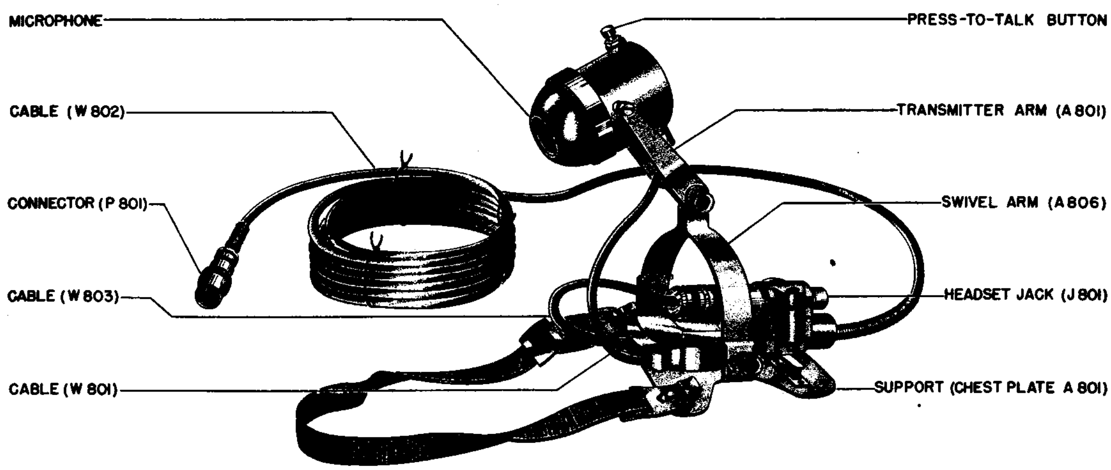
The loudspeaker furnished with the later models of the TBS series differs from the earlier model in that a perforated plate is used in the front instead of the wire grill while the wiring and internal arrangement differs as will be seen in the illustration below.

In this speaker the load attenuator is connected across the leads to the voice coil of the speaker unit, the latter being of the permanent magnet type and attached to the front of the housing as shown.

The matching transformer is mounted in the rear section of the housing and is provided with taps to permit matching the speaker to lines of varying impedances. The volume control is also located in the rear section which is intended to be fastened to wall or bulkhead. Keyhole slots in the front section permit it being slipped into place over the machine screw heads, rotated slightly to the right, and clamped into place with the screws.



TELEPHONE ACCESSORIES



THE CHEST SET

NOTE: A chest set is supplied with all models.
Navy Type CRV-51018 with TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-6;
Navy Type CYH-51018 with TBS-4, TBS-7;
Navy Type CRV-51018A with TBS-8.

The chest set consists of a breast plate fitted with woven straps to support it on the operator's chest to which is attached a 35 ohm single button microphone. The microphone support consists of pivoted metal straps that permit placing the microphone in the most convenient position for use, the microphone shell carrying a press-to-talk switch.

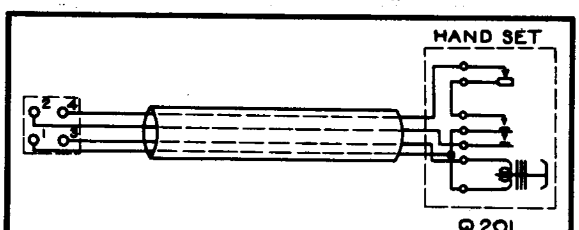
The breast plate is fitted with a jack into which may be plugged a standard Navy 600 ohm headset (not furnished). A twenty foot flexible cord terminating in a polarized plug for attachment to the control box is connected to the breast plate.

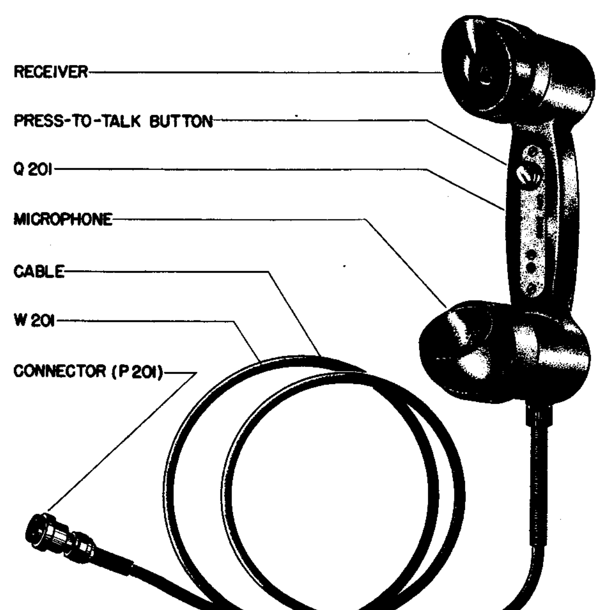
The internal wiring of this unit is similar to that of the handset, the press-to-talk switch acting to control the transmitter and cut off the loudspeaker by means of the relay in the control unit as in the case of the handset. However, monitoring the transmitter is impossible with the chest set unless a headset is employed with it.

THE HANDSET

NOTE: Two handsets supplied with each model.
Navy Type CRV-51019 with TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-6;
Navy Type CYH-51019 with TBS-4 and TBS-7;
Navy Type CRV-51019A with TBS-8.

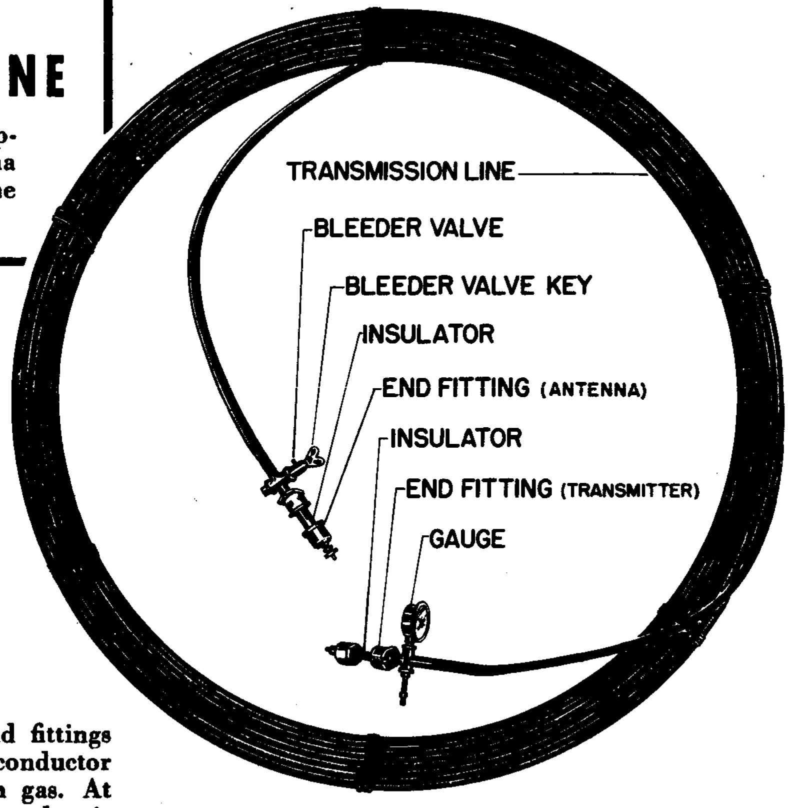
The handsets furnished with the TBS models consist of a molded plastic shell in which are mounted a 600 ohm earpiece, a 35 ohm single button microphone and a press-to-talk switch as shown in the illustration. A four conductor cable is attached to the handset and is fitted with a polarized plug to connect the handset to the jack in the control box. The press-to-talk switch mounted conveniently in the handle is used to control the transmitter operation as well as cut off the loudspeaker if mounted adjacent to the point where the handset is in use. As shown in the schematic of the handset, the switch in the handle has three contacts. Pressing the button closes the circuit to the microphone and the circuit in which is wired the loudspeaker relay in the control box. A relay in the transmitter acts to operate the transmit-receive antenna switch which closes the plate current circuit to the power amplifier, thus putting the carrier on the air for transmission. The earpiece remains in the circuit with the receiver and acts to monitor the transmission so it is possible to instantly detect failure of the transmitter.





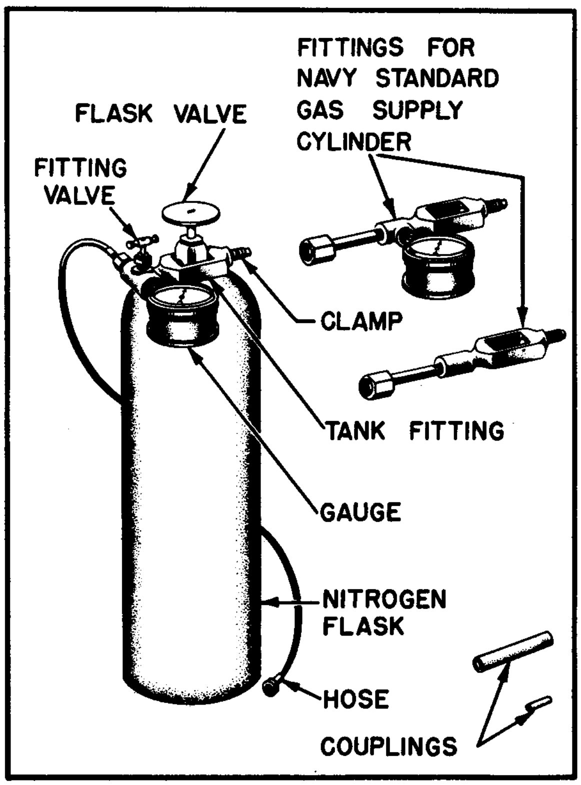
THE TRANSMISSION LINE

NOTE: The transmission line supplied for destroyer type antenna is 120 ft. long, while the submarine type is 80 ft. long.



The transmission line connecting the radio equipment to the antenna is of the concentric type, gas filled. That is, one conductor is formed by the outer soft copper tube three-eighths of an inch in diameter, the other conductor is in the center of the tube and insulated from the outer with ceramic beads. The line is kept filled with nitrogen to a pressure of ten lbs. per square inch to keep out moisture and indicate damage to the line by loss of gas pressure, so repairs may be made at once.

The ends of the line are fitted with end fittings mounting an insulator for the central conductor and attachments for filling the line with gas. At the antenna end of the line a bleeder valve is attached to allow the escape of entrapped air or moisture-laden gas when clearing the line for filling.



At the point of installation of the equipment the line terminates in a junction box shown in the illustration on Page 35 and is fitted with a gauge and inlet valve. The junction box is located close to the transmitter to permit connections being made to the flexible antenna lead on the transmitter.

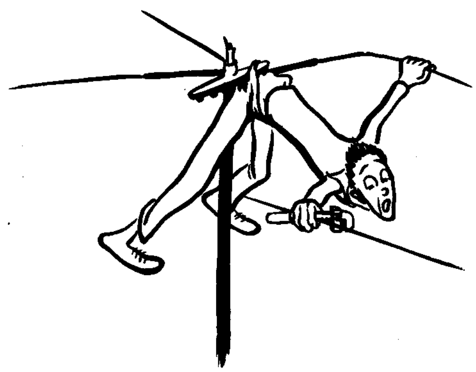
TRANSMISSION LINE KIT

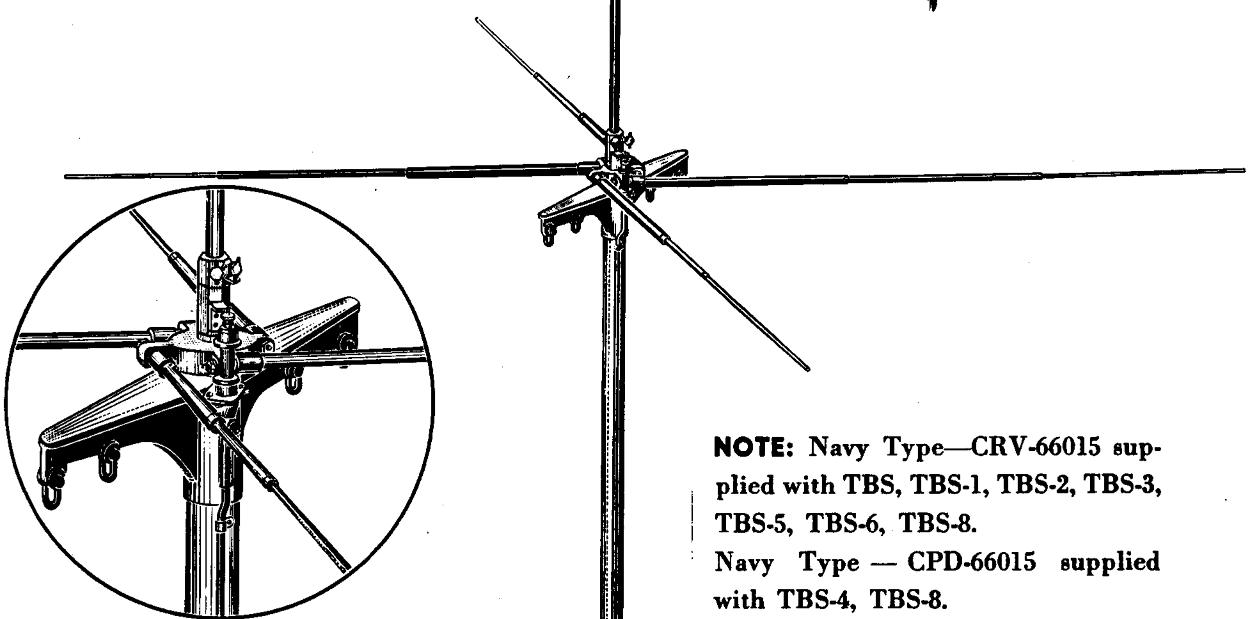
To maintain correct operating condition of the transmission system, a kit is furnished consisting of a small cylinder for storing nitrogen gas under 2000 lbs. pressure. A fitting for the tank mounts a 0-2000 lb. gauge and micrometer valve for controlling the flow of gas and a two foot flexible hose terminating in a fitting to couple the tank to the gas inlet valve of the transmission line. In addition a fitting is provided so the small cylinder may be coupled to a standard Navy gas cylinder to refill the small flask. This fitting mounts a 0-2000 lb. gauge in kits with the latter models, being as shown in the earlier kits.

The parts making up this kit are shown in the attached illustration. The gauge on the tank fitting indicates the pressure within the gas flask, while the pressure on the transmission line, while filling, is read from the gauge on the line.

DESTROYER ANTENNA

The antenna shown in the illustration is furnished for use on destroyers and small surface craft. This is of the quarter wave, vertical type and employs four horizontal rods to form the ground plane. Since the length of the vertical radiating and collecting section is rather critical three rods are furnished, each being used for one of the three frequency bands for which the transmitter and receiver may be tuned. The rods are readily changed, a socket with two clamping screws securing them in position.





NOTE: Navy Type—CRV-66015 supplied with TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-6, TBS-8.
Navy Type — CPD-66015 supplied with TBS-4, TBS-8.

On the member supporting the ground rods a clamp is provided for the termination of the transmission line with connecting strap as shown in the illustration. The cross arm shown fitted with shackles can be used to support flag halyards with the antenna mounted in place on the destroyer mast.

The lower section of the antenna support contains a grounded concentric section of the antenna. The length of the grounded concentric section has been so chosen as to be approximately one-eighth wavelength, thus presenting an inductive reactance.

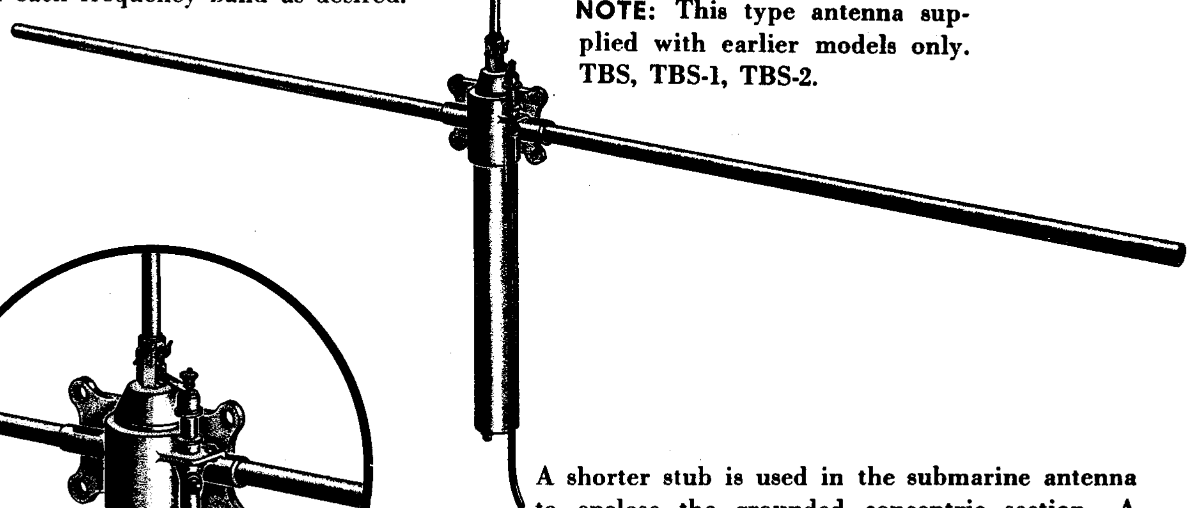
The radiation section, being slightly less than a quarter wavelength, possesses both radiation resistance and some capacitive reactance. Thus the inductive reactance of one section neutralizes the capacitive reactance and presents a pure resistance of 70 ohms to the transmission line. Actually this neutralization is only perfect at one particular frequency but this construction results in good matching of antenna and transmission line impedances over the full width of the band covered by any selected radiator.

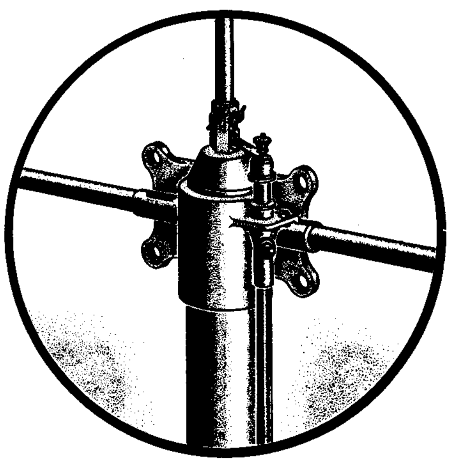
SUBMARINE ANTENNA

Intended for mounting on the king post of a submarine, this antenna has the same electrical characteristics as the destroyer type but employs two ground rods. The details of its construction are shown in the illustration. Three radiating rods are furnished with this antenna, only one of which is used with each frequency band as desired.

The means provided for connecting the transmission line to antenna are clearly shown, the antenna structure being mounted on the craft by bolting the plate with four holes to a plate welded on the post of the submarine.

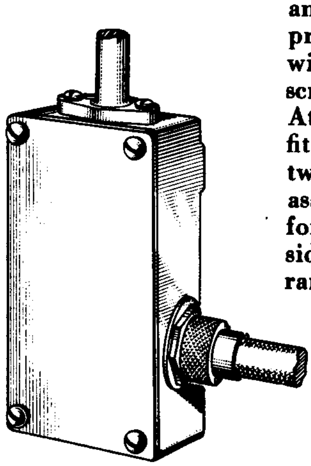
NOTE: This type antenna supplied with earlier models only. TBS, TBS-1, TBS-2.





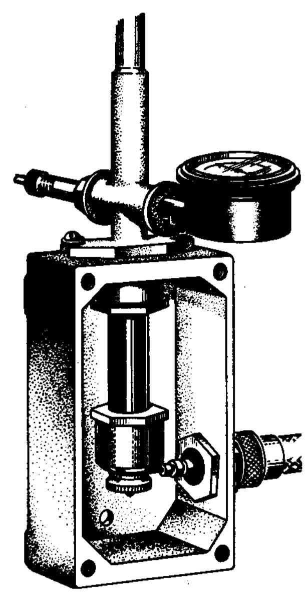
A shorter stub is used in the submarine antenna to enclose the grounded concentric section. A drainage plug at the bottom is used to drain out any moisture that may collect in this section of the antenna structure and interfere with proper operation.

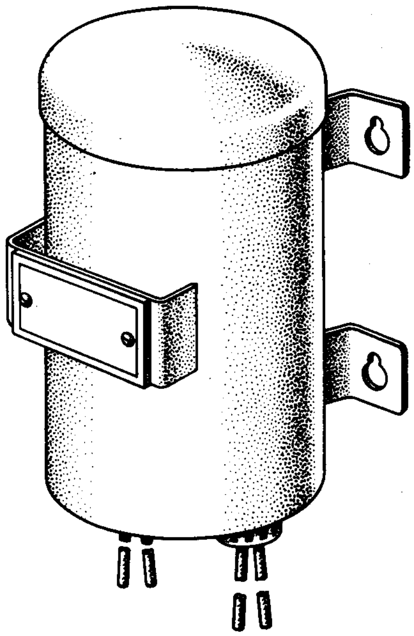
JUNCTION BOX



For the purpose of terminating the antenna transmission line and facilitating the connection of the antenna lead of the transmitter a junction box is provided. This consists of a rectangular metal box with a removable cover held in place with four screws as shown in the illustration.

At the top of the box is an opening into which is fitted the lower terminal of the transmission line, two screws being provided to attach the end seal assembly which carries the inlet valve and gauge for filling the transmission line with gas. At the side of the junction box another opening is arranged to admit the flexible antenna lead from the transmitter, the central conductor of which connects to the center lead on the transmission line within the box. A threaded sleeve on the box receives the threaded collar on the flexible lead which is thus clamped rigidly in place.

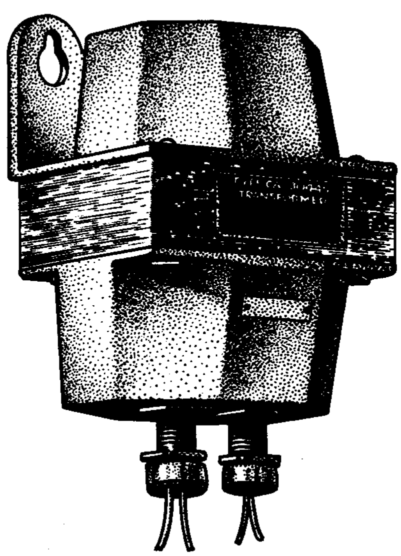




STEP DOWN TRANSFORMER FOR RECEIVER POWER SUPPLY

When the equipment must be used where no 110 volt a-c supply is available for receiver operation, a transformer was furnished with the TBS-7 to reduce the 230 volt a-c to 110 volts.

This took a form of a cylindrical can as shown in the illustration, provided with mounting straps for attachment to wall or bulkhead in any convenient location. The primary leads, at the left, are connected to the nearest source of 220-230 volt current. The secondary leads at the right are connected to terminals 18 and 19 on the terminal strip in the rear of the support stand.



LINE TRANSFORMER

NAVY TYPE CAT-30445

With TBS equipment intended to operate on 440 volt a-c circuits, a line transformer is furnished to provide the 220 volts necessary for the filament supply in the transmitter, and control voltage for the Magnetic Controller. The transformer is mounted adjacent to the magnetic controller and is connected thereto by means of the terminal leads provided for the purpose.

The transformer is wound for a two to one reduction in voltage, with no taps, the primary being connected to the 440 volt ship supply through the controller and the secondary connecting to the transmitter.

THEORY
OF OPERATION

TBS SERIES

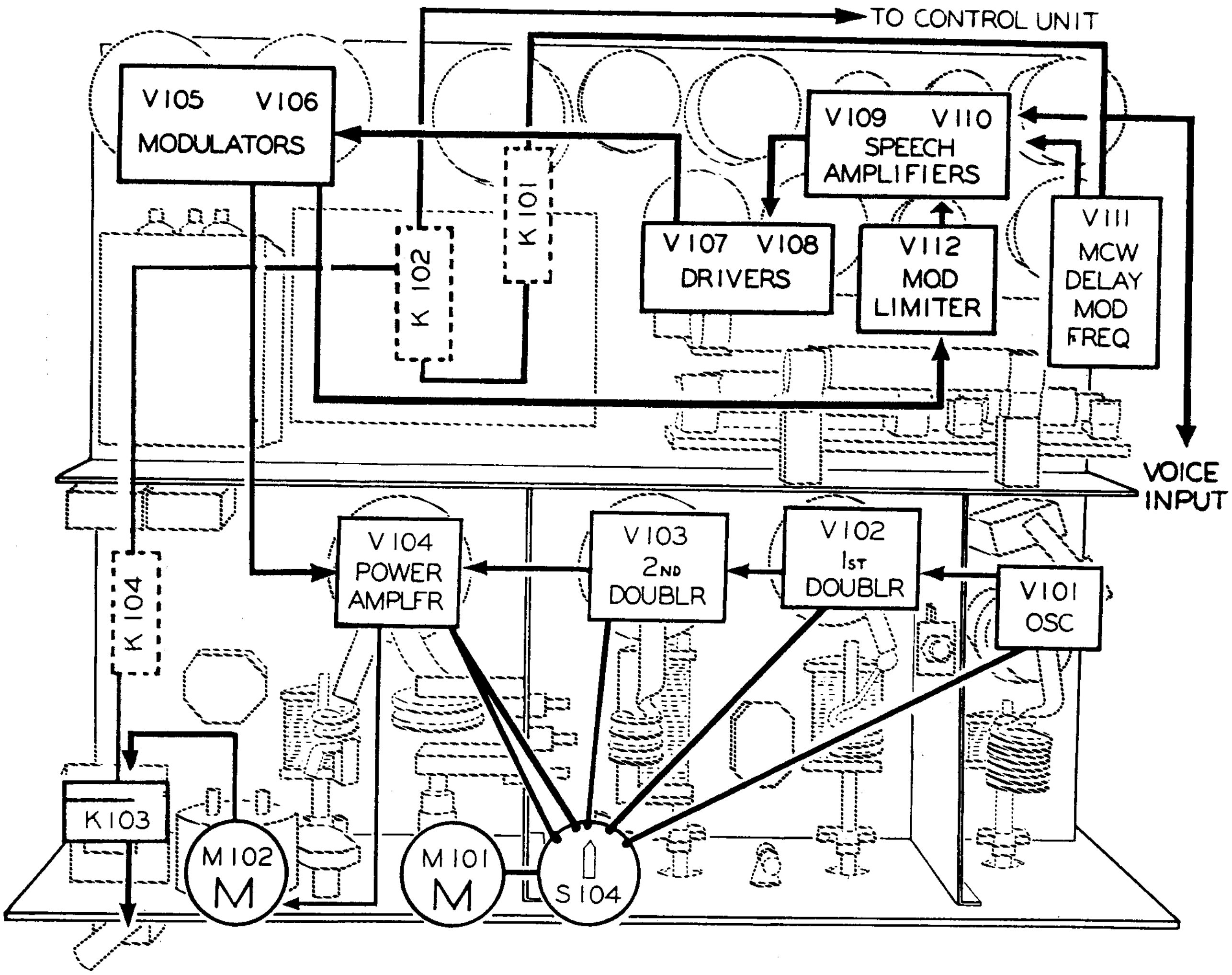
TABLE OF CONTENTS

THEORY OF OPERATION

SECTION 2

THEORY OF OPERATION

The circuits employed in the TBS Series of radio equipment present no novel features that require extensive treatment for the man familiar with basic principles of radio apparatus. But in the application of those circuits to equipment designed for use under severe conditions, on fixed frequencies and for operation from remote control points, several interesting and important circuits have been incorporated to control the functioning of the apparatus. This is true, particularly, of the transmitter where automatic means must be incorporated to permit switching from transmission to reception, and from phone to MCW communication with a minimum of manual operation.



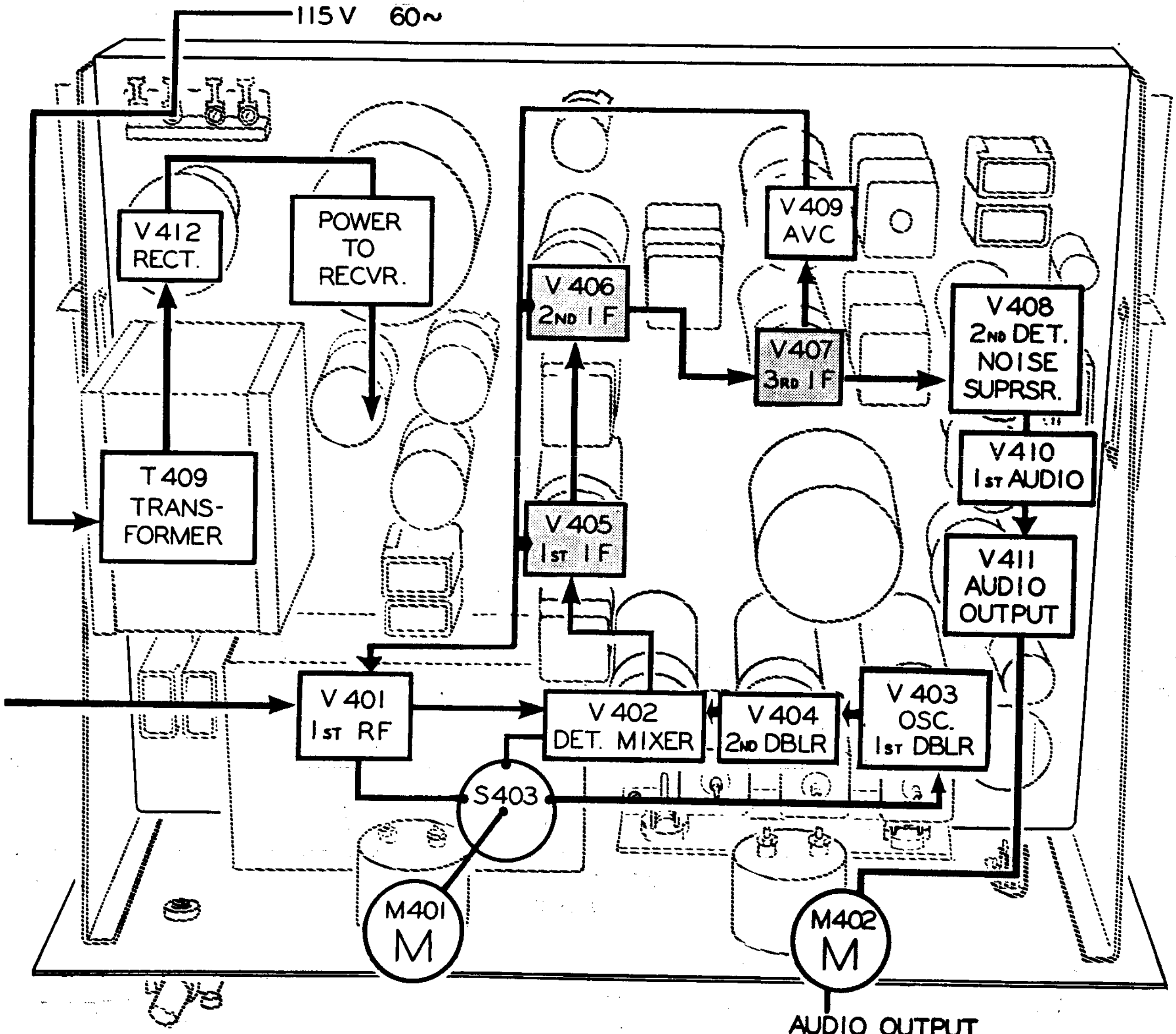
TRANSMITTER

As will be seen in the block diagram of the transmitter, the radio frequency components of the circuit are arranged on the front half of the base and consist of the orthodox crystal controlled oscillator, two doubler stages and the power amplifier stage.

The audio frequency stages to provide modulating voltage for voice and MCW transmission are shown on the rear half of the base and comprise the usual speech amplifier stage, a driver stage and the modulator stage, all push-pull to provide low distortion over a wide variation of input sound frequencies.

To prevent overmodulation and distortion, a Modulation Limiter is arranged to reduce the gain in the speech amplifier stage should the output of the modulator begin to exceed 75%.

A double triode tube VIII serves two purposes in this unit, one section acting as a source of 1000 cycle current to modulate the carrier when MCW transmission is employed, while the other section of the tube forms the delay element in the functioning of the MCW relay to hold the carrier on the air during key-up periods. Meters are shown in the diagram, one at M102 to indicate the output of transmitter, the other at M101 used to adjust the tuned circuits to resonance, being switched into the various circuits by means of switch S104.



RECEIVER

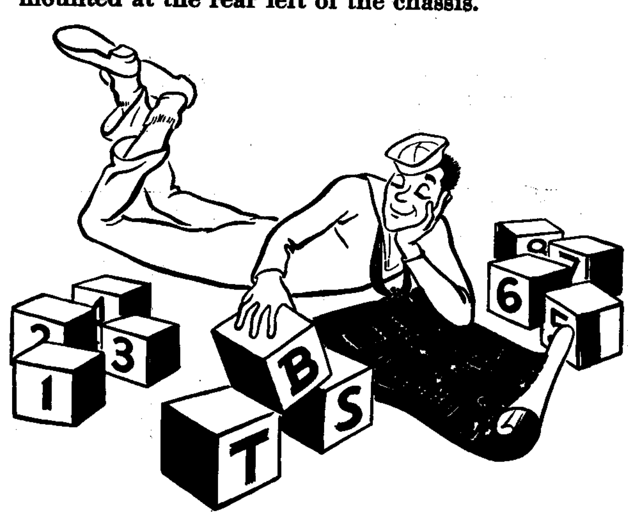
The receiver, the next major unit, is blocked into its component tube functions in the diagram below. Here we find the usual superheterodyne circuit with the local oscillator, crystal controlled to prevent frequency drift. With fixed-tuned receivers such as this, working in the 60 to 80 Mc range, the heterodyning frequency must be kept stable to obtain consistent reception over extended periods of time.

The three radio frequency circuits making up the receiver are located in the front and center of the receiver base. The r-f input at the left, the local oscillator tubes at the right, both feeding into the 1st detector or mixer tube to produce the intermediate frequency, for the i-f amplifier.

At the right is located the second detector and audio stages. The gain of the various amplifying stages and thus the output of the receiver is controlled by an AVC tube as shown.

Meters are provided in the receiver for indicating input at M401 and output at M402, the former being arranged to check operation of the local oscillator by proper switching.

The power supply for the receiver is entirely self contained in that it is only necessary to furnish 115 volt 60 cycle current to the terminals and both filament current and plate voltages are obtained from the transformer, rectifier and filter assembly mounted at the rear left of the chassis.



TBS CIRCUIT ANALYSIS

On the opposite page has been grouped the block diagrams of both transmitter and receiver with control units and power supply for the transmitter. From the consideration just given the two major units, this group diagram should not be difficult to understand.

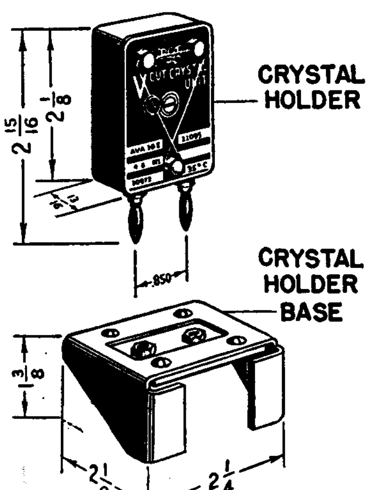
By means of the control circuits connecting control units, magnetic controller, radio transmitter and receiver, the operation of the entire equipment is possible from either control unit, though mounted at some distance from the other apparatus. During operation periods the receiver is left switched on and in condition for reception, the loudspeaker being used for the receiver output at such time. During actual communication periods, reception is usually by means of the earpiece in the handsets or by loudspeaker when the chest set is used for voice transmission. Switching from reception to transmission being by means of the press-to-talk button located on the handle of the headset.

Control of the motor generator to furnish current for operation of the transmitter is available at either control unit, a Start and Stop button for the purpose being provided on the panel of these units. When the motor generator is started from either control point, current is furnished only to the filaments of the tubes in the transmitter. Thus the apparatus is ready for instant use but plate potential is only applied to all the tubes while the press-to-talk buttons are depressed or during MCW transmission. In both cases the antenna is switched to the transmitter and the receiver antenna connection grounded during transmission.

To take care of switching necessary to transfer from transmitting to receiving and from phone to MCW, four relays are installed in the transmitter chassis. The antenna transfer and high voltage plate current relay at K103 on the rear of the panel of the transmitter. The low voltage plate current to the tubes is controlled by relay K104 mounted under the chassis. The keying relay K102 and the MCW relay K101 are likewise mounted on the underside of the chassis as indicated by the dotted lines.

CRYSTAL REFERENCE DATA

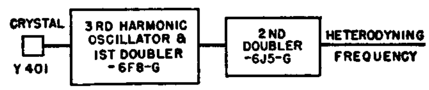
Ceramic Holder Used with TBS to TBS-7 Inclusive



V Cut Quartz
Frequency Range of Oscillator Circuit
60 to 80 Megacycles

TRANSMITTER OUTPUT FREQUENCY

RECEIVER HETERODYNING FREQUENCY



Temperature Coefficient of Crystal 2/megacycle/° C. from 0 to 50° C.
Frequency Deviation not to exceed ±0.02% over Temperature Range 0° to 80° C.
Crystals—Pressure assembled—spring and screw.

TYPICAL CRYSTAL COMPLEMENT

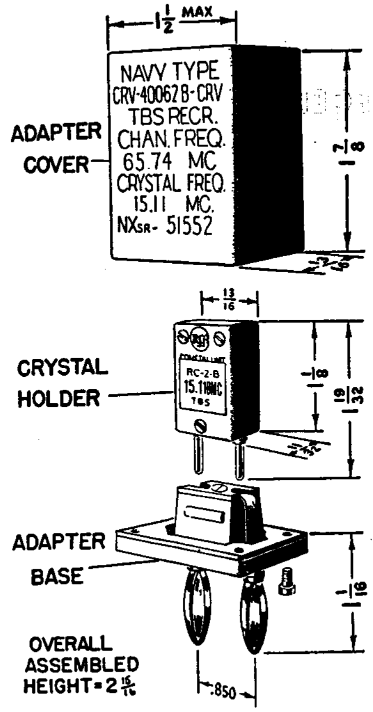
TRANSMITTER

Crystal Frequency		Channel Frequency
16.335	Megacycles	65.34
16.435	Megacycles	65.74
18.025	Megacycles	72.1
18.125	Megacycles	72.5

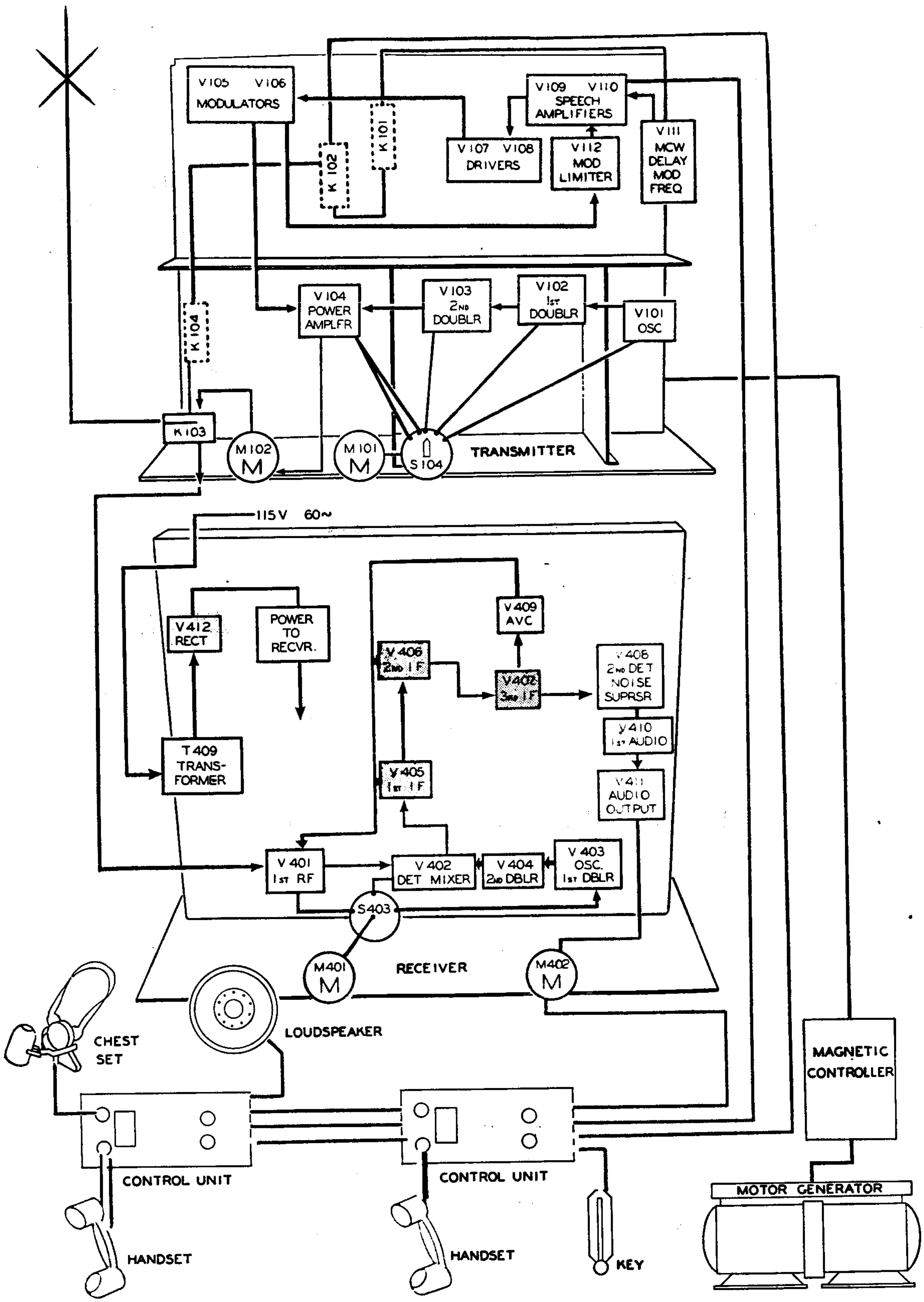
RECEIVER

Crystal Frequency		Channel Frequency
15.01	Megacycles	65.34
15.11	Megacycles	65.74
16.7	Megacycles	72.1
16.8	Megacycles	72.5

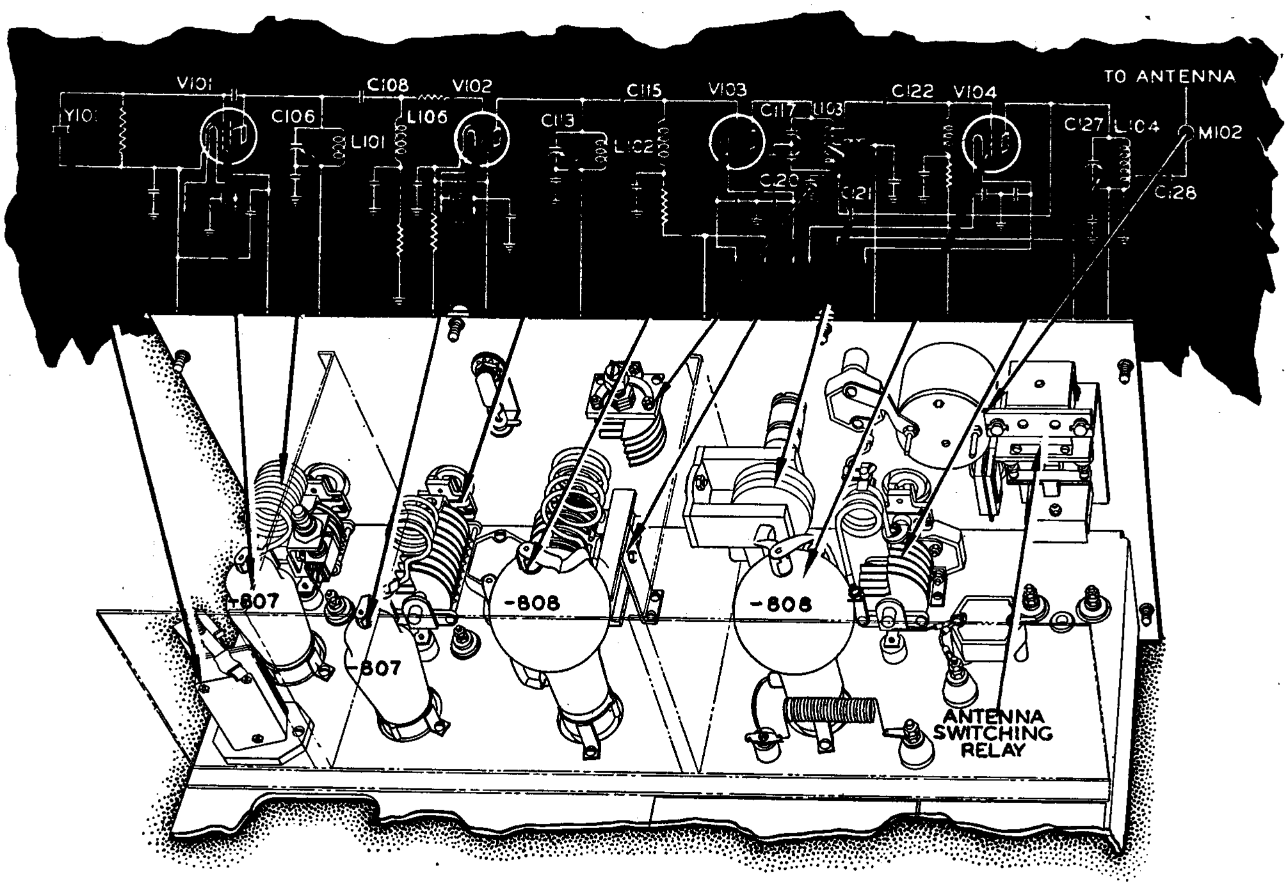
Miniature type Crystal Holder in Adapter Used with TBS-8



BLOCK DIAGRAM OF COMPLETE TBS EQUIPMENT



CIRCUIT ANALYSIS OF TRANSMITTER



RADIO FREQUENCY CIRCUIT

The arrangement of the radio frequency apparatus within the cabinet is shown in the figure with a partial schematic diagram attached to show the relationship between the various parts. Only the more important elements of the radio frequency apparatus are shown above the chassis, the smaller components such as fixed capacitors, resistors, switch connections and two of the meters being below the chassis level. A partial block diagram shows functional relationship of the circuit elements while a full schematic circuit of the transmitter is given on page 22.

The relative position of the various components and their position in the schematic is clearly shown by the arrows. The crystal, held in its socket by a spring mount next to the -807 (V101) tube and its associated tank circuit consisting of C106 and L101 comprise the first oscillator circuit.

This circuit operates at the frequency marked "Crystal frequency" on the crystal holder, which is three times the fundamental frequency of the quartz crystal. This is not a tripling action similar to the doubling action employed later but the crystal is actually ground so its fundamental frequency is one third of the frequency desired in the plate circuit of the first oscillator. The plate-tank circuit of the oscillator is then tuned to three times the fundamental frequency of the crystal which then actually works on the third harmonic of its fundamental frequency. Most quartz crystals when carefully ground will operate in this manner on successive odd harmonics of their fundamental frequency but with decreasing activity as the harmonic is raised.

The first oscillator tank circuit, C106 and L101, is tuned to crystal operating frequency and coupled to the grid of the first doubler through capacitor C108. A choke coil L106 connected to the grid of the first doubler prevents drain of the r-f energy to ground through the resistor furnishing grid bias to the tube.

Proper biasing assures sufficient harmonic distortion in the output of the first doubler so that its plate-tank circuit, C113 and L102 can be resonated at twice the frequency fed into the tube, to obtain a doubling action. The r-f output of the first doubler is coupled to the second doubler V103 through capacitor C115. An -808 tube is used in this stage with the choke isolated grid being returned to a center tap on the filament winding of the transformer to prevent hum, since this is a filament type triode.

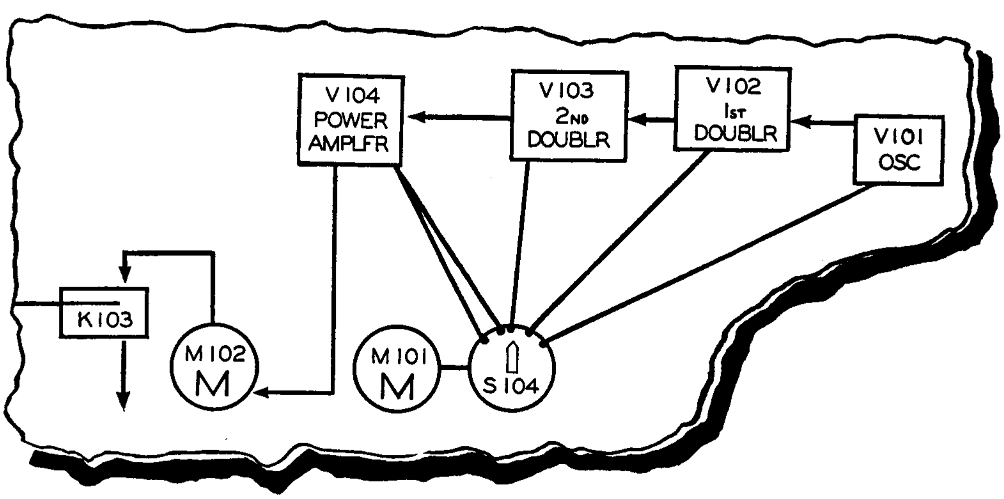
The plate-tank circuit of the second doubler comprising C117, L103 and C120 has its plate voltage fed into the center of the plate inductance through a choke L108 and employs a split variable capacitor at C117. The plate circuit is tuned to twice the frequency of the output of the first doubler so the r-f output of this tube has a frequency four times the operating frequency of the crystal, giving the desired carrier frequency.

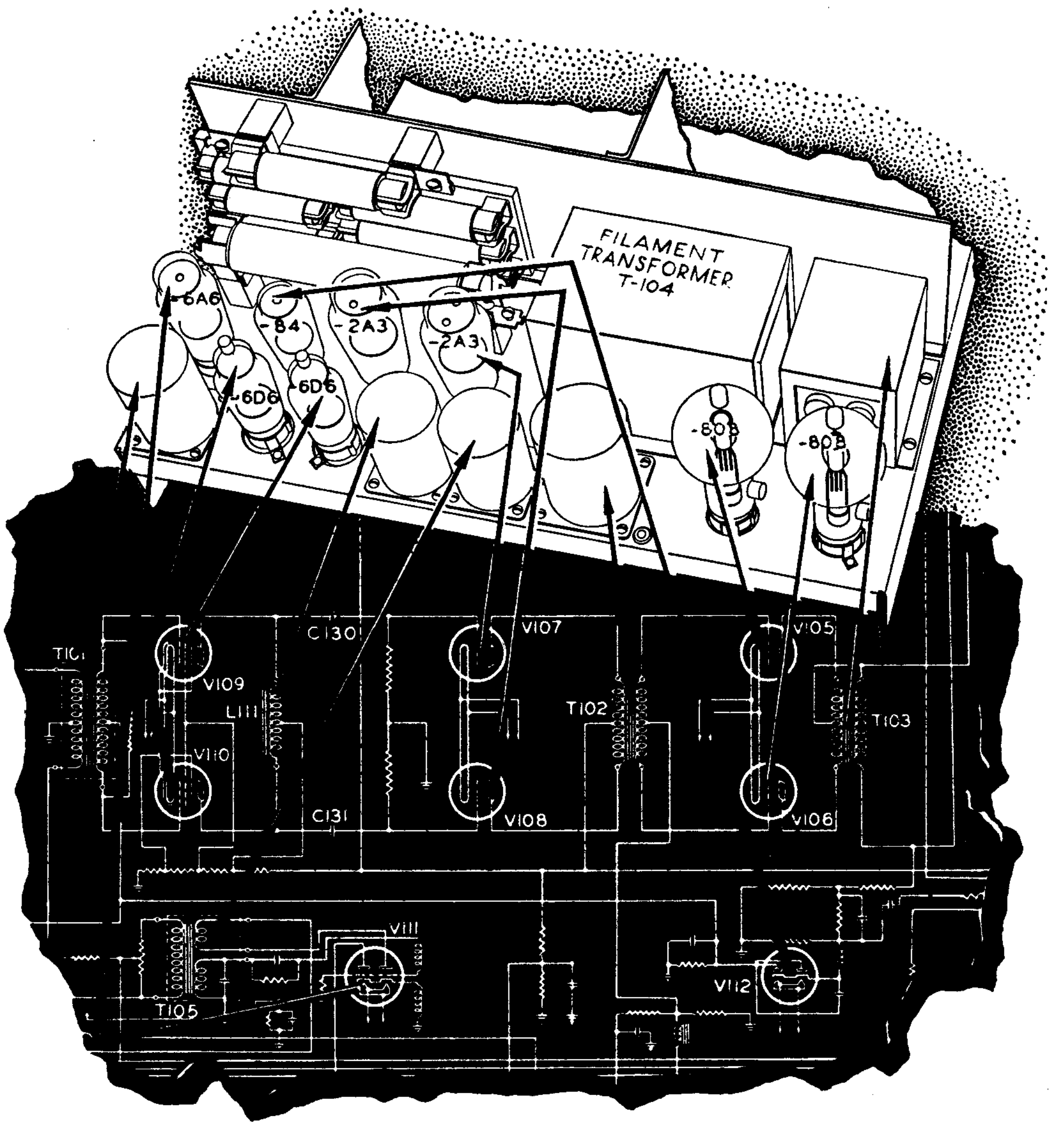
The output of the second doubler is now coupled into the type -808 tube V104 acting as a power amplifier, through the capacitor C122. Here again the grid return is to the center tapped filament winding but an overload relay K105 as shown in the schematic diagram on page 22 has its coil connected into this circuit so an overload on the tube will trip the relay. When the current in this circuit reaches 160 milliamperes the overload relay latches up and opens the circuit to the magnetic controller relay and stops the motor generator supplying current to the transmitter. Having been stopped by the action of the relay it is impossible to restart the motor generator until the Reset button on the panel for this relay is pushed in to reset the relay armature.

A neutralizing capacitor C121 connects the plate of the power amplifier V104 to the lower end of plate inductance L103 of the second doubler V103 and serves to neutralize the capacity feedback between plate and grid of the power amplifier tube V104 that would tend to put this tube into oscillation independent of the crystal controlled frequency developed through the doublers.

The plate-tank circuit C127 and L104 of the power amplifier is tuned to resonance with the frequency developed by the second doubler and its output fed to the transmission line from a tap on the plate-tank coil through a capacitor C128 and the Line Current Meter M102 and one terminal of the antenna switching relay.

The Antenna Transfer Relay K103 not only serves to transfer the antenna from the receiver to the transmitter during periods of transmission but also closes the plate circuits to the last tubes in 2nd Doubler, Power Amplifier and Modulator stages of the transmitter. During periods of reception with the motor generator running, only the filament circuits of the transmitter tubes are energized, voltage being applied to the plate circuits through the medium of relays when the press-to-talk buttons are depressed or the key operated.





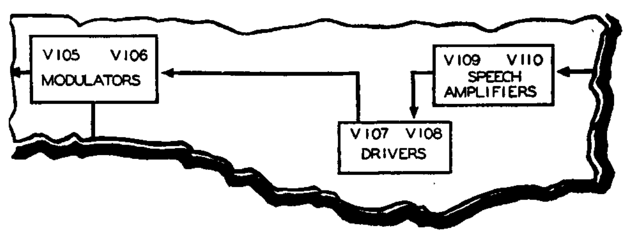
AUDIO FREQUENCY CIRCUITS

The audio frequency circuit components and control tubes are mounted on the rear half of the chassis. The layout of the more important elements and their position in the schematic circuit are shown in the illustration where arrows associate respective parts of the circuit.

The speech amplifying system for modulating the radio frequency output of the transmitter consists of three stages of push-pull amplification. The audio signals are fed into primary of the speech input transformer T101 which has an input impedance of 600 ohms to match the secondary windings of the microphone transformers in the control units. The secondary of the transformer connects to grids of the two -6D6 tubes V109 and V110 which form the push-pull speech amplifier stage. The center tap of the transformer is connected to the variable bias output of the modulation limiter to be discussed later. Voltages for plate, screen and fixed cathode bias are obtained from the voltage divider connected across the low voltage plate supply (300 volts).

The speech amplifier stage is impedance coupled by L111 through capacitors C130 and C131 to the driver stage which employs two type -2A3 tubes V107 and V108 operating in push-pull. Grid bias for this stage is obtained from the resistor connected to the center tap of the tube filaments.

The output of the driver stage is coupled to the modulator tubes through the transformer T102. Two type -808 tubes V105 and V106 are used in the modulator stage, the output of which is coupled through the modulation transformer T103 to the plate circuit of the r-f power amplifier to produce a high level of plate modulation. Plate voltage for this stage is obtained from the 875 volt output of the motor generator.



MODULATION LIMITER

To prevent over modulation with its resultant distortion a type -84 tube V112 is connected as a half wave rectifier and employed as a modulation limiter. The illustration shows a simplified form of this circuit along with a sectional schematic. The voltage developed across the modulation transformer T103 is fed through a capacitor-resistor network formed by R121, R122, R123, R124 and C137 to the cathodes of the -84 tube. The plates of the tube are tied together and connected to a capacitor-resistor filter consisting of R120 and C134B. A r-f choke L112 and bypass capacitor C143 are intended to filter any r-f currents out of the circuit.

The values of the resistors in the input network to the tube are so chosen that the d-c bias applied to the electrodes of the V112 tube is such as to prevent rectification till modulation has reached 75 per cent of maximum. Up to this point the gain of the speech amplifier stage will be linear.

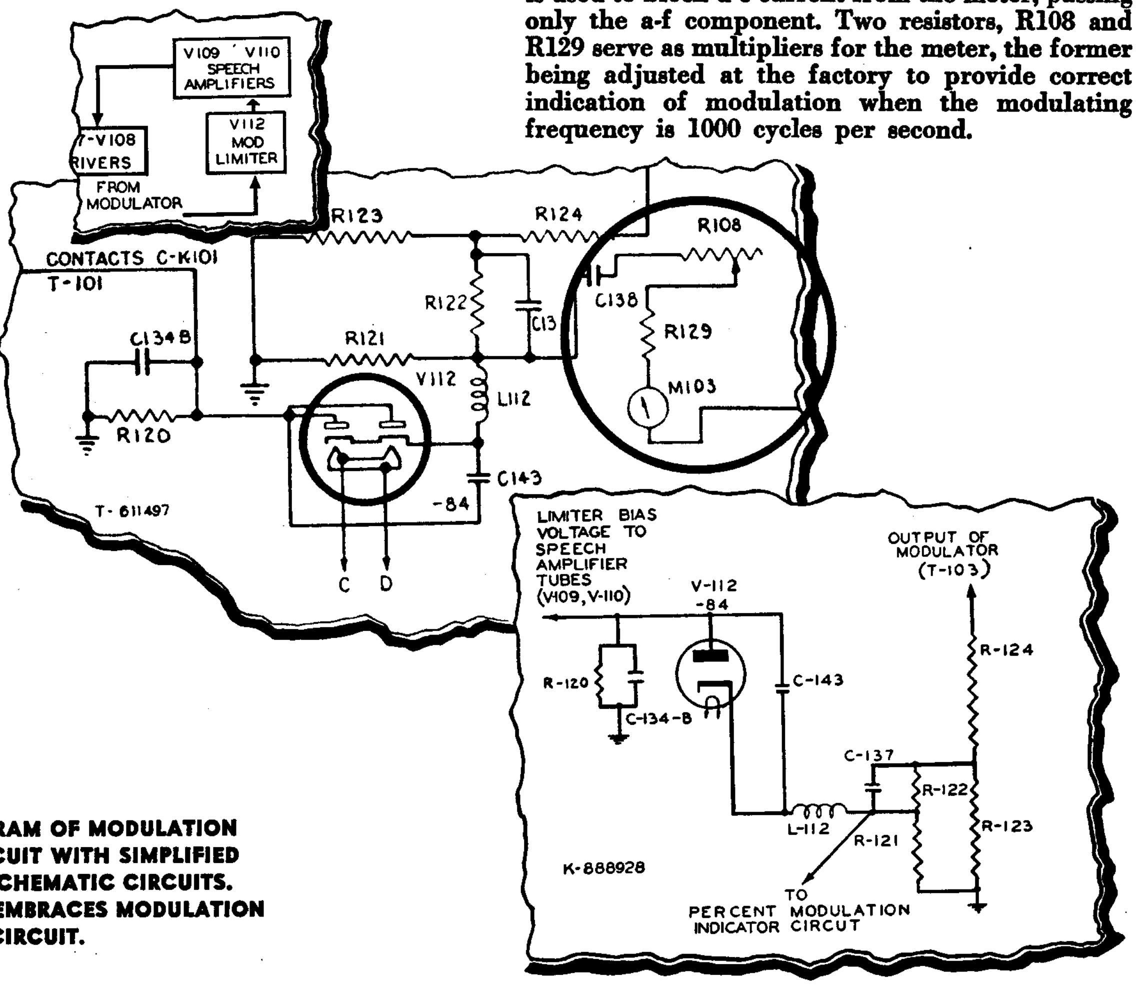
Above 75 per cent modulation, rectification of the audio currents applied to V112 begins to take place in the modulation limiter tube and a d-c voltage appears across the capacitor-resistor circuit connected to the plates of the tube. The voltage thus generated is applied as additional bias to the speech amplifier tubes and reduces the amplification factor in this stage, thus providing a limiting action to the modulation voltage generated across the modulation transformer. A 10 decibel increase in the input sound level above that required to produce 75 per cent modulation will result in only 95 per cent modulation. Consequently, wide variations in the input level may be tolerated without over modulation while full gain is retained at the lower input levels.

The action in holding down the modulation level is practically instantaneous when a high level signal appears at the input. When the signal ceases, the gain of the audio system increases relatively slow (90 per cent recovery in 3 seconds) because of the slow discharge rate of resistor-capacitor combination R120 and C134B. This action prevents rapid variations in the gain between syllables of words and the resultant distortion.

MODULATION INDICATOR

A PER CENT MODULATION meter M103 is provided on the panel of the transmitter, the connections to this meter being ringed in black in the illustration. The dial of the meter is calibrated to indicate approximate percentage of modulation and consists of a voltmeter movement with a rectifier, its readings being proportional to the a-f voltage across the output of the modulation transformer.

As will be seen from the diagram, a capacitor C138 is used to block d-c current from the meter, passing only the a-f component. Two resistors, R108 and R129 serve as multipliers for the meter, the former being adjusted at the factory to provide correct indication of modulation when the modulating frequency is 1000 cycles per second.



BLOCK DIAGRAM OF MODULATION LIMITER CIRCUIT WITH SIMPLIFIED AND FINAL SCHEMATIC CIRCUITS. THE CIRCLE EMBRACES MODULATION INDICATOR CIRCUIT.

MODULATED CONTINUOUS WAVE AND RELAY CIRCUITS

For communication by means of telegraphically keyed signals, a source of audio frequency current must be provided to modulate the carrier and, with remote control as in the case of the TBS equipment, means for switching the audio oscillator on and off. Both ends have been achieved by employing a type -6A6 twin triode tube V111 as both audio oscillator and delay control in the functioning of the MCW switching relay K101.

As will be seen in the attached diagrams, where the two sections of the tube are shown separately, one triode section shown at A acts as an audio frequency oscillator to generate a 1000 cycle note. The two primary windings in the transformer T105 couple the plate and grid circuits to obtain the oscillations in the circuit, a capacitor-resistor combination C133 and R118 acting to maintain a suitable grid bias. Two r-f choke coils L113 and L114 in the grid and cathode circuits of the tube are intended to choke off any r-f oscillations.

The secondary of the transformer T105 is shunted by a potentiometer R117 to adjust its output through R116 to the input of the speech amplifier.

Consider now the functioning of the other triode section in the tube V111 shown in simplified form at B. The plate of this section is connected to the coil in the relay K101 and then to a source of d-c current.

The grid of the tube is connected to a grounded capacitor-resistor combination R119 and C134A through the resistor R137 and contacts A of keying relay K102. Under normal conditions, sufficient plate current flows in the circuit of the tube section to cause the magnetic coil in relay K101 to draw up its armature and hold open the three sets of contacts on the relay. This is the normal position of this relay during standby or phone transmission periods. The open contacts at A on the relay K101 open the plate supply to the audio frequency oscillator section of the tube. Contacts B connect to relay K104 controlling the low voltage plate current to the tubes in the transmitter and antenna transfer relay K103. The open contacts at C are connected across the modulation limiter bias output so the latter may continue to function.

Let us see now what does happen when MCW communication is desired. The Keying Relay K102 has two sets of contacts. Normally the A contacts are open, the B pair closed as shown in lower schematic. Pressure on the key at a control unit energizes the keying relay which opens contacts B, and removes the short on the audio output of the audio oscillator transformer T105. Contacts A closing, places a high negative potential on the grid of the delay section of tube V111, blocking the

BLOCK DIAGRAM AND SCHEMATICS OF MCW AND RELAY CIRCUITS.

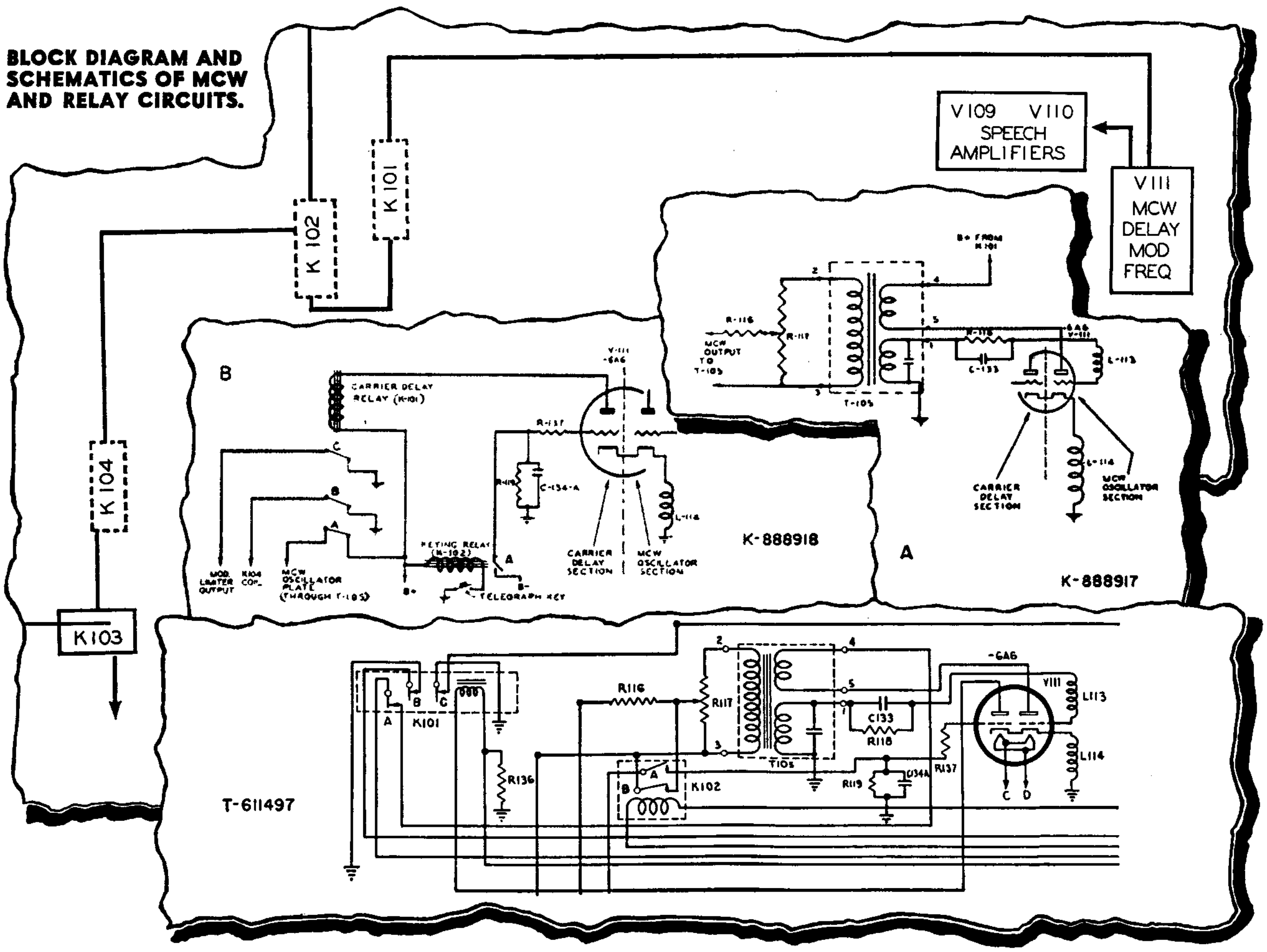
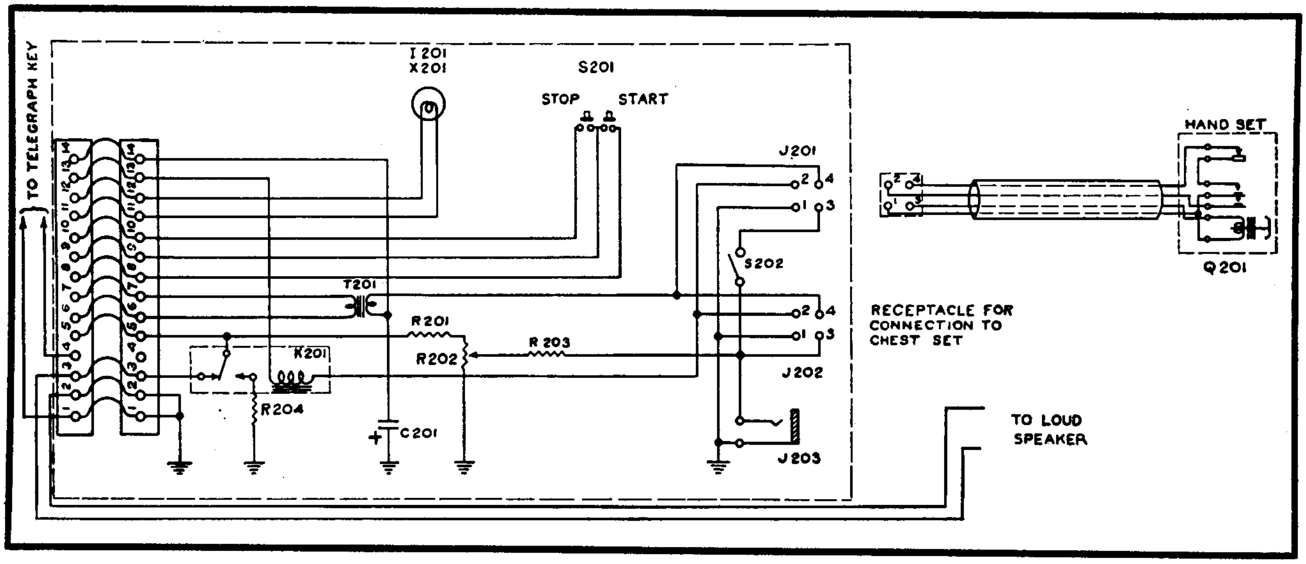


plate current flow. The decrease of plate current in this section of the tube causes the armature of MCW relay K101 to drop out and close all three sets of contacts. Contacts A of K101 close the plate circuit to the oscillator section of the tube and the audio frequency note is fed into the primary of the input transformer of the speech amplifier. Contacts B on closing, energize the low voltage plate current relay K104 and in turn energize the antenna transfer relay which transfers the antenna from the receiver to the transmitter and closes the high voltage plate supply to tubes in the transmitter. Contacts C on K101 on closing ground out the control bias of the modulation limiter and full modulation is obtained. Thus a modulated carrier is put on the air and a 1000 cycle modulated note is heard at a distant receiver as long as the key is depressed.

On raising the key to form the dots and dashes of the telegraph code the keying relay K102 opens, contacts B close, cutting off the modulating current to the audio amplifier but when contacts A open the negative charge on the grid of the tube is retained by capacitor C134A holding the grid of the delay section of the tube negative so plate current is not restored in this circuit at once and the contacts on the MCW relay K101 remain closed and the carrier remains on the air during the key up periods. The values of C134B and R119 are so chosen that it requires between 0.7 and 1.2 seconds for the negative charge in the capacitor to leak off through the resistor and when the key is held up for about one second the plate current will be restored in the delay section of tube V111 and relay K101 will be energized and the contacts all opened. This action stops the audio oscillator, removes the short from the modulation limiter and de-energizes relay K104; K103 in turn removes the carrier from the air and switches the antenna back to the receiver for reception.



PHONE TRANSMISSION CIRCUITS

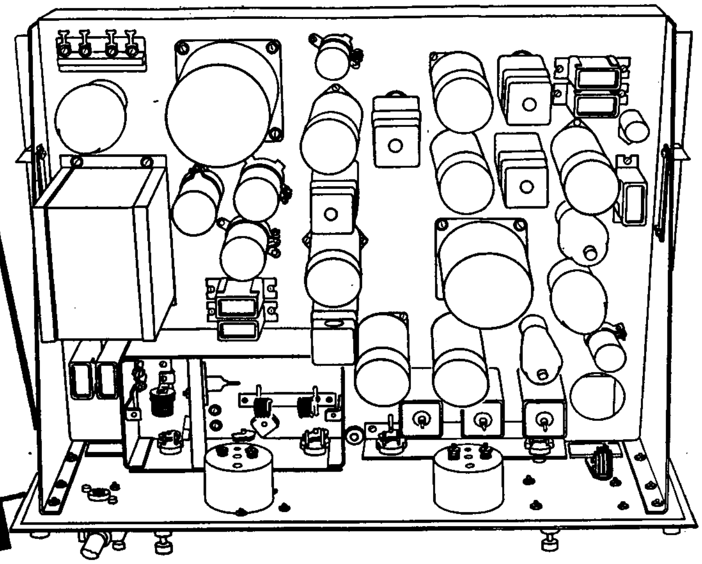
The sequence of relay operation is slightly different when the equipment is being employed for phone transmission. Complete control of the transmitter being possible from either control unit, the motor generator furnishing current to the transmitter may be started from either point by means of the Start and Stop buttons on the control unit panel. With the motor generator running the tube filaments in the transmitter will heat up.

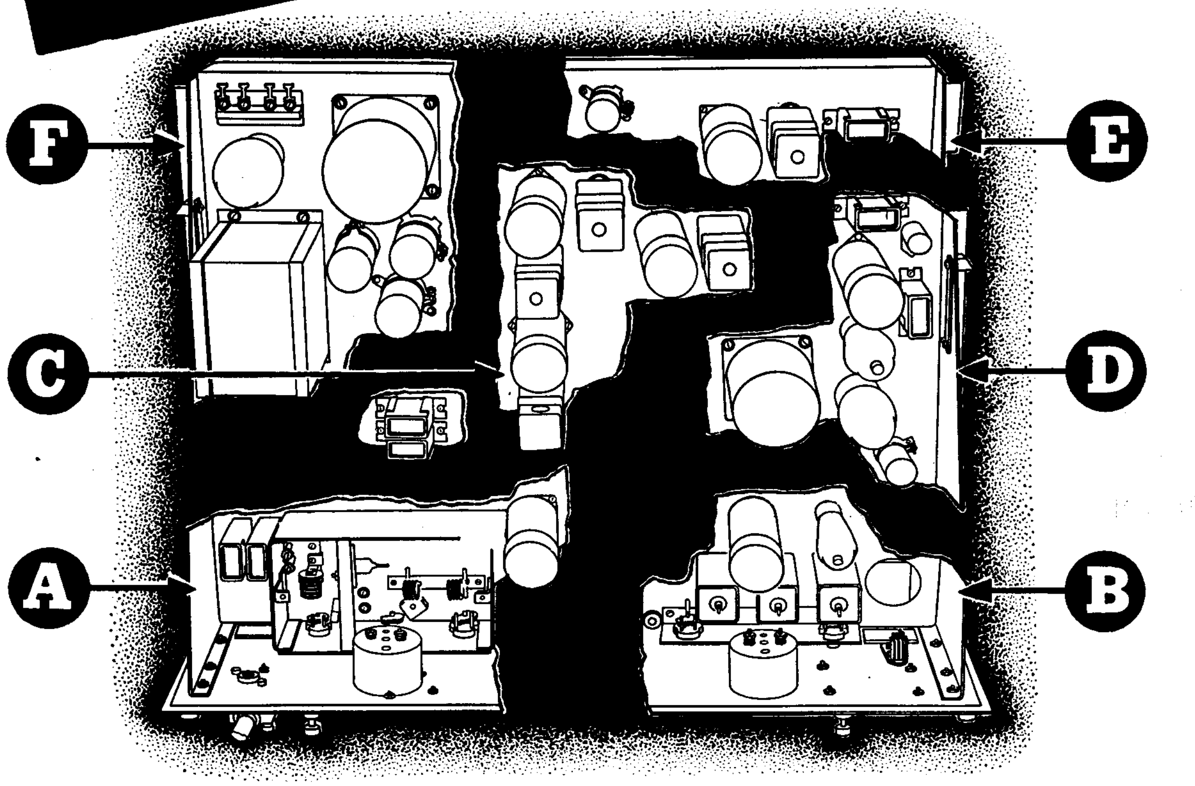
When it is desired to communicate by voice it is only necessary to depress the button on the handle of the handset or on the microphone of the chest set. This action closes a circuit through a relay K201 mounted in the control unit involved which cuts off the loudspeaker if connected to that unit and connects R204 across the line to maintain constant overall output impedance of system as shown in the complete schematic circuit on this page. The relay coil in the control unit is connected in series with the low voltage plate relay K104 in the transmitter which, on closing, applies low voltage plate current to the tubes and energizes the antenna transfer relay K103. The latter switches high voltage plate current on to the tubes and connects the transmitter to the antenna transmission line. The result is the emission of the carrier wave which may then be modulated by speaking into the microphone, either on the handset or chest set. Releasing the button permits the relays to drop out, opening plate supply to the transmitter tubes and restoring the antenna to the receiver.

The control units are fitted with a microphone transformer T201 as shown in the schematic to match the 35 ohm single button microphone to the 600 ohm input of the transformer T101 in the speech amplifier of the transmitter.

The necessary direct current for the microphone is obtained from the resistor network R127 and R218 connected across the 300 volt supply to the transmitter tube plate circuits in the transmitter chassis as shown in schematic on page 22. An impedance L110 serves as part of the filter, the remainder being formed by the capacitor C201 in the control unit.

CIRCUIT ANALYSIS OF THE RECEIVER





The circuit employed in the receiver is of the superheterodyne type and can be broken up according to function for study without difficulty. As shown herewith the circuit elements are arranged in groupings that can be considered individually, as they have been so grouped on the chassis.

For our purpose it will be found we can split the chassis into six parts with the circuit elements grouping in this manner.

A Radio Frequency tuning circuits.

B Local oscillator circuits.

C Intermediate-frequency amplifier circuits.

D Second detector and audio amplifier circuits.

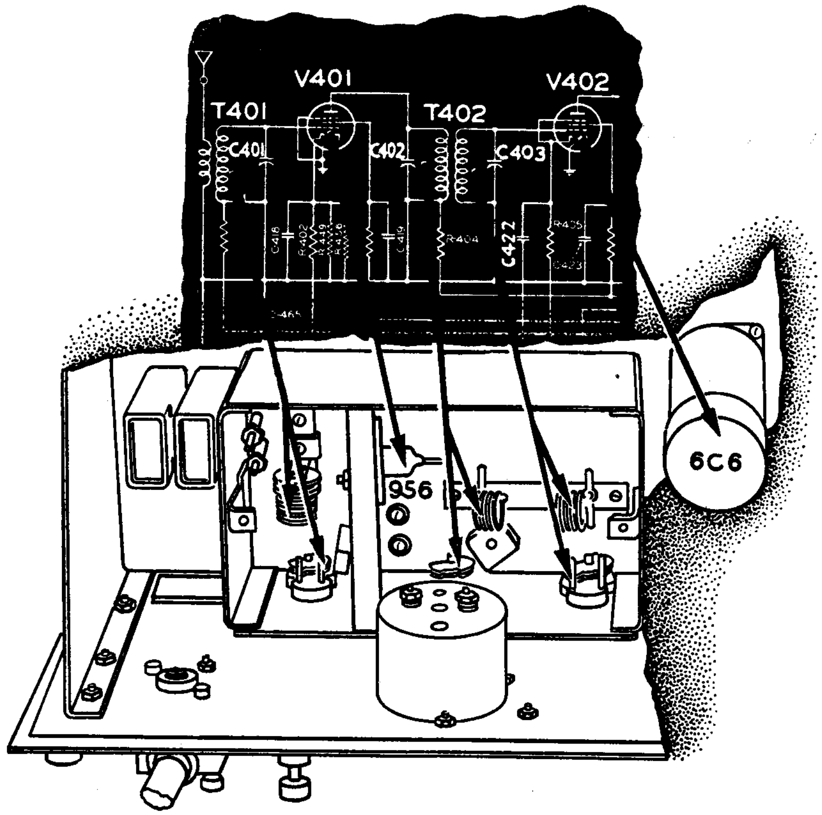
E Automatic volume control.

F Receiver power supply circuit.

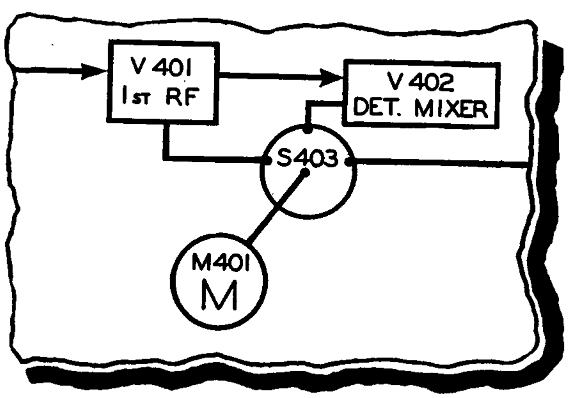
A THE RADIO FREQUENCY TUNING CIRCUITS

Excellent selectivity at the signal frequency is obtained in the receiver by the use of three highly efficient tuned circuits preceding the first detector. As shown in the illustration, which links schematic to the radio frequency portion of the chassis by arrows, the antenna is inductively coupled to the first tuned circuit in the grid circuit of the -956 tube V401 acting as a r-f amplifier. The degree of coupling used results in the maximum transfer of energy to the tube input.

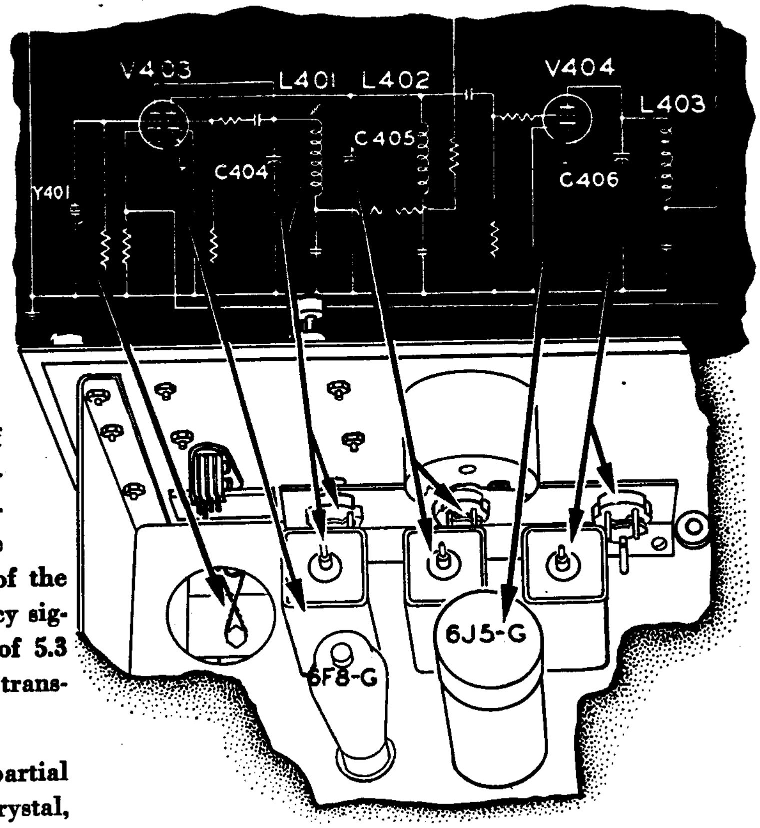
The tube, mounted on the shield between the two compartments in the r-f compartment, has its plate circuit tuned to resonance with the input of the tube to obtain maximum gain, give high signal-to-noise ratio and eliminate spurious frequency combinations in the first detector tube.



The output of the first r-f tube V401 is coupled into the first detector tube V402 by means of a coupling transformer or link circuit T402. Both primary and secondary of this coupling arrangement are separately tuned by capacitors C402 and C403 and the coupling between the windings is adjusted to obtain an optimum balance between r-f gain and selectivity over the complete tuning range.



The type -6C6 tube used as first detector or mixer V402 is operated as a power detector since this type detector is inherently free from blocking and cross modulation tendencies and produces a minimum of distortion when overloaded. The resonant circuit tuned by capacitor C403 feeds the signal frequency direct to the grid of the tube. The heterodyning frequency, which is mixed with the signal frequency to produce the intermediate frequency, is fed into cathode circuit of the detector tube through the capacitor C422 from the output of the local oscillator to be described next. This method of coupling results in a minimum of reaction between the tuned circuits.



B LOCAL OSCILLATOR CIRCUITS

For the purpose of considering the action of the local oscillator providing the heterodyning currents, that portion of the chassis assembly is shown as viewed from the rear. The principle employed here to obtain current of the correct frequency to mix with radio frequency signals to provide the intermediate frequency of 5.3 megacycles is similar to that used in the transmitter to provide carrier wave frequencies.

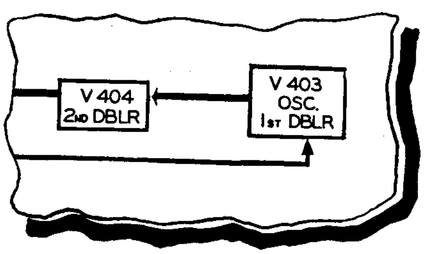
The illustration gives the tie-up between a partial schematic and the actual apparatus. The crystal, actually mounted below the chassis, can be seen through the opening at the left.

Operating the receiver on fixed tuning requires that the local oscillator, generating the heterodyning frequency must have a minimum of frequency drift over long periods of operation. To assure frequency stability, the oscillator is crystal controlled as in the case of the transmitter. A type -6F8G tube V403 is used as both oscillator and first doubler.

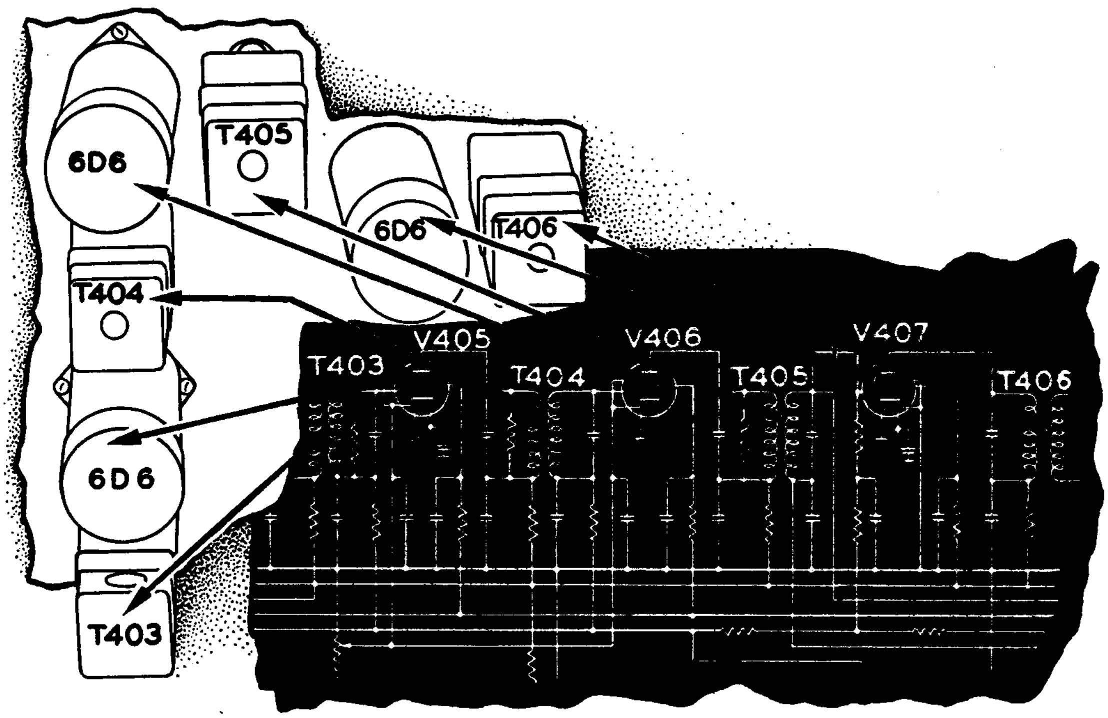
The operating frequency FC of the crystal Y402 in the grid circuit of the oscillator is one fourth of the difference between the signal frequency Fs and 5.3 mc.

$$F_c\ (MC)\ \frac{F_s\ (MC) - 5.3}{4}$$

The plate circuit of the first section of V403 is tuned to the crystal frequency, marked on the crystal holder, by L401 and C404. The r-f voltage of this circuit is coupled to the grid of the second section of the tube V403 through capacitor C443. The plate of the second section of the tube is tuned to twice the crystal frequency by L402 and C405. The output of this tuned circuit is coupled to the grid of the second doubler, a type -6J5-G tube V404 through capacitor C458. Resistor R448 prevents spurious oscillations in V404. The plate circuit of the second doubler is tuned to twice its grid input frequency or four times the crystal frequency, thus giving the desired heterodyning frequency. The output of the second doubler is coupled into the cathode of the first detector or mixer tube by means of C442.



In the earlier models of the TBS equipments, difficulty was experienced at times in the reception of frequencies between 65 and 69 megacycles. This was due to an absorption circuit being formed by capacitors C444, C445 and their connecting leads. The inclusion of the resistor R457, indicated by the arrow, in the circuit effectively eliminated this trouble in all subsequent models.



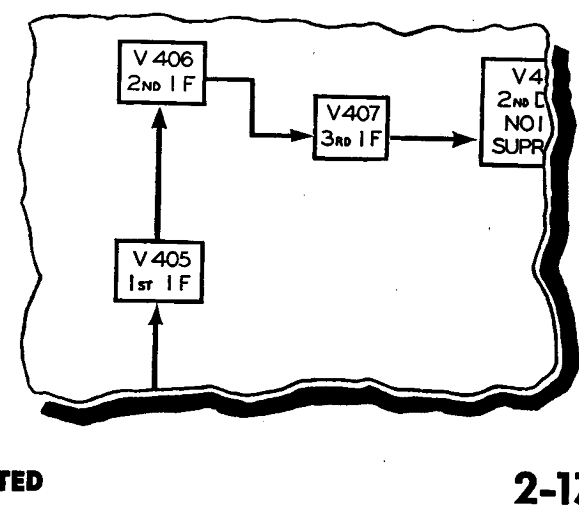
C INTERMEDIATE FREQUENCY AMPLIFIER CIRCUITS

The i-f or Intermediate frequency amplifier occupies the center section of the chassis and consists of three stages of fixed tuned amplification. As shown in the illustration, where a section of the schematic diagrams accompanies it, it consists of three -6D6 tubes, V405, V406 and V407 coupled by fixed i-f transformers.

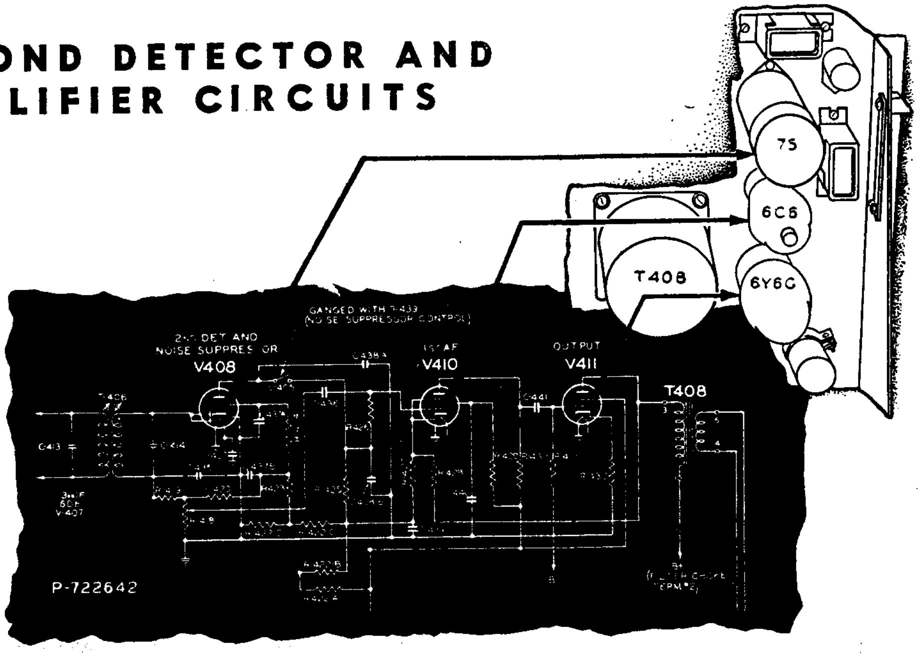
The signal and heterodyning frequencies are mixed in the first detector tube. The fixed tuned transformer T403 selects the difference component of the two frequencies in the plate circuit of the mixer tube and couples it to the grid of first stage of the intermediate frequency amplifier.

The amplifier comprises three stages of fixed tuned amplification consisting of the four coupling transformers, T403, to T406 in conjunction with three type -6D6 tubes, V405, V406, V407. Each transformer consists of two tuned circuits with coupling greater than critical to produce a selectivity curve with a broad top. In the first three intermediate frequency transformers, a resistor is connected across one of the windings to reduce the double peaking effect produced by the close coupling of the primary and secondary coils.

The transformers are tuned by fixed capacitors and adjustable magnetite cores. Sufficient selectivity is obtained to eliminate undesirable frequency components appearing in the plate circuit of the first detector and maintain a high degree of adjacent channel selectivity. All voltage leads to the amplifier stages are adequately filtered by resistance-capacitance combinations to insure stability and freedom from oscillation.



D SECOND DETECTOR AND AMPLIFIER CIRCUITS



The output of the i-f amplifier is coupled into the second detector tube V407, a -75 tube which functions both as a detector and noise suppressor. The -75 is of the diode-triode type, the former section being used as the detector since this type suffers little from overloading and has low distortion characteristics. The schematic accompanying the chassis section in the illustration shows this connection on the tube. The volume control R418 and R419 provides the diode load resistance. The audio output from the diode is capacitively coupled from the arm of R418 to the grid of the first a-f amplifier, through capacitor C436.

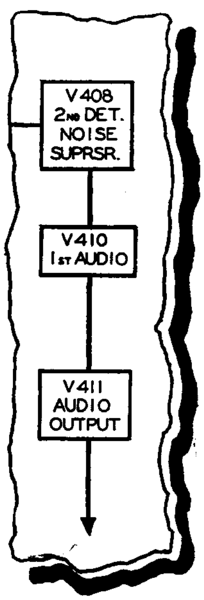
A portion of the negative d-c voltage developed by the diode second detector is impressed on the grid of the triode section of the Type -75 tube to control the noise-suppressor circuit. The signal input level at which the noise suppressor beings to function is adjustable by means of a variable resistor R439 connected in the cathode circuit of the first and second i-f amplifier stages, serving to vary the gain in these two stages as shown in the large schematic on page 22. A switch S405 is mounted on the cathode variable resistor control and renders the noise suppressor inoperative when the control is turned to its maximum counter-clockwise position.

The noise suppressor functions in the following manner: With no signal being received and the noise suppressor connected in the circuit, there is a small positive bias on the grid of the Type -75 tube. Under this condition, plate current is flowing in the tube and produces a voltage drop across the associated plate resistor R425. This resistor is connected in the grid circuit of the first a-f amplifier stage in such a manner that the voltage drop biases the a-f amplifier stage beyond plate current cut-off, rendering it inoperative. If a signal of sufficient magnitude is applied to the input of the receiver, a negative voltage will be developed across the diode resistor R425 of sufficient amplitude to override the positive delay on the grid of the noise suppressor section of the tube, and thus bias it to beyond plate current cut-off. When this condition is reached, there is no voltage drop across the plate resistor R425 of the noise suppressor tube, thus reducing the bias of the 1st audio amplifier and consequently the amplifier returns to its normal operating condition and is susceptible to signals.

Resistance-capacitance filters are provided in the noise-suppressor control circuits to insure that no audio-frequency voltage appears at either the grid or the plate of the noise-suppressor tube.

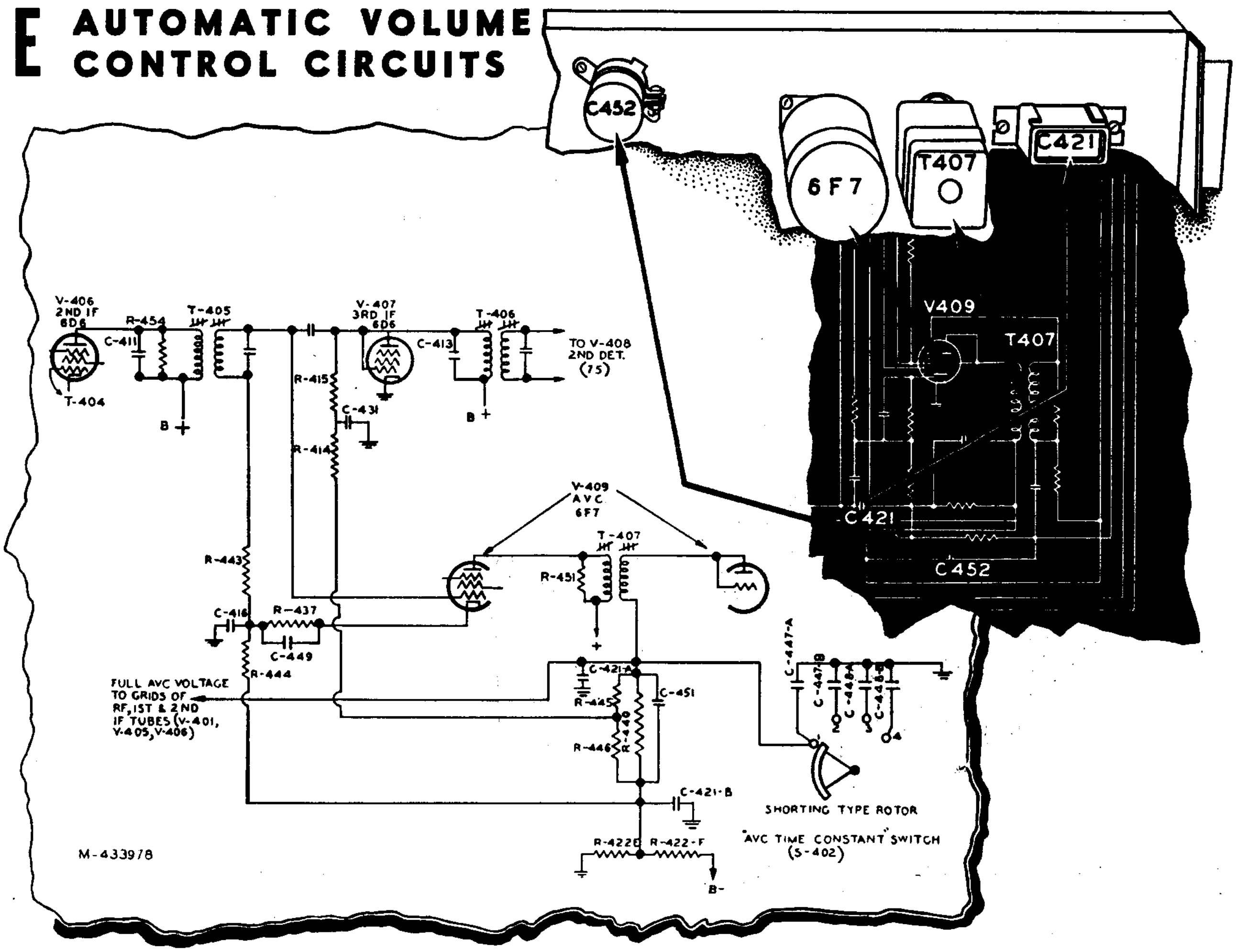
The audio-frequency amplifier consists of two stages: A Type -6C6 tube V410 as a voltage amplifier and a Type -6Y6-G tube V411 as a power amplifier. Resistance coupling is used between the second detector and the first a-f amplifier stage and between the two a-f amplifier stages.

The power amplifier is transformer coupled by T408 to the 600 ohm output impedance. Inverse feedback is employed in the audio-frequency amplifier through resistors R428 to the cathode circuit of first audio amplifier to reduce distortion and to improve the frequency response characteristic.



A telephone jack J401 is provided for plugging in a telephone head set for monitoring purposes. The telephone head set, if used, receives its energy from the secondary of the output transformer T408 through a series resistor R442 of suitable value to reduce the power to the head phones to approximately 6 milliwatts when the receiver is delivering 2 watts output to the 600 ohm line.

E AUTOMATIC VOLUME CONTROL CIRCUITS

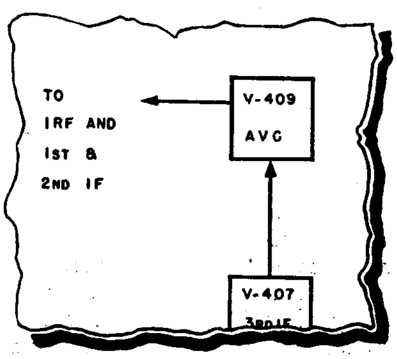


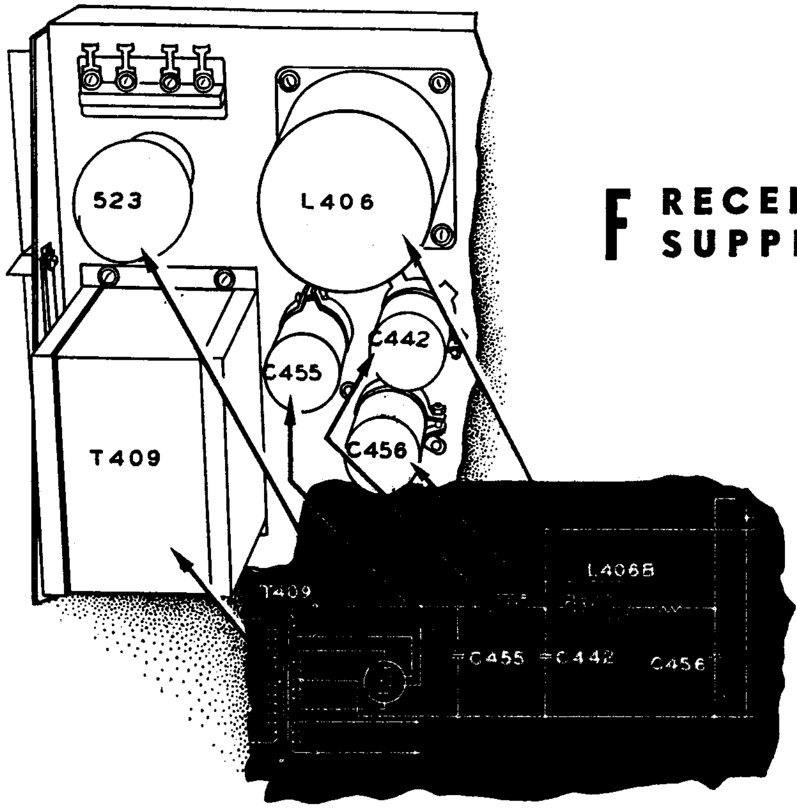
The Type -6F7 tube V409 employed in the automatic volume control circuit of the receiver is of the triode-pentode type and performs two functions. The pentode section of the tube as shown at the left in the simplified schematic in the illustration is used as an amplifier stage. The amplifier section is parallel fed from the input circuit of the third intermediate frequency amplifier and operates at full gain continually.

The output of the pentode section is coupled by means of the intermediate frequency transformer T407 to the triode section of the tube which is connected to function as a diode rectifier. The transformer is tuned by adjustable magnetite cores and distributed capacity. The d-c potential resulting from the rectification in the tube appears across the resistor-capacitor combination R440 and C451.

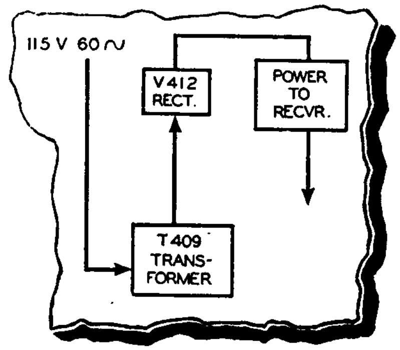
The full d-c output of the a-v-c rectifier appearing across R440 is fed back to the control grids of the first r-f stage and the first and second i-f stages. A portion of the output is fed to the grid of the 3rd i-f stage. This combination of a-v-c circuits and voltages produces an exceptional flat gain characteristic. A positive d-c voltage delay is provided for the circuit of the a-v-c rectifier. This allows the output to build up almost to maximum value before the a-v-c circuit starts to function, and thereafter the output will remain practically constant regardless of increase in signal input level.

Provision is made for variation in the a-v-c time constant by the selective switching of capacitors C447 and C448 across the a-v-c voltage by means of the Time Delay Constant switch S402 on the panel of the receiver. The time constant characteristic is such that the circuit starts to function almost instantly after the signal reaches a level requiring control but the a-v-c voltage will be held for a given time after the signal ceases. The length of time the control will be held can be controlled by the operator in four steps ranging from 0.5 second to 2.0 seconds.





F RECEIVER POWER SUPPLY CIRCUIT



All power for operation of the receiver is obtained from a 115-volt 60 cycle, single-phase service. The r-f filter unit in the power line, consisting of inductances L404, L405 and capacitors C453A, C453B, C454A and C454B, function to prevent so-called "back door interference" from entering the receiver over the power lines. Adequate shielding for this filter is provided beneath the receiver chassis.

The power transformer T409 supplies all voltages both high and low for the operation of the receiver and a Type -5Z3 rectifier tube is employed to supply all d-c operating potentials. Three ampere fuses are provided in each side of the line for the protection of the equipment in case of short circuits, tube failures, or the like. The power switch S401 mounted on the front panel opens both sides of the line, thus removing all a-c potentials from the line filter, fuses and primary of the power transformer.

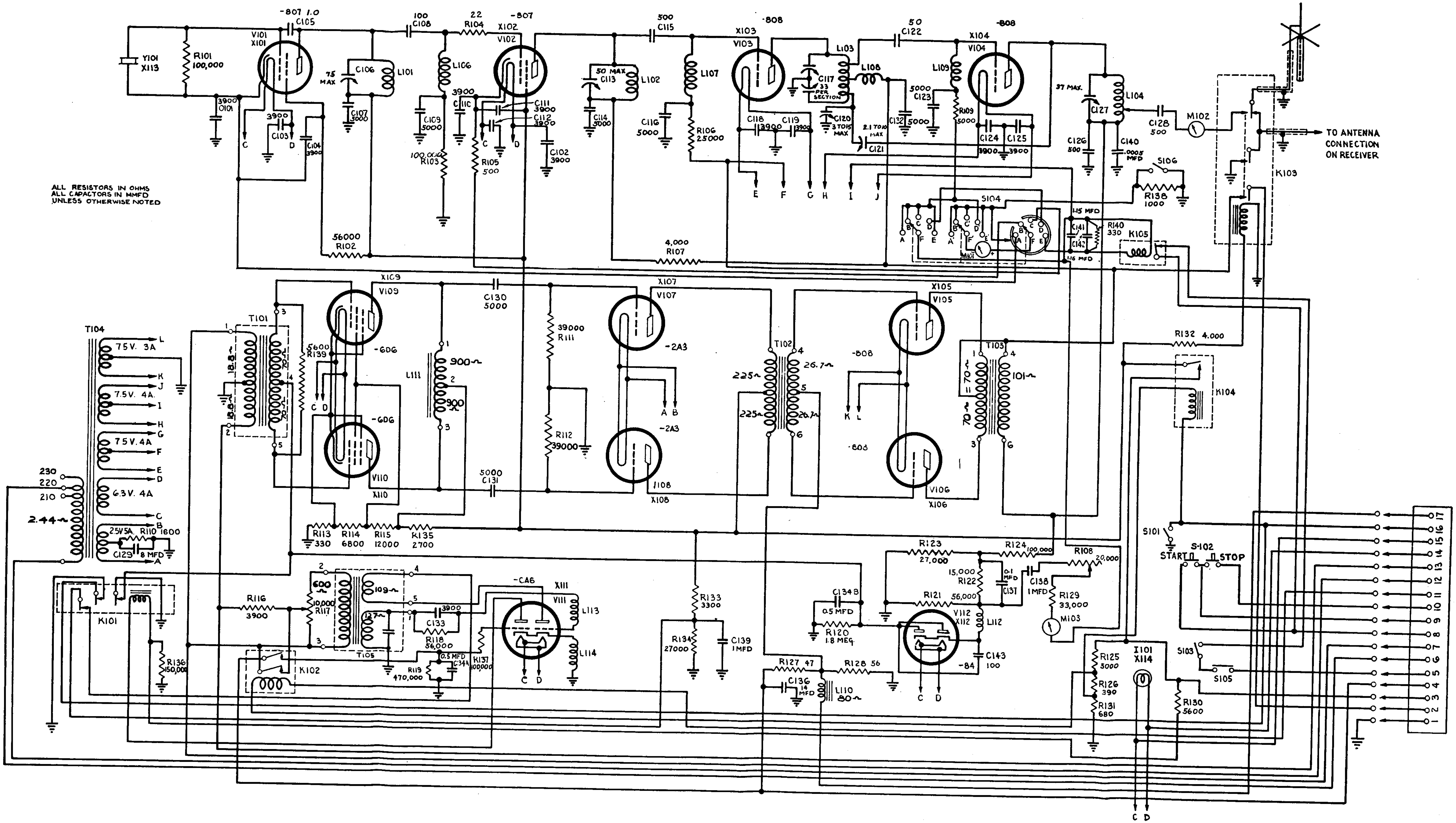
The pulsating d-c current resulting from rectification in the -5Z3 tube is smoothed out by the filter combination formed by iron core reactors L406A, L406B and three capacitors C455, C442, and C456. This furnishes a comparatively ripple free high voltage current for the tubes in the receiver. As will be noted in the schematic page 22, r-f chokes are provided in the filament supply leads to eliminate coupling between the tube circuits and prevent unstable operation.

Practically full output of the receiver is fed into the lines connecting to the control units, it being possible to adjust the sound level at the units or loudspeaker to suit the noise conditions where the units are located. An output meter M402 is arranged to be switched into the circuit by means of the switch S404 mounted on the panel of the receiver. The meter is calibrated to indicate the output of the receiver in decibels with a zero reference corresponding to a 2 watt output.

AUTOMATIC CONTROLS

For the protection of the operator and to assure proper operation of the equipment, certain automatic devices have been included in the equipment and accessories. The motor generator is remotely controlled by means of a magnetic controller, the relay of which is energized by pressing start buttons at either control unit or on transmitter panel.

A switch S103 is arranged so that by opening the top of the transmitter housing the switch will open the circuit to the relay in the magnetic controller, shutting down the motor generator to prevent harm to the operator from the high voltages used on the transmitter tubes.



TRANSMITTER UNIT (SCHEMATIC, T-618810)

INSTALLATION
AND INITIAL ADJUSTMENTS

TBS SERIES

SAFETY

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES (875 VOLTS) WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION BUT ALWAYS SHUT DOWN MOTOR GENERATOR OR OTHER POWER EQUIPMENT. UNDER CERTAIN CONDITIONS, DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES ALWAYS REMOVE POWER DISCHARGE, AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

Since the use of high voltages (875 volts) which are dangerous to human life is necessary to the successful operation of the equipment covered by these instructions, certain reasonable precautionary measures must be carefully observed by the operating personnel during the adjustment and operation of the equipment.

The major portions of the equipment are within shielding enclosures, provided where necessary with access doors which are generally fitted with safety interlock switches which act to shut off dangerous voltages within the enclosures when the access doors are open.

It should be borne in mind that interlocks are provided only on normal access doors on certain major units and therefore side, back or top screens, commutator covers, if removed, will not cause interlocks to function and will thereby allow access to circuits carrying voltages dangerous to human life.

While every practicable safety precaution has been incorporated in this equipment the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS—Under no circumstances should any person be permitted to reach within or in any manner gain access to the enclosure with interlocked gates or doors closed or with power supply line switches to the equipment closed; or to approach or handle any portion of the equipment which is supplied with power, or to connect any apparatus external to the enclosure to circuits within the equipment; or to apply voltages to the equipment for testing purposes while any non-interlocked portion of the shielding or enclosure is removed or open. Wherever feasible in testing circuits, check for continuity and resistances rather than directly checking voltage at various points.

DON'T SERVICE OR ADJUST ALONE—Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS—Under no circumstances should any access gate, door or safety interlock switch be removed, short circuited, or tampered with in any way by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

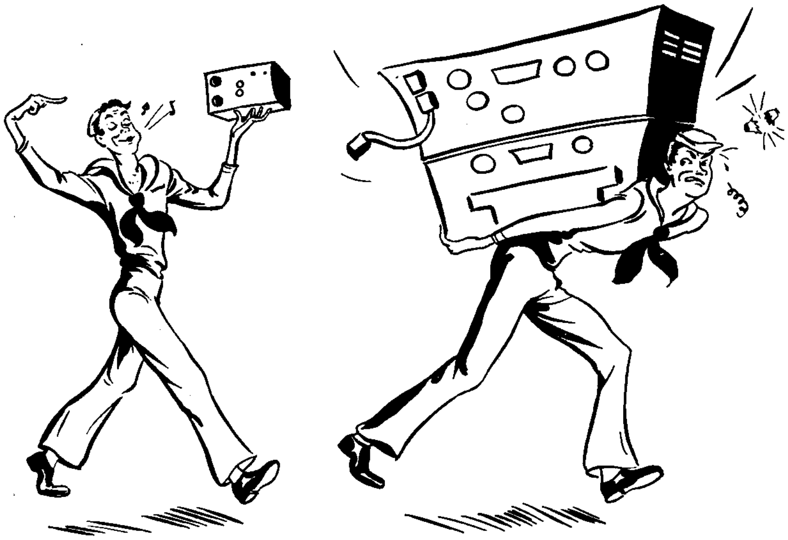
THE ATTENTION OF OFFICERS AND OPERATING PERSONNEL IS DIRECTED TO CHAPTER 67 OF BUREAU OF SHIPS MANUAL OR SUPERSEDING INSTRUCTIONS ON THE SUBJECT OF "RADIO SAFETY PRECAUTIONS TO BE OBSERVED."

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

TABLE OF CONTENTS

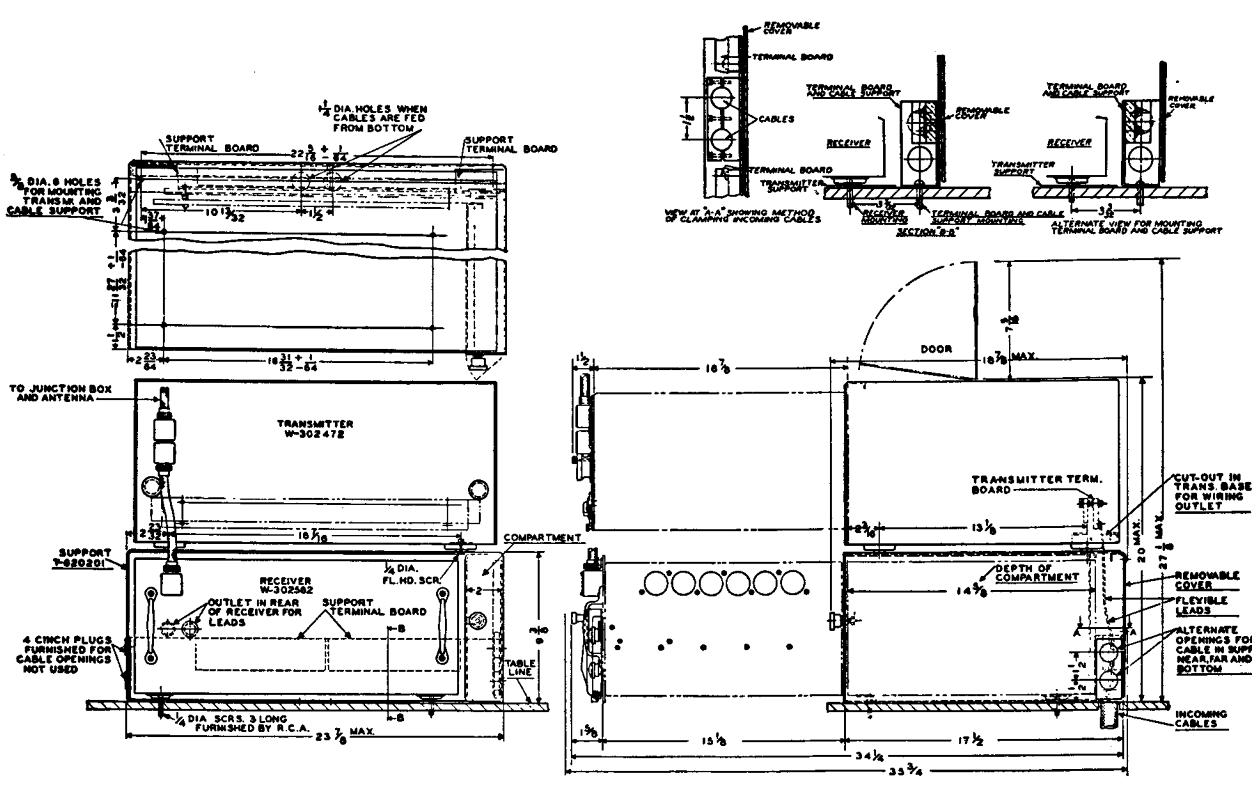
INSTALLATION
AND INITIAL ADJUSTMENTS
SECTION 2

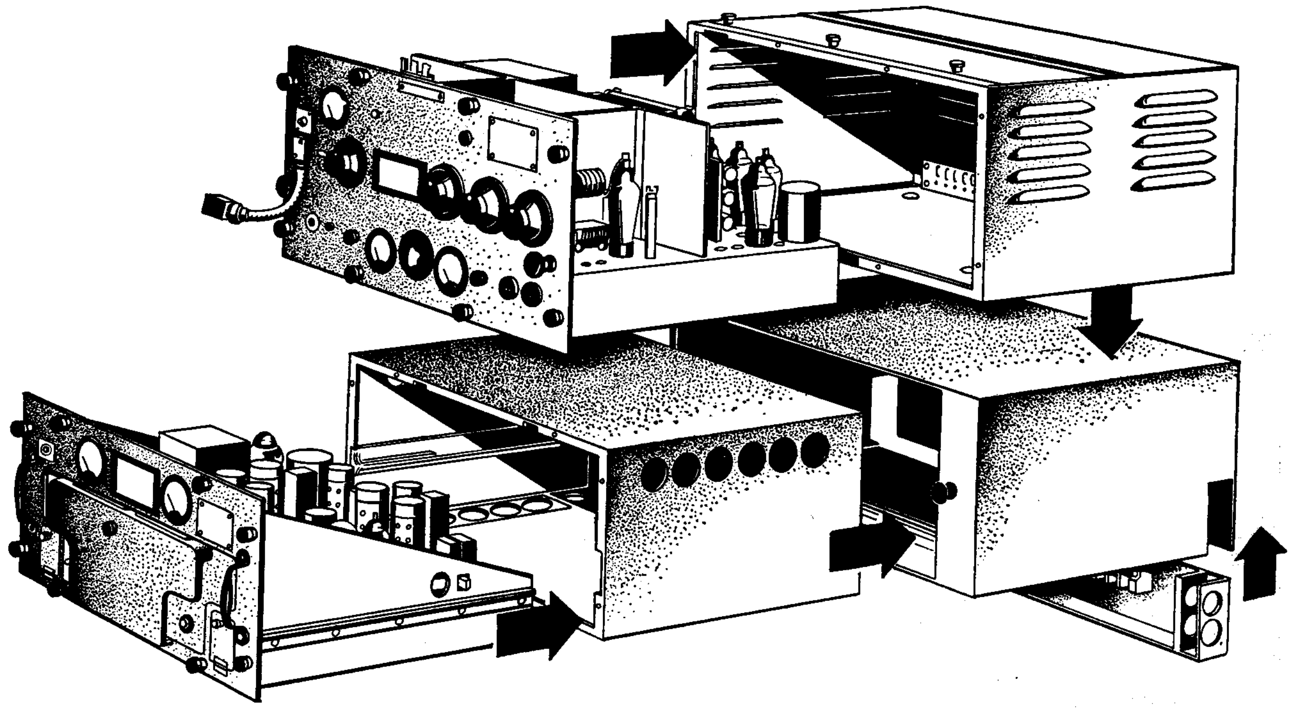
INSTALLATION OF TBS EQUIPMENT



NOTE: The following instructions and illustrations should be carefully studied before starting installation. A wrong connection or improper assembly may do great damage to the equipment.

In selecting the location for the installation of the various units in the TBS equipment due consideration must be given to the factor of maintenance and servicing. To that end the transmitter and receiver must be mounted so they can be withdrawn completely from their housing, with space above the transmitter to give access to the hinged top. The transmission line must terminate and the junction box be located within two feet of the antenna connection on the transmitter with the gauge and gas input valve readily accessible.

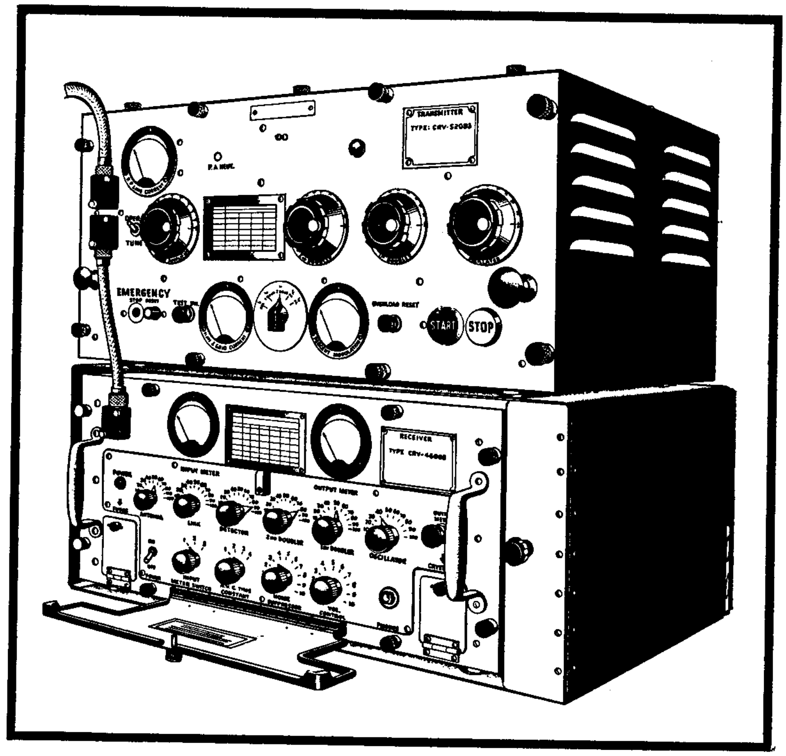




The overall dimensions of the transmitter and receiver unit are given herewith for guidance, with the illustration on the opposite page showing how various parts fit together to form the assembly. At the rear bottom of the enclosure stand will be noted a small detachable member which mounts the terminal board to which all connections for transmitter and receiver are made. This terminal strip normally occupies the space between the rear of the receiver and the back of the support stand.

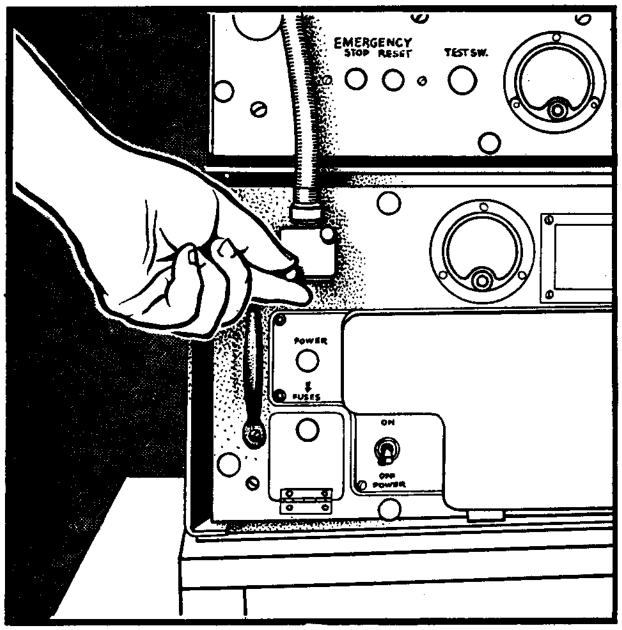
The arrows in the illustration give the order in which the assembly is made so it follows that dismantling for installation should be done in the reverse order as discussed later.

While uncrating the unit in preparation for installation, use care not to damage the controls or panel equipment. Examine the apparatus carefully for any damage that may have occurred to these parts in shipment. Requests for replacements should be put through at once. As the transmitter is further dismantled to mount terminal board and enclosure stand, each part should be carefully examined for damage or loose connections in the wiring.

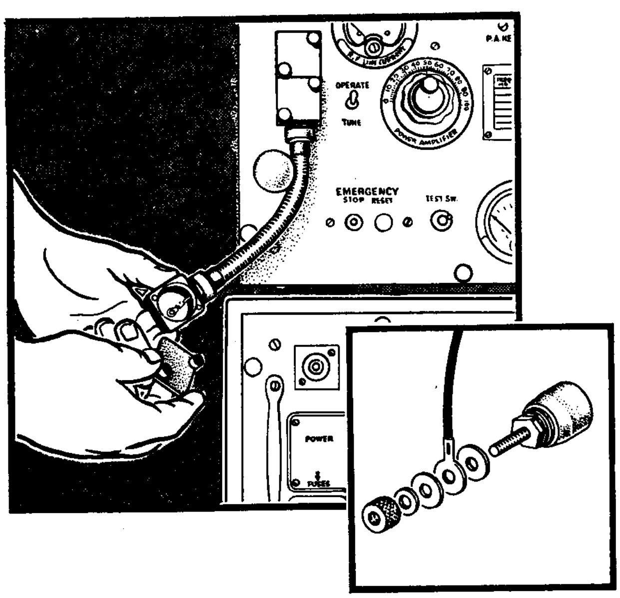


DISMANTLING THE TRANSMITTER AND RECEIVER FOR INSTALLATION

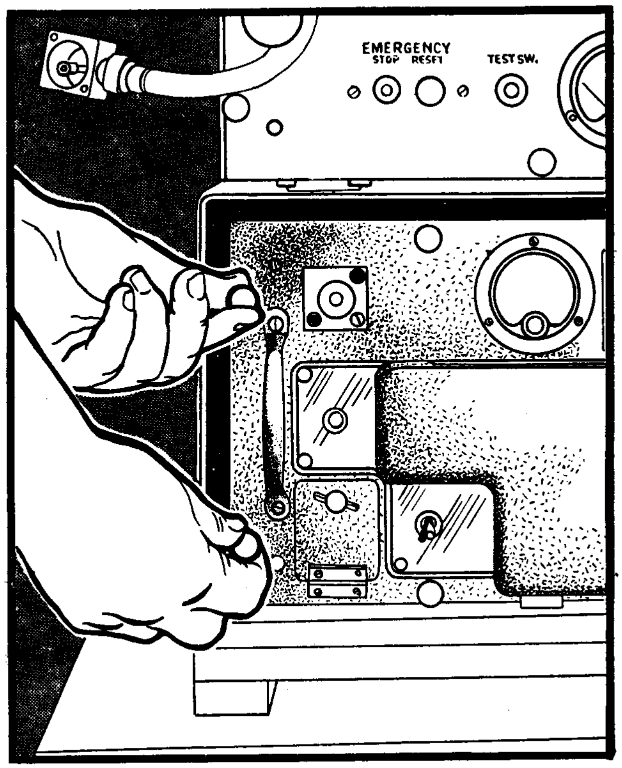
The progressive steps for dismantling the transmitter and receiver units are shown in the attached illustrations and it is important that this order be followed.



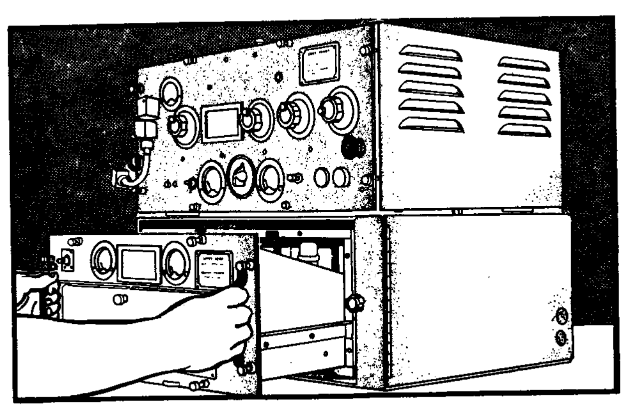
1 Loosen two screws on front of antenna connection to receiver and remove cover.



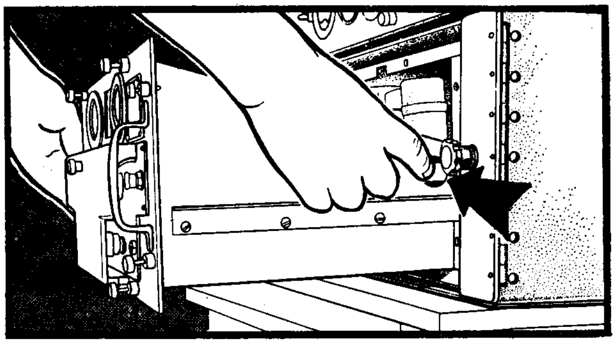
2 Disconnect antenna lead from receiver by removing thumbnut holding terminal lug on standoff insulator and swing flexible lead to side.



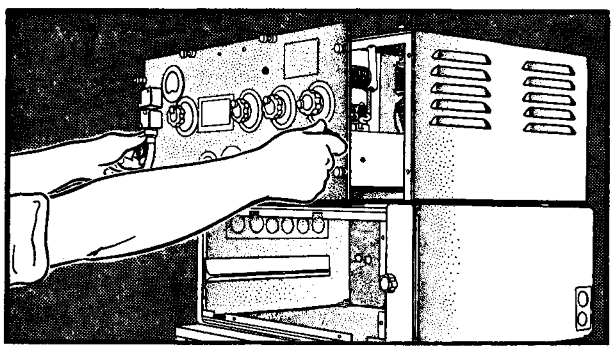
3 Unscrew eight thumbscrews holding receiver in case.



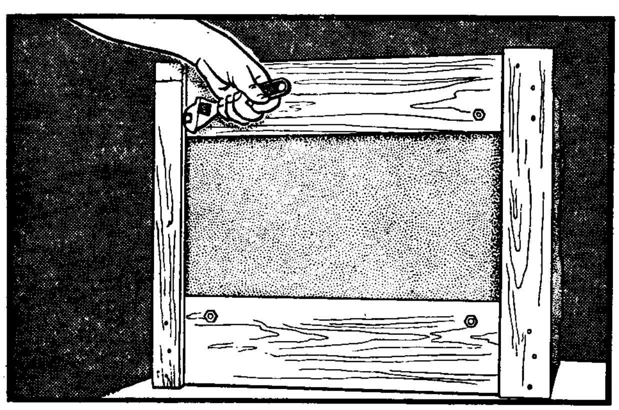
4 Withdraw receiver chassis to stops by means of the handles provided.



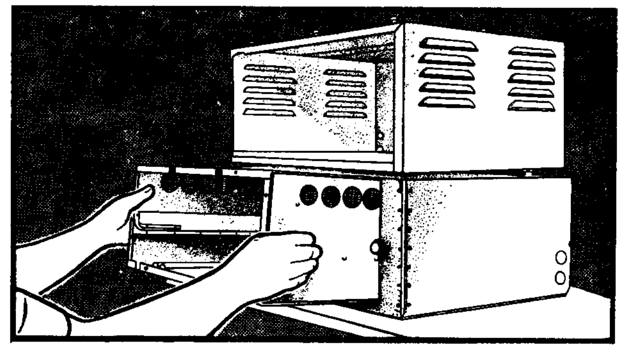
5 Release the two stops on receiver chassis with finger tips and remove receiver from case.



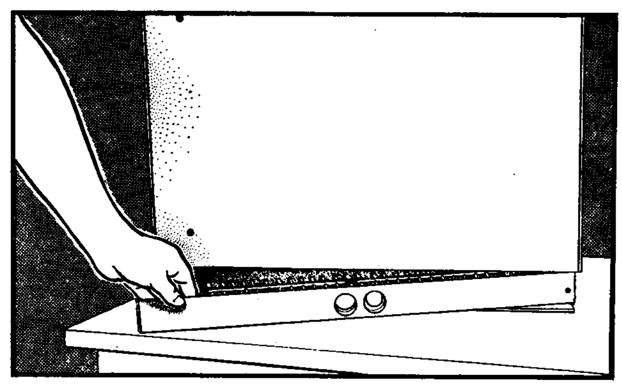
6 Loosen eight thumbscrews holding transmitter in case and remove the transmitter. No stops are on the chassis of the transmitter.



7 Turn support stand on its side and remove four screws holding stand to wood base.

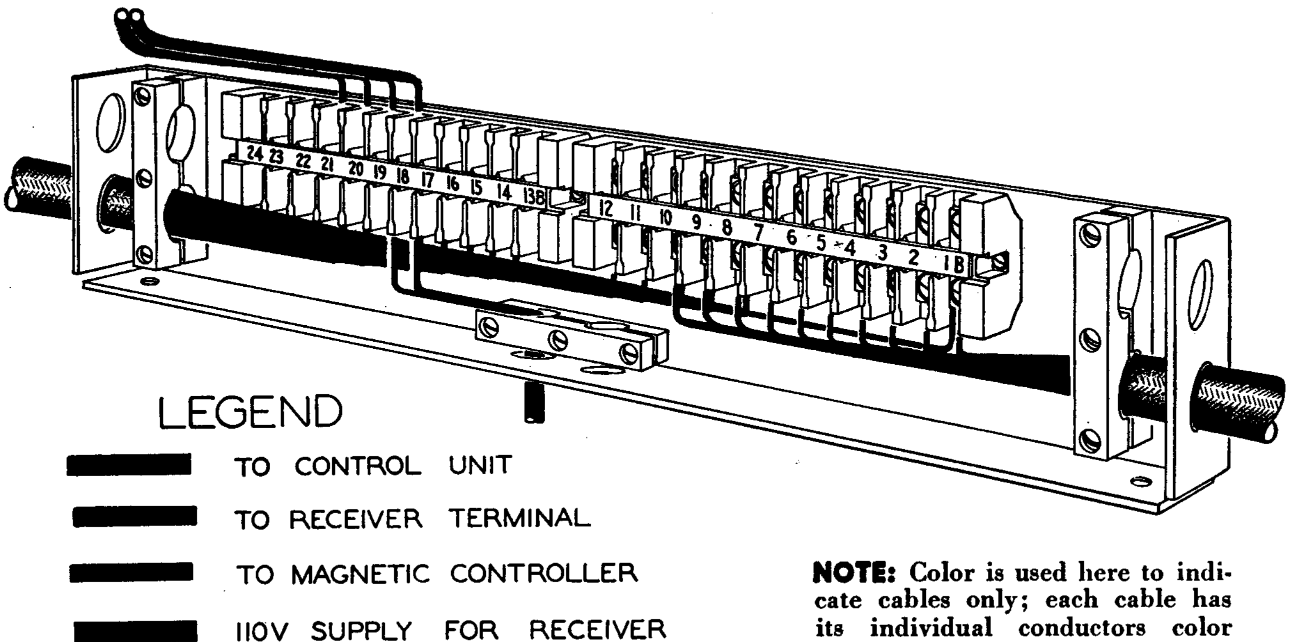


8 The receiver case can now be removed from enclosure stand.



9 The terminal board can then be removed from rear of support stand.

WIRING THE TRANSMITTER AND RECEIVER



NOTE: Color is used here to indicate cables only; each cable has its individual conductors color coded.

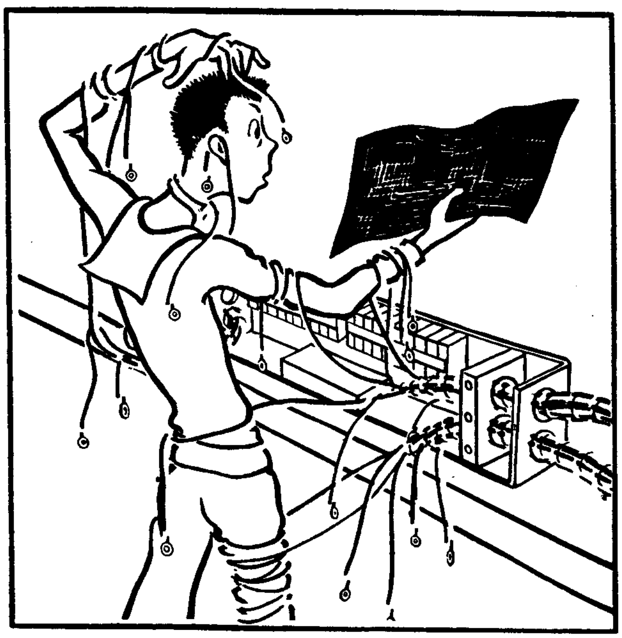
The first step in wiring the apparatus is to mount the terminal board assembly in place on the table or support where the apparatus is to be assembled by means of screws through the hole in the base of the terminal board frame. Its position being such as to occupy the opening in the bottom of the enclosure at the rear when the equipment is assembled.

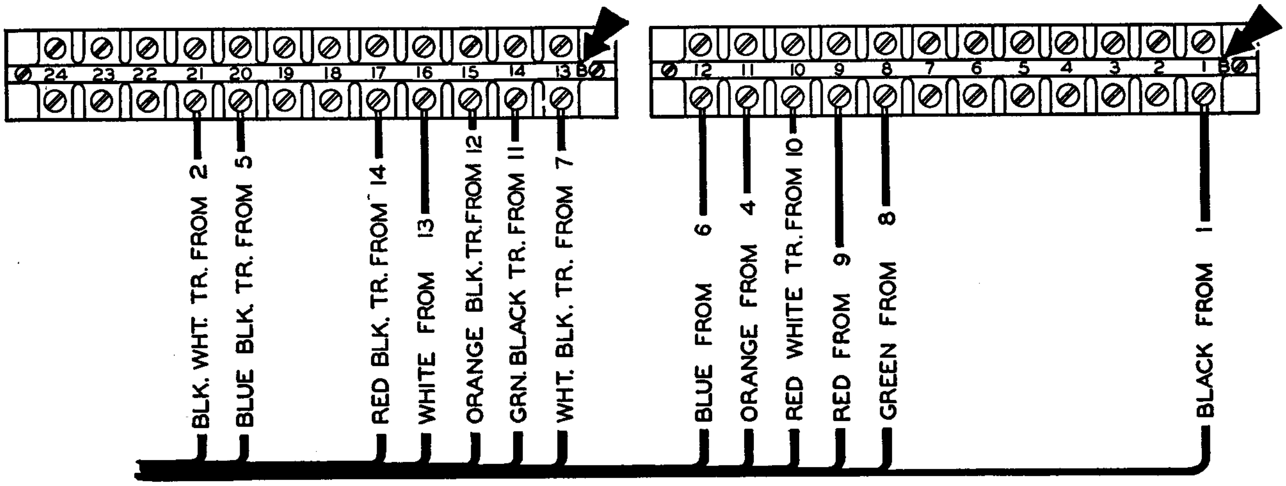
This assembly may be located with the terminals accessible from the front or from the rear, depending on which is the most convenient method of mounting. If the equipment is mounted against a bulkhead, the terminal boards should, of course, be mounted so that they are accessible from the front. The numbering on the terminal strips is so arranged that the side of the strips marked "B" is correct when the terminal boards face the front. When the boards face the rear, the marking strips must be removed, turned over to the side marked "A" and interchanged so that number "1" on the board is on the right-hand side of the assembly, viewing the rear.

As shown in the illustration of the terminal strip mounted on its support, six holes are provided for the insertion of the cables, two in each end and two in the bottom, any of which may be used as found most convenient.

The cable from the control units must be Navy Type MHFA-14. Cables from both control units may be connected to this terminal board provided the total length of cable used is not over 200 ft. If more convenient, one cable may run from the transmitter-receiver terminal board to one of the control units and another cable from that unit to the other control unit.

For connection to the magnetic controller a ten conductor cable will be required, having sufficient insulation for 900 volts d-c and 220 volts a-c. Navy Type MHFA is suited to this purpose.

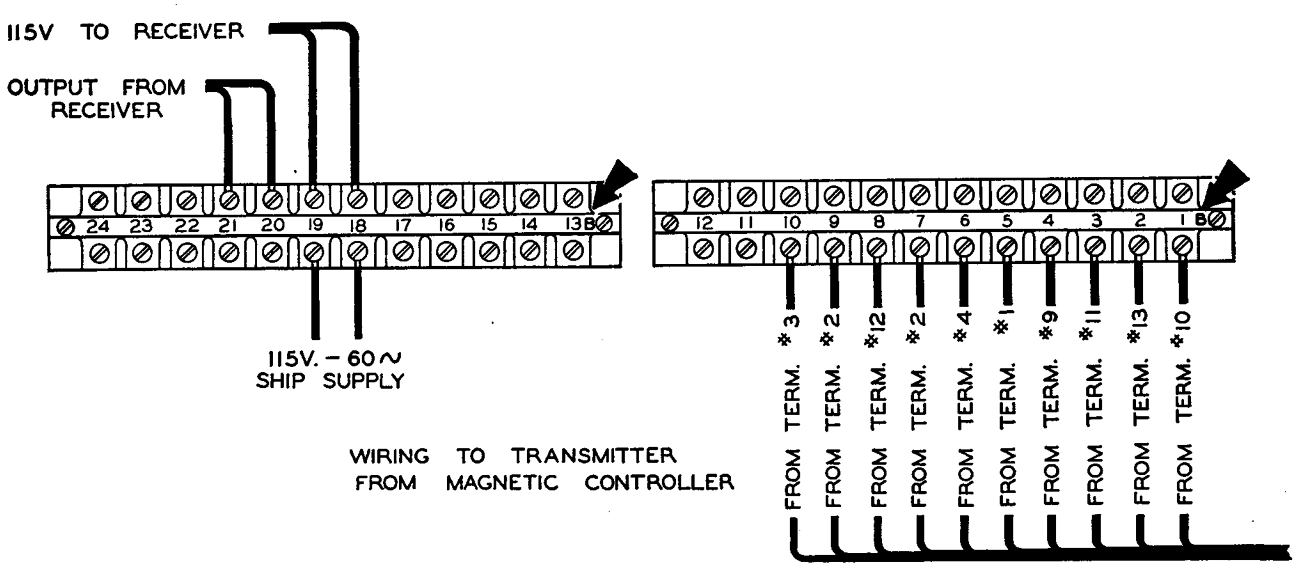




WIRING TO TRANSMITTER FROM CONTROL UNIT

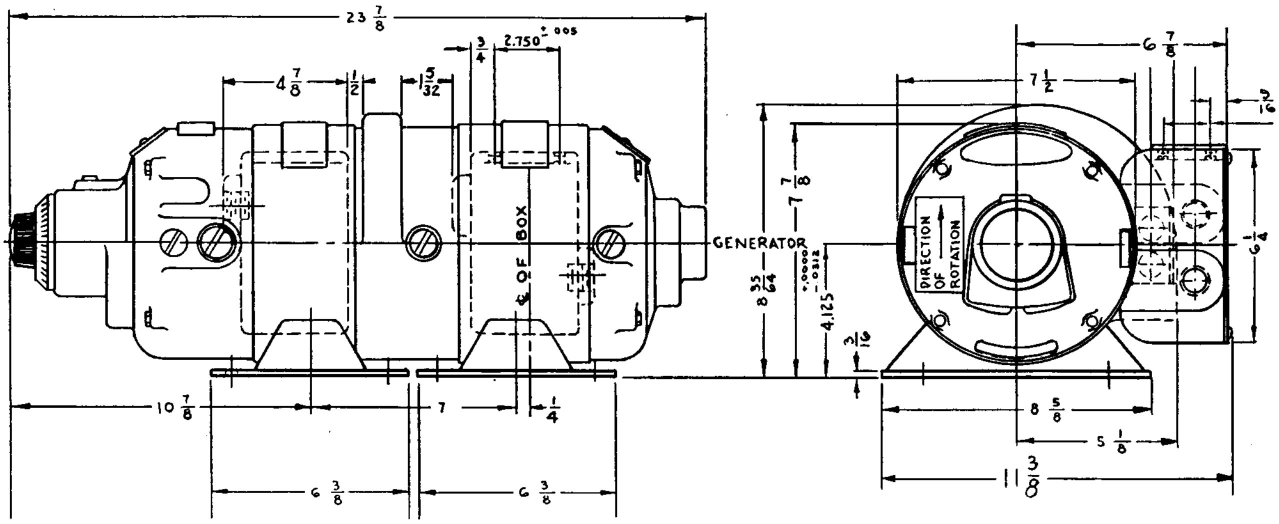
Before inserting the cables in the opening in the terminal board mounting, remove the sheath to expose a sufficient length of the conductors to make the necessary connections to the terminals and clamp the cable in place with the clamps provided inside the openings. For convenience two simplified wiring diagrams are given herewith, the complete interconnection diagram being given on Page 35. The color code given for the wiring should be followed carefully, making connections to the lower row of terminals. Only 13 wires are required to make the connections, the 14th being cut off close to the end of the sheath or kept as a spare conductor.

Connections are also shown for the two conductor cables, type MCS-2, that connect to the receiver chassis. These should be about three feet long. A two conductor cable is also connected to the terminal board from the 115 volt a-c ship supply circuit to furnish current for the operation of the receiver. It is well to complete all the wiring to the various units before the radio apparatus is assembled so wiring can be checked readily when completed.

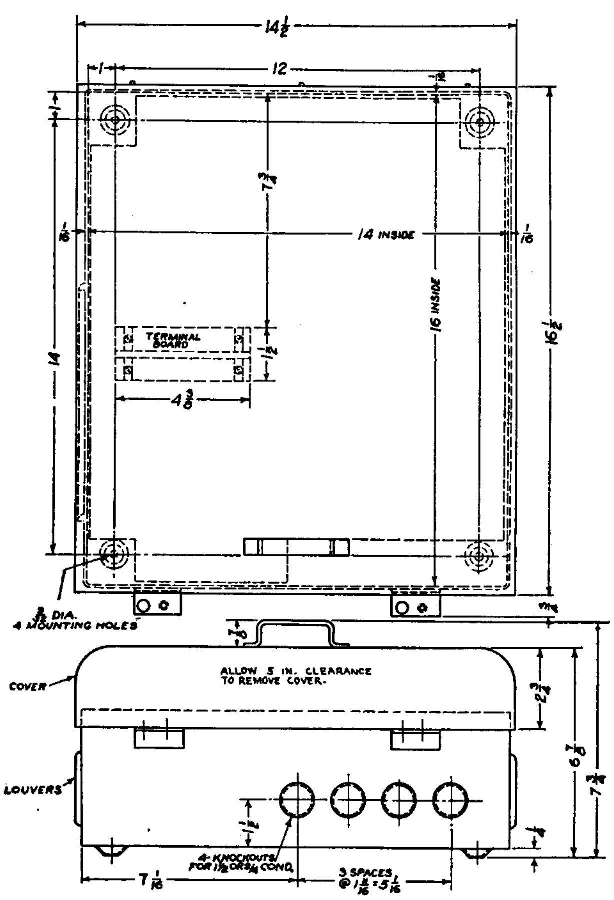


WIRING TO TRANSMITTER FROM MAGNETIC CONTROLLER

INSTALLING THE POWER SUPPLY UNITS



On the following pages are given the overall dimensions and measurements required for guidance in mounting the motor-generator units and their associated magnetic controllers. Since it is necessary to wire these units when making the installation a color coded wiring diagram is shown with the various types of motor generators furnished with the different TBS models.



The motor-generator units should be mounted on a firm foundation by means of lag screws or bolts. These units require frequent inspection and lubrication, so should be readily accessible with sufficient clearance for service or repair.

The magnetic controller must be mounted on wall or bulkhead close to the motor generator in a VERTICAL position, otherwise the gravity type starting contactor will not open. The cable used to connect these units should have sufficient insulation to withstand 900 volts d-c in the case of the generator output wiring.

As will be seen from the color chart given with each wiring diagram of magnetic controller and motor generator, the red lines indicate the cable from the terminal strip in the transmitter and receiver support housing and are numbered according to the terminal they connect to on that strip. The blue lines indicate leads from controller to motor while the green lines indicate output from the motor generator.

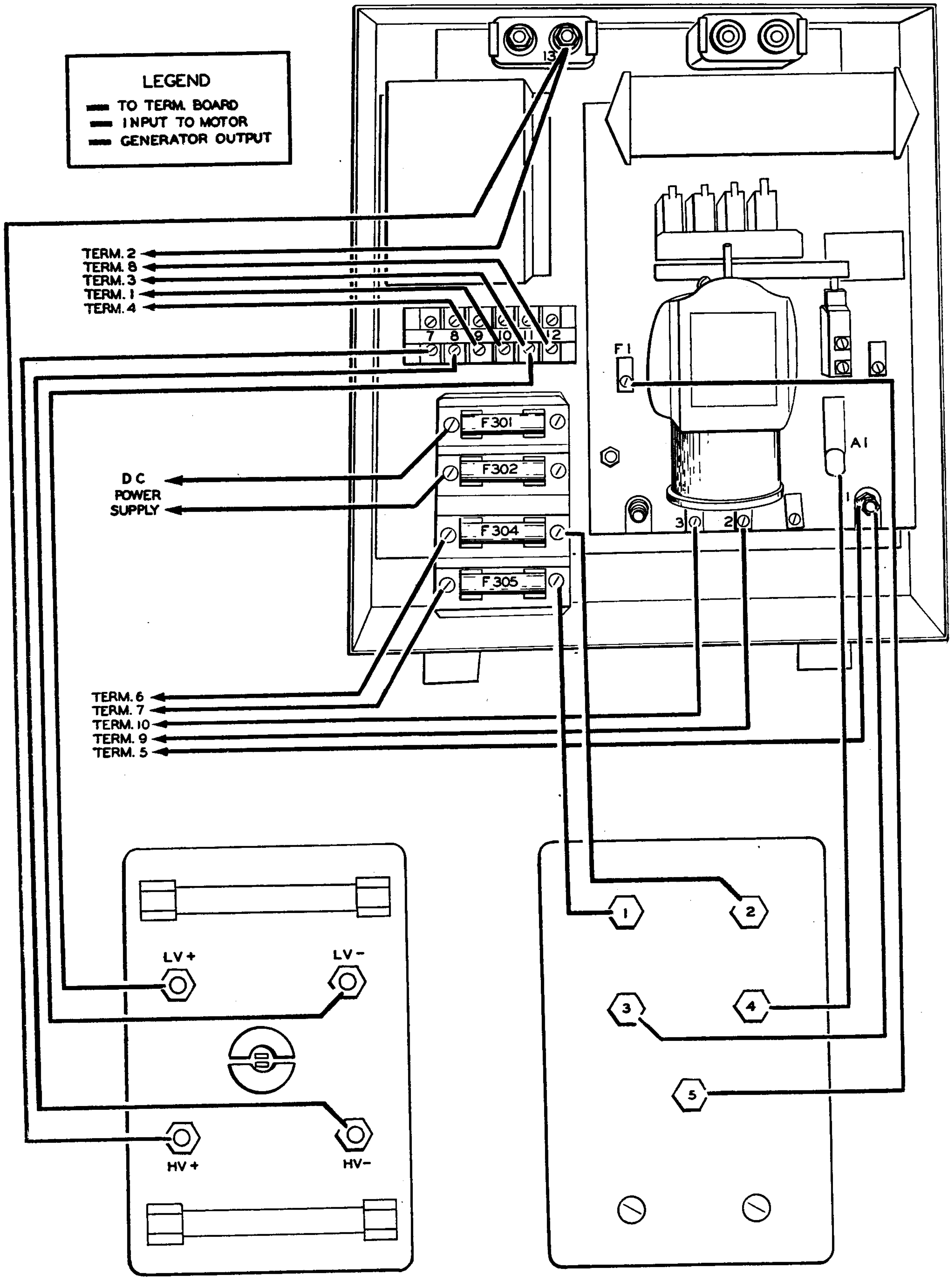
WIRING DIAGRAM FOR USE WITH 120 V. AND 230 V. D-C SUPPLY UNITS:

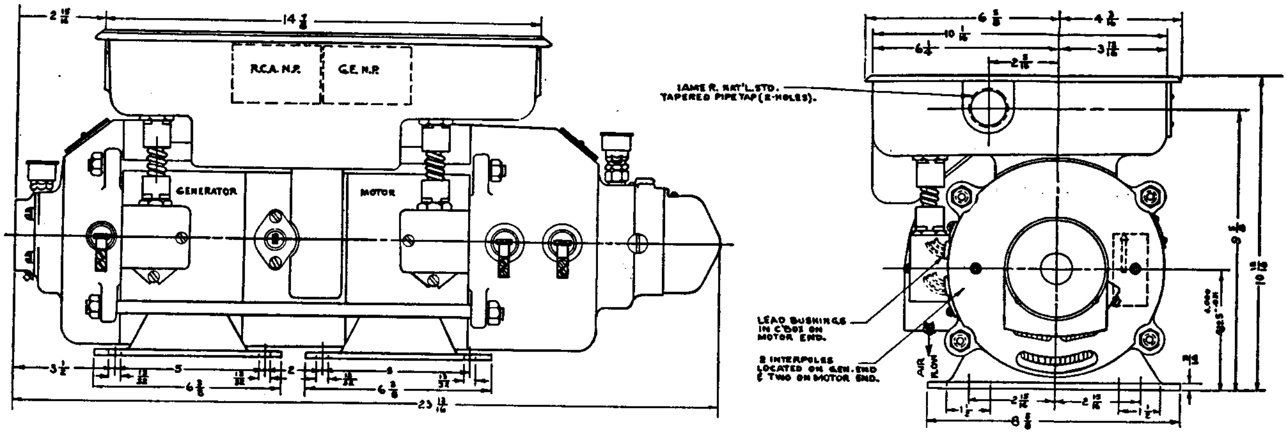
120 VOLT Navy Type CG-21300 Motor Generator and Navy Type CRV-21319 Magnetic Controller furnished with TBS, TBS-1, TBS-2, TBS-3, TBS-5.

Navy Type CG-21300A Motor Generator and Navy Type CG-21319 Magnetic Controller furnished with TBS-4.

230 VOLT Navy Type CG-21745 Motor Generator and Navy Type CRV-21804 Magnetic Controller furnished with TBS-3, TBS-5.

Navy Type CG-21745 Motor Generator and Navy Type CG-21804 Magnetic Controller furnished with TBS-4.

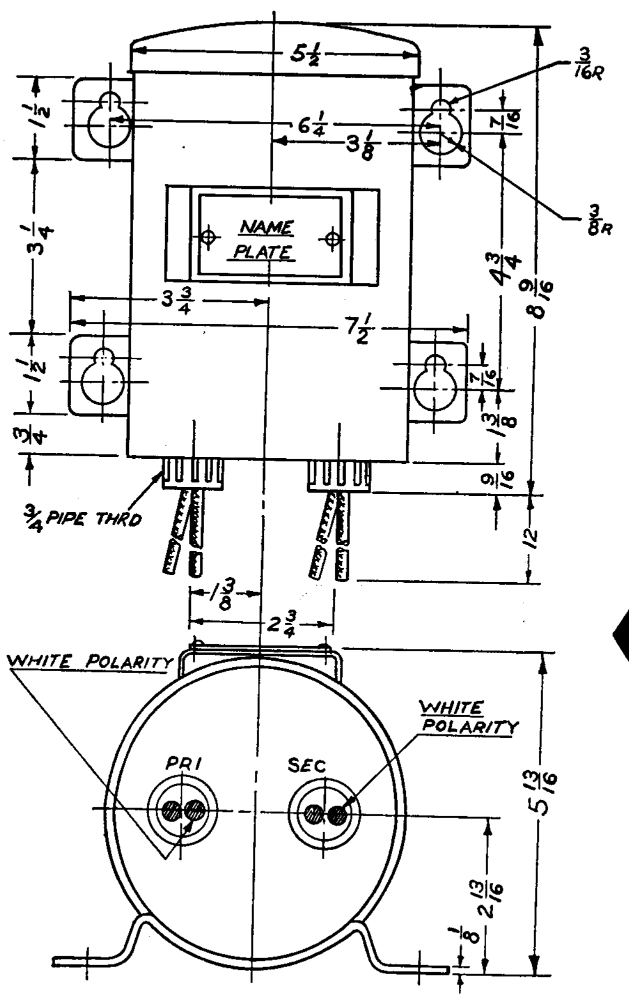

LEGEND
TO TERM. BOARD
INPUT TO MOTOR
GENERATOR OUTPUT
TERM. 2
TERM. 8
TERM. 3
TERM. 1
TERM. 4
13
7
8
9
10
11
12
F1
F301
F302
F304
F305
A1
DC
POWER
SUPPLY
TERM. 6
TERM. 7
TERM. 10
TERM. 9
TERM. 5
LV+
LV-
HV+
HV-
1
2
3
4
5



WIRING DIAGRAM FOR 120 V. AND 230 V. D-C MOTOR GENERATOR WITH TERMINALS ON TOP.

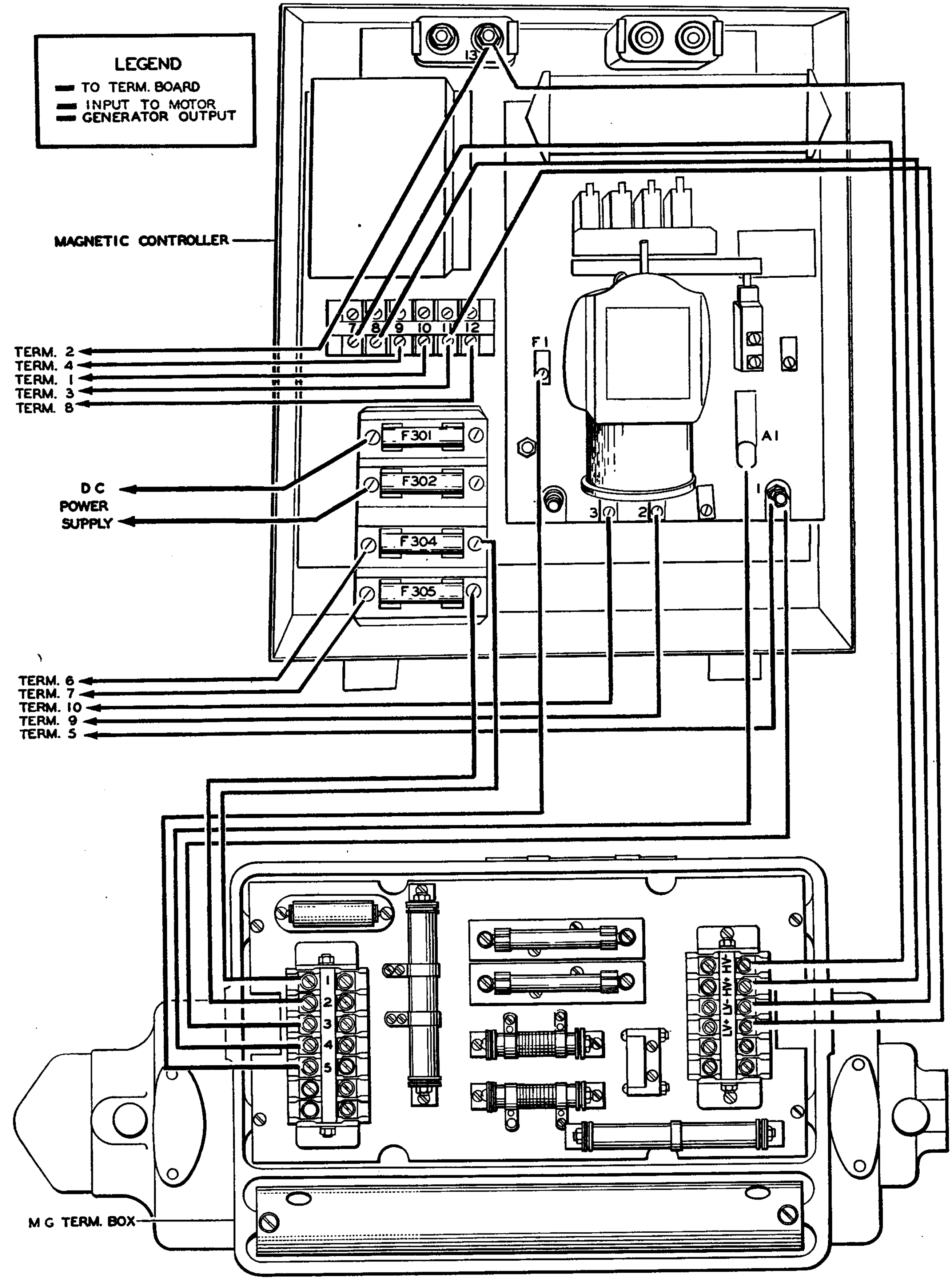
120 VOLT Navy Type CG-211127 Motor Generator and Navy Type CG-21319 Magnetic Controller furnished with TBS-7.

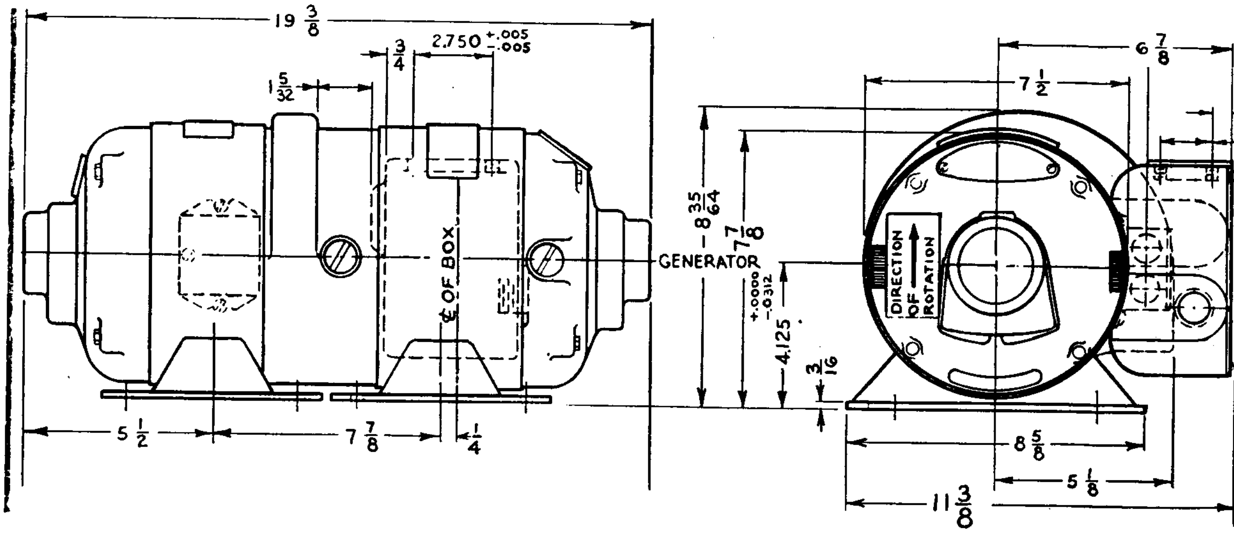
220 VOLT Navy Type CG-211130 Motor Generator and Navy Type CRV-21804 Magnetic Controller furnished with TBS-6. Navy Type CG-211130 Motor Generator and Navy Type CG-21804 Magnetic Controller furnished with TBS-7.

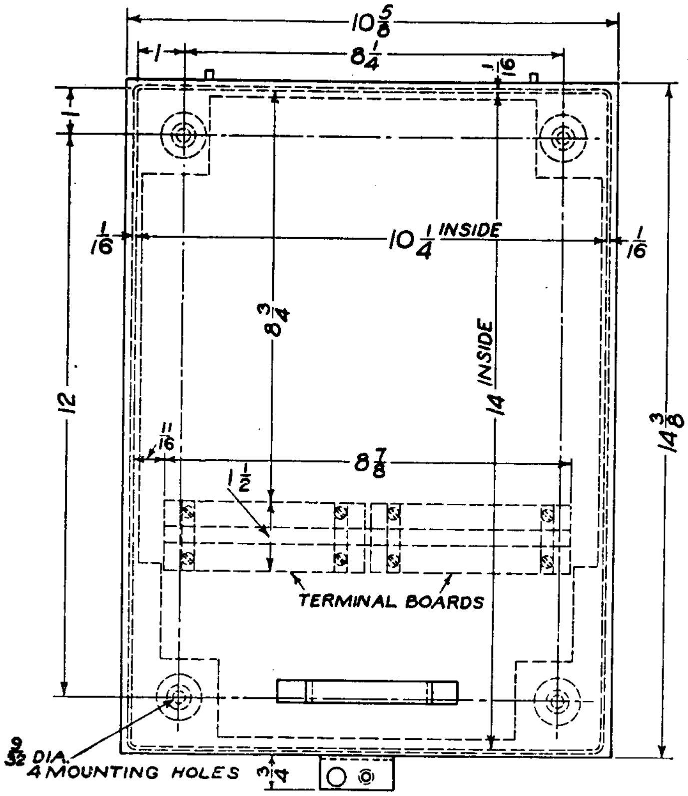


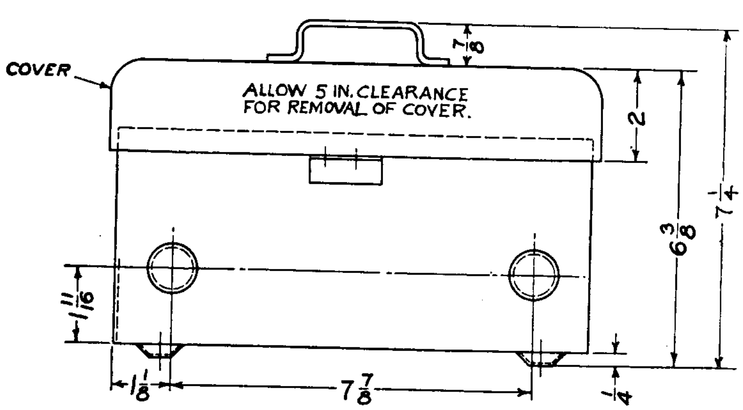
STEP DOWN TRANSFORMER

A step down transformer 220 volt to 110 volt a-c is furnished with the TBS-4 equipment to supply the 110 volt a-c for the operation of the radio receiver when the available ship supply current is 220 volt a-c. The attached illustration gives the overall and mounting dimensions of this transformer which may be installed on the bulkhead close to the receiver location. The primary of the transformer is connected to the ship supply lines, leads from the secondary being connected to terminals 18 and 19 on the terminal strip in the support stand.


LEGEND
TO TERM. BOARD
INPUT TO MOTOR
GENERATOR OUTPUT
MAGNETIC CONTROLLER
TERM. 2
TERM. 4
TERM. 1
TERM. 3
TERM. 8
DC POWER SUPPLY
F301
F302
F304
F305
F1
A1
TERM. 6
TERM. 7
TERM. 10
TERM. 9
TERM. 5
M G TERM. BOX



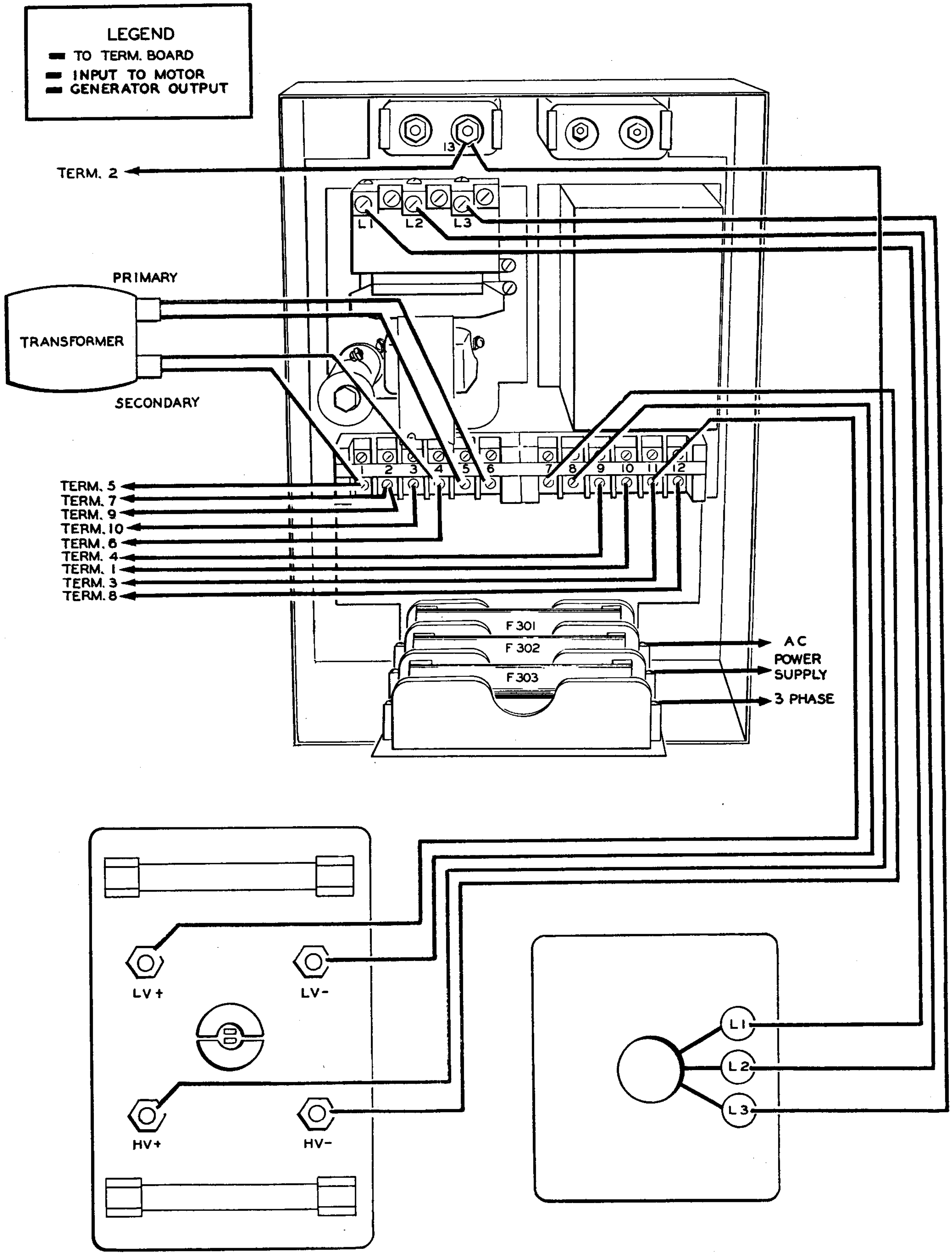


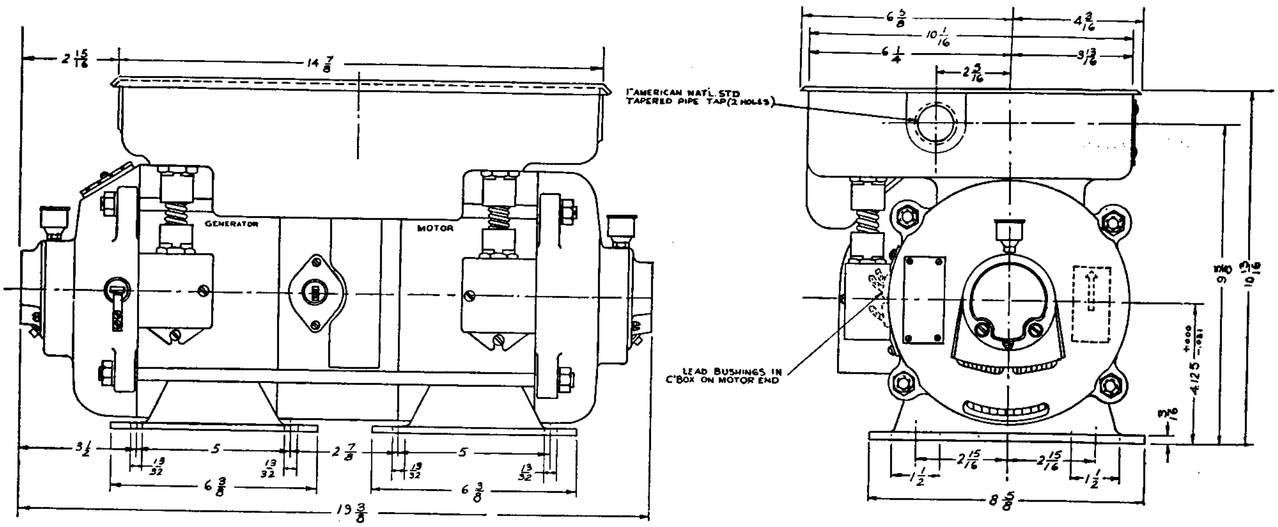


WIRING DIAGRAM FOR 220 V. AND 440 V. A-C MOTOR GENERATORS AND MAGNETIC CONTROLLERS.

220 VOLT CG-21301 Motor Generator and CRV-21320 Magnetic Controller furnished with TBS, TBS-3, TBS-5.

440 VOLT Navy Type CG-21302 Motor Generator and Navy Type CRV-21320 Magnetic Controller furnished with TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-6. Navy Type CG-211129 Motor Generator and Navy Type CG-21320 Magnetic Controller furnished with TBS-7.


LEGEND
TO TERM. BOARD
INPUT TO MOTOR
GENERATOR OUTPUT
13
TERM. 2
L1
L2
L3
PRIMARY
TRANSFORMER
SECONDARY
1
2
3
4
5
6
7
8
9
10
11
12
TERM. 5
TERM. 7
TERM. 9
TERM. 10
TERM. 6
TERM. 4
TERM. 1
TERM. 3
TERM. 8
F 301
F 302
F 303
AC
POWER
SUPPLY
3 PHASE
LV+
LV-
HV+
HV-
L1
L2
L3



WIRING DIAGRAM FOR 440 V. A-C MOTOR GENERATORS WITH TERMINALS ON TOP.

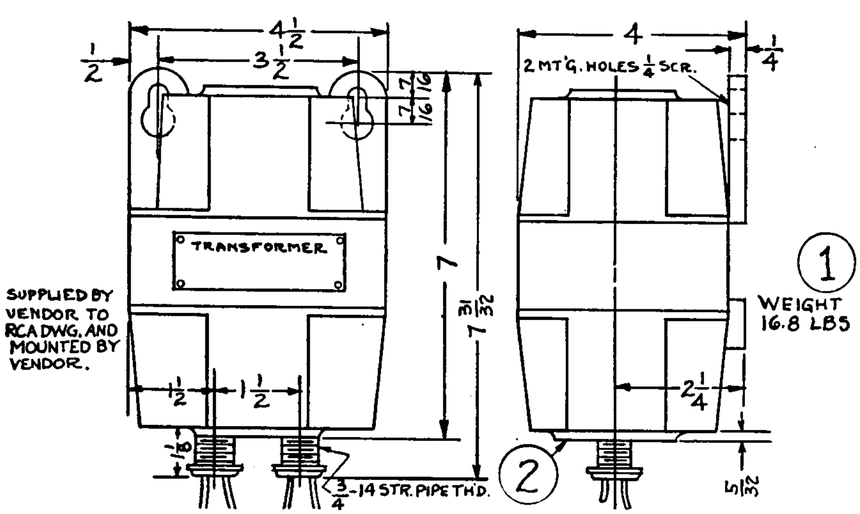
440 VOLT Navy Type CG-211129 Motor Generator and Navy Type CRV-21320 Magnetic Controller furnished with TBS-6.

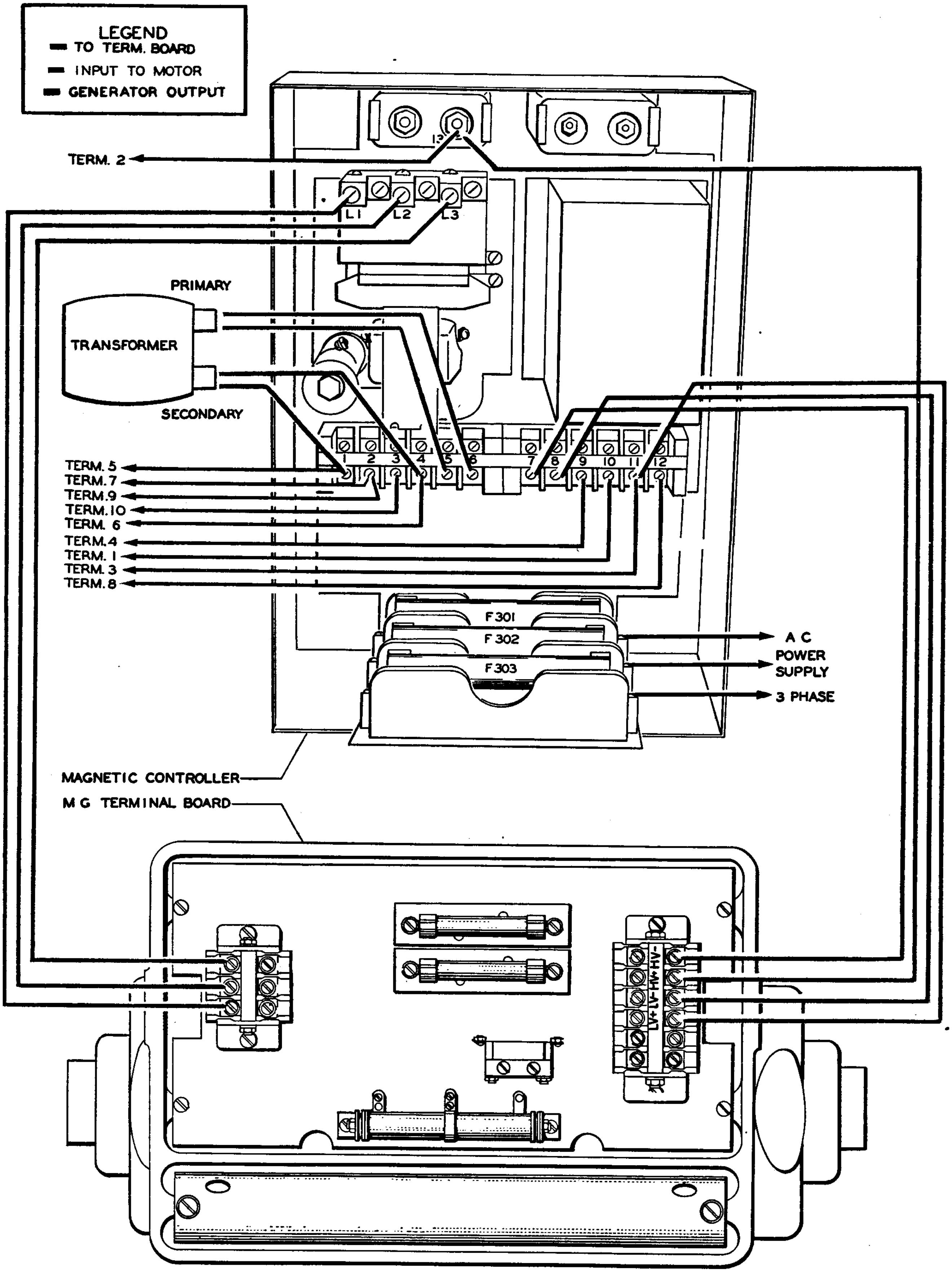
Navy Type CG-211129 Motor Generator and Navy Type CG-21320 Magnetic Controller furnished with TBS-7.

LINE TRANSFORMER

Overall dimensions and mounting hole location on the line transformer are shown at the left. This transformer is furnished with 440 volt a-c equipment and installed near the magnetic controller. The method of wiring the transformer into the circuit is shown in the wiring diagram for the magnetic controller and motor generator on opposite page. The primary winding is connected to terminals 5 and 6 while the secondary winding is connected to terminals 1 and 4 on the terminal strip of the a-c magnetic controller. The transformer then furnishes the 220 volts a-c for the transmitter filament transformer.

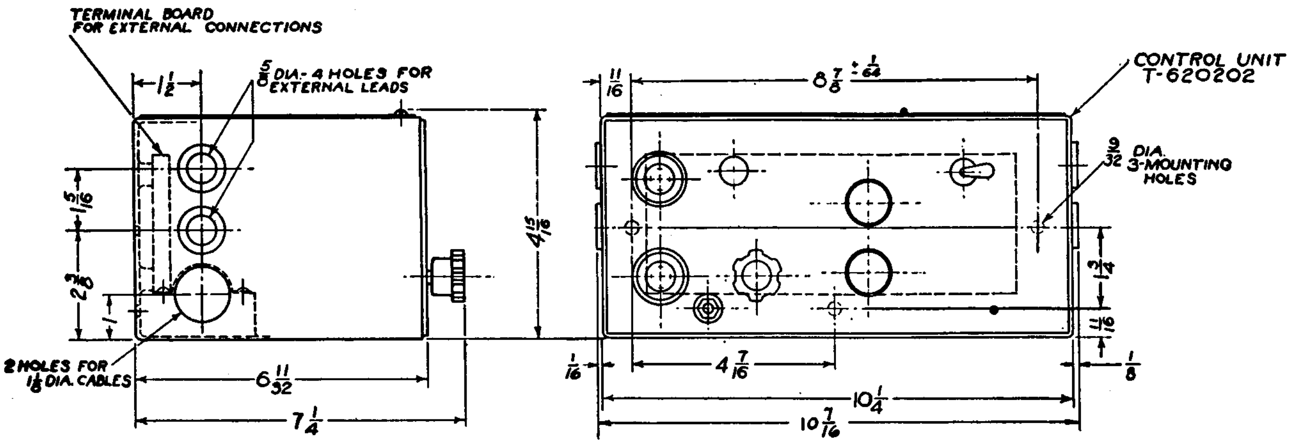
In 220 volt a-c installations the transformer is not required, connection being made directly from terminal 4 to 5 and 1 to 6 by short jumpers within the automatic starter.





LEGEND
TO TERM. BOARD
INPUT TO MOTOR
GENERATOR OUTPUT
TERM. 2
L1
L2
L3
PRIMARY
TRANSFORMER
SECONDARY
TERM. 5
TERM. 7
TERM. 9
TERM. 10
TERM. 6
TERM. 4
TERM. 1
TERM. 3
TERM. 8
1
2
3
4
5
6
7
8
9
10
11
12
F301
F302
F303
A C
POWER
SUPPLY
3 PHASE
MAGNETIC CONTROLLER
M G TERMINAL BOARD
LV+ LV- HV+ HV-

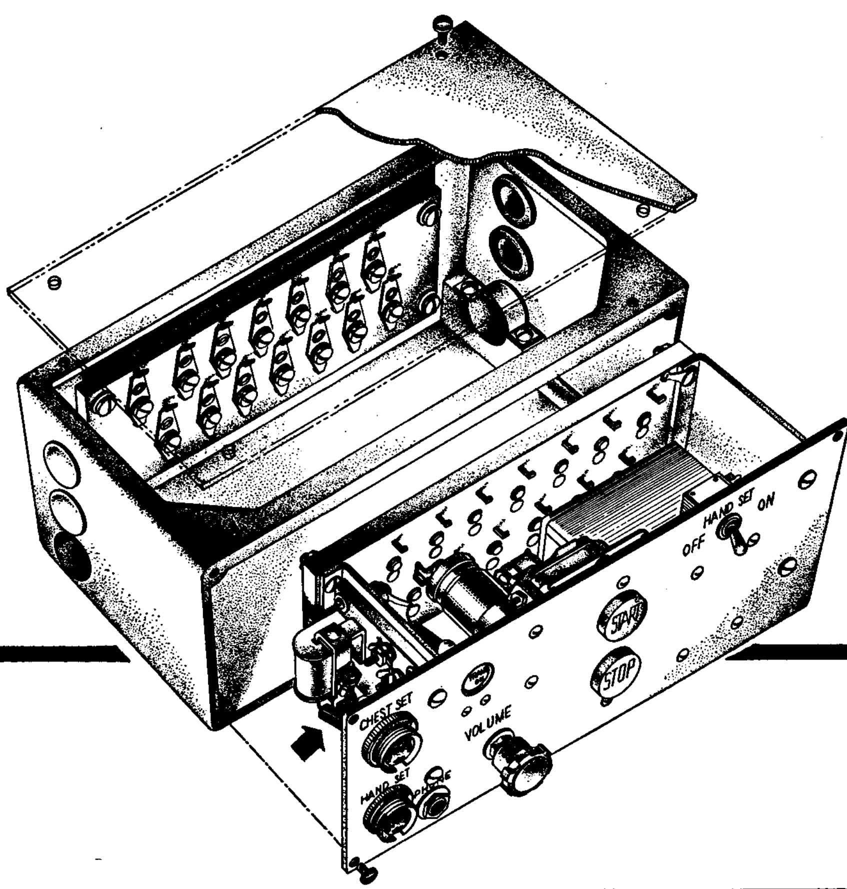
INSTALLING THE CONTROL UNITS

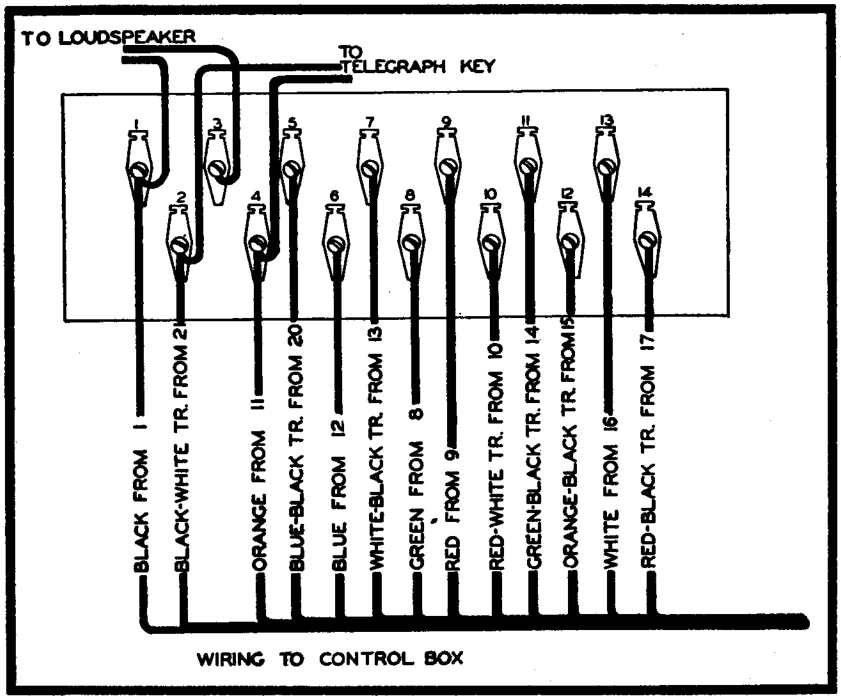


To install the control units it is first necessary to remove the panel by loosening the four screws holding it in place on the metal housing. The panel with its assembly may then be withdrawn from the case, flexible leads being provided to permit its removal without disconnecting the leads from the rear terminal board as shown in the illustration, leads having been omitted for clarity.

The case of the unit may then be mounted on wall or bulkhead by means of screws or bolts through the three holes in the back. Dimensions for drilling these holes, if bolts are used, together with overall size for guidance in locating the units are given in the attached illustration.

If desired, the units may be mounted on a table by removing the top of the case, drilling holes in the bottom and using the case as template for locating screws or bolts.





Holes are provided on both ends of the units for the entry of the cable connecting it to the transmitter and receiver or other control unit. Two rubber grommets are provided to admit 3/8 inch cables so the loudspeaker may be connected with Type TTHFA cable to the unit as desired and leads from a telegraph key of type MHFA-2 cable can be connected to the terminal board.

After the control unit has been mounted, the cable from the transmitter may be connected to the terminal board. This cable must enter by one of the lower holes at each end of the unit where provision is made to clamp it in place. Before inserting the cable remove the outer sheathing at the end so the clamp will make contact with the shielding. Cut the wires in the cable to the correct lengths for connecting to the terminal board.

The attached diagram gives the color code in the MHFA-14 cable to be followed in making the connections. THESE CONNECTIONS SHOULD BE CHECKED OVER CAREFULLY WHEN COMPLETED TO BE SURE THEY AGREE WITH THE COLOR CODE GIVEN IN THE CONNECTION DIAGRAM.

The cables from the loudspeaker and telegraph key may be fed in through any of the other holes in the case and connected as shown in the diagram. Metal snap buttons are provided to blank off the holes not used.

NOTE: At the unit where the loudspeaker is not employed a slight modification must be made to avoid loss of volume in reception. The resistor R204 indicated by the arrow must be removed from the circuit by clipping the leads connecting it to the relay terminal and ground.

The unit may now be reassembled by replacing the panel and top plate and fastening them in place.

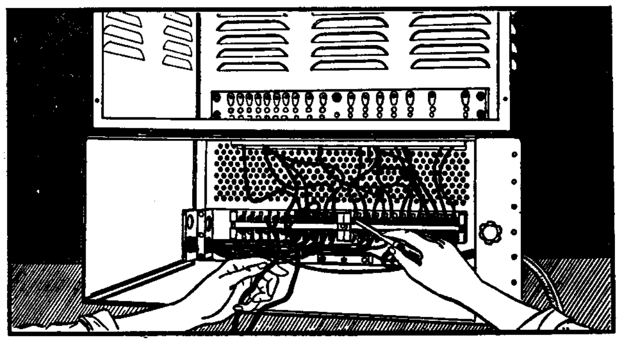
STOWAGE HOOKS

Two stowage hooks for the handsets are furnished with the equipment and one of these hooks should be installed near each control unit by fastening with screws to a nearby wall or bulkhead. The illustration shows the manner of mounting. The handset when not in use is stowed on the hook by placing the earpiece on the top fork and sliding the microphone under the lower spring.

REASSEMBLING THE TRANSMITTER AND RECEIVER

Having completed and carefully checked the wiring between the major units of the equipment, the transmitter and receiver may be assembled in their operating position. The support stand with the attached transmitter case is placed over the terminal block mount on the table or other support and the holes in the bottom used as a template for marking the holes for bolting the unit in place.

After drilling the mounting holes, the support stand may be placed over the terminal strip again

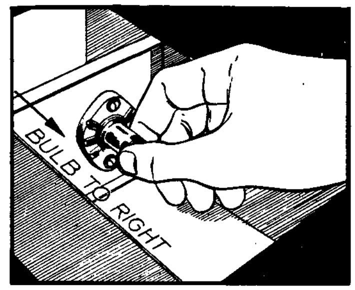


but not fastened. The flexible leads from the transmitter extending down through an elongated slot in the top of the support stand are to be connected to the terminal strip. Like numbered terminals on the transmitter and main terminals strips are to be connected together.

The receiver case may be inserted into the support stand, at the same time passing the two 2 conductor cables, previously attached to the terminal board, through the rubber grommets provided in the back of the receiver housing. With the receiver case in place, it will be found the rubber shock mounts in the bottom of the receiver case can be lined up with holes in the support stand and the whole assembly fastened to the table or other support by bolts or screws through these holes and the holes in the table or shelf.

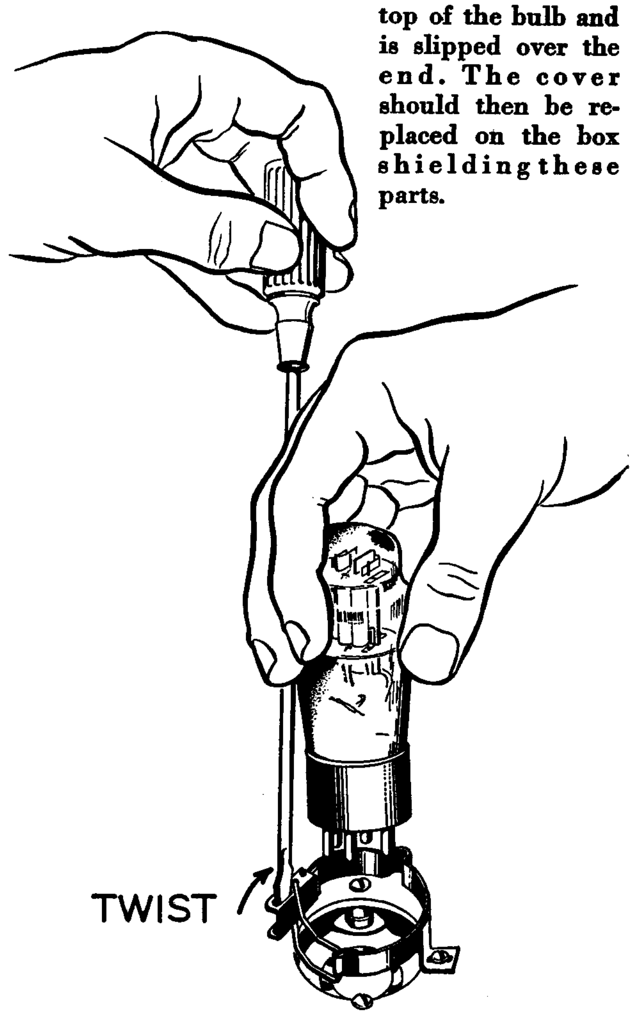
To prepare the receiver for operation it will be necessary to insert the tubes in their sockets. The proper position for the various tubes has been stenciled on the receiver chassis and no trouble should be encountered in properly placing them. It may be found that more than one type tube is specified for a particular socket as in the case of the second doubler where a 6J5, 6J5-G or a 6J5-GT-G are all indicated and where any one of the three types may be used.

The tube for the r-f stage, a -956, is to be installed in the socket mounted on the shield between the r-f stage and the link tuning and is inserted as shown in the illustration.

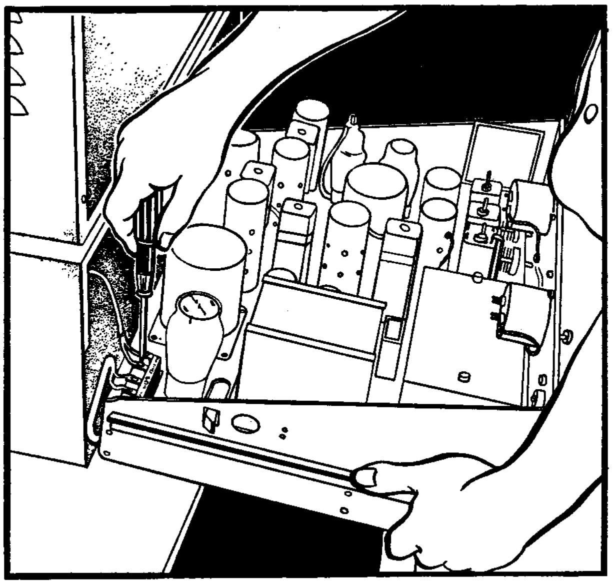


NOTE: THE -956 TUBE IS PUT IN PLACE BY GRIPPING THE BULB OF THE TUBE BETWEEN THE FINGERS OF THE RIGHT HAND MAKING CERTAIN THE SET OF THREE TERMINALS EXTEND TOWARD THE PANEL AND SLIPPING THE TERMINALS CAREFULLY INTO CLIPS ON THE SOCKET MOUNTED ON THE SHIELD.

The tiny clip on the flexible wire in the r-f tuning compartment is slipped over the terminal of the tube extending into that compartment. A flexible lead and clip makes connection to terminal on the top of the bulb and is slipped over the end. The cover should then be replaced on the box shielding these parts.



In the TBS-8 model it will be found that tube clamps have been installed above the sockets of the unshielded tubes in the receiver. To open the clamp, the blade of a long slim screwdriver is inserted in the slot in the top of the short hinged member as shown in the illustration, a twist to the left of the screwdriver releasing the clamp for the tube to be inserted. When the prongs of the tube have been pushed all the way into the socket the hinged member is swung to the right as indicated by the arrow and the tube is securely clamped in the socket and not subject to loosening from vibration.



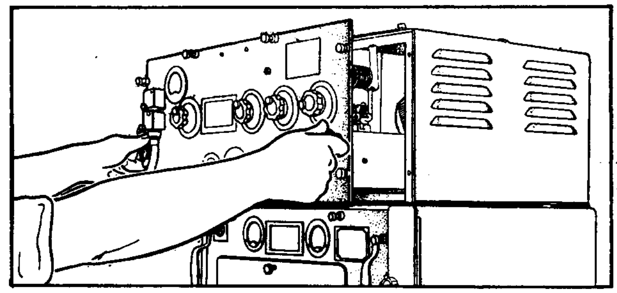
The chassis can now be slid into its case after attaching the two flexible cables that come through the back of the receiver case to the terminals on the rear of the receiver as shown in the illustration.

NOTE: Be sure these leads are attached correctly. The pair from terminals 18 and 19 of the terminal strip go to the terminals marked 115 V 60 cycle and the leads from terminals 20 and 21 are connected to terminals on the receiver marked Output.

The chassis can then be slipped into the case and thumbnuts on panel tightened to hold it securely.

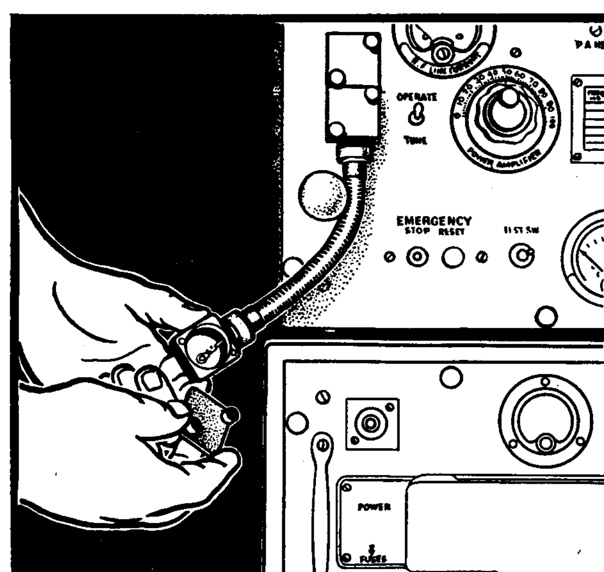
Before inserting tubes in the transmitter chassis inspect the relays K101, K102, K104 and K105 under the chassis to be sure they work freely. Make certain the overload relay with the reset knob on the panel opens and latches when the armature is pushed towards the coil with the finger. Turn the chassis right side up and check the action of the transmit-to-receive relay K103 located behind the panel near the antenna post by raising with the finger the member carrying the contact springs.

The tubes should be inserted into the sockets as marked. In the TBS-8 model there will be found tube clamps that are operated as described in connection with the receiver.



The chassis can then be slid into the housing, it not being necessary to make any connections since the plug and jack arrangement in the rear of the case takes care of all connections to the transmitter. As the transmitter is pushed into place the metal strip on the hinged lid should contact the interlock switch mounted on the shielding and actuate it. The chassis can be fastened in place in the cabinet by the thumbscrews on the panel front.

The antenna lead between transmitter and receiver can be reconnected by removing thumbnut and washer from standoff insulator on receiver panel, swinging flexible antenna lead with the square member clamped to its end into place over the insulator. Fit the lug on the central conductor over the threaded stud on the insulator and replace the washer and tighten thumbnut on stud tightly. The cover is replaced on the front of the small box member and the whole clamped into place on the panel by means of the two long thumbscrews removed in dismantling the equipment.

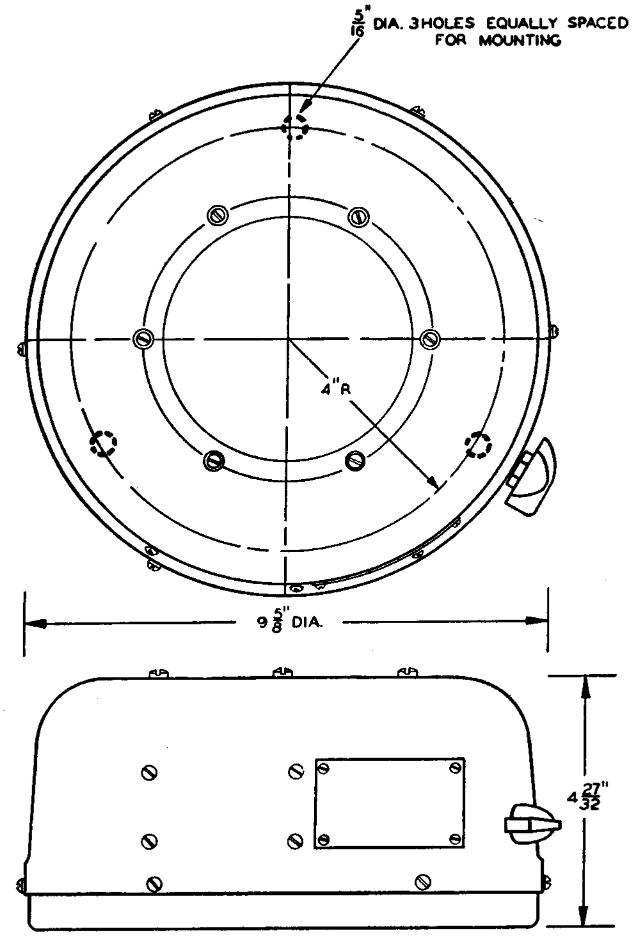


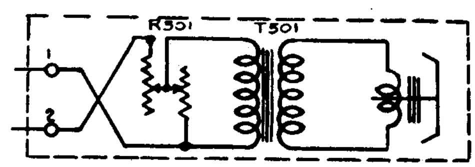
INSTALLING THE LOUDSPEAKER

The loudspeaker is installed near the control unit with which it is to be used and located at such a height, and in such a position that the operator will be in the direct path of the sound beam. The two types of speakers furnished with the different models of the TBS series differ somewhat in detail of installation.

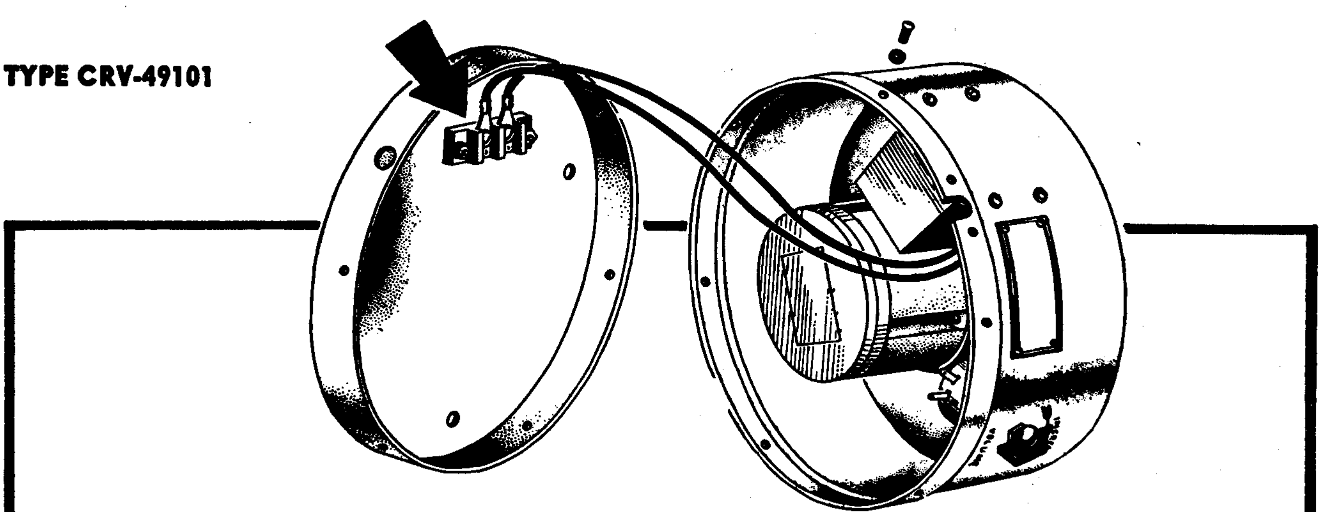
INSTALLING TYPE CRV-49101

Remove the six screws holding the two sections of the speaker together. Disconnect the two wires on the terminal block in the rear housing of the speaker. The rear section of the speaker can now be attached to the wall or bulkhead by bolts or screws in the desired location, with the threaded opening in the side wall of the section down. The two-conductor cable from the control box is passed through the hole provided and connected to the terminal block. The two wires from the front section of the speaker are reconnected and the sections fastened together by the screws first removed, with the nameplate of the front section at the bottom and the volume control knob to the right.





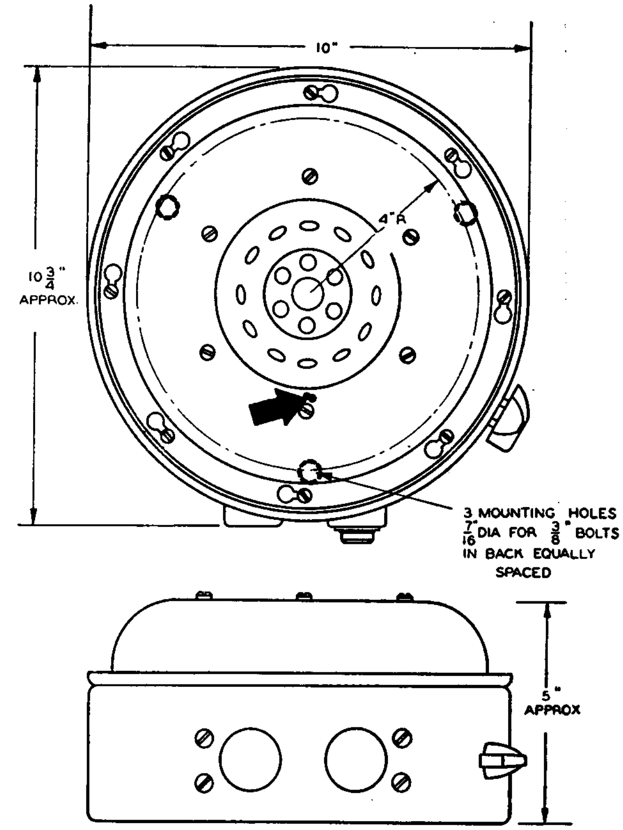
TYPE CRV-49101

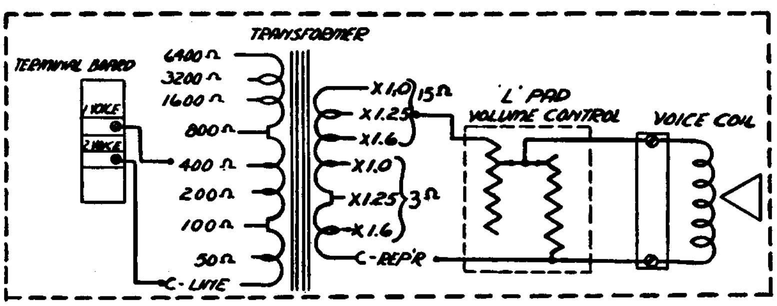


INSTALLING TYPE CRV-49155, CMX-49155

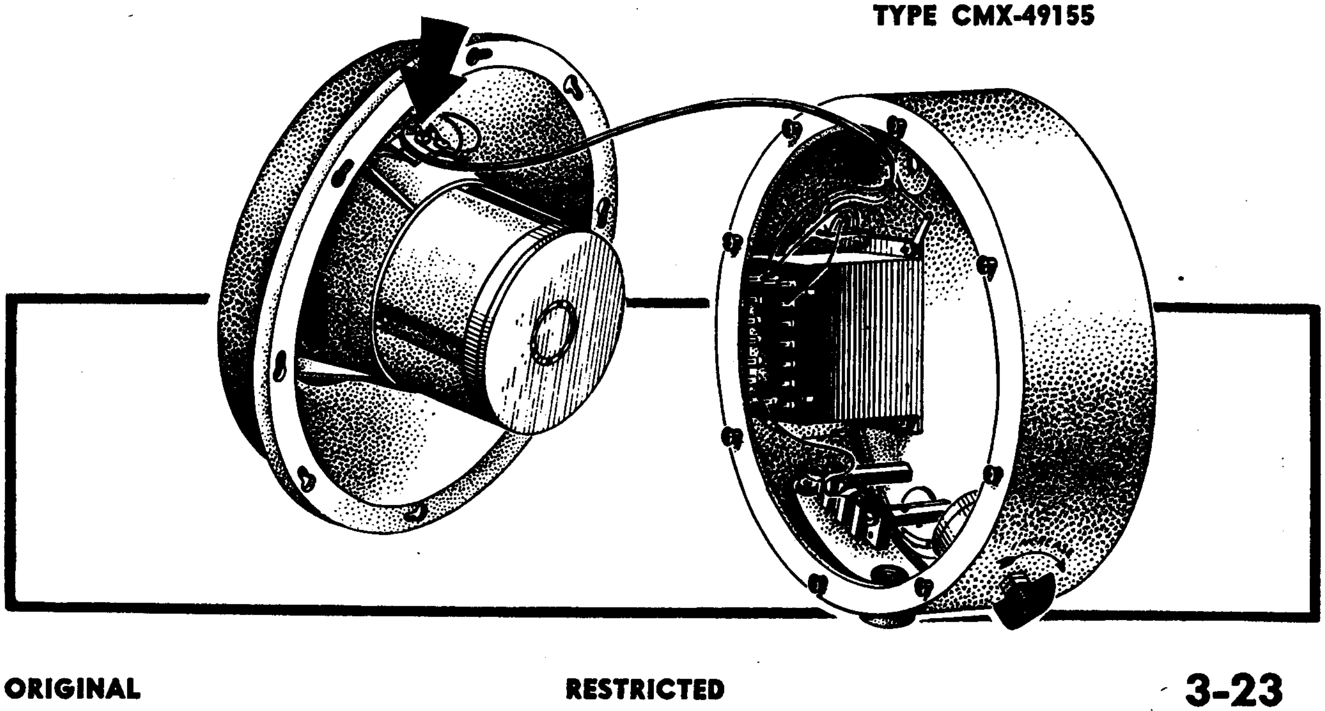
The loudspeaker is first dismantled by loosening the six screws around the rim and rotating the top section till it can be lifted off, the screw heads passing through the holes of the keyhole slots. Disconnect the two wires from voice coil terminals of the speaker mechanism in the front section, noting the wire with the black tracer connects to the Pos. terminal. Untie the cable stay cord and the two sections can be parted.

Mount the rear section of the speaker in the desired position by means of the holes in the back by screws or bolts as preferred with the threaded opening in the side of the rear section at the bottom. The cable to the speaker can be brought up through this hole and connected to the terminal block adjacent to the hole on the inside of the speaker base. After reconnecting the two leads to the speaker mechanism in the front section, the unit may be assembled in place with the small hole in the front of the speaker, as indicated with arrow, at the bottom to permit moisture to drain from the loudspeaker diaphragm.





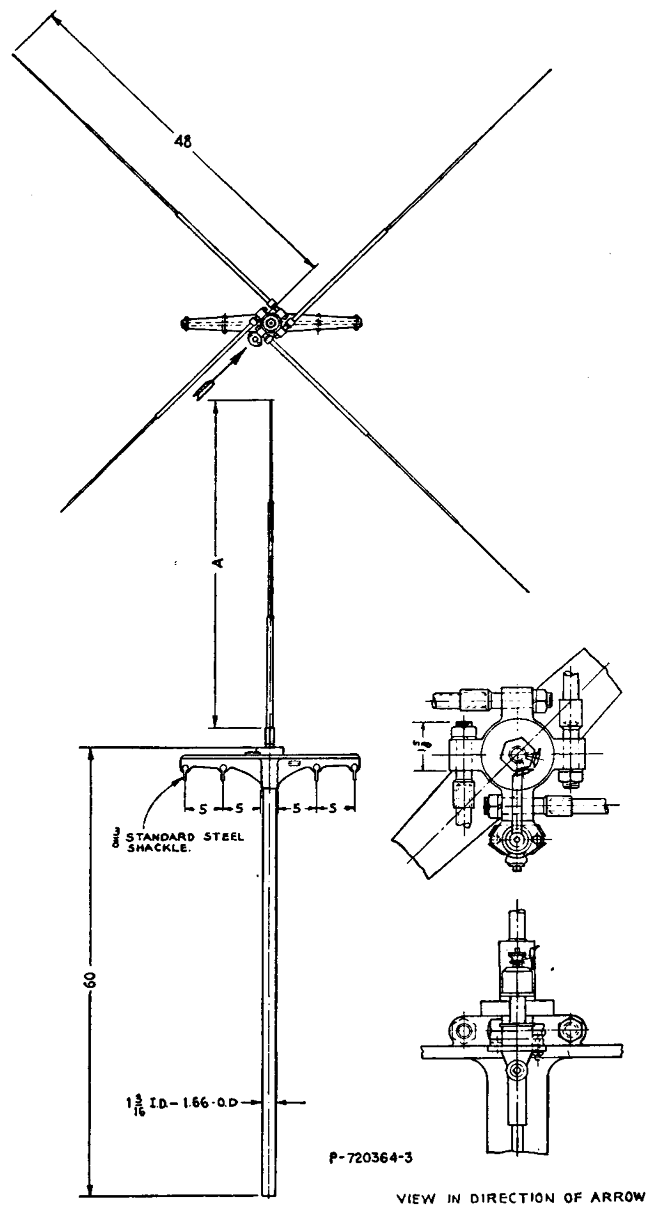
TYPE CRV-49155
TYPE CMX-49155



INSTALLING THE ANTENNA

DESTROYER TYPE

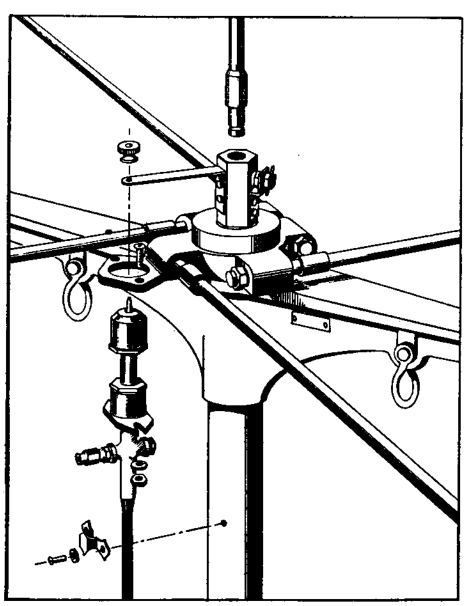
Navy Type CRV-66015, furnished with TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-6, TBS-8.
Navy Type CPD-66015 furnished with TBS-4, TBS-7.



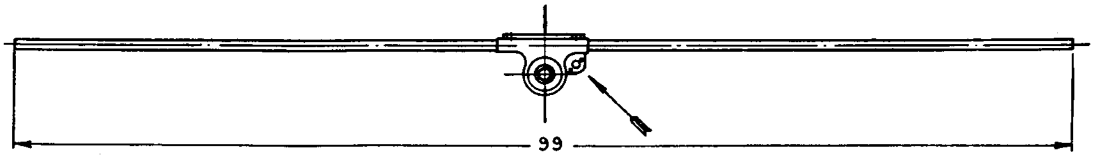
The antenna supplied is designed for installation on the top of the forward mast of the ship. It is shipped partly disassembled and must be put together before installation. Seven rods are supplied along with the main antenna structure. The four rods of equal length (48") should be fastened in place to extend horizontally (right angle to pole) as shown in the illustration, which gives all dimensions of the assembly. These rods form a ground plane for the radiating section which protrudes vertically above the pole. The other three rods are used as radiators (or collectors) for the radio-frequency signal. Only one of these is used at a time depending on the frequency of transmission or reception, according to the following table:

Length of Rod (inches)	Frequency Band (MC)
44	60 to 65
38⅜	64.5 to 71.5
33	71 to 80

Provisions are made in the antenna assembly for flag halyards, thus eliminating the necessity of the flag staff on the ship. The flag staff, therefore, should be removed and the antenna then clamped to the mast using the same fittings. It is important that this antenna be mounted in the clear, away from all metallic objects which might protrude above the level of the four ground rods. The position of the antenna when clamped to the mast should be such that sufficient clearance for the running light is obtained. Since it may be necessary later to substitute a different radiating section, the base of this section should be so located that it will be accessible to a man on the mast of the ship. If necessary to make the antenna fit in a given installation, a portion of the supporting pole may be cut off. As much as 32 inches may be removed from the bottom of the pole.



A bracket for attaching the end seal of the transmission line is located on the assembly. The central conductor of the transmission line fits into the angle piece through which connection is made to the radiating section of the antenna, as shown in illustration.

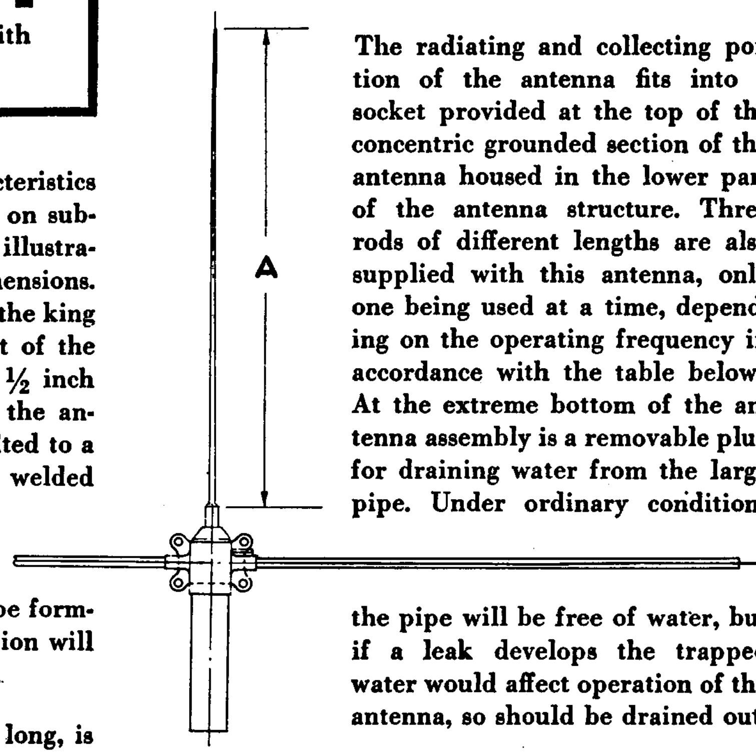


SUBMARINE TYPE

Navy Type CRV-66016 furnished with TBS, TBS-1, TBS-2.

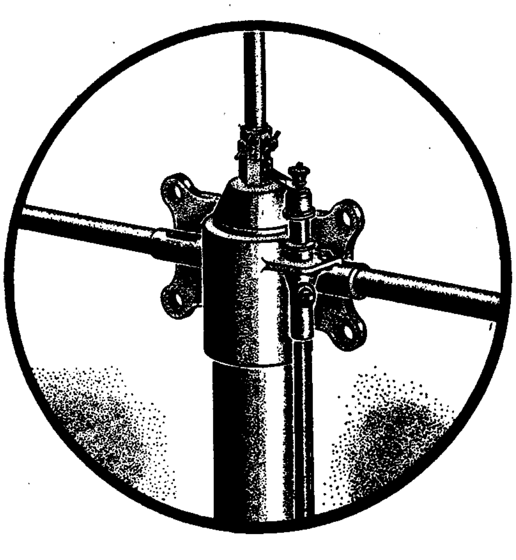
An antenna with the same electrical characteristics as the Destroyer type is furnished for use on submarines. As shown in the accompanying illustration it differs in mechanical details and dimensions. It is designed to be mounted on the side of the king post which is located on the forward part of the submarine. A cast bronze plate with four ½ inch mounting holes extends from the side of the antenna structure. This mounting plate is bolted to a matching plate, not supplied, that must be welded or bolted to the king post of the submarine. The antenna should be so mounted that the bottom clears the torpedo boom tackle and that the one-inch pipe forming the ground plane for the radiating section will lie parallel to the center line of the ship.

An Everdur pipe, eight feet, three inches long, is slipped through the hole provided and clamped into position with four thumbscrews so that an even length of pipe extends fore and aft of the antenna structure. If broken off or badly bent this pipe may be replaced with a similar length of one-inch iron pipe.

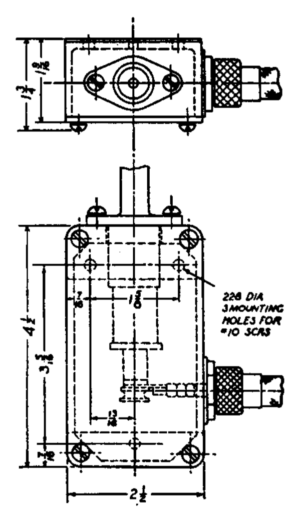


The radiating and collecting portion of the antenna fits into a socket provided at the top of the concentric grounded section of the antenna housed in the lower part of the antenna structure. Three rods of different lengths are also supplied with this antenna, only one being used at a time, depending on the operating frequency in accordance with the table below: At the extreme bottom of the antenna assembly is a removable plug for draining water from the large pipe. Under ordinary conditions the pipe will be free of water, but if a leak develops the trapped water would affect operation of the antenna, so should be drained out.

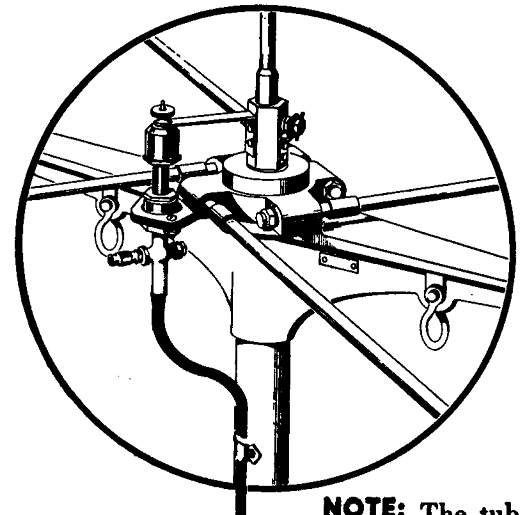
Length of Rod (inches)	Frequency Band MC
41⅞	60.0 to 64.5
34¾	64.5 to 71.0
28¼	71.0 to 80.0



DIMENSION FOR INSTALLATION OF JUNCTION BOX AT TRANSMITTER



INSTALLING THE TRANSMISSION LINE



The transmission line comes in a fixed length with end seals to retain the gas pressure, so it is well to determine exactly what holes must be cut in decks or bulkheads to permit its installation. Bear in mind that no bend having a radius less than eight inches can be used and that the lower end of the line must terminate within two feet of the antenna connection on the transmitter.

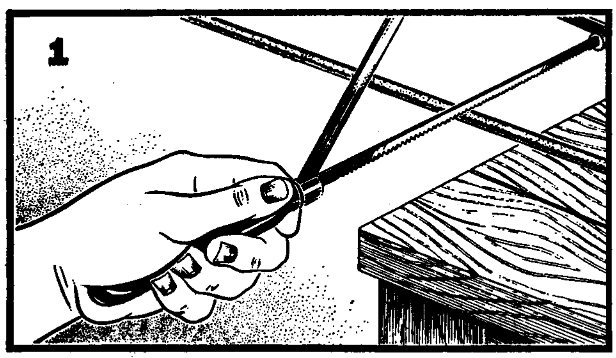
When ready to install, the line should be uncoiled carefully to prevent kinking. As large a radius as possible should be used in making bends as the line is passed through the openings cut for it, thus gradually bringing the antenna end of the line up to the antenna.

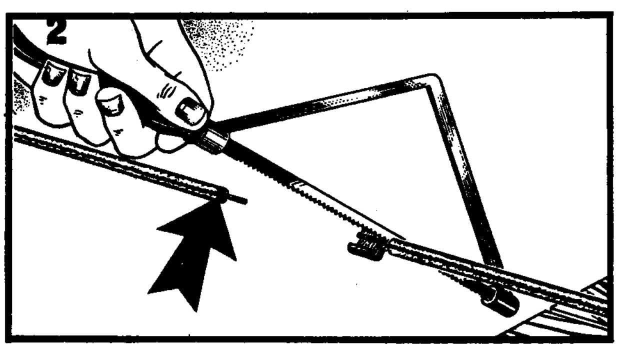
NOTE: The tubing of the transmission line is made of soft copper. Extreme care should be taken to avoid denting it during installation and while in use.

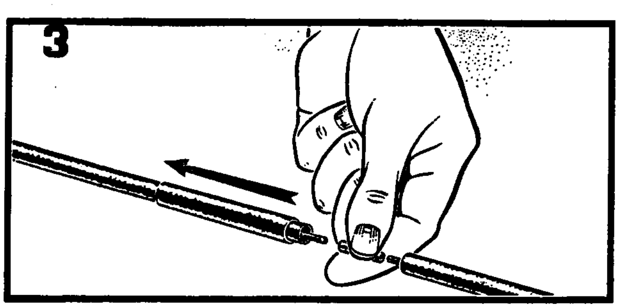
The top seal and fitting of the transmission line should be inserted in the bracket on antenna and clamped into place as shown in the illustration. Then working down the line, bend it carefully to its final position, working all bends down slowly but retaining as large a radius as possible at such bends as must be made. Strap the line in place, clamping it only enough for adequate support while permitting it to slide freely through the clamps.

SHORTENING TRANSMISSION LINE

Should the line prove too long for a particular installation it can be shortened by removing a section at some convenient place along its length. Determine the length of the piece to be removed from the line and proceed as shown in the series of illustrations.







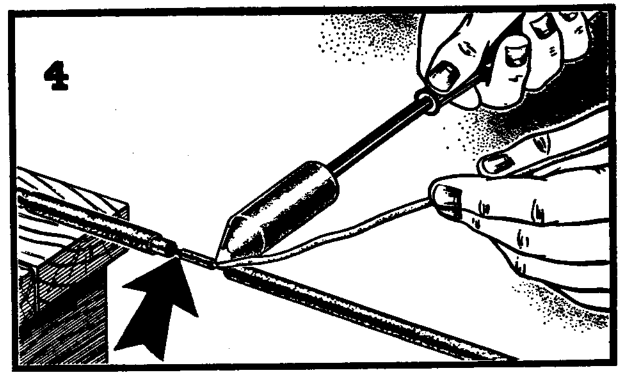
1 Cut through sheath and central conductor at two points to remove a length of the line a foot shorter than the length of span to be removed. Saw evenly around tube till nearly cut through and break off by bending tube.

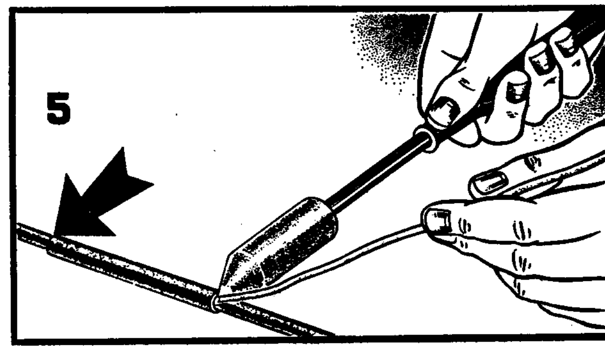
2 Cut back the sheath of the line at both of the free ends till the insulators on the inside are not inset more than one half inch from the end of the sheath. Cut center conductor so it extends one half inch beyond end of sheath.

3 Remove burrs from end of copper tubing with penknife, slip large coupling sleeve over sheath and join the ends of the inner conductor with small coupling sleeve.

4 Solder connecting sleeve at both ends with soldering iron and rosin core solder.

5 Clean ends of outer sheath with steel wool or fine sandpaper and slide outer coupling over joint and solder in place with hot soldering iron and rosin core solder. Make sure solder flows freely in between sheath and sleeve.





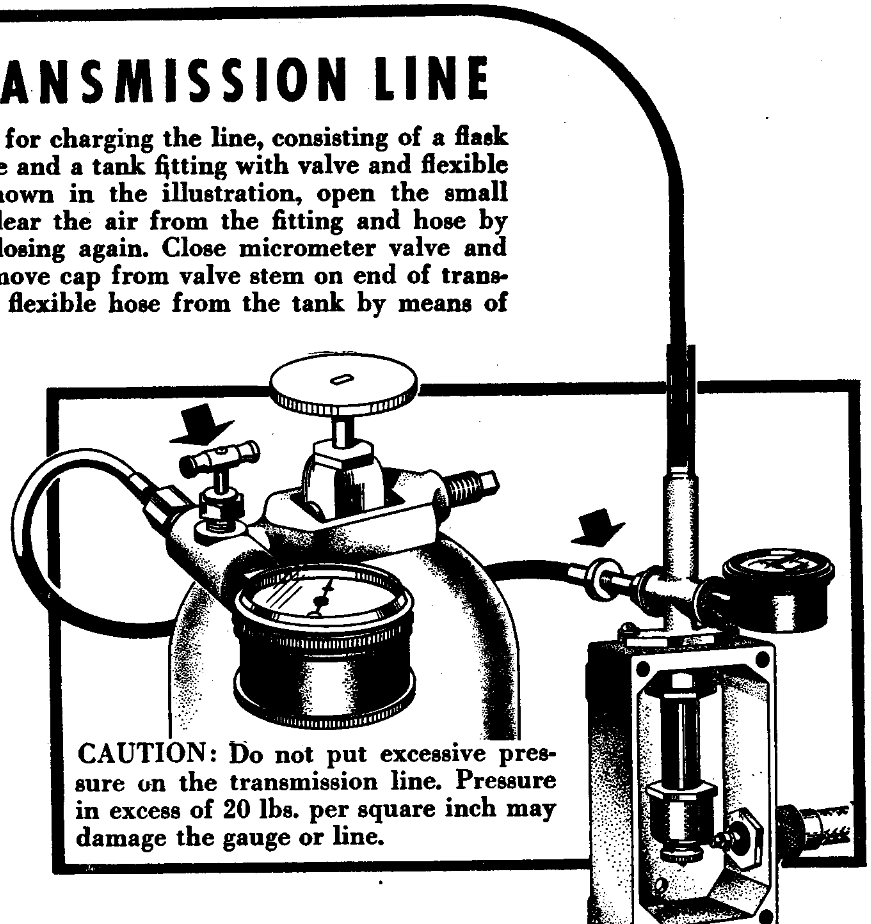
With the transmission line in place, the junction box can be attached. Remove the lid from the junction box and remove the two screws located on the end of the box. Insert transmission line end seal insulator and sleeve into the box and replace the screws to clamp the box and line together, as shown in the illustration.

The flexible lead to the transmitter panel should be fitted into the opening in the side of the junction box, by slipping the eyelet on the end of the flexible central conductor of the lead over the threaded stub mounted on the transmission line seal. The flexible lead from the transmitter can be clamped rigidly to the box by means of the threaded collar. The connection in the box is completed by replacing the washer and thumbnut on the terminal on the transmission line seal. Replace the lid on the box and the installation is complete.

FILLING THE TRANSMISSION LINE

A transmission line kit is provided for charging the line, consisting of a flask of nitrogen under 2000 lbs. pressure and a tank fitting with valve and flexible hose. Attach fitting to tank as shown in the illustration, open the small micrometer valve on the fitting, clear the air from the fitting and hose by opening flask valve slightly and closing again. Close micrometer valve and open flask valve one half turn. Remove cap from valve stem on end of transmission line fitting and attach the flexible hose from the tank by means of the threaded fitting on hose.

Open the bleeder valve on the transmission line seal where it is attached to the antenna. Admit gas to the transmission line by opening micrometer valve slightly, allow gas to flow through the line slowly for five minutes to clear the line of air and remove any moisture present. The micrometer valve should then be closed. Close bleeder valve tightly at antenna end of line. Open the micrometer valve slowly to admit gas to the line meanwhile watching the gauge on the transmission line. Allow the pressure to build up to 10 lbs. per square inch and close the flask valve.



CAUTION: Do not put excessive pressure on the transmission line. Pressure in excess of 20 lbs. per square inch may damage the gauge or line.

The pressure on the transmission line should be watched to see if it begins to drop immediately. Should this occur, it indicates a leak in the line that must be found and repaired by soldering or other means before the apparatus can be put into service. When sure the line is tight the flexible hose may be detached from the valve on the line and the cap replaced on the valve.

ADJUSTING AND TUNING THE EQUIPMENT

SAFETY WARNING

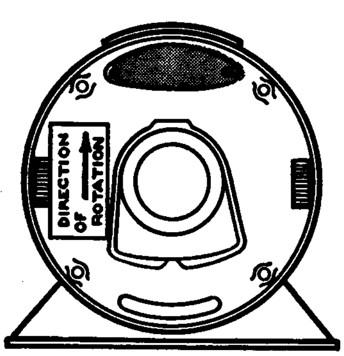
OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. SEE PAGE 3. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND ON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION BUT ALWAYS SHUT DOWN MOTOR GENERATORS OR OTHER POWER EQUIPMENT AND OPEN THE MAIN SWITCH IN SUPPLY LINE TO EQUIPMENT.

CHECKING THE MOTOR-GENERATORS

After all connections have been completed and units reassembled the adjustment and tuning of the equipment can be undertaken. The power supply unit should be adjusted first to be sure proper operating voltages are furnished the transmitter.

First check the transmitter to be sure the Emergency Reset button is in, press the overload Reset to latch up the overload relay and close the lid on the transmitter case so the interlocking switch will prevent operation of the equipment. Close the switch on ship power line to magnetic controller.

Press the Start button on the transmitter panel which should actuate the magnetic controller and start the motor generator, as will be indicated by pilot light on panel. Remove the cover plate from the motor end of the motor-generator, if of the a-c type, and check the direction of rotation as indicated by the arrow on the end of the motor frame. If the direction of rotation is wrong the motor may be reversed by shutting off the power at the main switch and interchanging any two of the three leads from the power supply where they are connected to the fuse block in the magnetic controller. On starting the machine again the direction will be found to be correct.



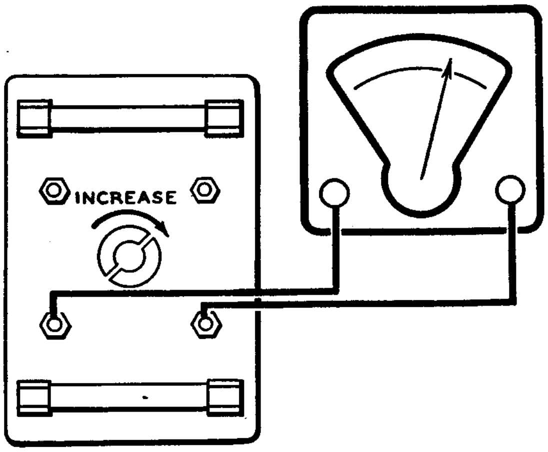
The next important factor is the speed of the motor-generator. This is fixed in the a-c machines which always run at 3450 on 60 cycle current. In the case of d-c machines, changes in supply voltage may affect the speed, so a speed regulator is built into the machine at the motor end. On the motor-generators furnished with the earlier models of the TBS this control took the form of a dial on the end of the motor; in the later models a knob is provided, being protected from injury by a metal cap which must be removed to make adjustments.

Two means may be employed for checking the motor-generator speed while making adjustment. A frequency meter may be connected across the terminals of the lower pair of fuses in the magnetic controller case, which carry the 220 volt a-c furnished by the special winding in the motor. The speed of the machine is adjusted by means of the knob or dial till the meter reading of 60 cycles is obtained when the motor-generator speed will be 3600 revolutions per minute.

The second method of checking the speed is to use a stroboscope, setting it for 3600 and holding the lamp near the opening in the machine housing after the inspection plate is removed from the end. When the machine is running at the correct speed of 3600 R.P.M. the armature will appear to be standing still; but if it appears to be turning slowly in the direction of rotation it is running too fast and is slowed down to the correct speed by turning the adjusting knob on the motor housing slowly to the right. If the armature appears to be turning against the direction of rotation when viewed under the stroboscope lamp, it is running slow and can be speeded up slightly till it appears stationary by turning the knob or dial to the left. This speed will have to be checked again under full load condition after the equipment is all operating.

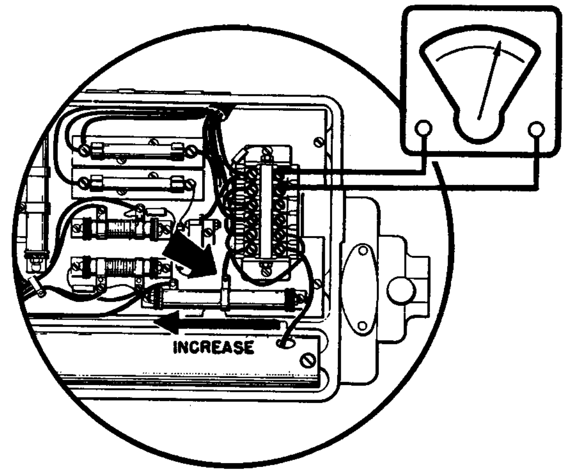
The d-c output of the machine must be checked in order to provide proper voltage supply to the tubes. If the plate voltage is too high, the life of the tubes will be unduly shortened, while a plate voltage that is too low will result in low output power and improper modulation of the carrier by the voice frequencies. This setting should be finally made while the equipment is operating under full load with 90% tone modulation but a preliminary setting should be made at this time with a final check after adjustments are complete.

To check the voltage on the motor-generators which have the terminal box on the side of the machine, a d-c voltmeter with a 0 to 1000 volt scale is connected across the HV+ and HV— terminals



as shown in the illustration while the machine is not running. Start the motor generator by means of the push-buttons and if the voltage reading is below 875 volts insert a screwdriver in the slot indicated by the arrow and turn to the right until correct voltage is obtained.

The voltage adjustment of the motor-generators with the terminal box on the top, is slightly different, as will be seen in the illustration. The voltmeter is connected across the high voltage terminals with the machine shut down as in the previous case. Adjustment of voltage is made by shutting down the machine and loosening the clamping



screw on the metal band around the resistor as shown and shifting it to the left and reclamping, to increase the voltage.

When all adjustments are complete on the motor-generator the plates on terminal boxes and motor housing should be replaced.

NOTE: Shut down the machine while making adjustments by opening the power supply switch. Do not rely on shutting off the motor-generator with the stop-button. Someone might press a start-button on the control box by accident or through curiosity and start the machine.

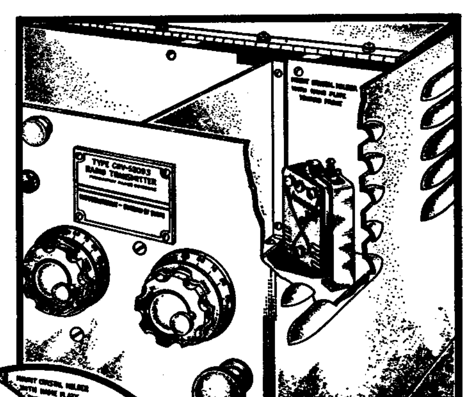
ADJUSTING THE TRANSMITTER

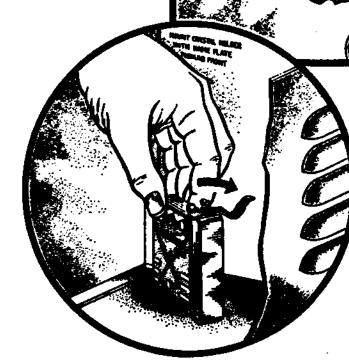
Having determined the frequency to which the equipment is to be tuned, insert the proper rod in the radiating section of the antenna in accordance with the following table.

FREQUENCY RANGE	DESTROYER TYPE	SUBMARINE TYPE
60 -64.5 M.C.	44 inches	41⅞ inches
64.5-71.0 M.C.	38⅜ inches	34¾ inches
71.0-80.0 M.C.	33 inches	28¼ inches

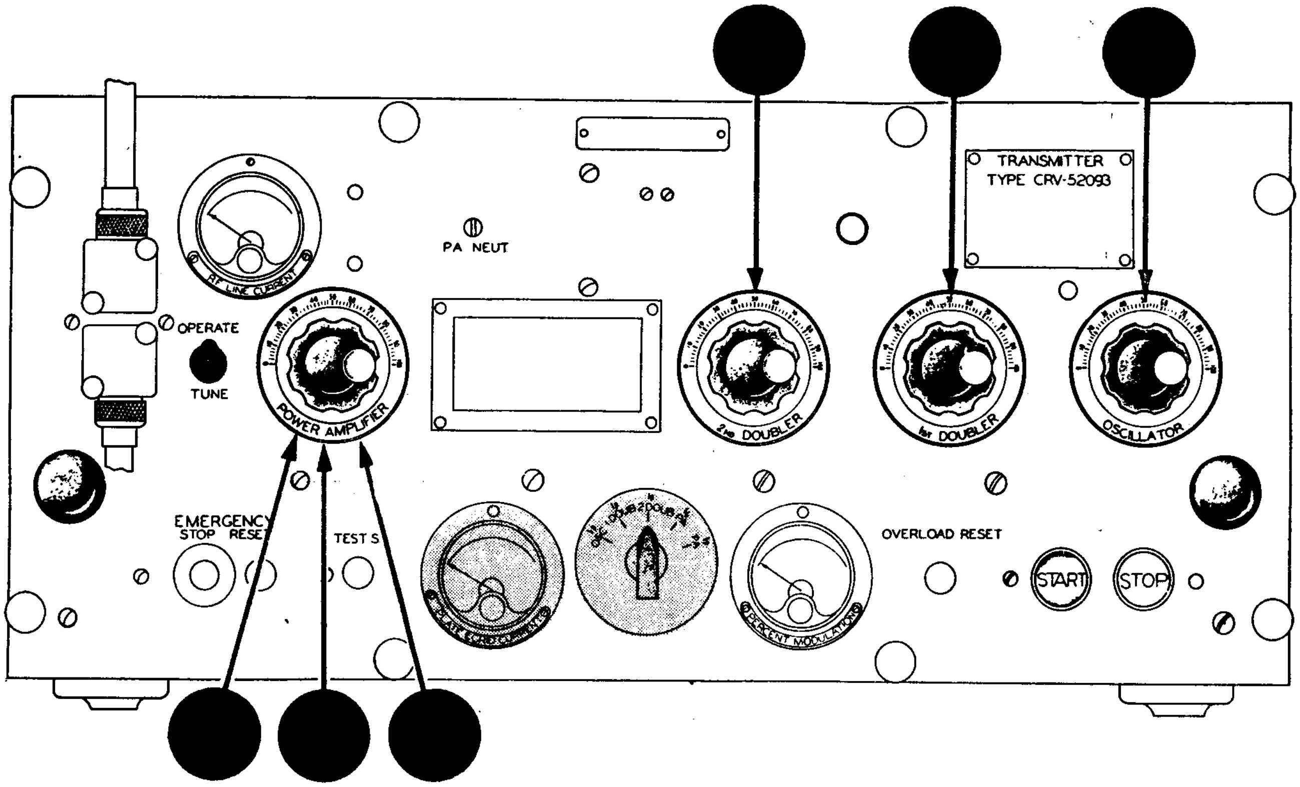
The proper rod is inserted in the hexagonal brass sleeve supported by the ceramic insulator in the center of the antenna structure and clamped tightly by the two thumbnuts on the side of the socket.

The proper transmitter crystal for the channel frequency to be used is inserted in the jacks in the oscillator section of the transmitter by raising the access door as shown in the illustration. The crystal frequency marking on the crystal holder plate should be one fourth of the channel frequency and the crystal holder is inserted in the jacks with the nameplate to the front of the transmitter.





The rubber protected clip over the crystal mounting socket is raised and swung to the back shield as shown and the crystal holder inserted.

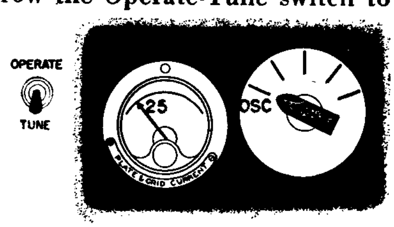


Either of the openings in the crystal holder socket may receive the left-hand prong of the crystal holder. The metal clip is then swung back and rests on the top of the crystal holder to prevent vibration from affecting the crystal mounting.

Two spare crystal holders, one for the transmitter and the other for the receiver, may be stored in the crystal rack mounted at the rear of the power amplifier shield.

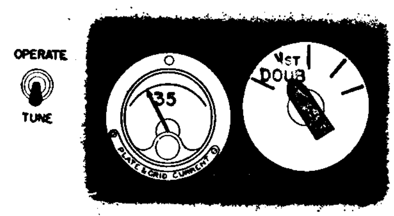
After inserting the crystal holder, close the transmitter access door, press the START button on the transmitter panel and the motor-generator will start and supply current to the tube filaments of the transmitter. This will be indicated by the pilot light glowing on the transmitter panel. Allow the tubes to heat for a minute or two.

A Meanwhile throw the Operate-Tune switch to the Tune position and move the Meter switch to the I_p Osc. position as shown, thus placing the Pl. & Grid Current meter in the plate circuit of the oscillator tube.

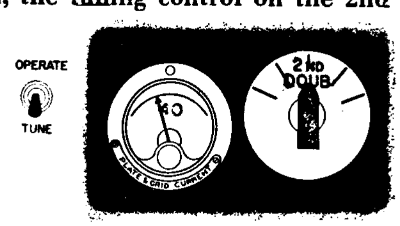


When the tubes have warmed sufficiently, which requires about one minute, press the Test Switch and beginning at zero rotate the OSCILLATOR dial very slowly in a clockwise direction until the plate current reading suddenly drops to a minimum value. This circuit should always be adjusted by starting at zero and turning the dial clockwise. At the point of minimum plate current the oscillator is functioning but a final adjustment will have to be made when the other circuits are properly tuned.

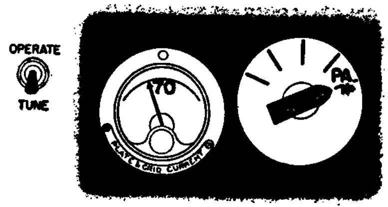
B Move the Meter switch to the second position marked I_p 1-Doub. and with the Test switch still in, rotate the dial of the 1st Doubler till the meter indicates MINIMUM current in the plate circuit of this tube. The plate current dip for this stage may be small and the dial should be rotated past the point of resonance once or twice to get the lowest plate current reading possible.



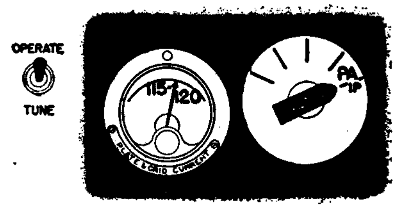
C The Meter switch is now moved to the I_p 2-Doub. position on the dial and again holding the Test switch in, the tuning control on the 2nd Doubler is rotated to obtain a MINIMUM current in the plate circuit of this tube as indicated by the Plate and Grid Current meter. The readings given on the meters in the illustration showing the switch positions are close approximations of the readings that should be obtained with tubes in good condition. Should they vary appreciably it may be advisable to change the tube in the stage showing marked deviation from the above readings.



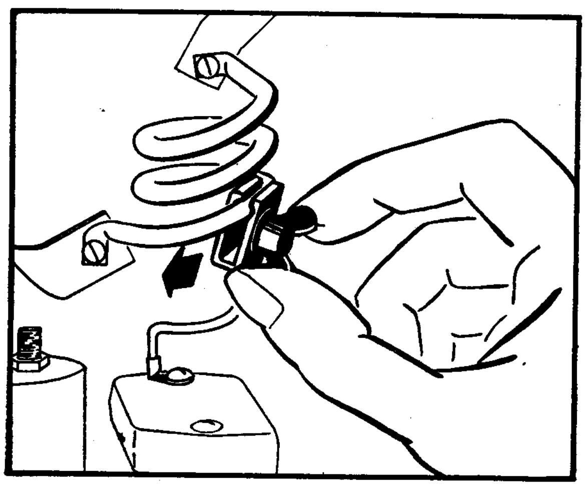
D Rotate the Meter switch to the I_p PA position as shown, and with the Test switch in, rotate the dial of the Power Amplifier until MINIMUM plate current is indicated in this stage by the meter. A reading of 75 ma will usually be obtained as the output circuit of the Power Amplifier.



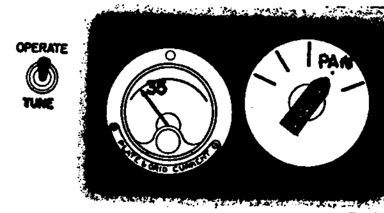
E With the Meter switch still in the I_p PA position throw the Tune-Operate switch to the Operate position. The PA plate current as indicated by the meter should now be between 115 and 120 ma to assure full power output of the transmitter.



If the current is not within these limits the location of the tap on the PA plate-tank coil must be changed. To make this adjustment first shut off all power to the transmitter, open the transmitter access door and loosen the thumbscrew which holds the tap in position on the coil as shown in the illustration. The position of the tap on the coil should be moved in a clockwise direction if the meter reading was below 115 ma and in a counter-clockwise direction if the plate current reading was above 120 ma. After moving the tap position a quarter inch as a trial setting, close the transmitter access door and start the motor generator again. After allowing the tubes to warm up for a minute press the Test switch and take another PA plate current reading. If PA plate current is still not within the 115 to 120 ma. range repeat the shifting of the plate-tank tap until this condition is obtained.



F The Meter switch is now moved to I_g PA position and with the Tune-Operate switch in the Operate position allow the transmitter to warm up well for four or five minutes, then carefully readjust the settings of the 1st and 2nd Doubler tuning controls to the point that provides the MAXIMUM amount of current in the grid circuit of the Power Amplifier as indicated by the meter. Then detune the oscillator setting on the high frequency side of resonance by rotating the tuning dial clockwise a few degrees till the meter indicates 35 ma. in the grid circuit of the Power Amplifier.

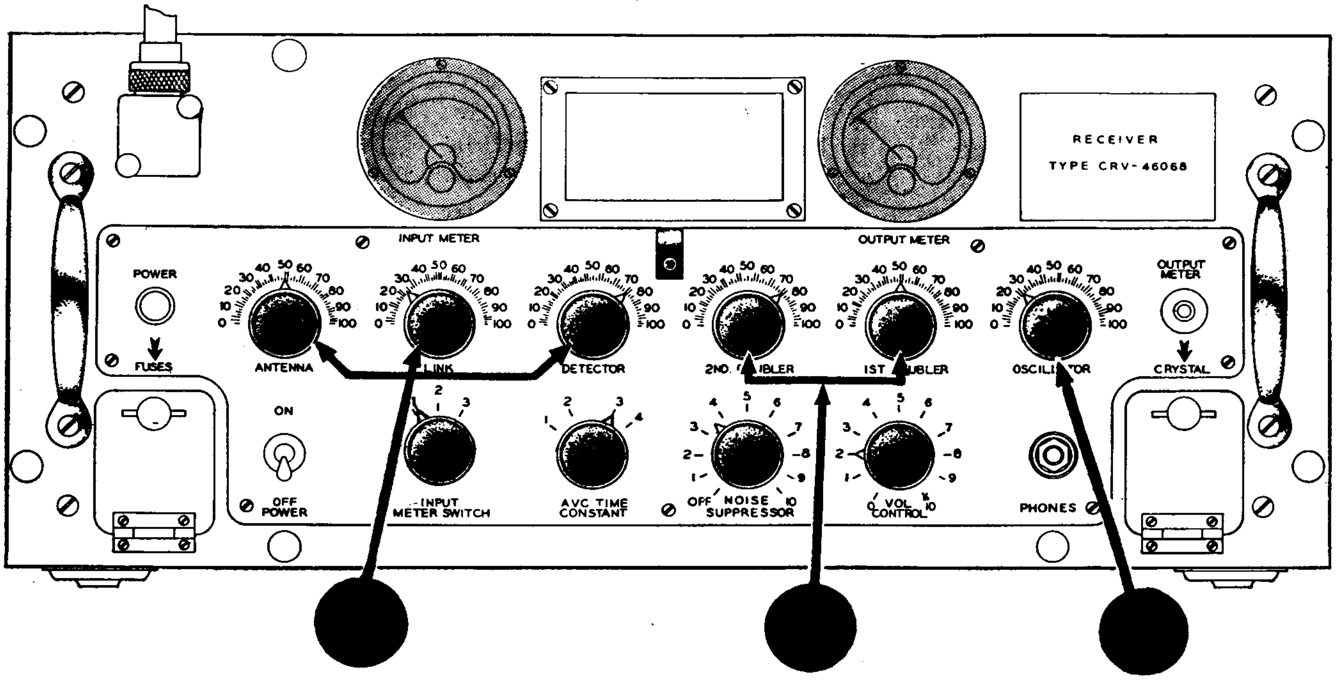


Reset the Meter switch to the fourth position (D) with the pointer on I_p PA position and with the Test switch in, readjust the PA tuning control to obtain a MINIMUM amount of plate current. Should the plate current on the PA stage not fall within the 115 to 120 ma. range it may be necessary to readjust the tap on the plate-tank coil as previously explained to obtain this condition. This completes the tuning of the transmitter and all four of the tuning controls should be locked in position by tightening the thumbscrews attached to the control knobs. Special care should be exercised that the tuning is not disturbed and the output of the PA stage should be checked again after the tuning is completed.

A tuning record chart is provided near the center of the front panel of the transmitter. This is intended to record the settings of the dials when the transmitter has been tuned to a given frequency and serves as a guide in making future settings of the tuning controls, but in any case, the final adjustments should be made by checking plate and grid currents in the various stages as just described. A chart is shown herewith giving average settings of the controls as would be recorded on the chart.

AVERAGE CALIBRATION DATA FOR TRANSMITTER

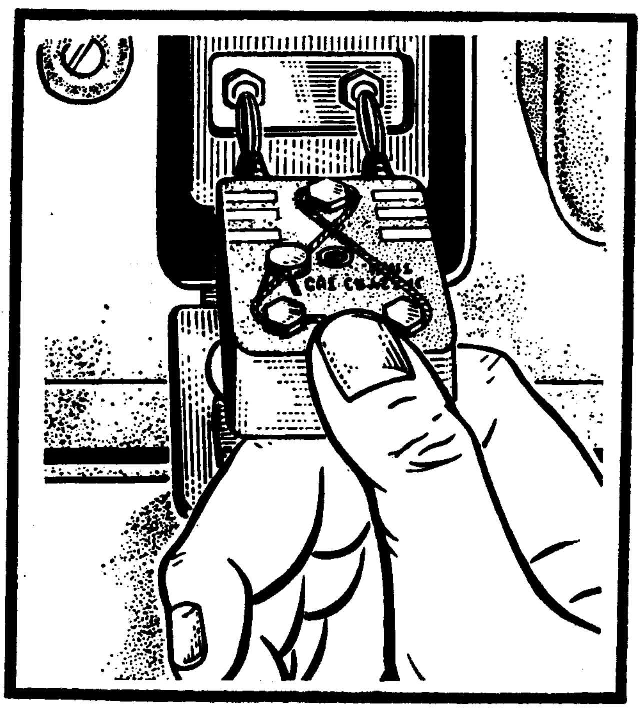
Frequency (MC)	Oscillator	Control Setting 1st Doubler	Control Setting 2nd Doubler	Power Amplifier
60.0	8	8	8	8
65.7	33	40	35	37
73.5	58	68	63	68
80.0	72	89	82	86



TUNING THE RECEIVER

The receiver, being of the fixed tuned type and designed for operation from remote control units, requires tuning to the same frequency as that of the transmitter carrier. It remains fixed on that frequency until the adjustments are disturbed or a change of frequency of the installation is necessary.

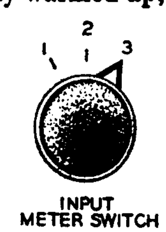
The first step in tuning the receiver is to select the proper receiver crystal for the signal frequency to be received. A receiver crystal, readily identified by the blue nameplate in the earlier models, should be used having the same channel frequency marking as that used in the transmitter. The crystal holder is inserted into the jacks in the receiver by opening the small hinged door to the right of the receiver panel. The crystal holder is inserted, nameplate up, and is held tightly in the jacks by the small rubber knob on the back of the hinged door when it is latched shut.



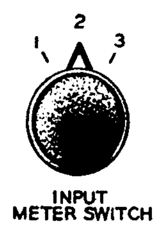
The power switch on the front panel is placed in the On position and, if all connections are correct, the pilot light on the panel will glow indicating the power is on the receiver.

Set the Volume Control at approximately mid-position, turn the Noise Suppressor knob to the Off position, and place the AVC control on Pos. 1.

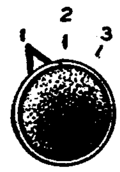
A Move the Input Meter switch to position 3 and after the tubes are thoroughly warmed up, slowly rotate the dial on the Oscillator until a sudden dip followed by a sudden rise is noted on the Input meter. The tuning control on the oscillator should be set three dial divisions to the right of the setting giving the greatest dip on the meter.



B Shift the Input Meter switch to position 2 where it will connect the meter in the cathode circuit of the 1st Detector tube and adjust the tuning controls on the 1st and 2nd Doublers until the meter indicates the maximum excitation on the 1st Detector. It may be desirable to change the setting of the tuning control on the 1st Detector toward the left or low frequency side to obtain the greatest degree of deflection on the input meter for this adjustment.



C Move the Input Meter switch to position 1. Usually no signal will be available for tuning, so the Antenna, Link and Detector controls must be tuned to resonance by noting the noise in the output of the receiver, heard at the loudspeaker or headset plugged into the jack on the panel. The point of resonance will be indicated by the loudest noise in the output or maximum reading on Output meter and the volume control may be readjusted to obtain a satisfactory output level for making these adjustments.



INPUT METER SWITCH

The Receiver, having been brought to a fair degree of sensitivity the final adjustments can be made when a signal of the correct frequency is picked up. The adjustments of the oscillator will be correct but the Antenna, Link and Detector tuning controls may need slight readjustment.

With the Input Meter switch on Position 1 and the Output Meter button on the panel depressed the point of resonance in the three circuits will be indicated by a maximum reading on both Input and Output meters. The reading of the latter meter is dependent upon the volume control setting but an effort should be made to obtain the highest reading for any given setting of the volume control knob.

After tuning is completed the volume control should be set approximately three quarters of maximum so local adjustment of sound level can be made at control units and loudspeaker.

The setting of the Noise Suppressor control will depend upon operating conditions. Where background noise is light compared to signal strength the knob can be turned to the right till the noise just fades out. However, should background noise level be as high or higher than the weakest signal to be received it will be necessary to compromise and hold the noise below the nuisance level to the extent that will permit the weak signals to be heard.

The setting of the A.V.C. Time Constant control is made to suit the operator and may be placed on setting 2 or 3. This gives an average value of delay in the return of automatic volume control to maximum sensitivity after receiving a high level signal impulse. Where there is rapid fading or "flutter" in the voice reception or fast keying in the telegraph signals the knob should be turned to Position 1 to obtain optimum results. When the received signals fade in and out slowly, Position 4 of the knob gives better results.

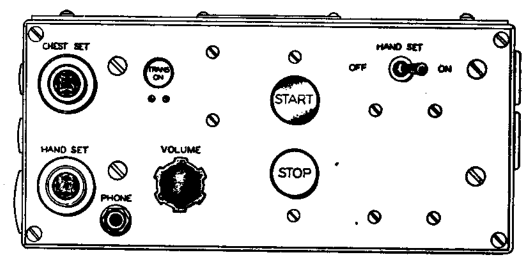
A tuning chart is provided on the front panel of the receiving unit. The setting of each tuning control for each frequency to which the receiver has been tuned should be recorded on this chart. Reference can then be made to this chart when returning to a given frequency but final adjustments must be made as described above.

AVERAGE CALIBRATION DATA OF RECEIVER

Frequency (MC)	Ant.	Link	Det.	Control Setting 2nd Doubler	Control Setting 1st Doubler	Osc.
60	15	15	15	15	15	15
80	88	81	80	80	88	80

When all adjustments are complete the hinged cover should be swung up over the control knobs and locked into place with the thumbscrew provided.

CHECKING THE CONTROL UNIT



Make sure the ship power supply to the motor-generator is on and then switch on the receiver by means of the switch on the panel.

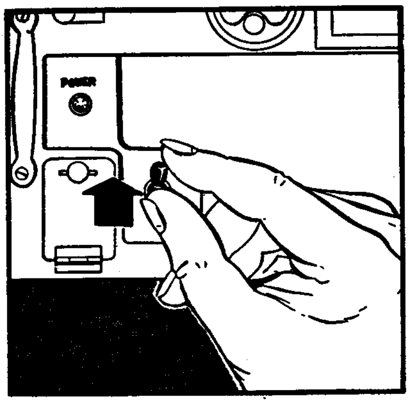
Proceed to the control unit and connect a handset into the proper receptacle. Press the Start button on the control unit panel and the transparency in the panel should glow, indicating Trans. On.

While listening to the handset rotate the volume control knob and note rise and fall of background noise level. After permitting tubes in transmitter to heat properly, press the button on the handle of the handset. This will put the carrier on the air and anything spoken into the microphone of the handset will be heard in the earpiece of the handset as the receiver is acting as a monitor and a check on transmission.

At the control unit where the loudspeaker is connected, check to see that the buttons on the handset and chest set both act to cut the loudspeaker out of the circuit while speaking into the microphone.

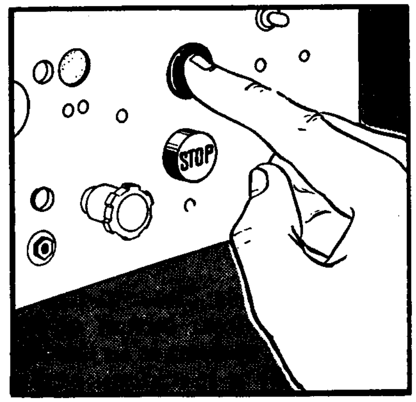
When a telegraph key is used with the equipment, the carrier delay circuit for MCW transmission should be checked. To test the circuit, turn the volume control to a fairly high level and press the key, holding for a second or two, and then release. Listen in the earpiece of the handset for a click when the carrier goes off the air. The time period between raising the key and hearing the carrier-off sound should be between 0.7 and 1.2 seconds. The equipment should now be ready to turn over to operating personnel.

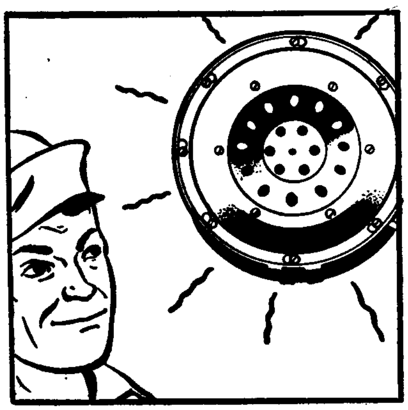
OPERATION TEST SEQUENCE



Switch on Receiver by placing Power toggle switch, at the left of the panel of the receiver, in the ON position. Pilot light on panel will glow and background noise will be heard in loudspeaker as tubes warm up.

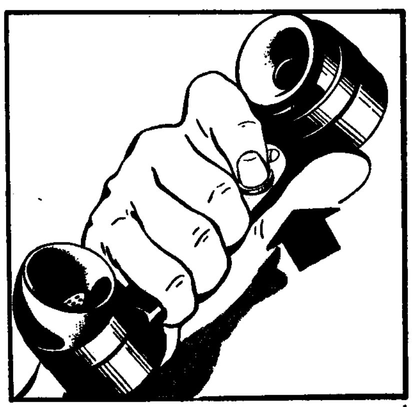
Press Start button on Transmitter panel or Control Unit and indicator lamps will come on as Motor Generator starts. Tubes in transmitter will begin to warm up for operation.

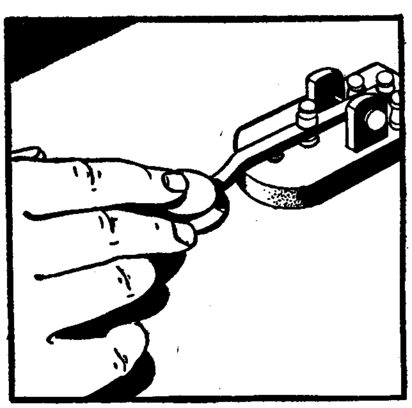




Equipment is now in the Standby condition. Loudspeaker or earpiece of any handset switched on will reproduce any signals picked up by the receiver if Noise Suppressor control is not set too high.

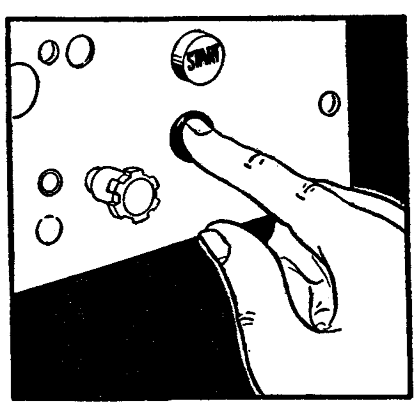
To transmit by phone, depress the Press-to-Talk switch on either handset or chest set microphone and speak into the associated microphone. R-F Line Current meter will indicate output of Transmitter and Modulation meter will indicate percentage of modulation obtained. Release switch for reception.

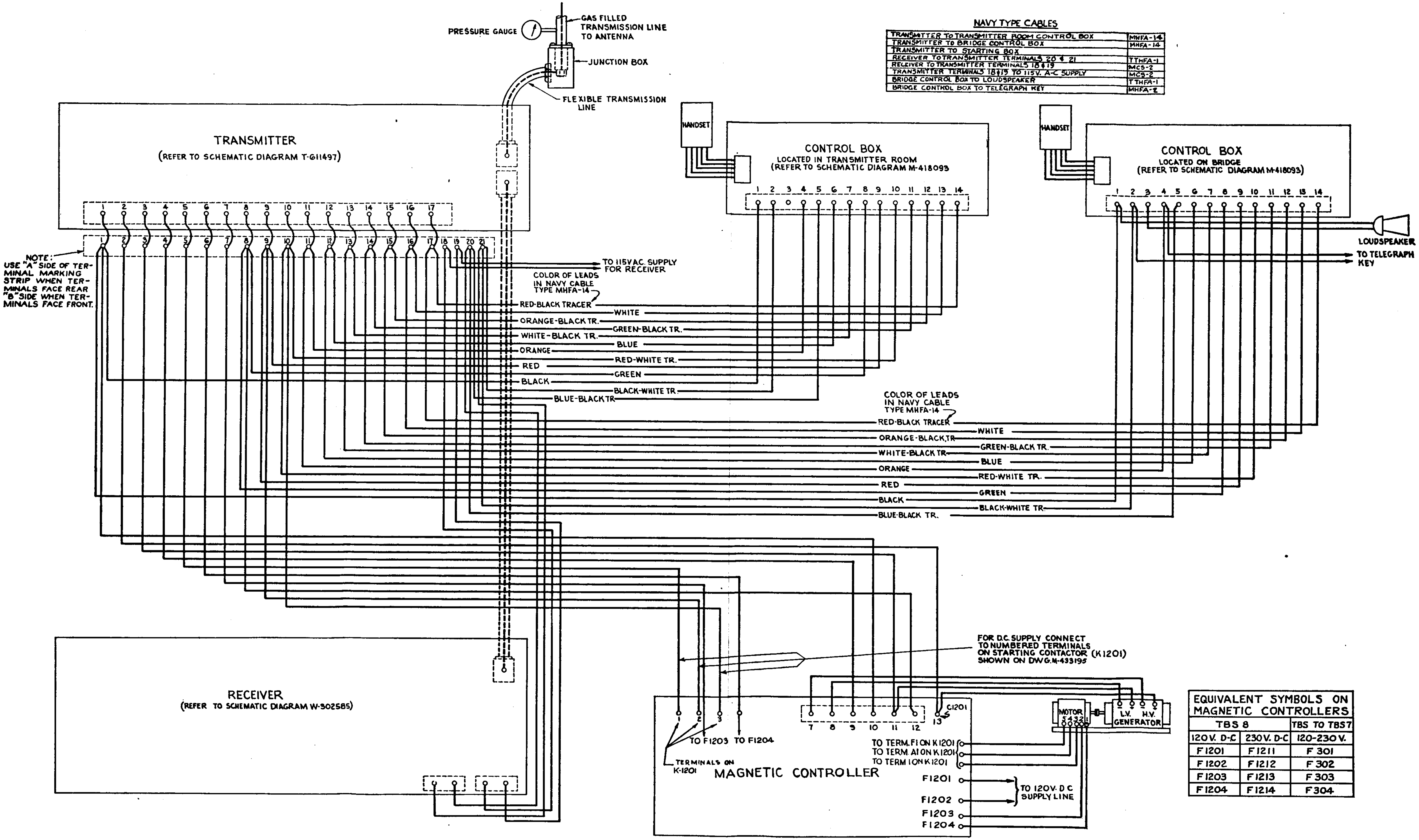




To transmit, using MCW, close telegraph key and hold for a second or two and then proceed with transmission. When key is left up for a second or so, equipment returns automatically to receiving condition.

When transmission is complete, the transmitter may be shut off by pressing Stop button on transmitter or either control unit. Receiver continues to function till shut off by switch on panel.





NAVY TYPE CABLES

TRANSMITTER TO TRANSMITTER ROOM CONTROL BOX	MHFA-14
TRANSMITTER TO BRIDGE CONTROL BOX	MHFA-14
TRANSMITTER TO STARTING BOX	
RECEIVER TO TRANSMITTER TERMINALS 20 & 21	TTHFA-1
RECEIVER TO TRANSMITTER TERMINALS 18 & 19	MCS-2
TRANSMITTER TERMINALS 18 & 19 TO 115V. A-C SUPPLY	MCS-2
BRIDGE CONTROL BOX TO LOUDSPEAKER	TTHFA-1
BRIDGE CONTROL BOX TO TELEGRAPH KEY	MHFA-2

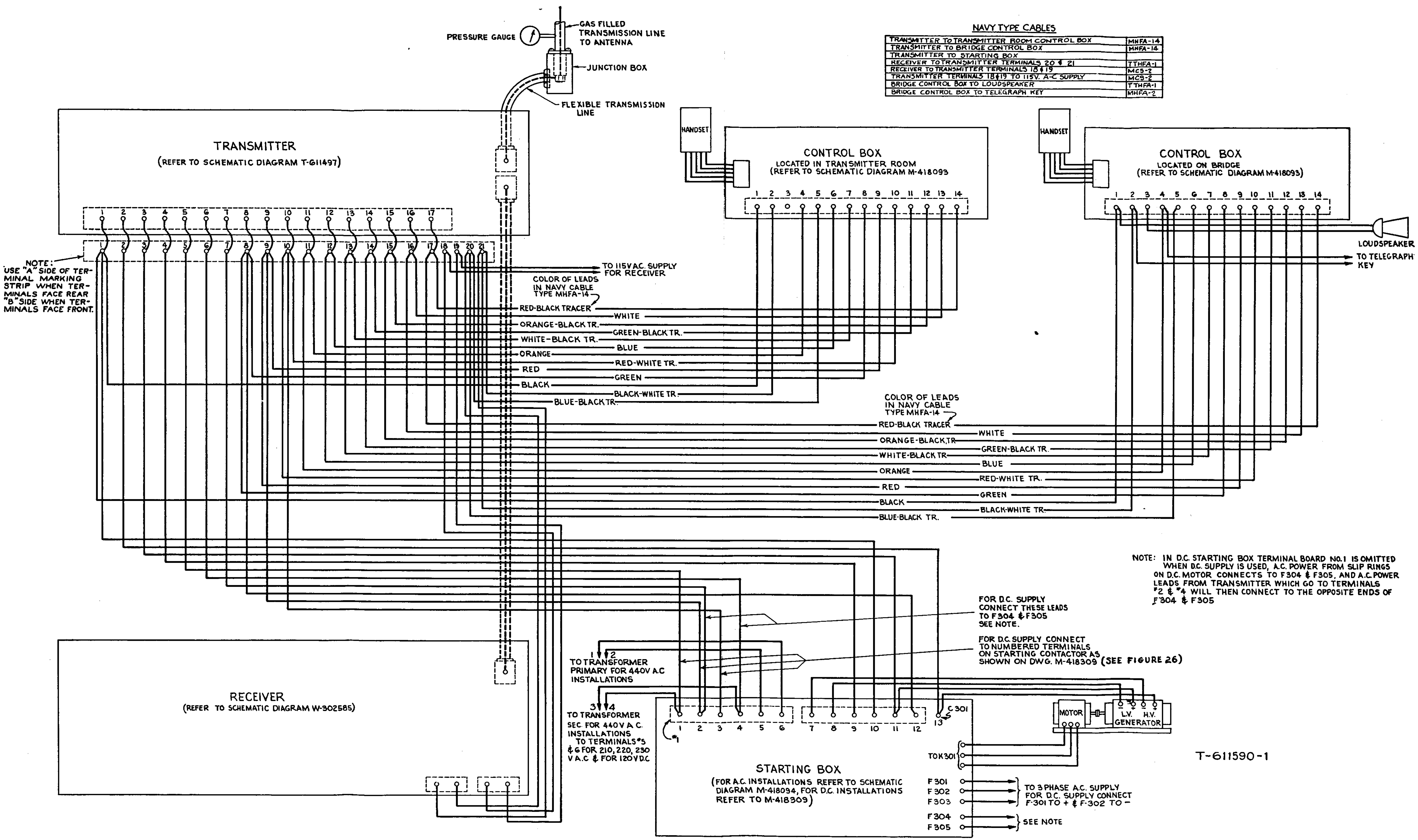
EQUIVALENT SYMBOLS ON MAGNETIC CONTROLLERS

TBS 8		TBS TO TBS7
120V. D-C	230V. D-C	120-230V.
F1201	F1211	F301
F1202	F1212	F302
F1203	F1213	F303
F1204	F1214	F304

INTERCONNECTION DIAGRAM
D-C EQUIPMENT

NAVY TYPE CABLES

TRANSMITTER TO TRANSMITTER ROOM CONTROL BOX	MHFA-14
TRANSMITTER TO BRIDGE CONTROL BOX	MHFA-14
TRANSMITTER TO STARTING BOX	
RECEIVER TO TRANSMITTER TERMINALS 20 & 21	TTHFA-1
RECEIVER TO TRANSMITTER TERMINALS 18 & 19	MCS-2
TRANSMITTER TERMINALS 18 & 19 TO 115V. A-C SUPPLY	MCS-2
BRIDGE CONTROL BOX TO LOUDSPEAKER	TTHFA-1
BRIDGE CONTROL BOX TO TELEGRAPH KEY	MHFA-2



INTERCONNECTION DIAGRAM
A-C EQUIPMENT

OPERATION

TBS SERIES

SAFETY

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES (875 VOLTS) WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION BUT ALWAYS SHUT DOWN MOTOR GENERATOR OR OTHER POWER EQUIPMENT. UNDER CERTAIN CONDITIONS, DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES ALWAYS REMOVE POWER DISCHARGE, AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

Since the use of high voltages (875 volts) which are dangerous to human life is necessary to the successful operation of the equipment covered by these instructions, certain reasonable precautionary measures must be carefully observed by the operating personnel during the adjustment and operation of the equipment.

The major portions of the equipment are within shielding enclosures, provided where necessary with access doors which are generally fitted with safety interlock switches which act to shut off dangerous voltages within the enclosures when the access doors are open.

It should be borne in mind that interlocks are provided only on normal access doors on certain major units and therefore side, back or top screens, commutator covers, if removed, will not cause interlocks to function and will thereby allow access to circuits carrying voltages dangerous to human life.

While every practicable safety precaution has been incorporated in this equipment the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS—Under no circumstances should any person be permitted to reach within or in any manner gain access to the enclosure with interlocked gates or doors closed or with power supply line switches to the equipment closed; or to approach or handle any portion of the equipment which is supplied with power, or to connect any apparatus external to the enclosure to circuits within the equipment; or to apply voltages to the equipment for testing purposes while any non-interlocked portion of the shielding or enclosure is removed or open. Wherever feasible in testing circuits, check for continuity and resistances rather than directly checking voltage at various points.

DON'T SERVICE OR ADJUST ALONE—Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS—Under no circumstances should any access gate, door or safety interlock switch be removed, short circuited, or tampered with in any way by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

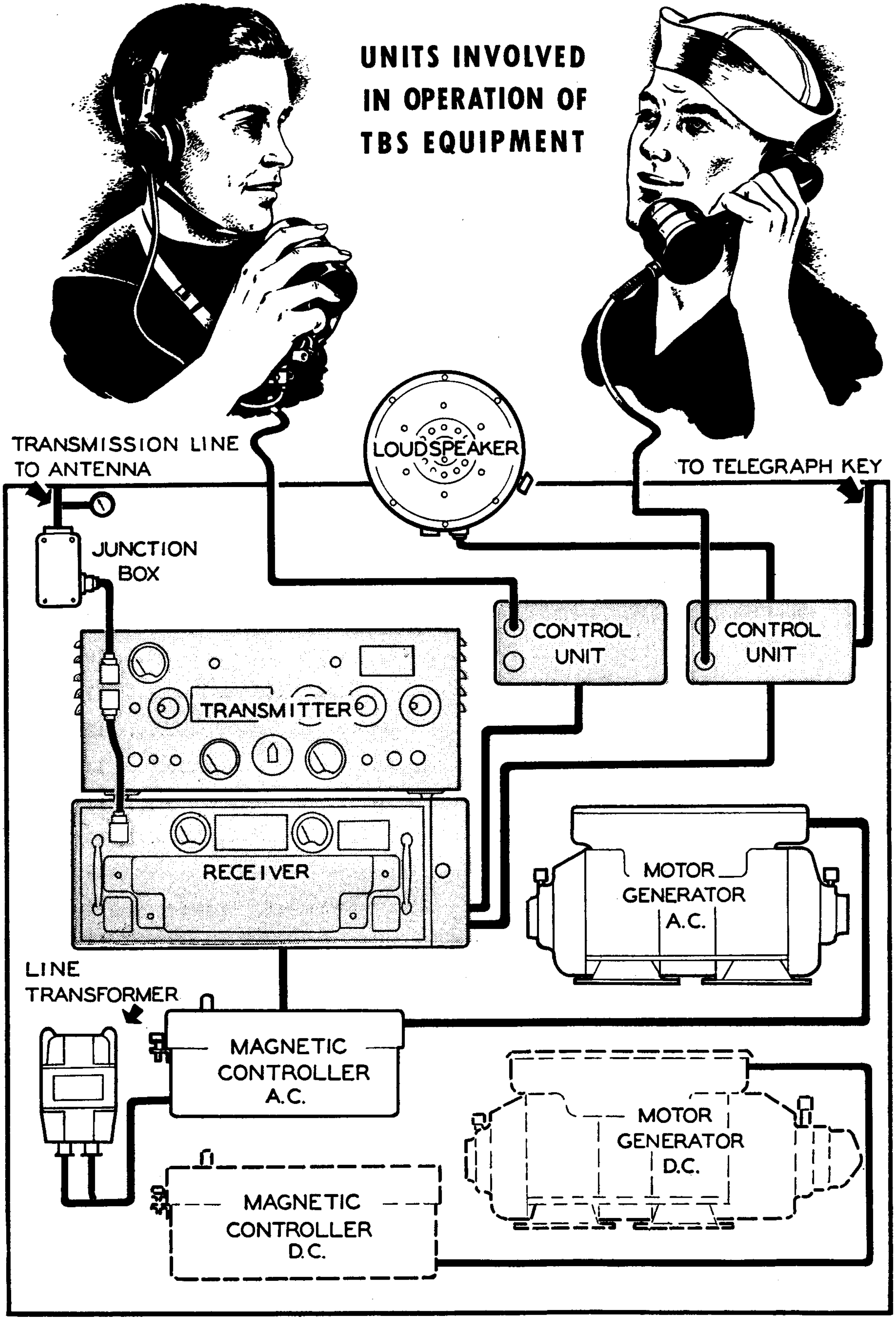
THE ATTENTION OF OFFICERS, AND OPERATING PERSONNEL IS DIRECTED TO CHAPTER 67 OF BUREAU OF SHIPS MANUAL OR SUPERSEDING INSTRUCTIONS ON THE SUBJECT OF "RADIO SAFETY PRECAUTIONS TO BE OBSERVED."

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

TABLE OF CONTENTS

OPERATION

SECTION 4

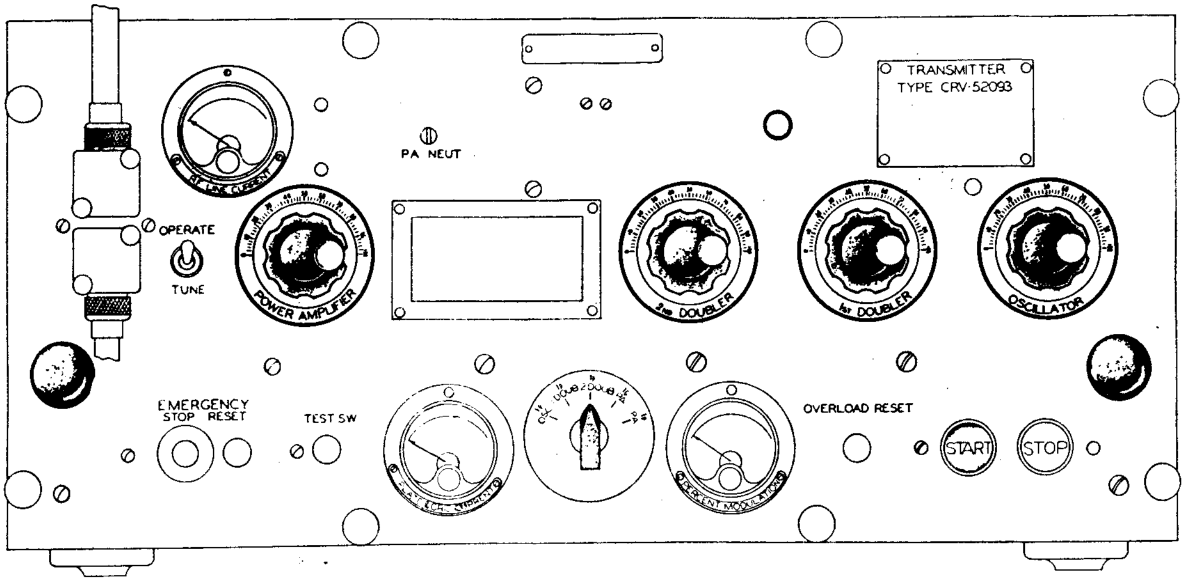

UNITS INVOLVED
IN OPERATION OF
TBS EQUIPMENT
TRANSMISSION LINE
TO ANTENNA
LOUDSPEAKER
TO TELEGRAPH KEY
JUNCTION
BOX
CONTROL
UNIT
CONTROL
UNIT
TRANSMITTER
RECEIVER
MOTOR
GENERATOR
A.C.
LINE
TRANSFORMER
MAGNETIC
CONTROLLER
A.C.
MOTOR
GENERATOR
D.C.
MAGNETIC
CONTROLLER
D.C.

OPERATION OF TBS EQUIPMENT

The units that make up the TBS models of radio communication equipment are shown on the opposite page. The physical appearance and method of operation of the transmitter, receiver and control units are identical in all the models in the series. Differences will be found in the motor generators and magnetic controllers furnished with the various models. In addition to Antenna, Transmission Line, Loudspeaker and spares, each installation comprises the following OPERATING equipment.

MAJOR OPERATION UNITS

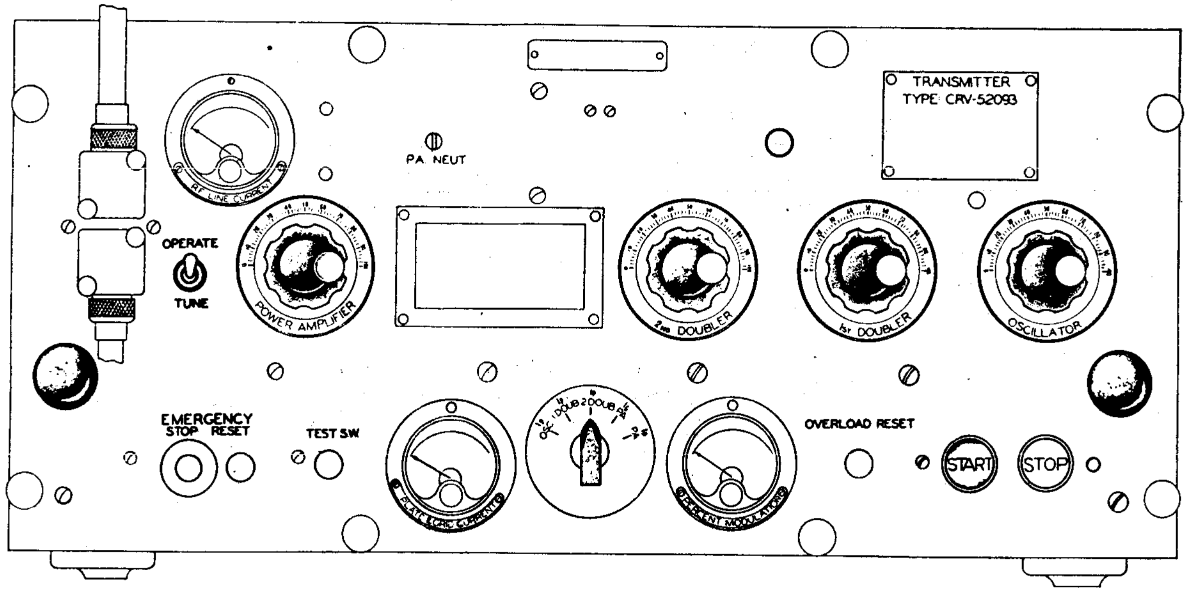
QUANTITY	UNIT	NAVY TYPE AND MODEL
One	RADIO TRANSMITTER	Navy Type CRV-52093 in TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-6. Navy Type CRV-52093A in TBS-8. Navy Type CG-52093 in TBS-4, TBS-7.
One	RADIO RECEIVER	Navy Type CRV-46068 in TBS, TBS-1, TBS-2, TBS-3. Navy Type CRV-46068A in TBS-5, TBS-6. Navy Type CRV-46068B in TBS-8. Navy Type CG-46068 in TBS-4, TBS-7.
Two	CONTROL UNITS	Navy Type CRV-23135 in TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-6, TBS-8. Navy Type CG-23135 in TBS-4, TBS-7.
One	MOTOR GENERATOR AND MAGNETIC CONTROLLER	Type and Characteristic for different models given in detail in Section 1, Page 7.
Two	HANDSETS	Navy Type CRV-51019 in TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-6. Navy Type CYH-51019 in TBS-4, TBS-7. Navy Type CRV-51019A in TBS-8.
One	CHEST SET	Navy Type CRV-51018 in TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-6. Navy Type CYH-51018 in TBS-4, TBS-7. Navy Type CRV-51018A in TBS-8.



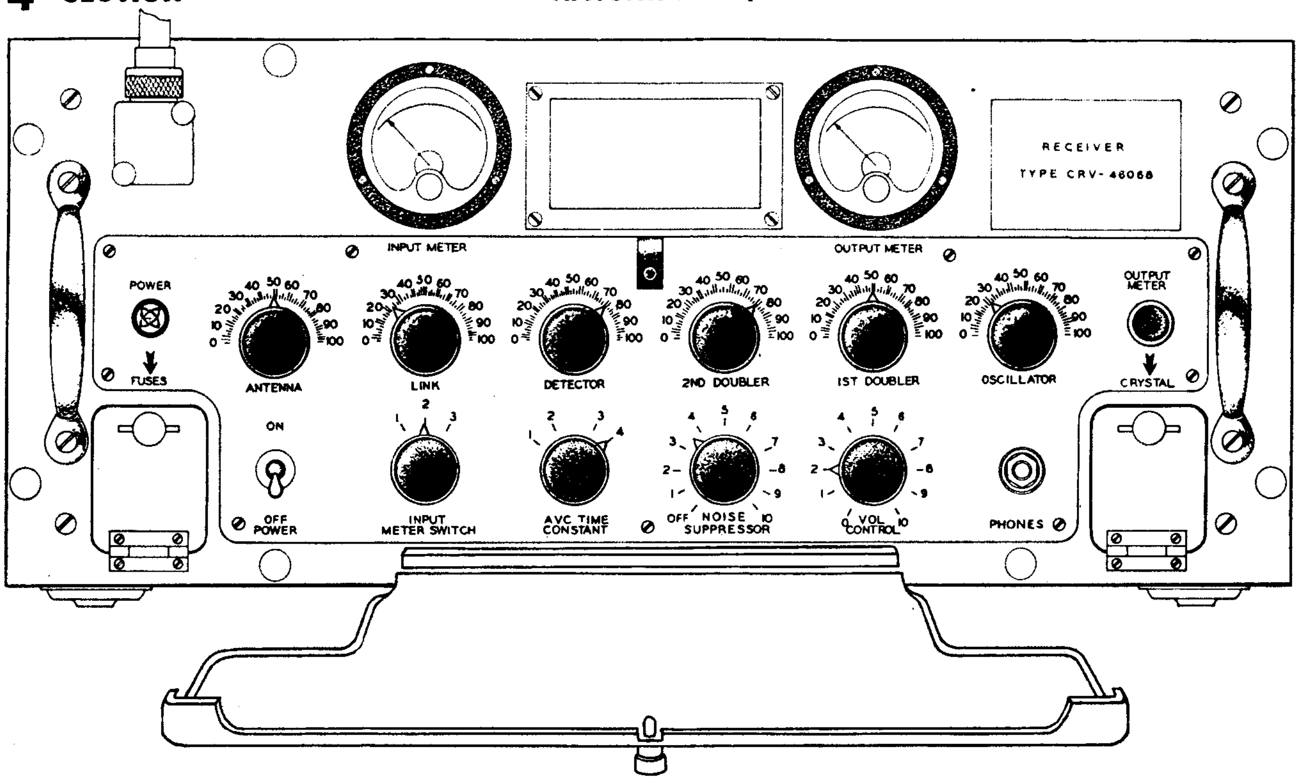
TRANSMITTER PANEL CONTROLS

Navy Type CRV-52093 used in TBS,
TBS-1, TBS-2, TBS-3, TBS-5, TBS-6.
Navy Type CRV-52093A in TBS-8.
Navy Type CG-52093 in TBS-4, TBS-7.

DESIGNATION	ITEM	FUNCTION
R-F LINE CURRENT	Meter	Indicates r-f current fed into transmission line.
POWER AMPLIFIER	Dial	Tunes output circuit of power amplifier tube.
2ND DOUBLER	Dial	Tunes output circuit of 2nd Doubler tube to provide channel frequency.
1ST DOUBLER	Dial	Tunes plate circuit of tube doubling oscillator frequency.
OSCILLATOR	Dial	Tunes plate circuit of crystal controlled oscillator.
PILOT LIGHT	Bulls-eye	Indicates when motor generator is running by glowing red.



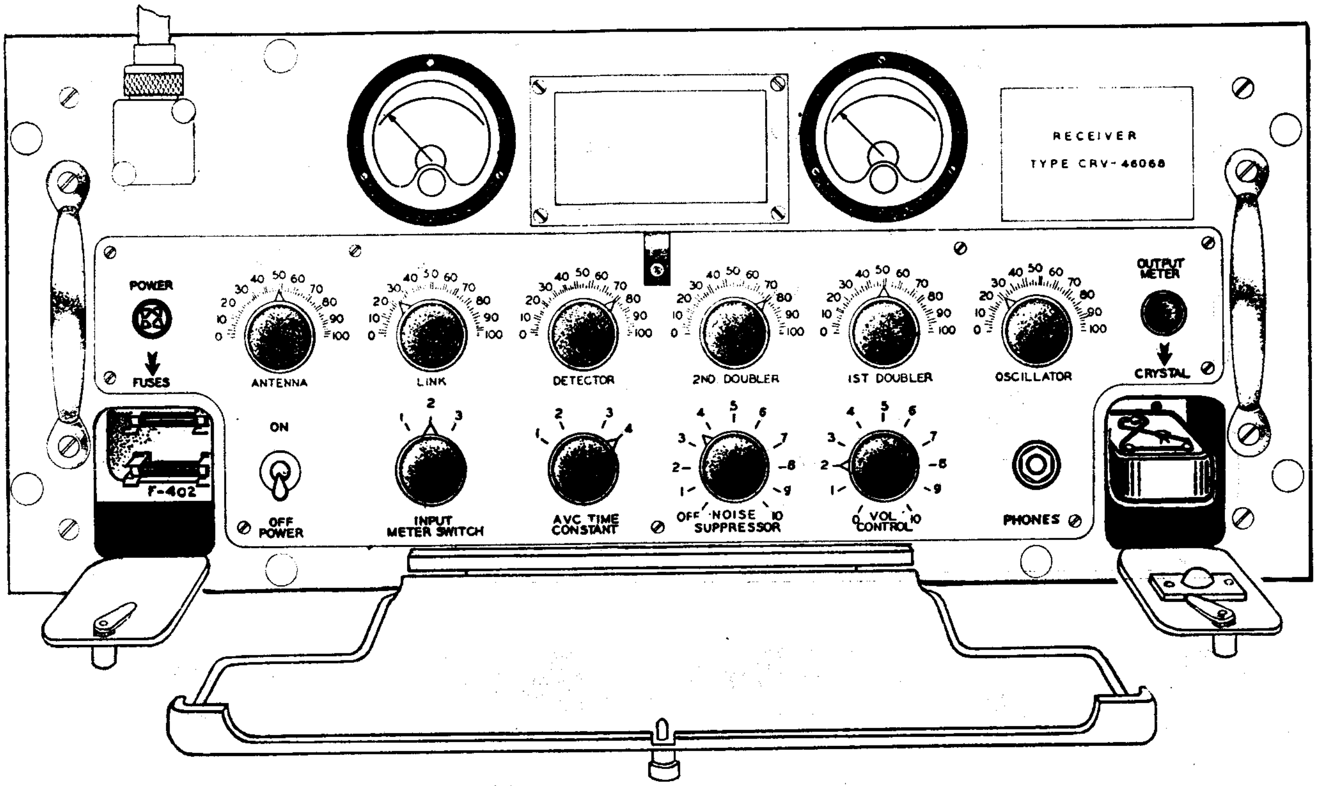
DESIGNATION	ITEM	FUNCTION
OPERATE-TUNE	Switch	Limits current to tube plates while tuning, in TUNE position.
EMERGENCY STOP-RESET	Switch	Used to shut down equipment if regular control fails.
TEST SW.	Switch	Switches transmitter plate current into tubes while testing or tuning.
PLATE & GRID CURRENT	Meter	Indicates plate and grid currents in r-f tubes.
METER SWITCH	Rotary Switch	Switches plate and grid current meter in tube circuits.
PERCENT MODULATION	Meter	Indicates amount of modulation in carrier emission.
OVERLOAD RESET	Push button	Resets overload relay that opens when Power Amplifier current exceeds safe limit.
START-STOP	Push buttons	Used to start and stop motor generator supplying power to transmitter.



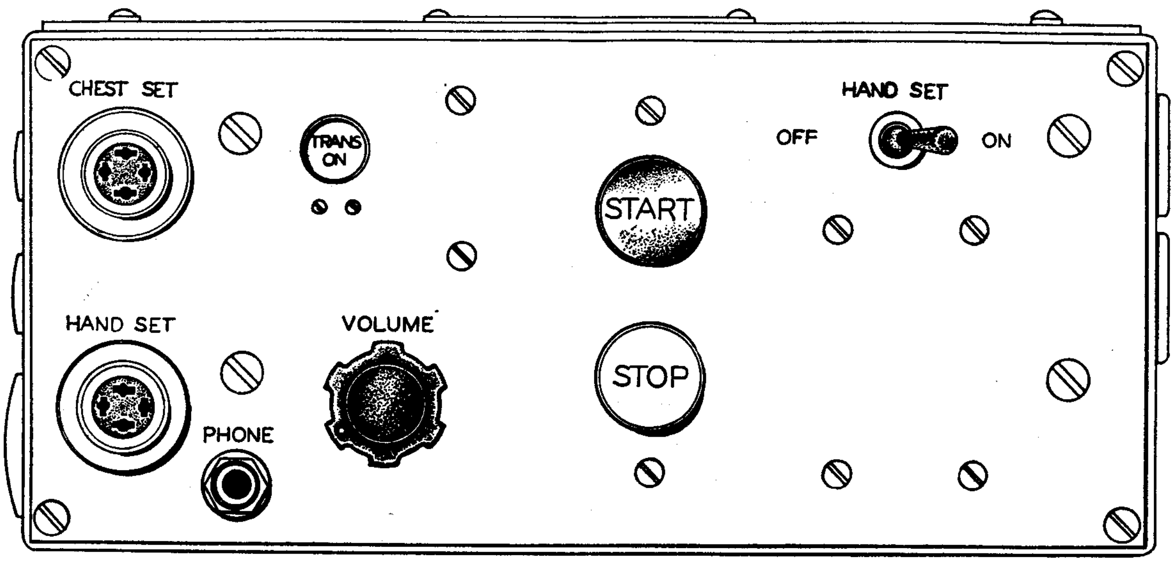
RADIO RECEIVER PANEL CONTROLS

Navy Type CRV-46068 used in TBS, TBS-1, TBS-2, TBS-3.
Navy Type CRV-46068A in TBS-5, TBS-6.
Navy Type CRV-46068B in TBS-8.
Navy Type CG-46068 in TBS-4, TBS-7.

DESIGNATION	ITEM	FUNCTION
ANTENNA	Knob	Tunes radio frequency input to receiver.
LINK	Knob	Tunes plate r-f amplifier.
DETECTOR	Knob	Tunes r-f input to 1st detector.
OSCILLATOR	Knob	Tunes plate of crystal-controlled oscillator.
1ST DOUBLER	Knob	Tunes plate of tube doubling oscillator frequency.
2ND DOUBLER	Knob	Tunes plate of tube doubling oscillator frequency second time.
INPUT METER	Meter	Indicates cathode currents in r-f amplifier, first detector and oscillator stages as selected.
OUTPUT METER	Meter	Indicates output level of receiver when switched into output circuit.



DESIGNATION	ITEM	FUNCTION
POWER	Bulls-eye lamp	Indicates power is on receiver when lighted.
POWER ON-OFF	Toggle switch	Switch for controlling power to receiver.
INPUT METER SWITCH	Knob	Switches Input Meter into proper circuits.
A.V.C. TIME CONSTANT	Knob	Controls time constant of A.V.C. circuit.
NOISE SUPPRESSOR	Knob	Setting determines input signal necessary to overcome noise suppression action of the circuit.
VOL. CONTROL	Knob	Controls volume level of receiver output.
PHONES	Jack	To plug in headset when desired.
OUTPUT METER	Push Switch	Switches output meter into circuit when desired.
FUSES	Hinged Cover	Permits access to fuses.
CRYSTAL	Hinged Cover	Permits insertion of crystal holder.



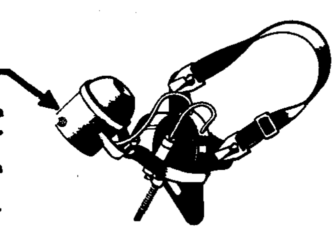
CONTROL UNIT

Navy Type CRV-23135 used in TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-6, TBS-8.
Navy Type CG-23135 used in TBS-4, TBS-7.

DESIGNATION	ITEM	FUNCTION
CHEST SET	Plug Recpt.	Receptacle for plug on cord of chest set.
HANDSET	Plug Recpt.	Receptacle for plug on cord of handset.
TRANS ON	Indicator Lamp	Indicates when motor generator is running.
VOLUME	Knob	Controls sound level in handset.
PHONE	Jack	For connection of headset if desired.
START-STOP	Push buttons	To start and stop motor generator.
HANDSET	Toggle switch	Switches receiver unit in handset on or off.

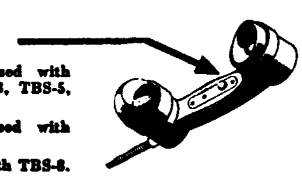
CHEST SET
PRESS TO TALK

Navy Type CRV-51018 used with TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-6.
Navy Type CYH-51018 used with TBS-4, TBS-7.
Navy Type CRV-51018A with TBS-8.

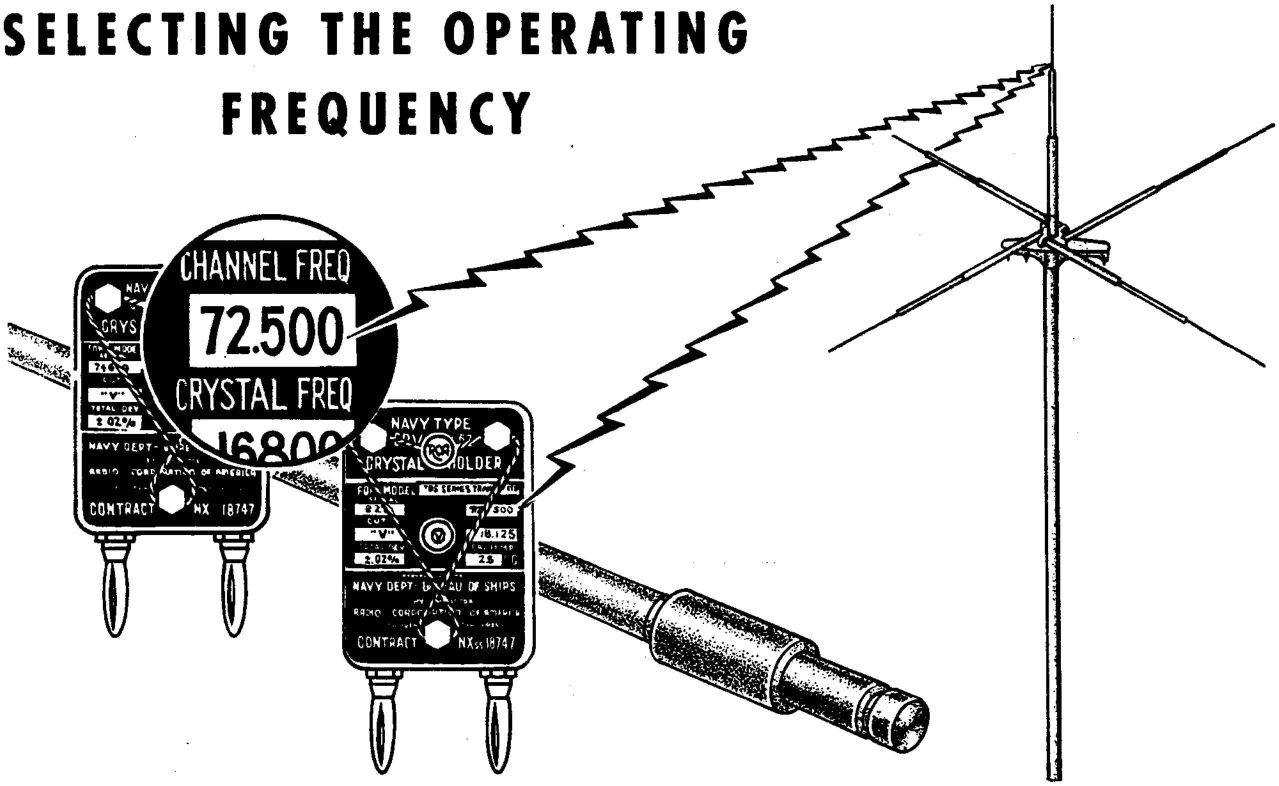


HANDSET
PRESS TO TALK

Navy Type CRV-51019 used with TBS, TBS-1, TBS-2, TBS-3, TBS-5, TBS-6.
Navy Type CYH-51019 used with TBS-4, TBS-7.
Navy Type CRV-51019A with TBS-8.



SELECTING THE OPERATING FREQUENCY



As previously mentioned, the TBS equipment may be tuned to operate at any frequency within the 60 to 80 Mc range for which crystals are provided. Since both transmitter and receiver are crystal controlled, several sets of crystals are furnished with the equipment and one spare set that is usually stored in the rack provided in the Power Amplifier section of the transmitter.

There have also been provided three vertical rods of different lengths to use as the radiating section of the antenna according to the frequency on which it is desired to operate.

To change the operating frequency of the equipment, it is necessary to select a pair of crystals, one for transmitter and one for receiver, having the same channel frequency marked on both. It will be noted the crystal frequency differs on the matching pair. The lower crystal frequency on the receiver crystal is such that, when doubled twice by the two doubler stages in the receiver oscillator, the resultant frequency will be 5.3 megacycles below the channel frequency to be received. Thus the beat frequency is obtained for intermediate amplification in the receiver.

The proper radiator rod to use with the channel frequency desired may be selected from the following listing:

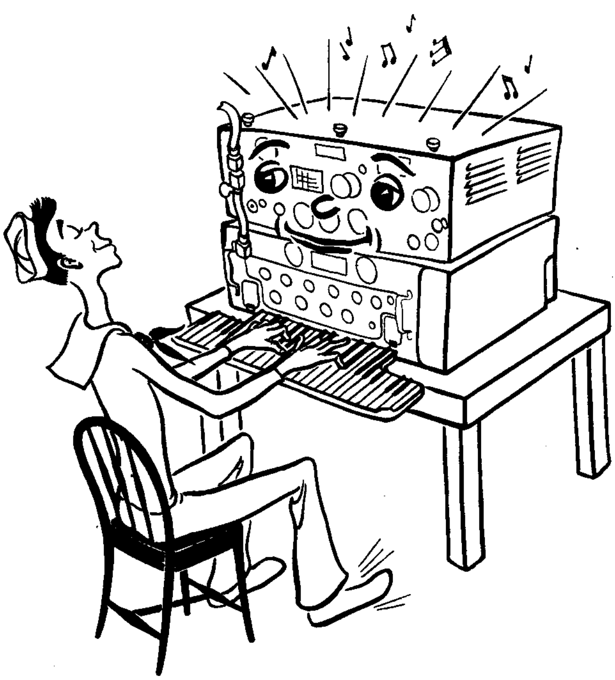
	DESTROYER ANTENNA	SUBMARINE ANTENNA
FREQUENCY	ROD LENGTH	ROD LENGTH
60 —64.5 Mc.	44 inches	41⅞ inches
64.5—71.0 Mc.	38⅜ inches	34¾ inches
71.0—80.0 Mc.	33 inches	28¼ inches

The rod is to be installed in the antenna by loosening the two thumbscrews and locknuts holding the vertical rod in the brass socket in the center of the antenna structure and after removing the rod in place, install the new rod and tighten thumb screws and locknuts to hold it firmly.

At the time of changing the radiating rod the ground rods extending horizontally from the antenna structure should be inspected for loose clamping bolts. If badly bent, straighten or replace.

The proper crystals can be inserted in their respective jacks in the transmitter and receiver and the equipment tuned to the correct frequency by the methods given on the following pages. A convenient place to store extra crystals is the compartment to the right of the receiver, where they will always be handy in an emergency and not liable to damage.

PREPARING EQUIPMENT FOR OPERATION



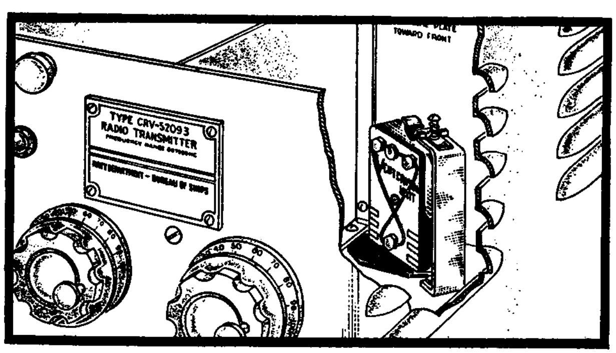
Since the equipment is designed for instantaneous radio communication it operates on a fixed frequency and requires no tuning or adjustments during operation. The operating frequency of both receiver and transmitter is crystal controlled. The equipment can be tuned to any frequency within the 60 to 80 Mc frequency range.

In addition to phone communication, the transmitter is arranged so the carrier may be tone modulated and signals transmitted by means of a key when telegraph communication becomes desirable. All switching required when changing from transmitting to receiving and from phone to MCW communication is done by a system of relays within the transmitter and full control of the apparatus is possible from the remote control units with the exception of switching the receiver on and off. Normally the antenna is connected to the receiver.

The transmission line from the antenna terminating in the junction box, to which the flexible antenna lead from the transmitter is connected, is of the co-axial type and gas filled. The gauge on the line should be checked to be sure the pressure has not dropped below 5 lbs.

PREPARING THE TRANSMITTER FOR OPERATION

Loosen the thumbscrews holding the access door on the transmitter and inspect the OSCILLATOR compartment to see if the crystal holder is in place. Remove the crystal holder by swinging the rubber covered clip to the back and withdrawing crystal from jacks. Inspect the nameplate and determine Channel Frequency marking on crystal which will indicate frequency to which transmitter is tuned.



After replacing crystal holder and clip holding it in place, close door and fasten.

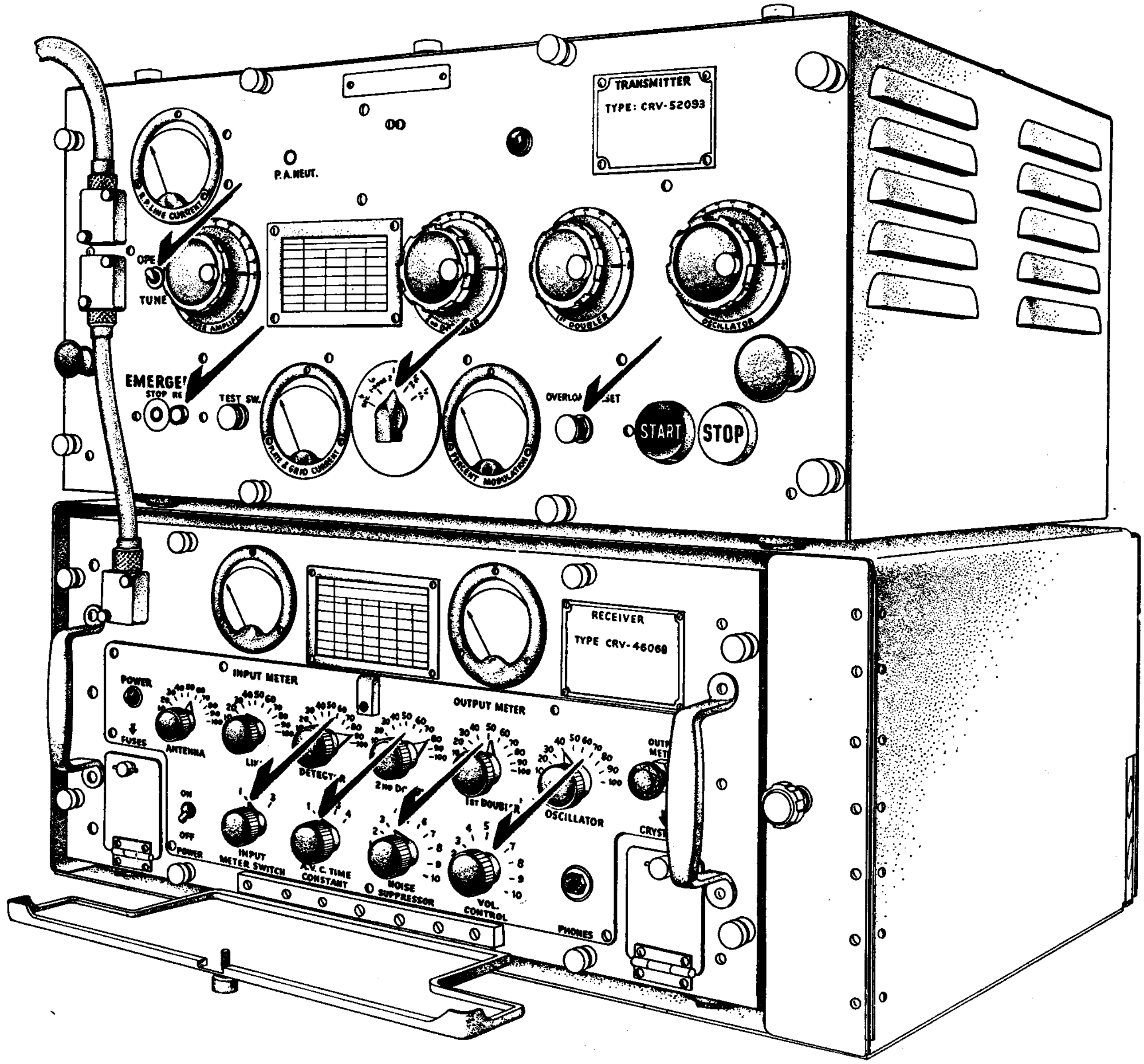
Refer to the chart on the panel of the transmitter and check the setting of the dials with the record of settings for the channel frequency of the crystal in use. Do not change if deviation is slight as they may vary slightly due to minute changes in electrical characteristics of the tubes or circuits and final adjustments are always made with a meter check as described later.

CHECK the transmitter panel to be sure the OPERATE-TUNE switch is in the OPERATE position.

The EMERGENCY switch and press in the RESET button if necessary.

The OVERLOAD RESET and press it in if the relay has tripped.

Turn the Meter Switch to the I_p PA position.



PREPARING THE RECEIVER FOR OPERATION

Loosen thumbscrew holding plate over control knobs on receiver. Do not disturb tuning controls in top row of knobs.

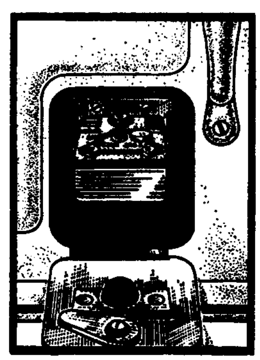
CHECK the lower row of controls and place INPUT METER SWITCH on position 1.

Turn the A.V.C. TIME CONSTANT control to position 1.

Turn the NOISE SUPPRESSOR to OFF.

Place VOL. CONTROL half on.

Open the hinged door marked CRYSTAL and be sure a crystal holder is inserted in the jacks with the nameplate up. By withdrawing the crystal holder and noting the Channel Frequency marked on the plate the operator can determine the frequency to which the receiver should be tuned. The Channel Frequency on the receiver crystal should agree with that marked on the transmitter crystal holder. Check the knob settings recorded on the chart on the receiver panel to see if the knob settings correspond and any great deviation should be noted so when the receiver is switched on the setting may be corrected, if necessary, under operating conditions.



OPERATING THE EQUIPMENT

RECEPTION

Switching on the receiver puts the equipment in condition for reception as outlined in diagram A. The antenna connects to the receiver and any signals picked up will be reproduced in the loudspeaker or headsets that are plugged in at the control units. The volume control may be adjusted for desired output, bearing in mind that local control of the sound level is provided at control units for headsets and on the loudspeaker case.

PHONE TRANSMISSION

To put the transmitter into operation the red START button is pressed on transmitter or control unit. This starts the motor generator as indicated by solid black line in Diagram B. Current is fed into the tube filaments immediately but no plate current is applied to the tubes. At least one minute should be allowed between starting motor generator and attempt to transmit so the tubes have time to warm up.

To put the carrier on the air for transmission, press the button on the handle of the handset. This actuates relay in control box cutting out loudspeaker to prevent acoustic reaction, closes the low voltage plate relay and energizes antenna transfer relay which connects transmitter to antenna, closes plate current circuit and places the equipment ready for transmission as shown at B. The button must be held in while talking and released to receive. The receiver antenna connection is grounded during transmission but the carrier modulation is monitored by the receiver and heard in the earpiece of the handset. Modulation of the carrier will be indicated by the modulation meter which is a check on the speech amplifier in the transmitter case.

MCW TRANSMISSION

When it is desired to communicate by keyed radio signals, the necessary switching and generation of modulating audio frequency is taken care of by a system of relays in the transmitter. As shown in Diagram C, with the motor generator running, pressing the telegraph key actuates the keying relay, bringing into action a tube which furnishes the 1000 cycle note for modulation and deenergizes the MCW relay. The action of the latter relay is delayed by the tube circuit, thus keeping the carrier on the air during key up periods. On leaving the key up for a second the relays drop back and the equipment returns to the receiving condition automatically.

The motor generator is shut down by pressing the black STOP button while the receiver is switched off as desired with the switch on the panel. The motor generator should be stopped only in the periods between transmission and reception of messages since the relay sequence renders the receiver inoperative for a second or more when the STOP button is pressed.

DIAGRAM A—RECEPTION

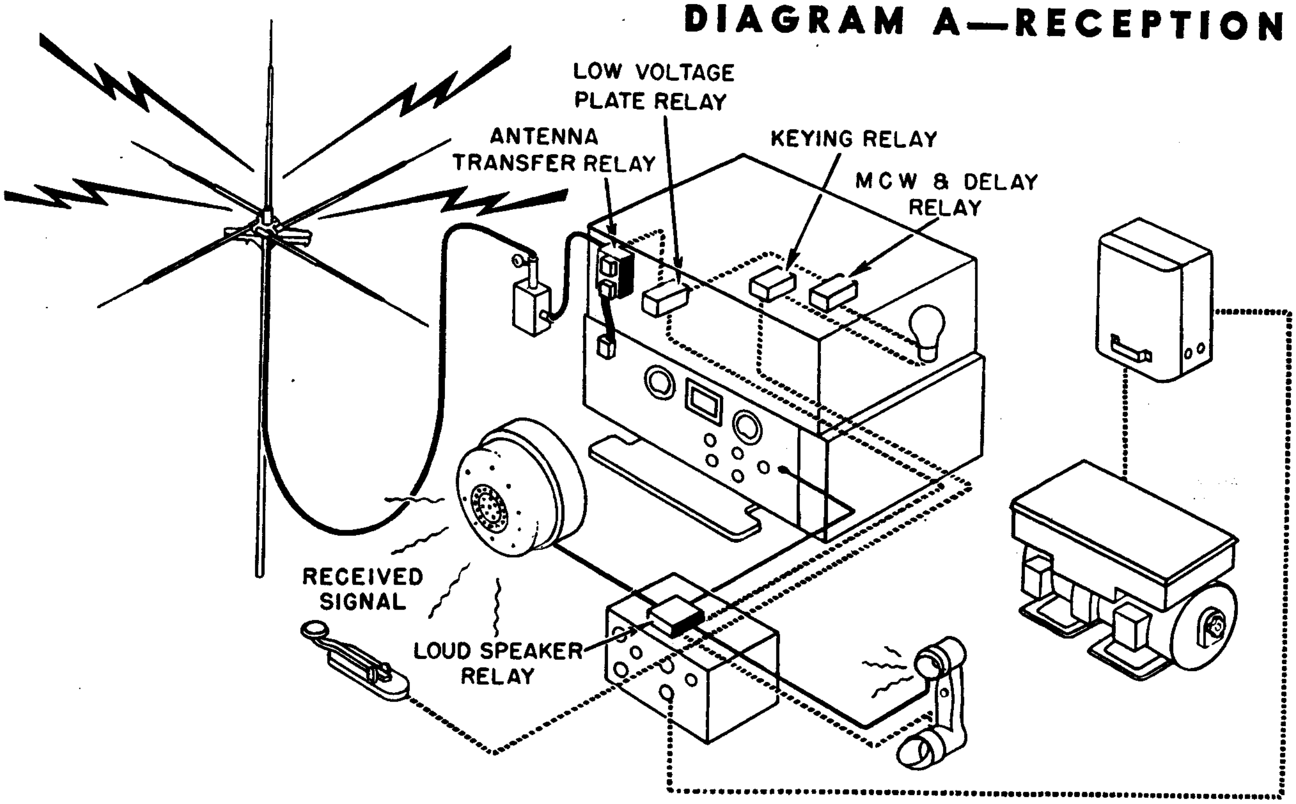


DIAGRAM B—PHONE TRANSMISSION

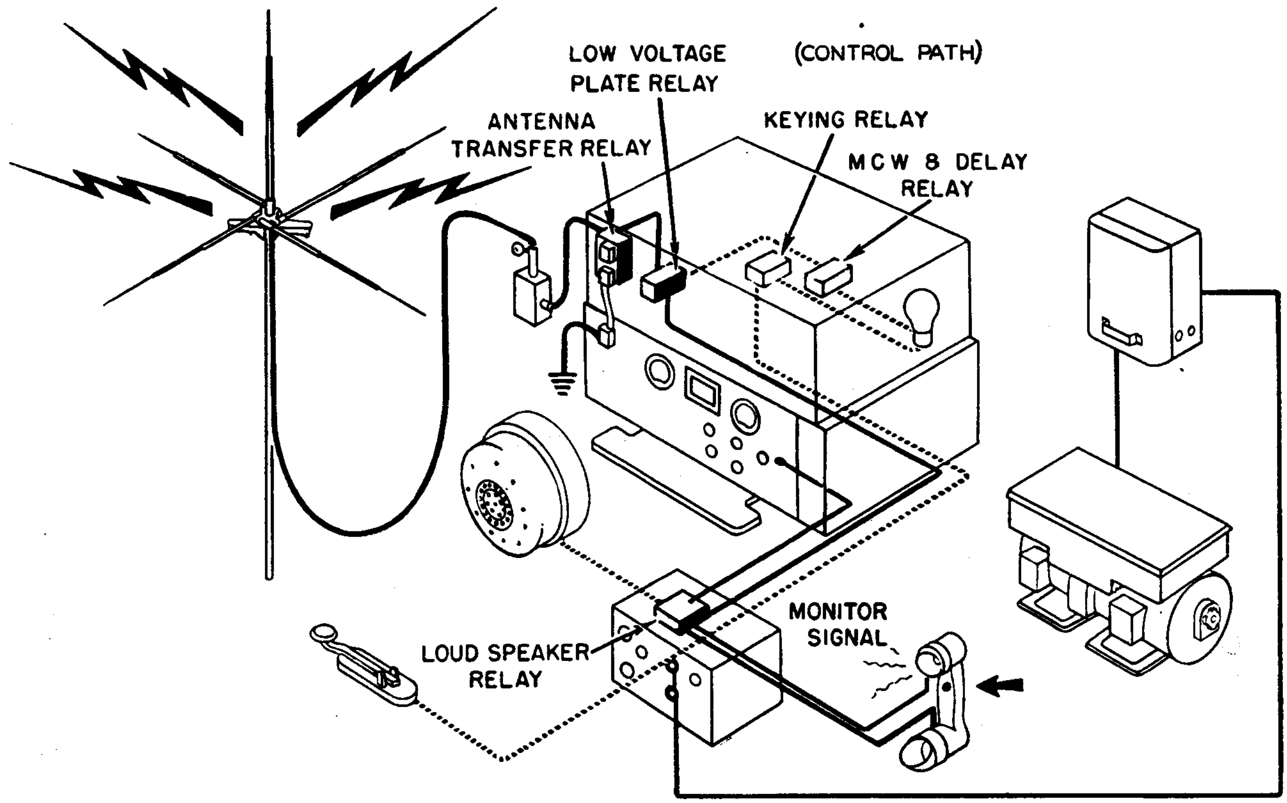
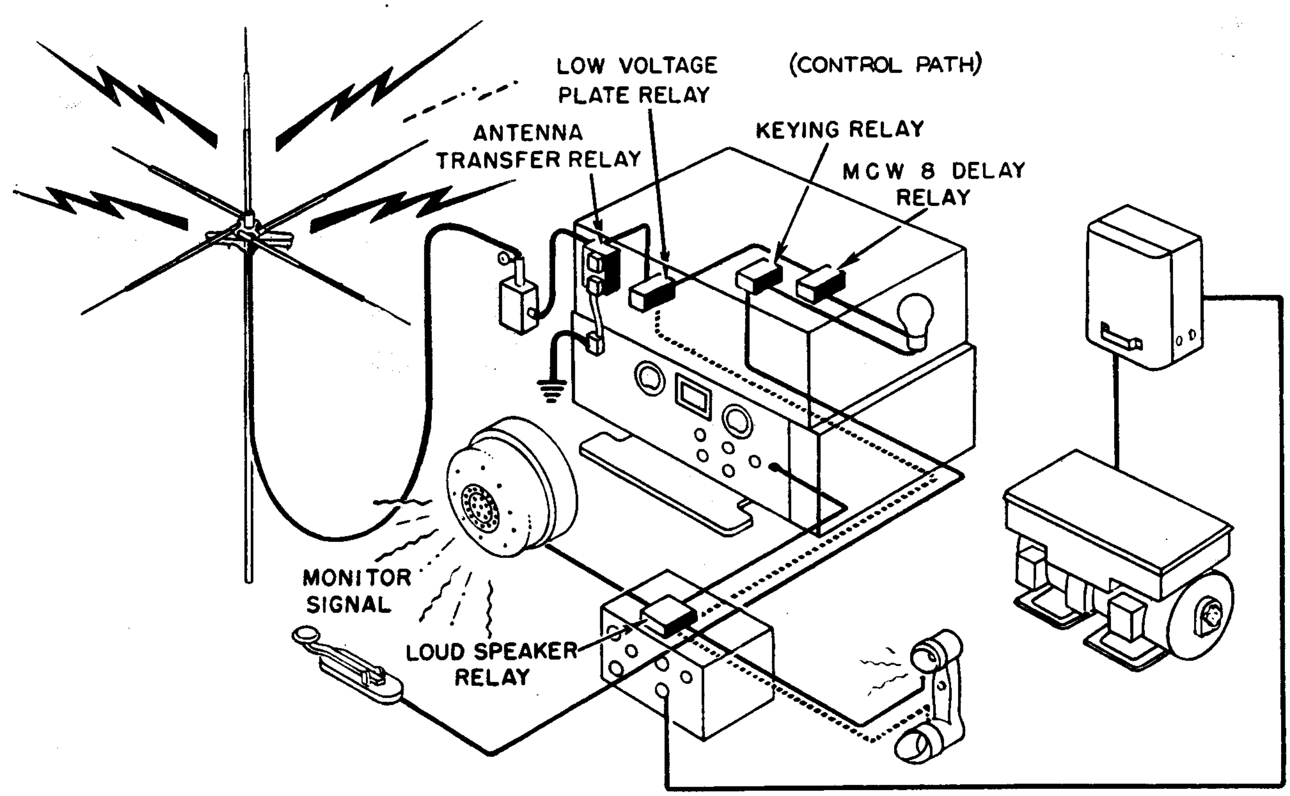


DIAGRAM MCW—TRANSMISSION



TRANSMITTER TUNING CHART

When necessary to tune the transmitter to change the operating frequency of the equipment the chart below shows the steps necessary to make the adjustments. The tests are made in the order numbered, the OPERATE-TUNE switch being in the position shown for each step and the TEST SW. being depressed to take the readings on the PLATE & GRID CURRENT meter for the various settings of the Meter Switch. It is good practice to make a note of the meter readings so subsequent tests would reveal defective tubes when test readings are below normal.

A. OSCILLATOR

OPERATE / TUNE

Set meter switch to I_p OSC. Rotate OSCILLATOR dial in a clockwise direction until the plate current suddenly drops to a minimum value as indicated on the PLATE & GRID CURRENT meter. This preliminary setting will be subject to further adjustment.

METER READING—25 MILLIAMPS APPROXIMATELY.

B. 1st DOUBLER

OPERATE / TUNE

Set Meter Switch to I_p 1st DOUBLER. Rotate 1st DOUBLER dial till meter again indicates MINIMUM current in the plate circuit of this tube. The dip may be very small in this stage and the adjustment must be carefully made to obtain the setting giving the lowest plate current reading.

METER READING—35 MILLIAMPS APPROXIMATELY.

C. 2nd DOUBLER

OPERATE / TUNE

Set the Meter Switch to I_p 2nd DOUBLER. Rotate the 2nd DOUBLER dial to obtain a minimum plate current reading in this circuit.

METER READING—40 MILLIAMPS APPROXIMATELY.

D. POWER AMPLIFIER (Plate)

OPERATE / TUNE

Set Meter Switch to I_p PA. Rotate dial of POWER AMPLIFIER to obtain the MINIMUM plate current or approximately 70 ma in this stage.

OPERATE / TUNE

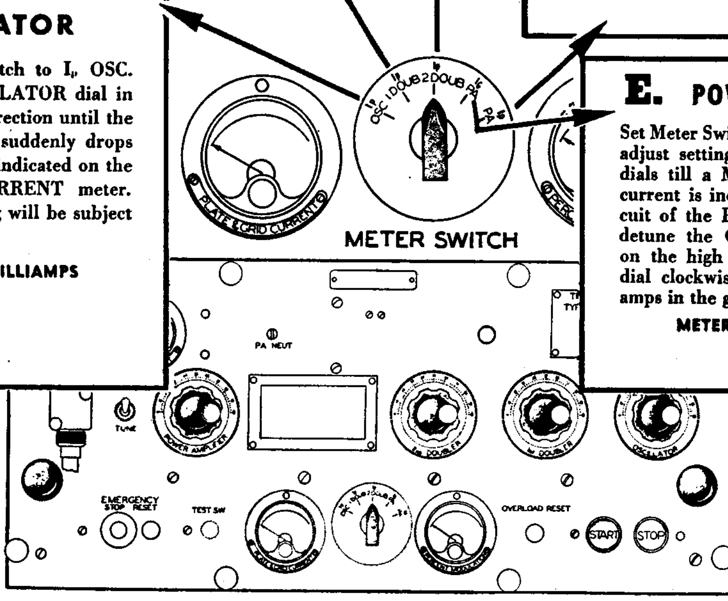
Throw the OPERATE-TUNE switch to the OPERATE position, the meter reading should now be 115 Milliamps. If above or below this figure, adjustment must be made of the plate-tank tap in the transmitter, see below.

E. POWER AMPLIFIER (Grid)

OPERATE / TUNE

Set Meter Switch to I_g PA. Carefully adjust settings of both DOUBLER dials till a MAXIMUM amount of current is indicated in the grid circuit of the Power Amplifier. Then detune the OSCILLATOR slightly on the high frequency side by rotating the dial clockwise till meter indicates 35 Milliamps in the grid circuit of amplifier.

METER READING—35 MILLIAMPS



NOTE: Should the plate current of the Power Amplifier not fall between 115 and 120 Milliamps in the Operate position, of the 4th test above, it will be necessary to shift the tap on the plate-tank coil in the output of the Power tube. To do this, shut down the equipment, open power supply switch and unfasten access door on transmitter. Loosen thumbscrew holding tap on coil in Power Amplifier section and move tap clockwise on coil to increase plate current or counterclockwise to decrease plate current. This adjustment should be made in quarter inch steps, testing between each trial setting till plate current of Power Amplifier is between 115 and 120 Milliamps. Then repeat the 5th test (E) above as final check.

When adjustments are complete lock the tuning controls by means of thumbscrews provided, taking care not to disturb the settings.

RECEIVER TUNING CHART

To tune the receiver, the lower row of controls on the panel should be set as follows:

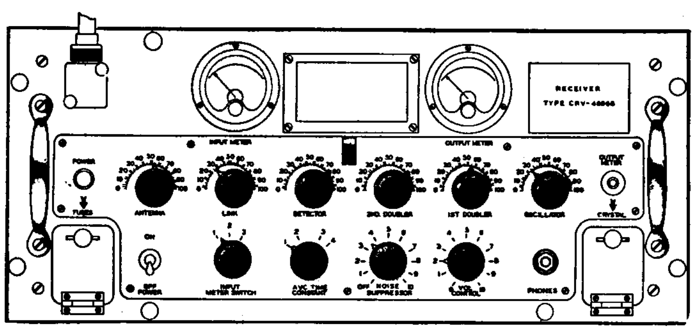
A.V.C. TIME CONSTANT.........on Pos. 1
NOISE SUPPRESSOR..............on OFF
VOL. CONTROL...............at mid-point

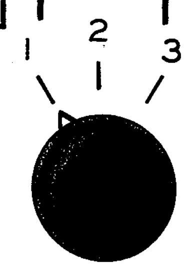
The receiver may then be switched on and the tubes allowed to heat up for several minutes before making the following adjustments.

A OSCILLATOR Set INPUT METER SWITCH on position 3. Rotate the dial of the OSCILLATOR slowly, observing the INPUT METER and when the point of resonance is reached for the particular crystal plugged into the receiver there will be a sharp dip in the plate current indicated on the meter. The control should be set slightly to the right of the point where greatest dip is obtained to assure stable operation and positive starting of oscillations in the circuit.

B DOUBLERS Set the INPUT METER SWITCH on position 2. Adjust the settings of the 1st and 2nd DOUBLERS till a maximum amount of excitation on the 1st detector is indicated by the maximum meter reading. The settings of these two controls track very closely with that of the OSCILLATOR, so the latter will serve as a guide in making this adjustment.

C INPUT Set INPUT METER SWITCH on position 1. The ANTENNA, LINK and DETECTOR controls are adjusted to a point of resonance as may be indicated by readings of Output meter or by the increase in noise in the loudspeaker or earpiece of a handset. The settings of these tuning controls should be very similar to those of the local oscillator controls, which will serve as a guide in adjusting them. If a signal is picked up as resonance is approached in tuning, the readings on the INPUT METER can serve as a guide in making the settings. Maximum volume at output is usually the best indicator of resonance, readjusting the volume control if necessary to the sound level desired in making the adjustments.





INPUT METER SWITCH

After tuning is completed the VOL. CONTROL is usually left three quarters on. The NOISE SUPPRESSOR can be brought into action and utilized to remove background noise between periods of reception. The setting should not be so high as to cut off the weakest signal to be received, as the circuit will not discriminate between signal and noise. The A.V.C. TIME CONSTANT is used to delay the return of the receiver to maximum sensitivity after the A.V.C. circuit has damped out a high level radio impulse. Position 1 is used for high speed telegraphy, telephone communication and rapid fading conditions. Positions 2 and 3 are used for medium speed code work and under medium fading rates. Position 4 is used for slow speed telegraphy, slow fading or swinging signals. The operator himself is the best judge of where this control should be set.

After making the desired settings, the hinged door should be swung up over the controls and fastened in place. The tuning will remain fixed for long periods without adjustment but, should signal strength fall off, check the tuning first.

AVERAGE DIAL SETTINGS FOR TRANSMITTER & RECEIVER

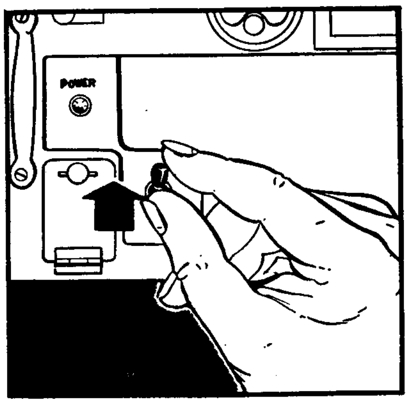
TRANSMITTER

Frequency (MC)	Oscillator	1st Doub.	2nd Doub.	Power Amplifier
60	8	8	8	8
80	72	89	82	86

RECEIVER

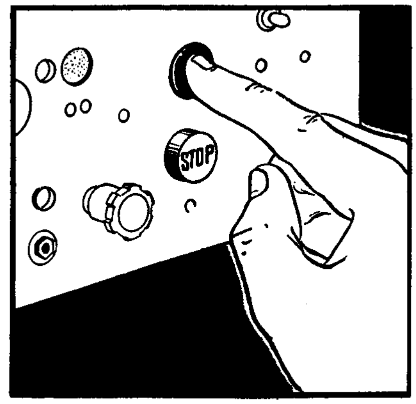
Frequency (MC)	Ant.	Link	2nd Doub.	1st Doub.	Oscillator
60	15	15	15	15	15
80	88	81	80	88	80

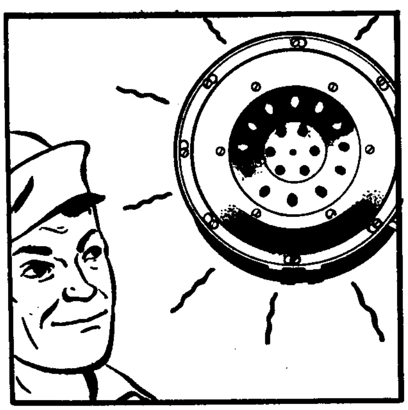
SUMMARY OF OPERATION



Switch on receiver by throwing Power toggle switch on the left of receiver panel to ON position.

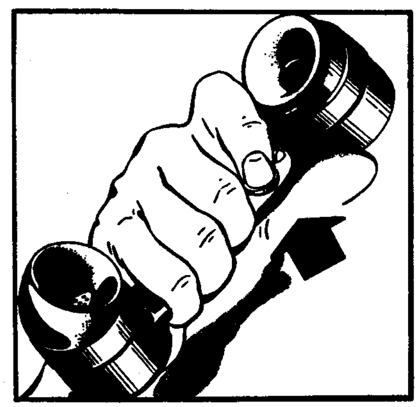
Press START button on transmitter or control unit.

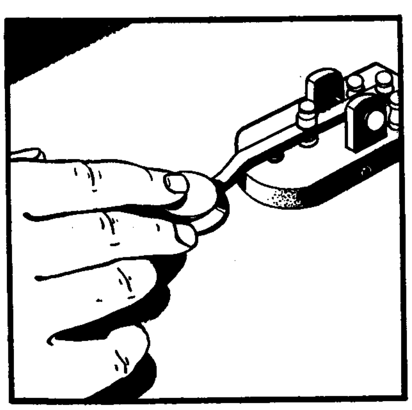




Equipment is now in the STANDBY condition. Loudspeaker or earpieces will reproduce any radio signal transmitted on the frequency to which the equipment is tuned.

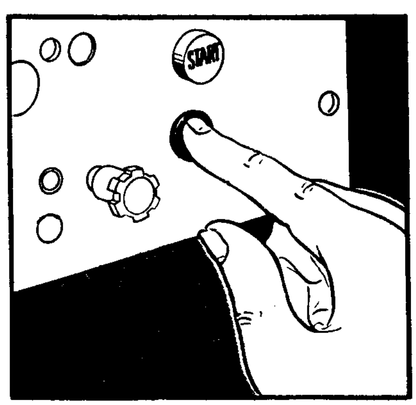
To transmit, using PHONE, depress the PRESS-TO-TALK switch on either handset or microphone of chest set and speak into the microphone.





To transmit, using MCW, close the telegraph key for a second or two and then proceed with the transmission. When the key is left up for a second the equipment returns automatically to the receiving condition.

To stop the equipment, press the STOP button on transmitter or control unit which cuts off the transmitter. When reception is no longer required, throw POWER toggle switch on the receiver to OFF.



OPERATOR'S MAINTENANCE

TBS SERIES

SAFETY

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES (875 VOLTS) WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION BUT ALWAYS SHUT DOWN MOTOR GENERATOR OR OTHER POWER EQUIPMENT. UNDER CERTAIN CONDITIONS, DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES ALWAYS REMOVE POWER DISCHARGE, AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

Since the use of high voltages (875 volts) which are dangerous to human life is necessary to the successful operation of the equipment covered by these instructions, certain reasonable precautionary measures must be carefully observed by the operating personnel during the adjustment and operation of the equipment.

The major portions of the equipment are within shielding enclosures, provided where necessary with access doors which are generally fitted with safety interlock switches which act to shut off dangerous voltages within the enclosures when the access doors are open.

It should be borne in mind that interlocks are provided only on normal access doors on certain major units and therefore side, back or top screens, commutator covers, if removed, will not cause interlocks to function and will thereby allow access to circuits carrying voltages dangerous to human life.

While every practicable safety precaution has been incorporated in this equipment the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS—Under no circumstances should any person be permitted to reach within or in any manner gain access to the enclosure with interlocked gates or doors closed or with power supply line switches to the equipment closed; or to approach or handle any portion of the equipment which is supplied with power, or to connect any apparatus external to the enclosure to circuits within the equipment; or to apply voltages to the equipment for testing purposes while any non-interlocked portion of the shielding or enclosure is removed or open. Wherever feasible in testing circuits, check for continuity and resistances rather than directly checking voltage at various points.

DON'T SERVICE OR ADJUST ALONE—Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS—Under no circumstances should any access gate, door or safety interlock switch be removed, short circuited, or tampered with in any way by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

THE ATTENTION OF OFFICERS AND OPERATING PERSONNEL IS DIRECTED TO CHAPTER 67 OF BUREAU OF SHIPS MANUAL OR SUPERSEDING INSTRUCTIONS ON THE SUBJECT OF "RADIO SAFETY PRECAUTIONS TO BE OBSERVED."

TABLE OF CONTENTS

OPERATOR'S MAINTENANCE

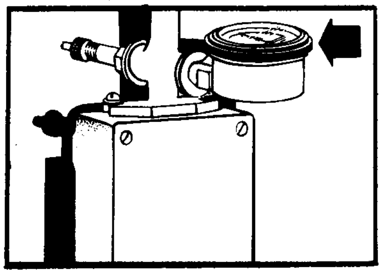
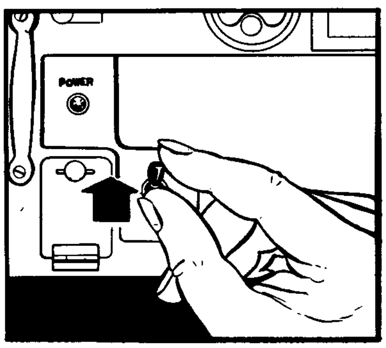
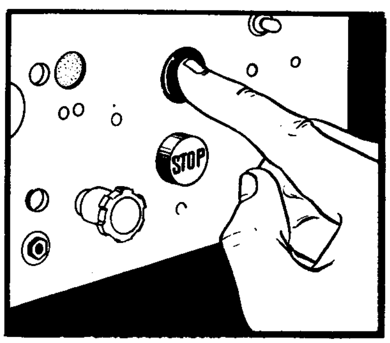
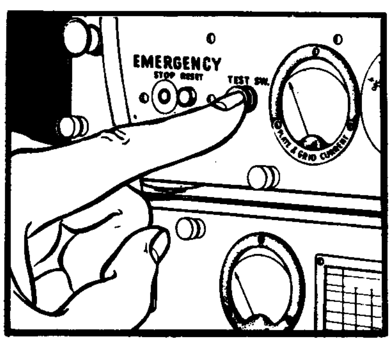
SECTION 5

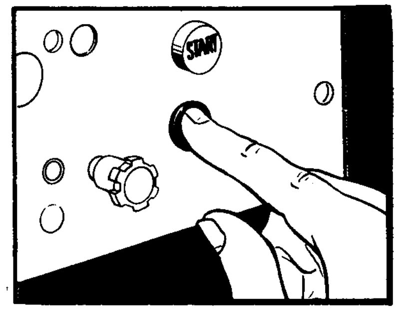
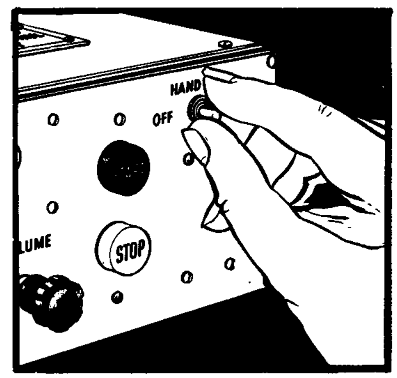
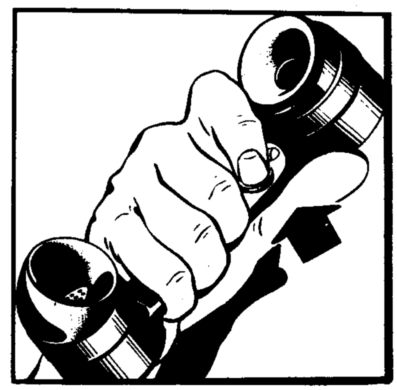
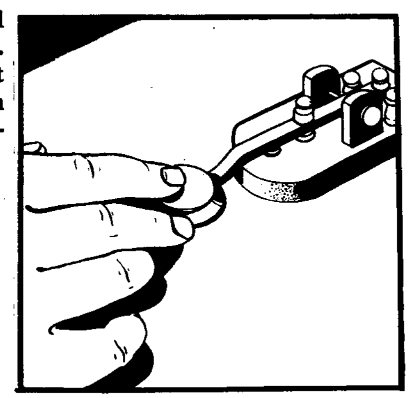
AN APPROVED POSTER ILLUSTRATING THE PRONE PRESSURE METHOD OF RESUSCITATION MUST BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR OR SONAR ENCLOSURE. POSTERS ARE AVAILABLE ON REQUEST TO BUREAU OF MEDICINE AND SURGERY.

ROUTINE OPERATIONAL CHECK

To assure peak performance of any radio equipment there will be demanded of the operator continual attention to minor details. Little defects that may develop from day to day that can be corrected with little effort and prevent major trouble developing later. In addition, the operator should be sufficiently familiar with the equipment to rectify minor damage or disarrangements that may develop during battle when technical aid is not always immediately available.

A check of the operation of the equipment should be made at the beginning of each watch so necessary adjustments may be made at once or technical personnel be advised of difficulties at the earliest possible moment. A quick check routine is given in the following chart.

	WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
	TRANSMISSION LINE	Read gauge on end seal of Transmission Line at Junction Box.	Pressure should not be allowed to fall below 5 lbs. Refill line to 10 lbs. when pressure drop has been gradual. Sudden drop or no pressure indicates damaged line or broken end seal insulator. Report to technician.
	RECEIVER	Switch on receiver. Open panel over receiver controls and place Noise Suppressor at OFF.	Background noise should be heard in loudspeaker or earpiece of handset if switched on. Readjust Noise Suppressor to lowest setting that will cut out background noise. Close and relock panel cover.
	MOTOR GENERATOR	With receiver on, press Start button on Transmitter panel or Control Unit.	Note any unusual noise or vibration in motor generator or magnetic controller.
	TRANSMITTER RADIATION	Close Test switch on Transmitter panel.	Note reading of R-F Line Current Meter and compare with record of last test. Reduction in output may indicate defective tubes or crystal. Release Test switch.

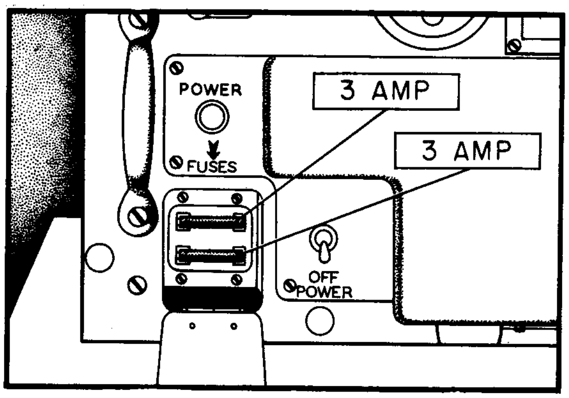
WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS	
CONTROL UNITS	Stop and Start Motor Generator by proper buttons at both positions.	Note if "Trans. On" glows red at both stations.	
LOCAL RECEPTION	Switch handset on and off at both positions.	Noise should be heard in earpiece with switch on.	
PHONE OPERATION	Test Press-to-talk buttons on handset handle and chest set microphone.	Click will be heard in earpiece as transfer relays function in transmitter.	
MCW OPERATION	Depress key.	Monitor signal will be heard in earpiece or loudspeaker. Click heard as delay circuit releases transfer relay when returning to condition for reception.	

NOTE: SHUT DOWN MOTOR GENERATOR AND RECEIVER IF NOT REQUIRED FOR OPERATION

POWER FAILURE

In general, failure of the equipment to operate can usually be quickly traced to one of the individual units. Sudden, complete failure being due in most cases to loss of supply power, the first step in case of trouble is to determine if power has gone off the unit failing to operate. The obvious procedure would be to check the fuses in the supply lines so location and test factors of fuses used in the TBS equipment are given in the chart below.

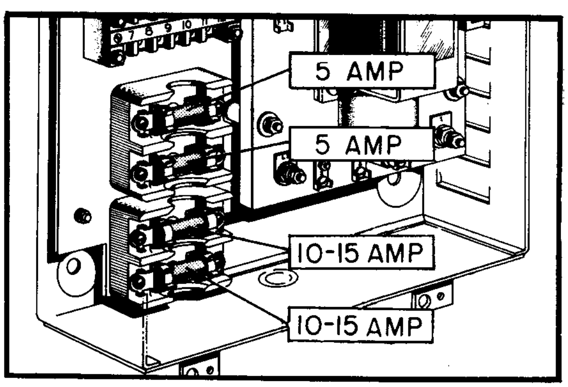
LOCATING THE FUSES



1. RECEIVER

Located behind the small hinged door at the left of the Receiver panel are two glass enclosed fuses. With the power switched off the receiver, all parts of the fuse mounting have all potentials removed so the fuses may be removed and inspected for signs of failure. Replace with spares.

250 Volt..................3 Amperes



2. D-C MOTOR GENERATOR

Fuses for the D-C Motor Generators are located in the Magnetic Controller at the lower left as shown in the illustration. The top pair are the supply line fuses and may be tested with a test lamp. If defective replace with

250 Volt...15 Amperes in 120-Volt Installations
250 Volt...10 Amperes in 250-Volt Installations

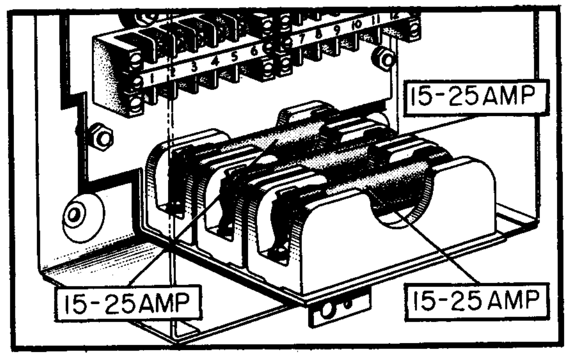
The lower pair of fuses are in the a-c lines from slip rings in Motor Generator to filament transformer in the transmitter and should be checked with test lamp if filament supply fails in transmitter. Replace if defective with

250 Volt..................5 Amperes

3. A-C MOTOR GENERATOR

Fuses for the supply lines for the A-C Motor Generators are also located in the magnetic controller on the bottom of the case as shown in the illustration. These fuses may be tested in position when care is used, remembering that some installations are 440 volt and treat accordingly. Replace if defective, after cutting off power at supply switch with

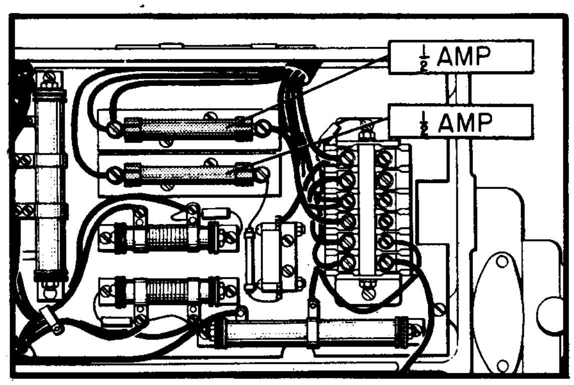
600 Volt...25 Amperes in 230-Volt Installations
600 Volt...15 Amperes in 440-Volt Installations



4. TRANSMITTER

When Motor Generators operate but power is off transmitter, the fuses in the output of the high voltage generator may have failed. In the machines with the terminal case on the top the fuses will be located by removing the top of the case. Shut off power before removing cover of terminal box and do not test fuses in place as high voltages are encountered that are dangerous. Test fuses on low voltage lines and if defective, replace with

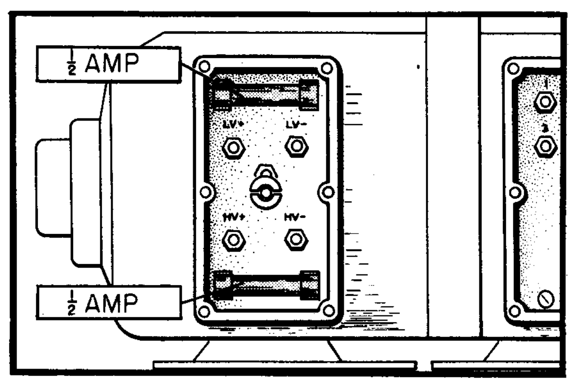
1000 Volt..................½ Ampere



5. TRANSMITTER

On Motor Generators with terminal boxes on the side of the unit, the fuses will be found in the box attached to the generator end of the unit. Shut off power before opening the box and test fuses on some lower voltage current. Replace if defective with

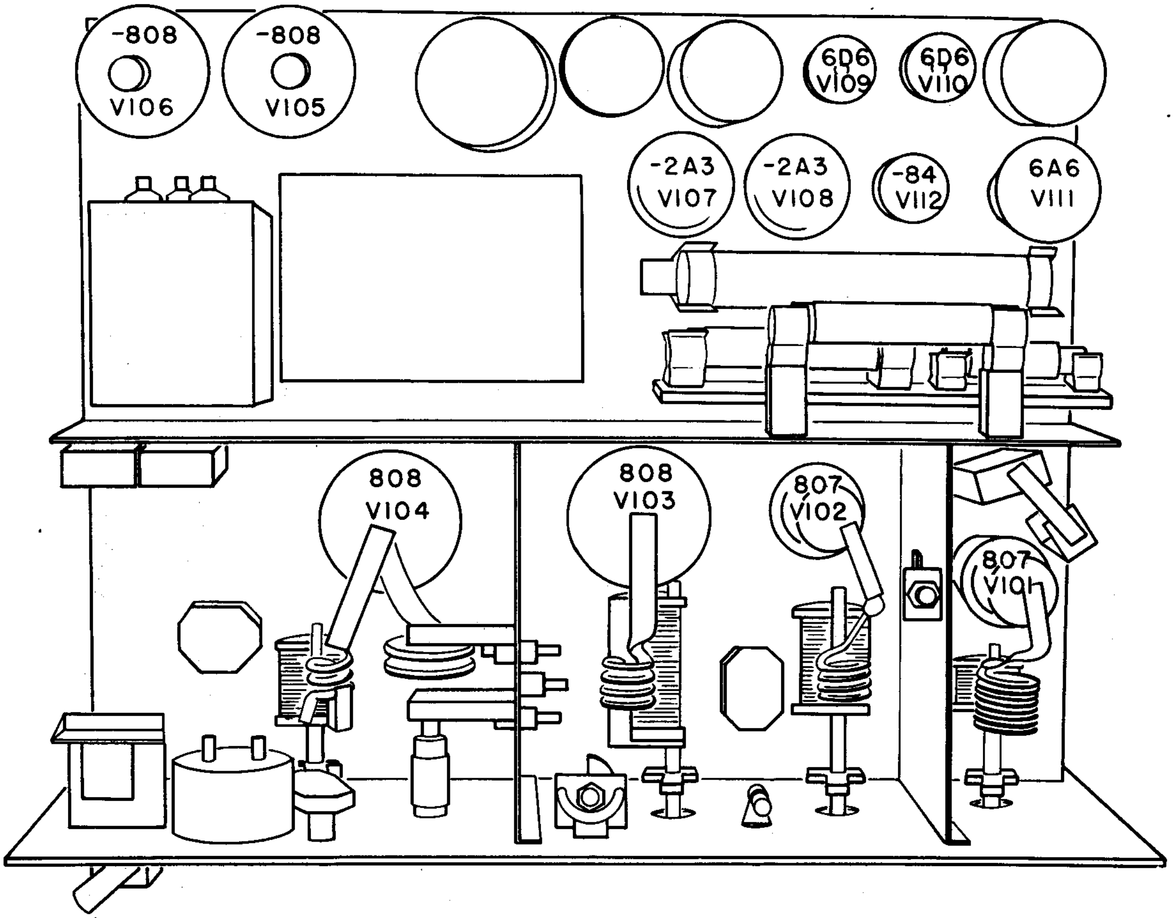
1000 Volt.................½ Ampere



WARNING: DO NOT ATTEMPT TO TEST OR REPLACE FUSES IN MOTOR GENERATOR TERMINAL CASES WITH MACHINE RUNNING. DO NOT REPLACE WITH FUSES OF HIGHER AMPERAGE RATING THAN GIVEN UNLESS EMERGENCY OPERATION OF THE EQUIPMENT IS MORE IMPORTANT THAN ITS PROTECTION. SHOULD FUSE BLOW IMMEDIATELY ON REPLACEMENT, LOCATE TROUBLE BEFORE REPLACING AGAIN.

TUBE REPLACEMENT DATA

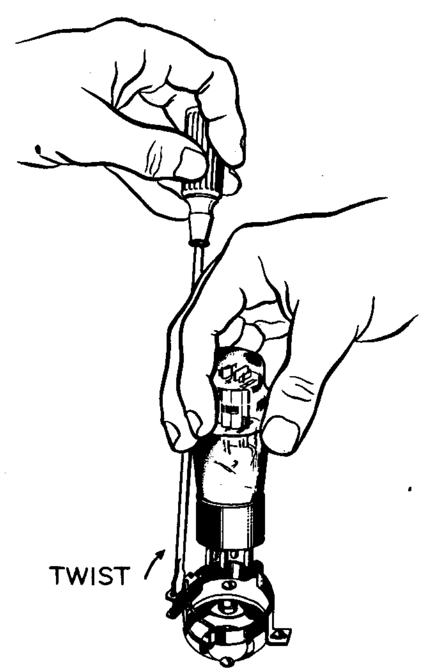
TRANSMITTER TUBE LOCATIONS



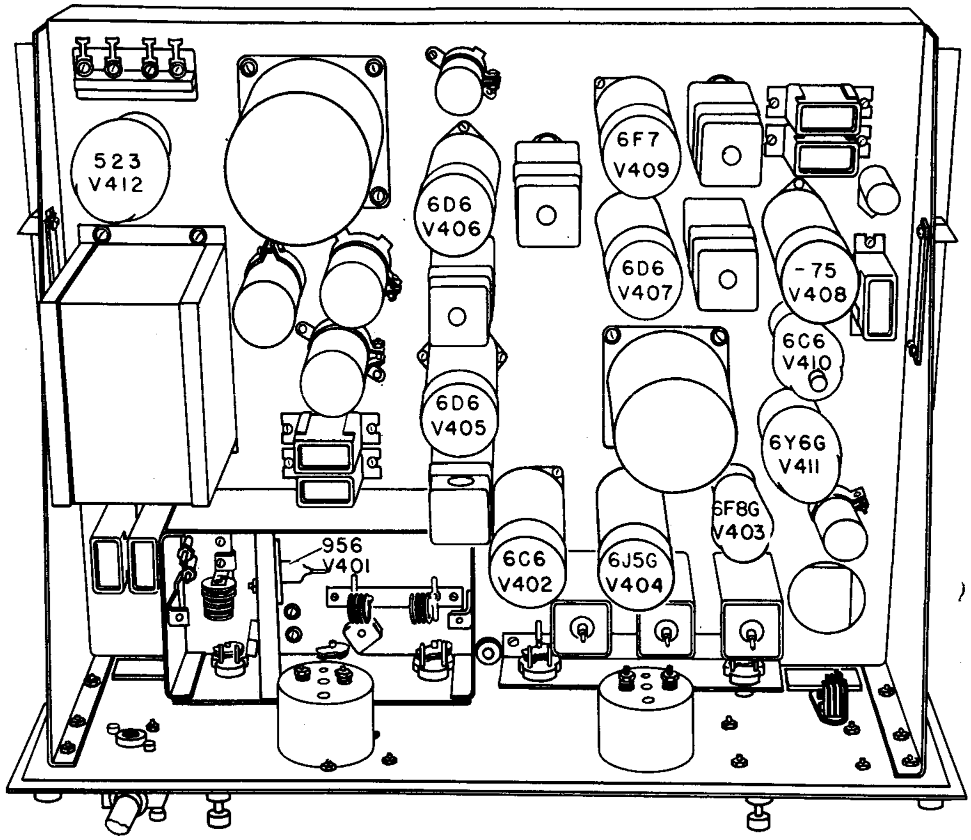
NOTE: ALL TUBES SUPPLIED WITH THE EQUIPMENT OR AS SPARES ON THE EQUIPMENT CONTRACT, SHALL BE USED IN THE EQUIPMENT PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

All tubes should be handled with care as they may be permanently injured if subjected to sudden shocks. They should, if possible, be stored in an upright position in their original containers. When inserting them into the sockets do not allow them to snap into position.

In the TBS-8 equipment, tube clamps are provided to prevent the tubes from loosening under extreme conditions of vibration. These clamps are operated in the manner shown in the illustration. A long-bladed screwdriver is inserted in the slot of the locking lever and twisted to the left to open the clamp. After inserting the tube in the socket, a twist to the right locks the clamp securely around the base of the tube.



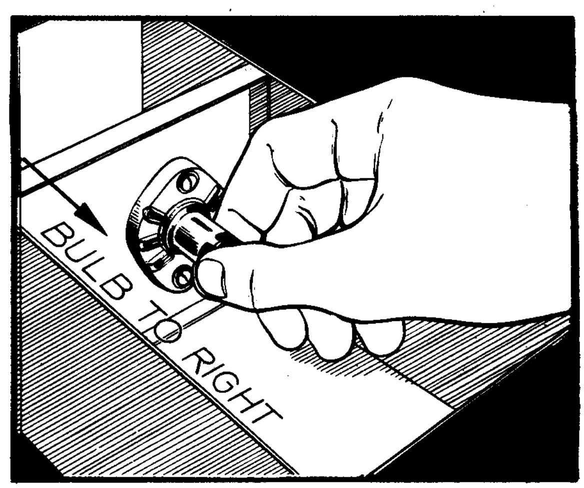
RECEIVER TUBE LOCATIONS



NOTE: A LOSS IN SENSITIVITY DOES NOT NECESSARILY INDICATE THAT TROUBLES OTHER THAN WORN-OUT TUBES DO NOT EXIST, BUT UNDER ANY CONDITION THE TUBES SHOULD BE CHANGED BEFORE DISTURBING ANY OF THE INTERNAL RECEIVER ADJUSTMENTS.

CAUTION: Particular care must be exercised in removing or replacing the r-f tube -956 mounted in the shielded compartment in the receiver. In replacing this tube the bulb of the tube should be grasped in the right hand, as shown in the illustration, with the three prongs on the side of the tube toward the panel of the receiver. The tube is then inserted base first into the opening in the shield and the terminal leads slipped into the clips on the socket, making certain they enter the clips properly. The flexible leads can then be clipped to the terminals extending into the two compartments.

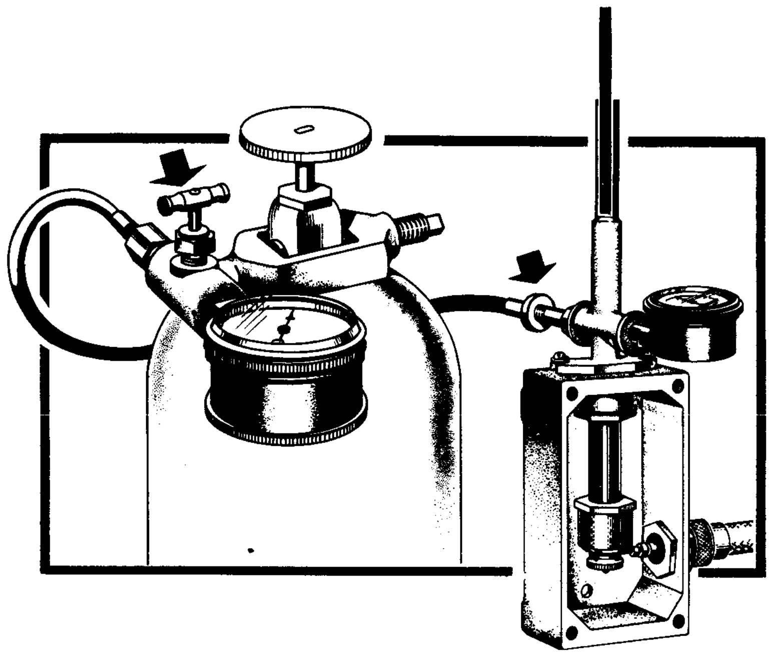
The vacuum tubes should be checked periodically in a reliable tester and replaced when the mutual conductance decreases to less than 70 per cent of the original value. So far as possible, tube failures should be anticipated by keeping an accurate record of all tubes, including the date of receipt, use intended, date placed in service, date of failure, number of hours operated and other pertinent information. All meter readings should be recorded regularly and compared with previous readings. A ten per cent reduction in plate current usually indicates a loss in filament emission and the suspected tube should be immediately replaced with another of the same type for purposes of test. To insure good contact, the Type -956 r-f amplifier tube should be removed from its socket periodically and the prongs cleaned.



TRANSMITTER TUBE TROUBLE CHART

SYMPTOM	TUBE AT FAULT	OTHER CAUSES AND PROCEDURE
Low Excitation in Power Amplifier Stage.	Defective tube in any preceding stage.	Improper tuning of transmitter. Retune as per chart in Section 4, to detect stage at fault and correct tuning.
Insufficient dip in Power Amplifier plate current at resonance.	Power Amplifier tube V808.	Short or open circuit in transmission line or antenna assembly.
Low Modulation Percentage on Voice Transmission.	Any tube in speech amplifier.	Replace tubes in pairs till defective stage is located.
Abnormally high Modulation Percentage, over 100% on voice.	Modulator Limiter tube V112.	Replace tube and check: If not cleared, circuit components are at fault.
Normal r-f output but high distortion on voice.	Defective tube in speech amplifier.	Replace tubes in pairs till defective stage is located. Otherwise, circuit components are at fault.
ON MCW OPERATION ONLY		
No r-f output, no plate current indication.	Defective Time-Delay Tube V111.	Replace tube. Continued trouble indicates relays or circuit components at fault.
R-F output but no tone modulation.	Defective Audio Oscillator tube V111.	Replace tube. Trouble continuing indicates fault in keying relay or transformer T105.
VOICE AND MCW INOPERATIVE		
Low plate current on all stages but oscillator; no dip when oscillator is tuned through resonance.	Defective oscillator tube, V101.	Replace tube. Crystal may also be at fault. Replace crystal and try tuning oscillator.

REFILLING THE TRANSMISSION LINE



The transmission line from the transmitter junction box to antenna is filled with nitrogen gas under pressure. The pressure in this line should be checked daily by means of the gauge on the end seal of the line. Should it fall below 5 lbs., additional gas must be charged into the line. A sudden complete loss of pressure indicates a break in the line and immediate steps should be taken to locate and repair the trouble before moisture enters the line and makes the equipment inoperative. In case of slow drop in pressure, the line may be refilled from tank and gauge fittings furnished in the transmission line kit as shown in the illustration.

A Open tank valve one-half turn.

B Open valve on fitting one turn for a few seconds to remove air from fitting and hose.

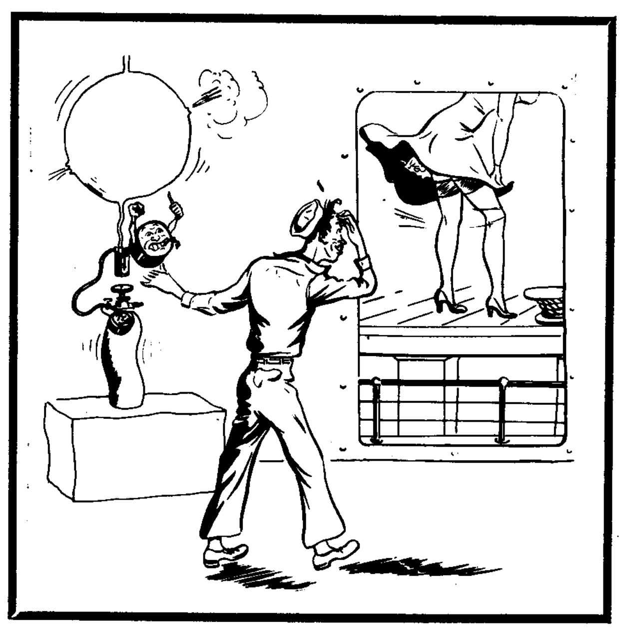
C Remove cap from intake valve on transmission line and seal and attach flexible hose from tank as shown.

D Admit gas to line slowly by opening small valve on tank fitting until gauge on line indicates 10 lbs. pressure.

E Close tank valve and uncouple hose.

F Replace cap on transmission line valve and stow tank and fittings.

CAUTION: DO NOT APPLY MORE THAN TWENTY POUNDS PRESSURE TO TRANSMISSION LINE OR RUPTURE OF LINE MAY RESULT.



NOTES

PREVENTIVE MAINTENANCE

TBS SERIES

SAFETY

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Since the use of high voltages (875 volts) which are dangerous to human life is necessary to the successful operation of the equipment covered by these instructions, certain reasonable precautionary measures must be carefully observed by the operating personnel during the adjustment and operation of the equipment.

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It should be borne in mind that interlocks are provided only on normal access doors on certain major units and therefore side, back or top screens, commutator covers, if removed, will not cause interlocks to function and will thereby allow access to circuits carrying voltages dangerous to human life.

While every practicable safety precaution has been incorporated in this equipment the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS—Under no circumstances should any person be permitted to reach within or in any manner gain access to the enclosure with interlocked gates or doors closed or with power supply line switches to the equipment closed; or to approach or handle any portion of the equipment which is supplied with power, or to connect any apparatus external to the enclosure to circuits within the equipment; or to apply voltages to the equipment for testing purposes while any non-interlocked portion of the shielding or enclosure is removed or open. Wherever feasible in testing circuits, check for continuity and resistances rather than directly checking voltage at various points.

DON'T SERVICE OR ADJUST ALONE—Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS—Under no circumstances should any access gate, door or safety interlock switch be removed, short circuited, or tampered with in any way by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

THE ATTENTION OF OFFICERS AND OPERATING PERSONNEL IS DIRECTED TO CHAPTER 67 OF BUREAU OF SHIPS MANUAL OR SUPERSEDING INSTRUCTIONS ON THE SUBJECT OF "RADIO SAFETY PRECAUTIONS TO BE OBSERVED."

TABLE OF CONTENTS

PREVENTIVE MAINTENANCE

SECTION 6

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

MAINTENANCE OF TBS EQUIPMENT

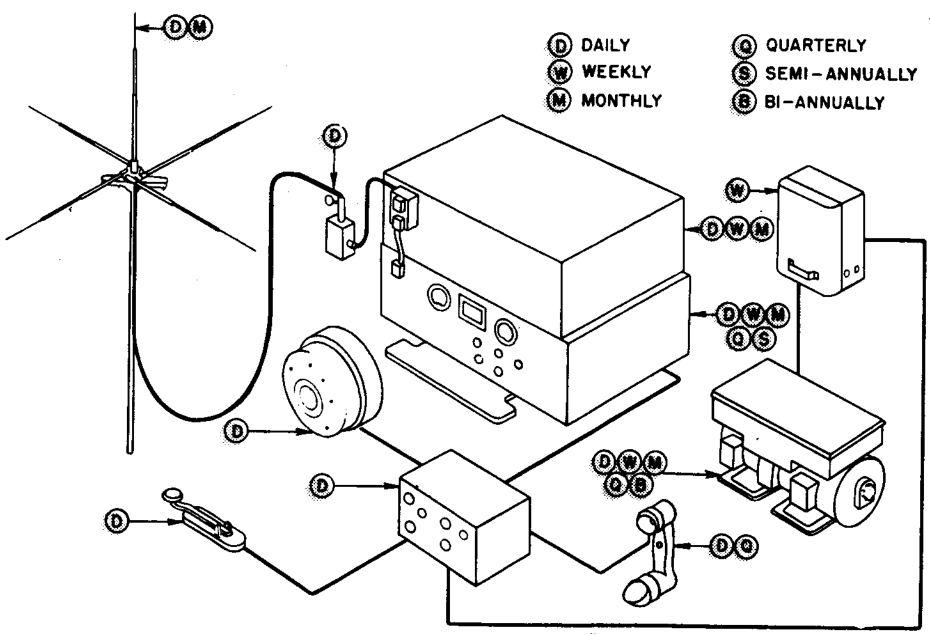
CAUTION!

The operation of this equipment requires the use of voltages dangerous to human life. Safety precautions should be observed at all times. Open main current supply switches when connecting test equipment to live parts. Wherever possible test circuit for resistance and continuity rather than checking voltage. Capacitors may retain dangerous voltages after power is off. Short or ground capacitors before touching.

With the recognition of the importance of reliable communication in the operation of ships of all types comes the realization that optimum performance of the radio equipment is necessary at all times. This implies a continual check on the condition of the apparatus which can only be achieved by systematic inspection and adjustment.

Every effort has been made to design and build a high degree of reliability into the TBS equipment, but all apparatus of this nature is subject to wear and deterioration, particularly in the tube complement, that can only be prevented by proper maintenance methods. By making the care of the apparatus a routine procedure, consistent operation will be assured and the efficiency and life of the equipment increased.

A maintenance chart is furnished, beginning on the opposite page and a diagram below as a guide and reminder of what should be done, when and how. Careful attention to this prescribed routine will make the work light and major troubles few. Under Procedure on the chart are listed in brief the steps necessary to make the check and minor repairs. Full details for the maintenance of the major units are given in section 7 under the heading of the unit that may be involved. Under the item being checked is given the page in this section where full details of servicing are to be found.



SERVICE CHART FOR TBS EQUIPMENT

TBS SERVICE CHART

DAILY CHECK	PROCEDURE
ANTENNA	Visual check.
TRANSMISSION LINE Page 6	Gauge at junction box at transmitter should show 5 lbs. Refill with gas if necessary. Zero pressure indicates leak in line. Locate and repair.
RECEIVER	Note noise level at loudspeaker and adjust noise suppressor if necessary. Leave receiver on while checking balance of equipment.
MOTOR GENERATOR	Press Start button and note any unusual noise or vibration.
TRANSMITTER Page 7	Close Test SW and note radiation on R-F Line Current Meter, 2.4. Turn meter test switch to I_p PA position and note plate current (115-120 Ma). Release Test Switch.
CONTROL UNIT	Start and stop motor generator by proper buttons at both positions. Switch handset on and off at both positions, note noise on and off in earpiece. Depress button of handset handle. This should remove noise from loudspeaker. Depress key and listen for monitor in earpiece or loudspeaker as check on MCW transmission.

WEEKLY CHECK	PROCEDURE
TRANSMITTER	Disconnect antenna lead to transmitter from junction box and antenna lead on receiver. Remove transmitter from case. Clean chassis and case thoroughly with bellows or blower and cloth.
TUBES	Examine carefully for loose tubes.
RELAYS Page 10	Examine contacts of relays under chassis and for loose connections on plate current relay K104 and antenna transfer relay K103 on rear of panel. Replace transmitter in case.
RECEIVER	Remove receiver from case to extent flexible leads will permit. Clean chassis and case with bellows and cloth.
TUBES AND SHIELDS	Tighten tubes or shields that may be loose. Examine carefully for loose connections. Replace receiver in case and reconnect antenna leads.
OPERATION Page 7	Start motor generators and allow tubes in transmitter to warm up for five minutes. Close Test Switch and rotate meter switch through all five positions, recording readings of Plate and Grid Current meter.
OVERLOAD RELAY Page 11	With meter switch in I_p PA position, and Test Switch closed, release and slowly rotate PA dial. Note reading of Plate and Grid Current Meter when overload relay trips out and shuts power off transmitter. If not close to 160 Ma, reset as per instructions.
INTERLOCK AND EMERGENCY SWITCHES	Start motor generator and open lid of transmitter to test interlock switch. Start motor generator again and test emergency and reset switches.
MAGNETIC CONTROLLER Page 11	Open ship current supply switch to magnetic controller and examine controller for loose connections, worn contacts or loose fuses. Replace lid and close switch.
MOTOR GENERATOR Page 13	Wipe off dust and make sure ventilating openings are clear.

MONTHLY CHECK	PROCEDURE
ANTENNA	Wipe off insulator, disconnect transmission line at antenna and junction box. Use Megger to test for insulation failure.
TRANSMITTER Page 7	Retune transmitter with tubes just installed and record meter readings.
RECEIVER	Retune receiver.
MOTOR GENERATOR Page 13	Remove and inspect brushes. Replace if worn down to ⅜ inch length. Check speed with Stroboscope or Frequency meter if d-c operated. Test for grounds with Megger.
SPARES	Check tube complement and order spares to fill allotment.

TBS SERVICE CHART

QUARTERLY CHECK	PROCEDURE
RECEIVER Page 8	Check sensitivity of receiver with standard signal generator such as Microvolter 18B. An input of 10 microvolts giving 2 watts output. Record findings in log.
TELEPHONE ACCESSORIES	Check all spare headsets and microphones by actual operation in equipment.
MOTOR GENERATOR Page 12	Lubricate. If early model, remove plug in housing top and drop in 3 drops of oil of SA10 viscosity. On later types with grease cup, remove plug in bottom of housing and turn down grease cup one turn. Run machine, wipe off any excess grease and replace plug.
SEMIANNUAL CHECK	**PROCEDURE**
TUBES	Install complete set of tested tubes in receiver and transmitter. Be careful in replacing No. 956 tube in receiver not to break tube when attaching clips to leads on tube. Test tubes removed and retain satisfactory tubes for further use.
SPARES	Make inventory of Spare Parts box and requisition parts to fill allowance. Conduct insulation and bar to bar test of spare armatures not in sealed containers.
MOTOR GENERATOR Page 13	Inspect speed regulator contacts.
ANNUAL CHECK	**PROCEDURE**
RECEIVER	Check for alignment by the Output meter method as given in Section 7 and realign only if necessary.
BIENNIAL CHECK	**PROCEDURE**
MOTOR GENERATOR	Completely dismantle machine, cleaning all parts thoroughly as instructed under Motor Generators, in Section 7. Reassemble and check for correct speed and voltages.

NOTE: The attention of maintenance personnel is invited to the requirements of Chapters 67 and 68 of the "Bureau of Ships Manual" of latest issue.

REFILLING THE TRANSMISSION LINE

The transmission line from the transmitter junction box to antenna is filled with nitrogen gas under pressure. The pressure in this line should be checked daily by means of the gauge on the end seal of the line and, should it fall below 5 lbs., additional gas must be charged into the line. A sudden complete loss of pressure indicates a break in the line and immediate steps should be taken to locate and repair the trouble before moisture enters the line and makes the equipment inoperative. In case of slow drop in pressure, the line may be refilled from tank and gauge fittings furnished in the transmission line kit as shown in the illustration.

CAUTION: Do not apply more than twenty pounds pressure to transmission line or rupture of line may result.

A Open tank valve one-half turn.

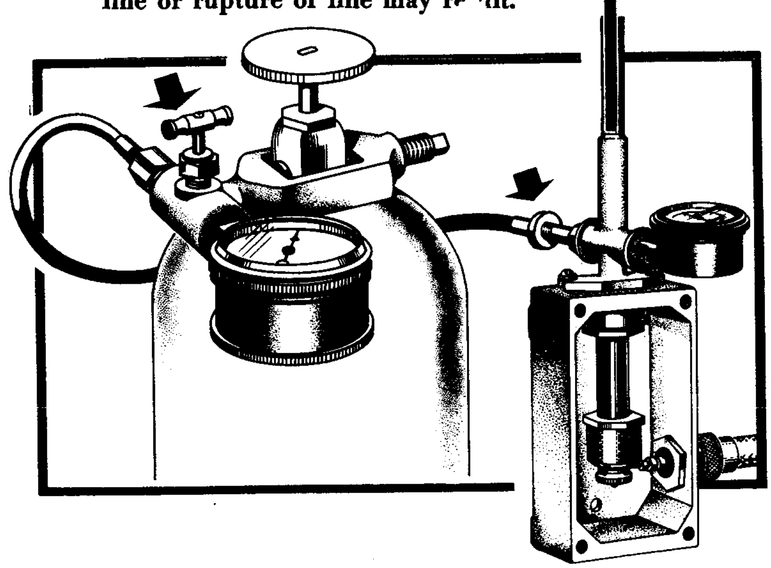
B Open valve on fitting one turn for a few seconds to remove air from fitting and hose.

C Remove cap from intake valve on transmission line and seal and attach flexible hose from tank as shown.

D Admit gas to line slowly by opening small valve on tank fitting until gauge on line indicates 10 lbs. pressure.

E Close tank valve and uncouple hose.

F Replace cap on transmission line valve and stow tank and fittings.



TRANSMITTER TUNING CHART

When necessary to tune the transmitter to change the operating frequency of the equipment the chart below shows the steps necessary to make the adjustments. The tests are made in the order numbered, the OPERATE-TUNE switch being in the position shown for each step and the TEST SW. being depressed to take the readings on the PLATE & GRID CURRENT meter for the various settings of the Meter Switch. It is good practice to make a note of the meter readings so subsequent tests would reveal defective tubes when test readings are below normal.

A. OSCILLATOR

OPERATE / TUNE

Set meter switch to I_p OSC. Rotate OSCILLATOR dial in a clockwise direction until the plate current suddenly drops to a minimum value as indicated on the PLATE & GRID CURRENT meter. This preliminary setting will be subject to further adjustment.

METER READING—25 MILLIAMPS APPROXIMATELY.

B. 1st DOUBLER

OPERATE / TUNE

Set Meter Switch to I_p 1st DOUBLER. Rotate 1st DOUBLER dial till meter again indicates MINIMUM current in the plate circuit of this tube. The dip may be very small in this stage and the adjustment must be carefully made to obtain the setting giving the lowest plate current reading.

METER READING—35 MILLIAMPS APPROXIMATELY.

C. 2nd DOUBLER

OPERATE / TUNE

Set the Meter Switch to I_p 2nd DOUBLER. Rotate the 2nd DOUBLER dial to obtain a minimum plate current reading in this circuit.

METER READING—40 MILLIAMPS APPROXIMATELY.

D. POWER AMPLIFIER (Plate)

OPERATE / TUNE

Set Meter Switch to I_p PA. Rotate dial of POWER AMPLIFIER to obtain the MINIMUM plate current or approximately 70 ma in this stage.

OPERATE / TUNE

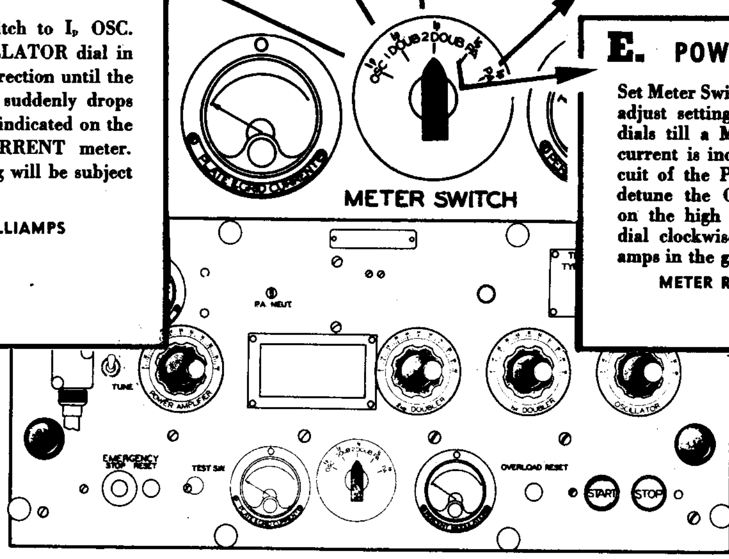
Throw the OPERATE-TUNE switch to the OPERATE position, the meter reading should now be 115 Milliamps. If above or below this figure, adjustment must be made of the plate-tank tap in the transmitter, see below.

E. POWER AMPLIFIER (Grid)

OPERATE / TUNE

Set Meter Switch to I_g PA. Carefully adjust settings of both DOUBLER dials till a MAXIMUM amount of current is indicated in the grid circuit of the Power Amplifier. Then detune the OSCILLATOR slightly on the high frequency side by rotating the dial clockwise till meter indicates 35 Milliamps in the grid circuit of amplifier.

METER READING—35 MILLIAMPS



NOTE: Should the plate current of the Power Amplifier not fall between 115 and 120 Milliamps in the Operate position, of the 4th test above, it will be necessary to shift the tap on the plate-tank coil in the output of the Power tube. To do this, shut down the equipment, open power supply switch and unfasten access door on transmitter. Loosen thumbscrew holding tap on coil in Power Amplifier section and move tap clockwise on coil to increase plate current or counterclockwise to decrease plate current. This adjustment should be made in quarter inch steps, testing between each trial setting till plate current of Power Amplifier is between 115 and 120 Milliamps. Then repeat the 5th test (E) above as final check.

When adjustments are complete lock the tuning controls by means of thumbscrews provided, taking care not to disturb the settings.

RECEIVER TUNING CHART

To tune the receiver, the lower row of controls on the panel should be set as follows:

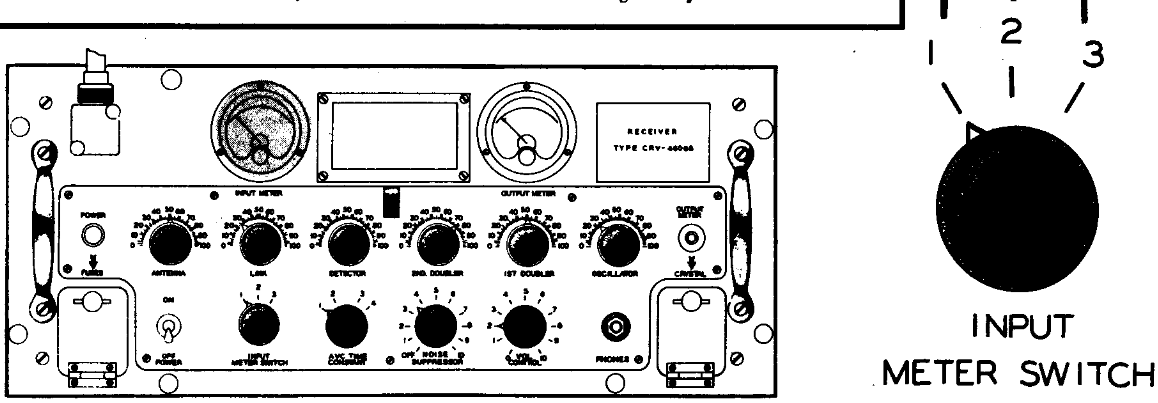
A.V.C. TIME CONSTANT.........on Pos. 1
NOISE SUPPRESSOR...............on OFF
VOL. CONTROL................at mid-point

The receiver may then be switched on and the tubes allowed to heat up for several minutes before making the following adjustments.

A OSCILLATOR Set INPUT METER SWITCH on position 3. Rotate the dial of the OSCILLATOR slowly, observing the INPUT METER and when the point of resonance is reached for the particular crystal plugged into the receiver there will be a sharp dip in the plate current indicated on the meter. The control should be set slightly to the right of the point where greatest dip is obtained to assure stable operation and positive starting of oscillations in the circuit.

B DOUBLERS Set the INPUT METER SWITCH on position 2. Adjust the settings of the 1st and 2nd DOUBLERS till a maximum amount of excitation on the 1st detector is indicated by the maximum meter reading. The settings of these two controls track very closely with that of the OSCILLATOR, so the latter will serve as a guide in making this adjustment.

C INPUT Set INPUT METER SWITCH on position 1. The ANTENNA, LINK and DETECTOR controls are adjusted to a point of resonance as may be indicated by readings of Output meter or by the increase in noise in the loudspeaker or earpiece of a handset. The settings of these tuning controls should be very similar to those of the local oscillator controls, which will serve as a guide in adjusting them. If a signal is picked up as resonance is approached in tuning, the readings on the INPUT METER can serve as a guide in making the settings. Maximum volume at output is usually the best indicator of resonance, readjusting the volume control if necessary to the sound level desired in making the adjustments.



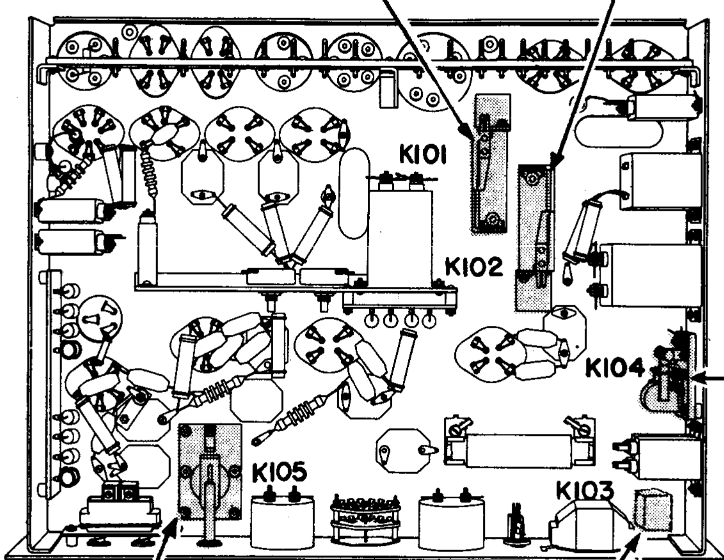
CHECKING SENSITIVITY OF RECEIVER

The following table shows the approximate inputs (modulated 30 per cent at 1000 cycles) required to produce standard output (two watts into a 600-ohm non-inductive resistance). These values will be found to vary considerably for different receivers but will serve as a guide as to the receiver operation. In general, the inputs will be somewhat less than those stated if the receiver is normal.

INPUT TO:	MICROVOLTS
Third i-f amplifier grid	350,000
Second i-f amplifier grid	200,000
First i-f amplifier grid	800
First detector grid	300
R-F amplifier grid	10
Dummy antenna	5

Conditions of measurement are: Noise suppressor at "OFF"; volume control at "10"; dummy antenna 50-ohm non-inductive resistance; a capacitor of at least 0.1 mfd in series with the lead to the signal generator.

SERVICING THE RELAYS



> **CAUTION: No relay should be readjusted unless it has been definitely proved to be out of adjustment. Remember, cleaning is easier than readjusting.**

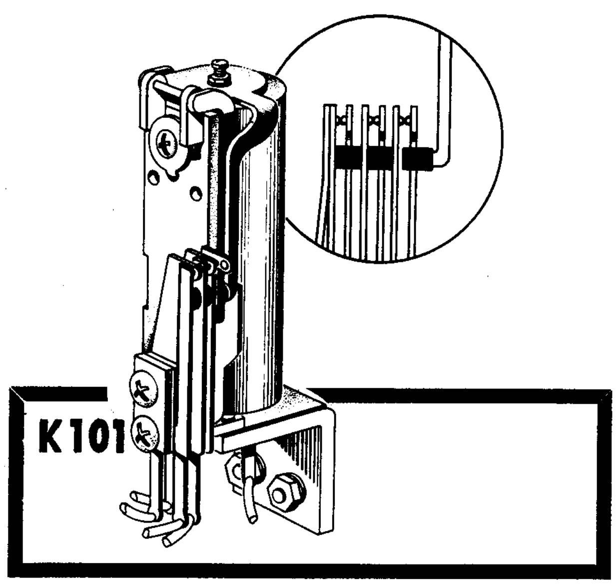
The relays necessary for the control of and their position in the TBS transmitter and associated equipment are shown in the illustration. The correct and satisfactory operation of the apparatus depends to a great extent on these relays and they may become a source of trouble and annoyance if not kept in good operating condition. This means chiefly keeping contacts clean to assure good connections during operation, for a dirty or burnt contact is invariably a source of noise and poor transmission or reception, particularly so at the high frequencies used in the TBS equipment.

THE CARRIER DELAY RELAY K101 has three pairs of contacts, normally closed, when relay is de-energized.

Contacts should be cleaned when necessary, by applying carbon tetrachloride to the contact surfaces with a soft brush.

Pitted or burned contacts should be polished with crocus cloth, burnished with a burnishing tool, or, if too badly damaged, replaced.

The set screw and associated lock nut at the end opposite the soldered connections should be checked for tightness. This screw should require readjusting only if the lock nut has become loose and the relay been jarred out of adjustment. Need for adjustment may be determined by pressing the relay armature against the magnet core and observing whether the contacts "make" with sufficient tension, and whether a clean "break" is obtained on release.

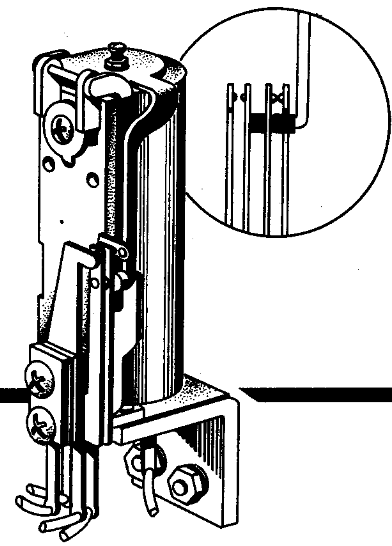


Avoid disturbing the top leaf tension on the relay, otherwise the carrier will not remain on for the required period of 0.7 to 1.2 seconds.

KEYING RELAY K102 has two pairs of contacts, one pair normally closed, the other pair open. This relay is similar in construction to the carrier delay relay and is cared for in the same manner. Contacts should be kept clean, either by application of carbon tetrachloride or by the use of fine crocus cloth.

The set screw adjusting the armature travel should be checked for tightness and readjusted if lock nut has worked loose.

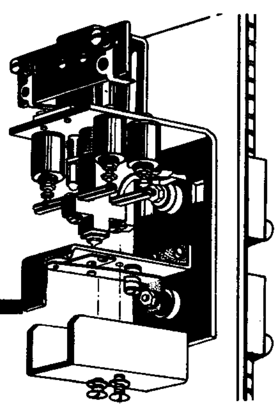
The set screw should be adjusted so the armature, when moved by hand, will cause the normally open


K 102

contacts to close firmly, with contact spring bending to the same degree that the normally closed contact spring bends when the relay is released.

THE ANTENNA CHANGE-OVER RELAY K103 has six pairs of contacts.

The two pairs of contacts nearest the front panel are of the normally open type, and these connect the antenna to the transmitter. Both pairs should make at the same time.


K 103

The two pairs of contacts farthest from the front panel are also of the normally open type, and these are the high voltage contacts. These should be checked and treated in the same way as the front pair.

The receiver contact arm, located in the shield can, normally makes contact with a pin which is studded into the isolantite contact frame above. This contact arm is required to be clean and to have reasonably good tension, since the antenna is in this way connected to the receiver. When the relay is energized, the pin should withdraw, breaking the contact with the receiver contact arm, and allowing the arm to be grounded by the contact located within the shield can.

Necessary adjustment to maintain continuity of contact between receiver and ground may be made by small set screw on top of shield can.

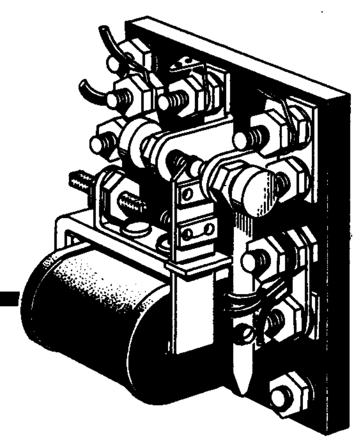
Clean all contacts of this relay with carbon tetrachloride applied with a soft brush.

Contacts may be polished by using a small piece of crocus cloth, taking care to avoid rounding the edges of the contacts. Crocus cloth placed over the handle of a nail file or other thin, flat object, will serve as a guide in polishing flat contact faces.

Contacts that are too badly worn, burned, or damaged, may be replaced with a spare by loosening the lock nut which locks the contact stud to the ceramic pillar, and unscrewing the contact. Replacement of contact arms may be accomplished by removing the contact arm and substituting a spare.

LOW VOLTAGE RELAY, K104, should require little adjustment beyond keeping contacts clean with carbon tetrachloride or burnishing with crocus cloth.

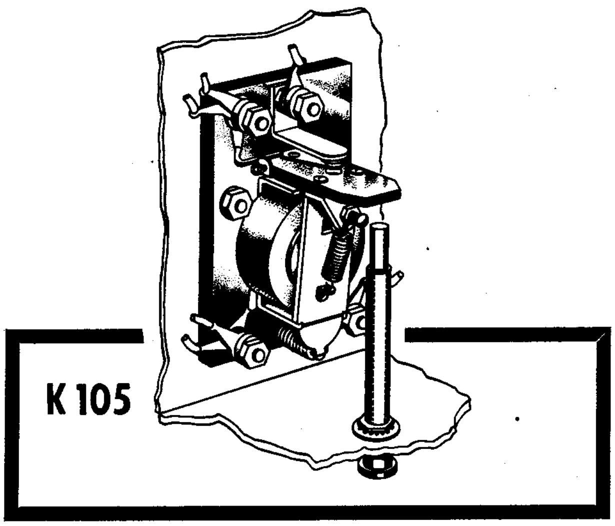
Tension on this relay is not so important but should be sufficient to give quick opening. The contacts should be so adjusted that they make contact just before the armature strikes the pole piece, to assure a firm contact when armature bends under the pull of the magnet.


K 104

THE OVERLOAD RELAY K105 should operate when the Power Amplifier draws between 150 and 160 milliamperes. The operation of this relay can be checked in the following manner.

With motor generator running, turn meter switch to I_p PA position, Tune-Operate switch on Operate, press Test Switch into place voltage on plates of tubes. Now slowly detune the Power Amplifier dial, watching the Plate and Grid Current meter.

When the meter reads 160 Ma the relay should trip and shut down the motor generator. If relay does not trip, adjust set screw clockwise. If it trips before 150 Ma, adjust the set screw on the relay counter clockwise and lock in position with nut.



Oiling is permitted at the armature pivots to relieve stiffness of operation. Contacts may be cleaned with carbon tetrachloride or with crocus cloth, if necessary.

CAUTION: The power amplifier circuit should not be allowed to remain detuned for more than a few seconds at a time, since the high plate current drawn under these conditions may injure the tube. A safer way to check this relay is to disconnect the leads to the coil and connect a small battery of 3 volts in series with a 30-ohm variable resistor, a milliammeter with a 0-200 ma scale and the relay coil winding. Starting with the variable resistance set at maximum, gradually reduce the resistance, noting the current when the relay operates, making such adjustment as may be necessary to bring the operating current to 150 ma.

LOUDSPEAKER CUTOUT RELAY

In each control box there is located a relay similar in type to the K104 relay used in the transmitter. The purpose of this relay is to cut the loudspeaker out of the circuit while using the microphone in the handset or chest set for transmission. The relay only performs this function in the unit to which the loudspeaker is connected and will require periodical inspection and cleaning.

Both stationary contacts on this relay are used and both should be cleaned as found necessary. Since the relay in the unit having no loudspeaker connected does no switching, contact care is not necessary but connections to the coil must be kept tight.

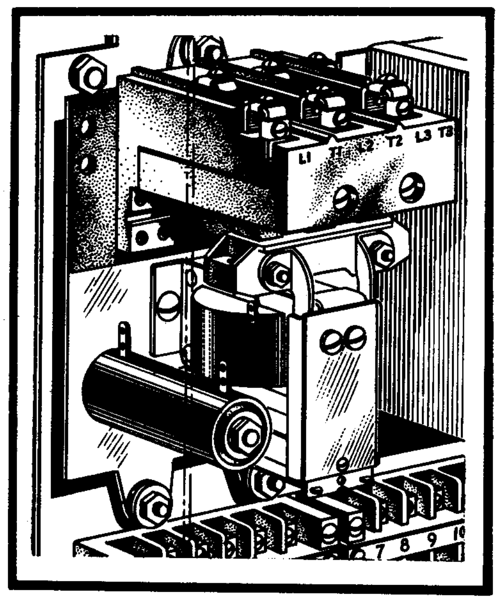
MAGNETIC CONTROLLER RELAY

The solenoids actuating the magnetic controller can be classed as a relay and should be inspected along with the others, as poor contacts at this point will be source of much noise.

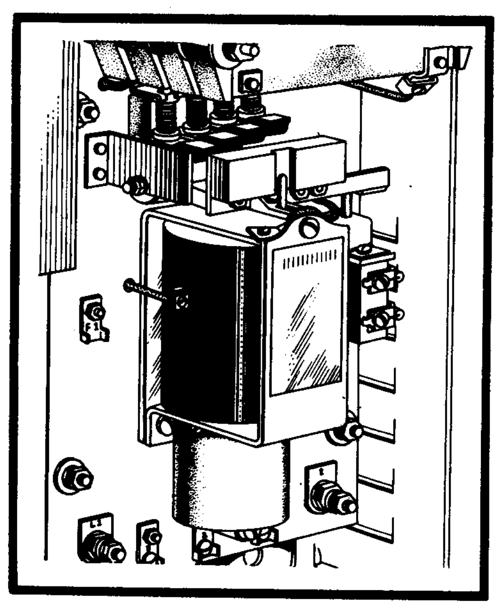
In some magnetic controllers, particularly the a-c type, the contacts are arranged to form a wiping contact, thus keeping them clean.

Contacts in the d-c controllers are more subject to burning or arcing and should be checked periodically and cleaned and adjusted at the first sign of burning.

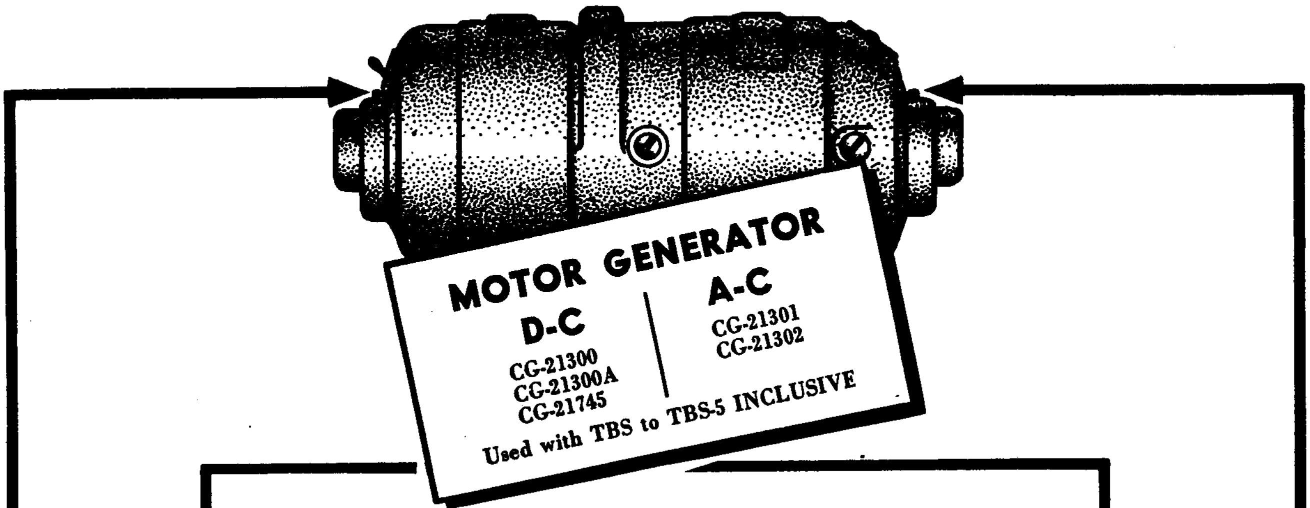
A-C TYPE



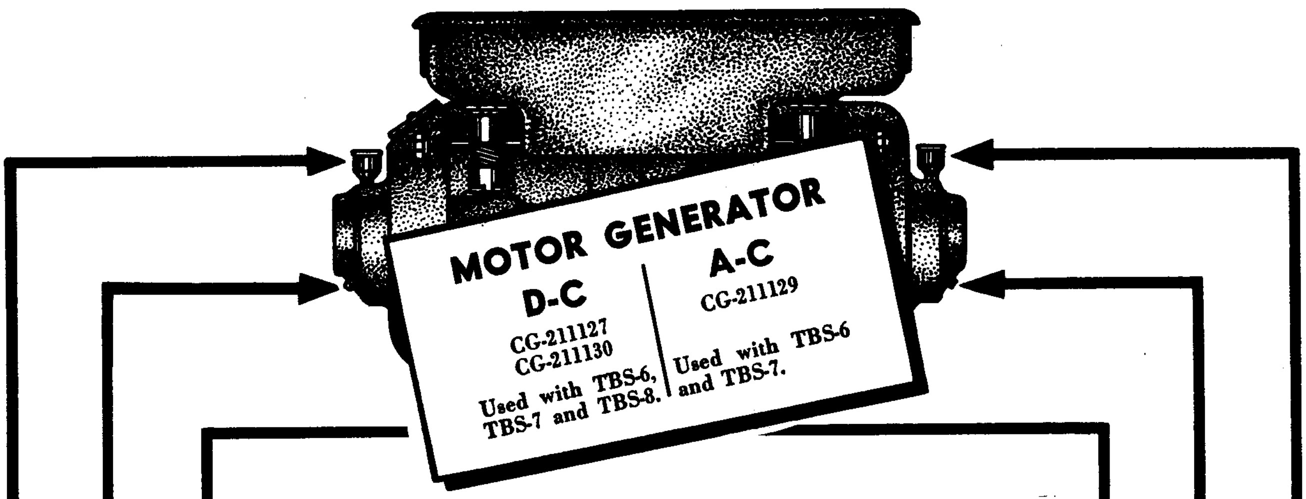
D-C TYPE



LUBRICATION CHART



Every three months or after approximately 1000 hours of operation, remove plug in top of bearing housing at both ends of machine and add three drops of oil of SA10 viscosity. Replace plug and wipe off machine. Bearing has sufficient grease storage space for approximately three years' operation and should be dismantled and regreased after that period of time. The addition of oil from time to time keeps grease soft.



At quarterly inspection period or after 3 months' operation, remove plug from bottom of bearing housing on both ends of machine. Screw down grease cup two turns or until grease extrudes from plug hole. Allow machine to run several minutes, wipe grease off carefully and replace plug. Refill cup with Navy Spec. 14L3, grade C as found necessary.

MOTOR GENERATOR MAINTENANCE

The most important factors in the care of this equipment are cleanliness, proper lubrication and the care of the brushes and commutators. The latter are subject to wear to a greater extent than other parts of the machine and should be inspected monthly, for defective brushes may result in damage to the commutator of the motor or generator.

There are nine brushes used in the d-c machines located in the following positions:

QUANTITY	SIZE	LOCATION
One	Small	Speed Regulator Housing.
Two	Small	Motor End Shield—A-C Output.
Two	Large	Motor End Shield—Motor.
Two	Small	Fan Housing—Low Voltage Plate Current 300 volt.
Two	Small	High Voltage Plate Current 875 volt.

To inspect these brushes, remove locking device on brush holder caps, unscrew cap and withdraw spring and brush. Mark each brush so it can be replaced in the proper holder and same relative position that it occupied before removal. If brushes are worn down to ⅜ inch length they should be replaced with new brushes. Be sure the new brushes are inserted so the curved face of the brush fits the curvature of the armature.

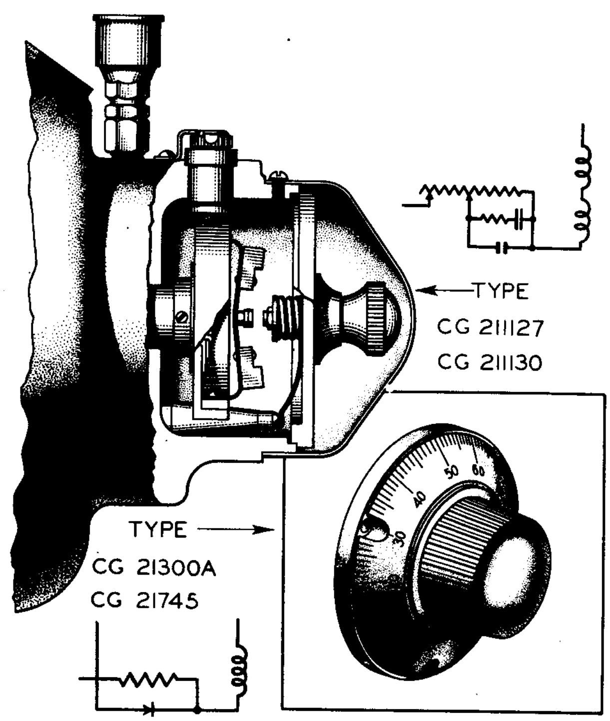
If the old brushes are replaced, wipe them off well with a dry cloth before replacing and be certain they slide freely into the brush holders. Tighten caps into place and replace the locking device.

Commutators and slip rings should also be inspected at monthly periods. Remove the cover plate at each end of the machine and examine the commutator for signs of grooving or burning. Should the commutators take on a dark brown glazed appearance they should not be disturbed as this is the ideal condition. A blackened or burnt appearance is due to brush sparking. The motor commutator may be cleaned up with a piece of 4/0 sandpaper applied with a dry stick through the opening, with the machine running. Make sure not to insert the fingers in the opening. Do not attempt this on generator end of the machine. After shutting down the machine, a soft cloth on a stick can be used to remove any dust on brush holders not carried off by the circulating air in the machine. The brushes should be checked to be sure they have sufficient tension and slide freely. Sparking seldom results with brushes properly fitted.

If commutator is badly burned, grooved or rough the machine will have to be dismantled and the commutators turned down in a lathe to obtain a smooth surface. Only sufficient metal is removed from the commutator to clean it up, finishing with sandpaper.

D-C SPEED REGULATORS

All d-c machines are fitted with speed regulators to assure that output currents are of correct voltage and frequency, as the case may be. This is mounted on the end of the motor shaft, the speed of the machine being regulated by means of an adjusting knob on the end of the machine.



The contacts of the regulator are subject to some wear and should be inspected once semi-annually. To remove the adjustable contact of the speed regulator, rotate the dial till the three grooves in the dial line up with the three screws in the regulator housing. Remove these screws and the dial and carrying plate may be removed. In the case of the type of machine using a knob, remove the cover from the knob by removing the screws and remove three screws from the round plate on the regulator housing end. The knob and contact can then be removed. The contacts should be inspected for signs of burning or roughness. Smooth them up with crocus cloth if necessary. In replacing the plate on the end of the machine, orient the knob so the metal strip on the back of the plate makes contact with insulated stud within the regulator housing.

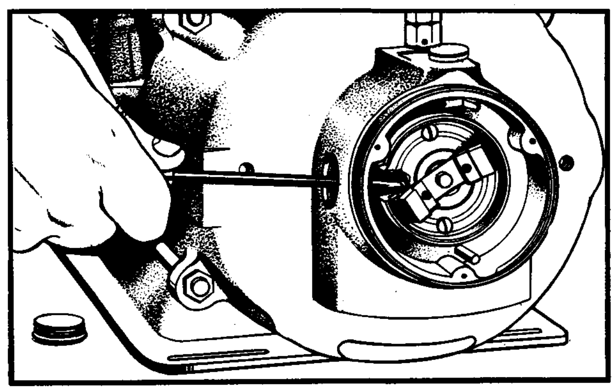
SERVICING SPEED REGULATOR

Should it become necessary to remove the speed regulator mechanism for repair or replacement the following procedure should be observed:

Remove knob and end plate as described above.

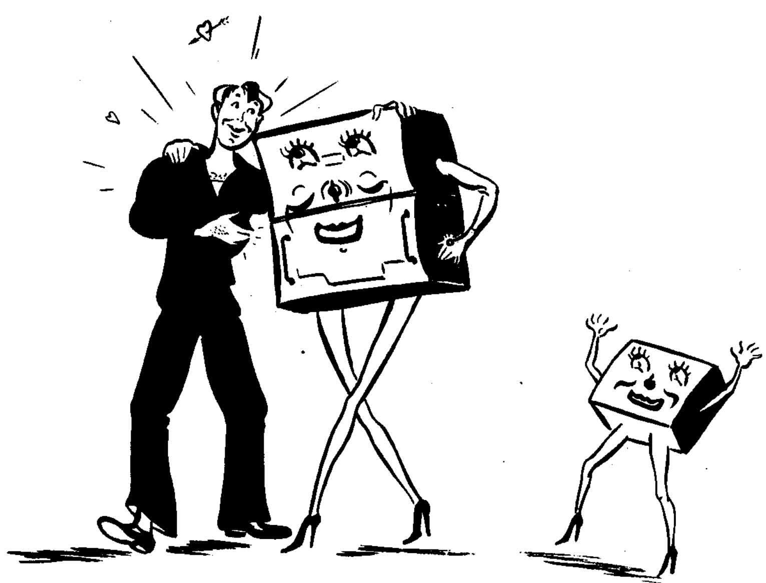
Remove small brush from holder on top of regulator housing.

Remove plug from the side of the regulator housing as shown in the illustration and rotate shaft by hand till the small set screw in the back of the speed regulator mechanism lines up with the hole. Loosen the set screw by inserting a thin screwdriver through the plug hole as shown and withdraw the regulator mechanism from the housing.



NOTE: In replacing the speed regulator mechanism, make certain that the set screw engages in the detent hole in the motor shaft.

The machine should operate at a speed of 3600 R.P.M. and should be adjusted to this speed after having been dismantled for repairs. The light from a stroboscope set for 3600, falling on the rotating armature through the hole in the casing, should show the armature standing still when the speed is correct. A frequency meter connected to the a-c output leads of the motor slip rings should show 60 cycles when speed is correct.



CORRECTIVE MAINTENANCE

TBS SERIES

TABLE OF CONTENTS

CORRECTIVE MAINTENANCE

SECTION 7

TABLE OF CONTENTS

CORRECTIVE MAINTENANCE, SECTION 7 — Continued

SAFETY

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES (875 VOLTS) WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT DEPEND UPON DOOR SWITCHES OR INTERLOCKS FOR PROTECTION BUT ALWAYS SHUT DOWN MOTOR GENERATOR OR OTHER POWER EQUIPMENT. UNDER CERTAIN CONDITIONS, DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES ALWAYS REMOVE POWER DISCHARGE, AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

Since the use of high voltages (875 volts) which are dangerous to human life is necessary to the successful operation of the equipment covered by these instructions, certain reasonable precautionary measures must be carefully observed by the operating personnel during the adjustment and operation of the equipment.

The major portions of the equipment are within shielding enclosures, provided where necessary with access doors which are generally fitted with safety interlock switches which act to shut off dangerous voltages within the enclosures when the access doors are open.

It should be borne in mind that interlocks are provided only on normal access doors on certain major units and therefore side, back or top screens, commutator covers, if removed, will not cause interlocks to function and will thereby allow access to circuits carrying voltages dangerous to human life.

While every practicable safety precaution has been incorporated in this equipment the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS

Under no circumstances should any person be permitted to reach within or in any manner gain access to the enclosure with interlocked gates or doors closed or with power supply line switches to the equipment closed; or to approach or handle any portion of the equipment which is supplied with power, or to connect any apparatus external to the enclosure to circuits within the equipment; or to apply voltages to the equipment for testing purposes while any non-interlocked portion of the shielding or enclosure is removed or open. Whereever feasible in testing circuits, check for continuity and resistances rather than directly checking voltage at various points.

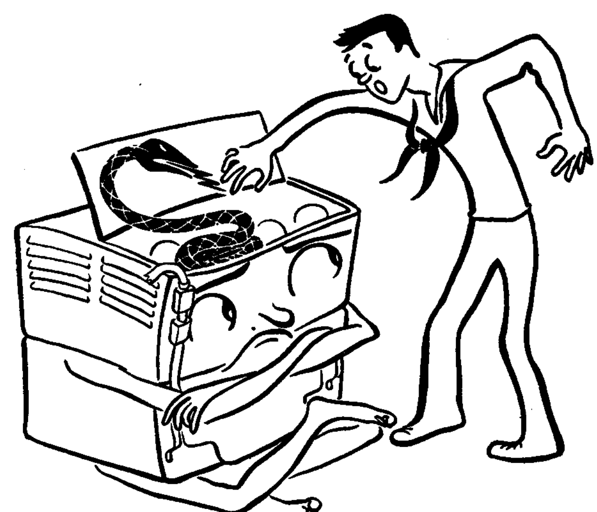
DON'T SERVICE OR ADJUST ALONE

Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS

Under no circumstances should any access gate, door or safety interlock switch be removed, short circuited, or tampered with in any way by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

THE ATTENTION OF OFFICERS AND OPERATING PERSONNEL IS DIRECTED TO CHAPTER 67 OF BUREAU OF SHIPS MANUAL OR SUPERSEDING INSTRUCTIONS ON THE SUBJECT OF "RADIO SAFETY PRECAUTIONS TO BE OBSERVED."



AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

FAILURE REPORTS

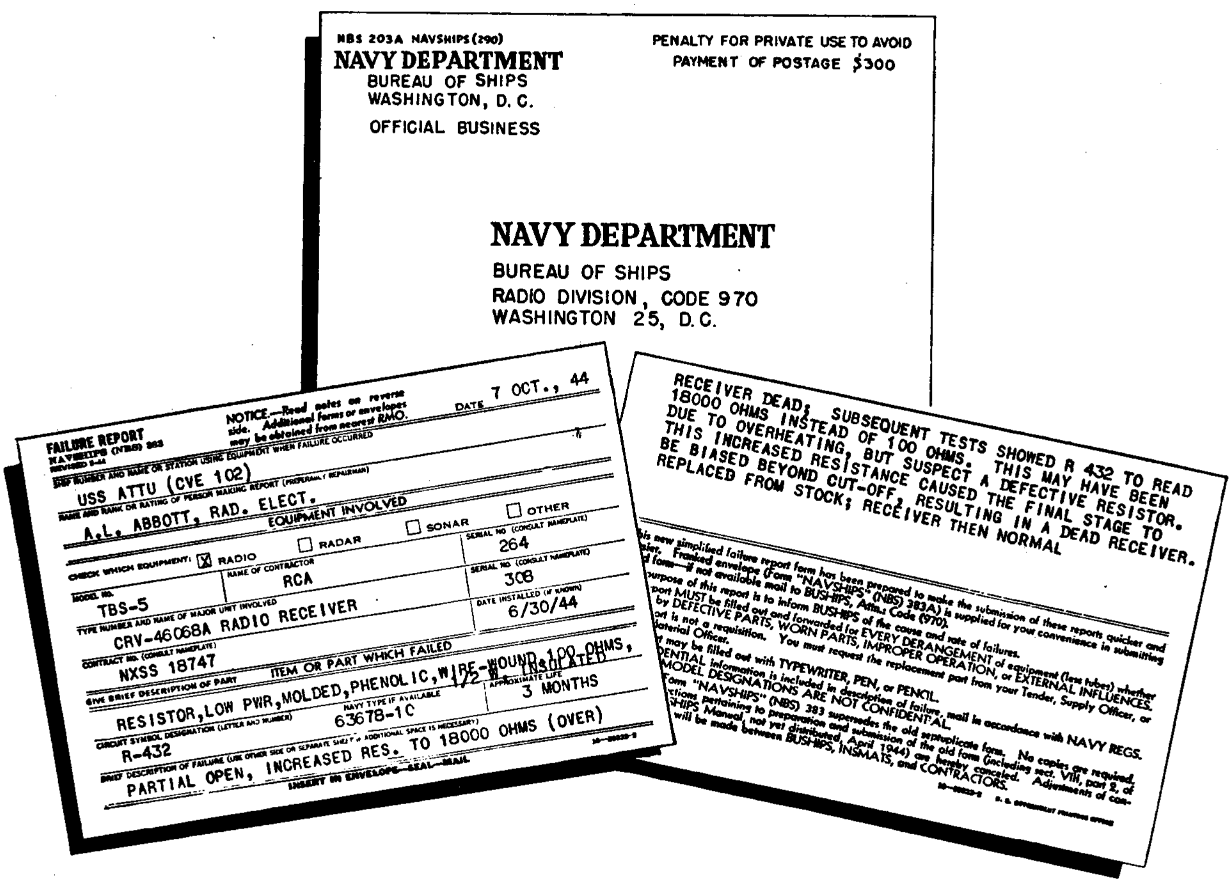
A FAILURE REPORT must be filled out for the failure of any part of the equipment (except tubes) whether caused by defective or worn parts, improper operation, or external influences. It should be made on Failure Report, form NBS-383, which has been designed to simplify this requirement. The card must be filled out and forwarded to BUSHIPS in the franked envelope which is provided. Full instructions are to be found on each card.

Use great care in filling the card out to make certain it carries adequate information. For example, under "Circuit Symbol" use the proper circuit identification taken from the schematic drawings, such as T803, in the case of a transformer, or R207, for a resistor. Do not substitute brevity for clarity. Use the back of the card to completely describe the cause of failure and attach an extra piece of paper if necessary.

The purpose of this report is to inform BUSHIPS of the cause and rate of failures. The information is used by the Bureau in the design of future equipment and in the maintenance of adequate supplies to keep the present equipment going. The cards you send in, together with those from hundreds of other ships, furnish a store of information permitting the Bureau to keep in touch with the performance of the equipment of your ship and all other ships of the Navy.

This report is not a requisition. You must request the replacement of parts through your Officer-in-Charge in the usual manner.

Make certain you have a supply of Failure Report cards and envelopes on board. They may be obtained from any RMO.



NBS 203A NAVSHIPS (290)
NAVY DEPARTMENT
BUREAU OF SHIPS
WASHINGTON, D. C.
OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID PAYMENT OF POSTAGE $300

NAVY DEPARTMENT
BUREAU OF SHIPS
RADIO DIVISION, CODE 970
WASHINGTON 25, D.C.

FAILURE REPORT
DATE 7 OCT., 44
USS ATTU (CVE 102)
A.L. ABBOTT, RAD. ELECT.
EQUIPMENT INVOLVED
CHECK WHICH EQUIPMENT: [X] RADIO [ ] RADAR [ ] SONAR [ ] OTHER
MODEL NO. TBS-5
NAME OF CONTRACTOR RCA
SERIAL NO. 264
SERIAL NO. 308
DATE INSTALLED 6/30/44
CRV-46068A RADIO RECEIVER
CONTRACT NO. NXSS 18747
ITEM OR PART WHICH FAILED
RESISTOR, LOW PWR, MOLDED, PHENOLIC, WIRE-WOUND, 100 OHMS, 1/2 W, INSULATED
63678-1C
APPROXIMATE LIFE 3 MONTHS
CIRCUIT SYMBOL R-432
PARTIAL OPEN, INCREASED RES. TO 18000 OHMS (OVER)
INSERT IN ENVELOPE—SEAL—MAIL

RECEIVER DEAD; SUBSEQUENT TESTS SHOWED R 432 TO READ 18000 OHMS INSTEAD OF 100 OHMS. THIS MAY HAVE BEEN DUE TO OVERHEATING, BUT SUSPECT A DEFECTIVE RESISTOR. THIS INCREASED RESISTANCE CAUSED THE FINAL STAGE TO BE BIASED BEYOND CUT-OFF, RESULTING IN A DEAD RECEIVER. REPLACED FROM STOCK; RECEIVER THEN NORMAL.

SAMPLE FAILURE REPORT CARDS FILLED IN

CORRECTIVE MAINTENANCE

In general, the failure of the system to operate can be usually traced without trouble to the unit responsible. The problem then resolves itself into locating the component of the unit that has failed. To assist in locating such defective components in the transmitter the following chart has been furnished as guide for making preliminary tests. As will be seen, the symptoms are given in the first column with suggested causes for the defect. Reference is then made in the last two columns to the section and page that gives complete information as to steps to take to make more extensive repairs. Instructions for servicing the various units that comprise the complete TBS system are given under the headings of the units themselves in this section.

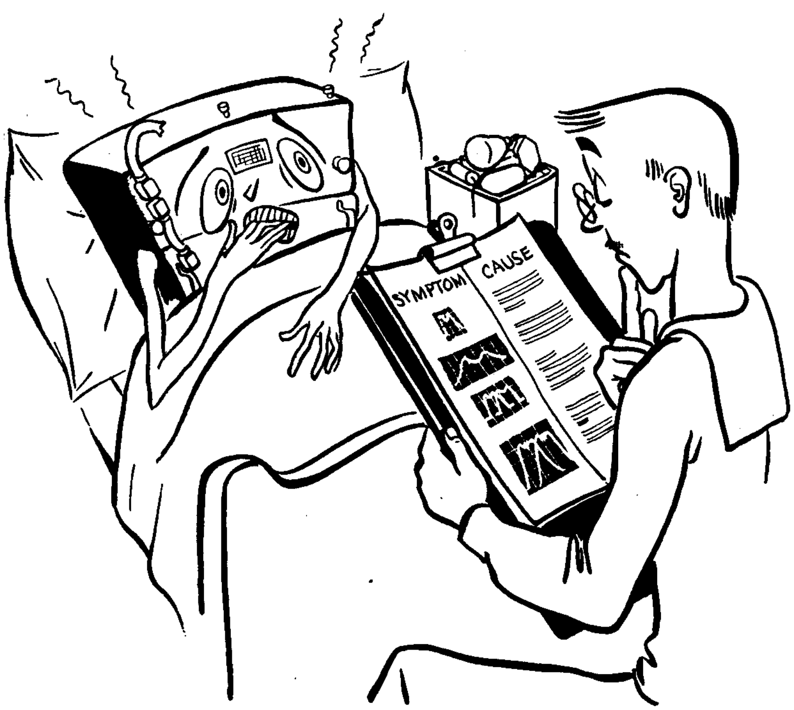
For failure of the receiver during operation a separate chart is given in the following pages, listing the most likely causes. Sudden and complete failure seldom occurs in normal operation, poor operation usually being due to the gradual deterioration of the tubes.

TRANSMITTER FAILURE CHART

SYMPTOM	CAUSE	Refer to Sec.	Refer to Page
PARTIAL FAILURES AND IMPROPER OPERATION			
Normal Operation at Transmitter but Signal Weak or Entirely Absent at Distant Receiver.	Short- or open-circuit in transmission line or antenna. One of the rods broken off antenna mast.	7	33
Normal R-F Output but High Distortion of Voice Modulated Signal.	Defective tube in speech amplifier or modulator or low voltage on these tubes. Transformer T101, T102, or T103 defective. Defective coupling capacitors C130 or C131.	6	9
Normal R-F Output but no Modulation.	Defective modulation meter M103. Resistor R108 or R129 defective. Defect in modulator circuit. Modulator Limiter Tube V112 defective.	7	13
Plate Current in Oscillator and First Doubler but not in Second Doubler or Power Amplifier Stages.	Poor contact on the plate voltage side of antenna transfer relay K103.	6	9
	Defective Fuse in Motor Generator.	5	6
Low Modulation Percentage on Voice and MCW.	Defective speech amplifier tube or Modulator. Low plate or screen voltage on speech amplifier tubes due to a resistor failure.	6	9
Insufficient Dip in Power Amplifier Plate Current at Normal Resonance Point.	Short or open circuit in transmission line or antenna.	7	33
FAILURE OF MCW ONLY			
No R-F Output, no Plate Current Indication.	Defective time-delay tube V111. Poor contact on relay K101. Low voltage across capacitor C136 when key is up. Any of these factors may prevent the proper operation of the antenna transfer relay K103 when operating on m.c.w.	6	9
R-F Output but no Tone Modulation.	Poor contacts on keying relay K102. Lack of a-f output from the oscillator at terminals 3 and 2 of transformer T105. Defective a-f oscillator tube V111.	6	10
FAILURE OF VOICE OPERATION ONLY			
No R-F Output or no Plate Current in the R-F stages.	Poor contact on the hand-set push-button switch. No circuit continuity between relay K201 (located in the control unit) and the transmitter.	7 6 7	36 11 31
R-F Output but no Modulation.	Defective microphone or its associated connecting cable and plug.	7	36
Abnormally High Modulation Percentage (over 100%) on Voice.	Modulation limiter tube V112 defective. Defective components (resistors R120 to R124 or capacitors C134B, C137, or C143) in the modulation limiter circuit. Terminal No. 4 of transformer T101 grounded. NOTE—This terminal is normally grounded with relay K101 energized but must not be grounded when relay K101 is de-energized.		
Low Plate Current on all Stages except Oscillator: no dip on Oscillator Dial when Tuned through Normal Resonance Point.	Defective crystal. Defective oscillator tube V101.	7	32

RECEIVER FAILURE CHART

SYMPTOM	CAUSE	Refer to Sec.	Refer to Page
No Signals in Receiver	Absence of background noise indicates defective receiver, improper tuning or defective loudspeaker.	6 7	8 29
	Noise suppressor set too high.		
	Transmission line shorted.	7	33
	Antenna insulator broken or rods bent.		
Noisy Reception	Microphonic Tube in receiver.		
	Loose tubes, shields or connections.		
	Varying contact between metal parts in vicinity of receiver such as loose cables or excessive vibration of one of the units due to loose screws or mounting bolts.		
	Poor contact at antenna transfer relay K103.	6	10
	If noisy only with motor generator running, it may be caused by loose or worn contacts in magnetic controller. Loose ferrules on fuses in motor generator or loose connections in terminal box.	5 6	6 11
	Interference from a nearby motor generator, gasoline engine or arc welder. Such interference may be picked up and fed into the receiver by antenna or leads to the terminal board at the rear of the receiver. The only satisfactory remedy for such a condition is to provide an interference filter at the terminals of the machine causing the trouble.		
Noise in Monitor Signal	Microphonic tube in transmitter.		
	Intermittent contacts on relays in transmitter or antenna transfer relay K103.	6	9
	Intermittent contacts in automatic controller or motor generator.	5	6
	Poor contacts in press-to-talk button in hand-set or chest set.	7	36



NOTE

All types of noise generated by any of the causes mentioned above, except interference from nearby electrical equipment, will usually be apparent only under conditions of vibration. It should be remembered that severe vibrations are likely to cause loose connections, intermittent contacts on relays, etc., in all types of radio communication equipment. At ultra-high frequencies, as used in this equipment, noise generated by these conditions is very much more severe than at lower frequencies, particularly when transmitter and receiver are installed close together. Such conditions should be checked and remedied during the routine inspections so they will not become serious enough to interfere with the operation of the system.

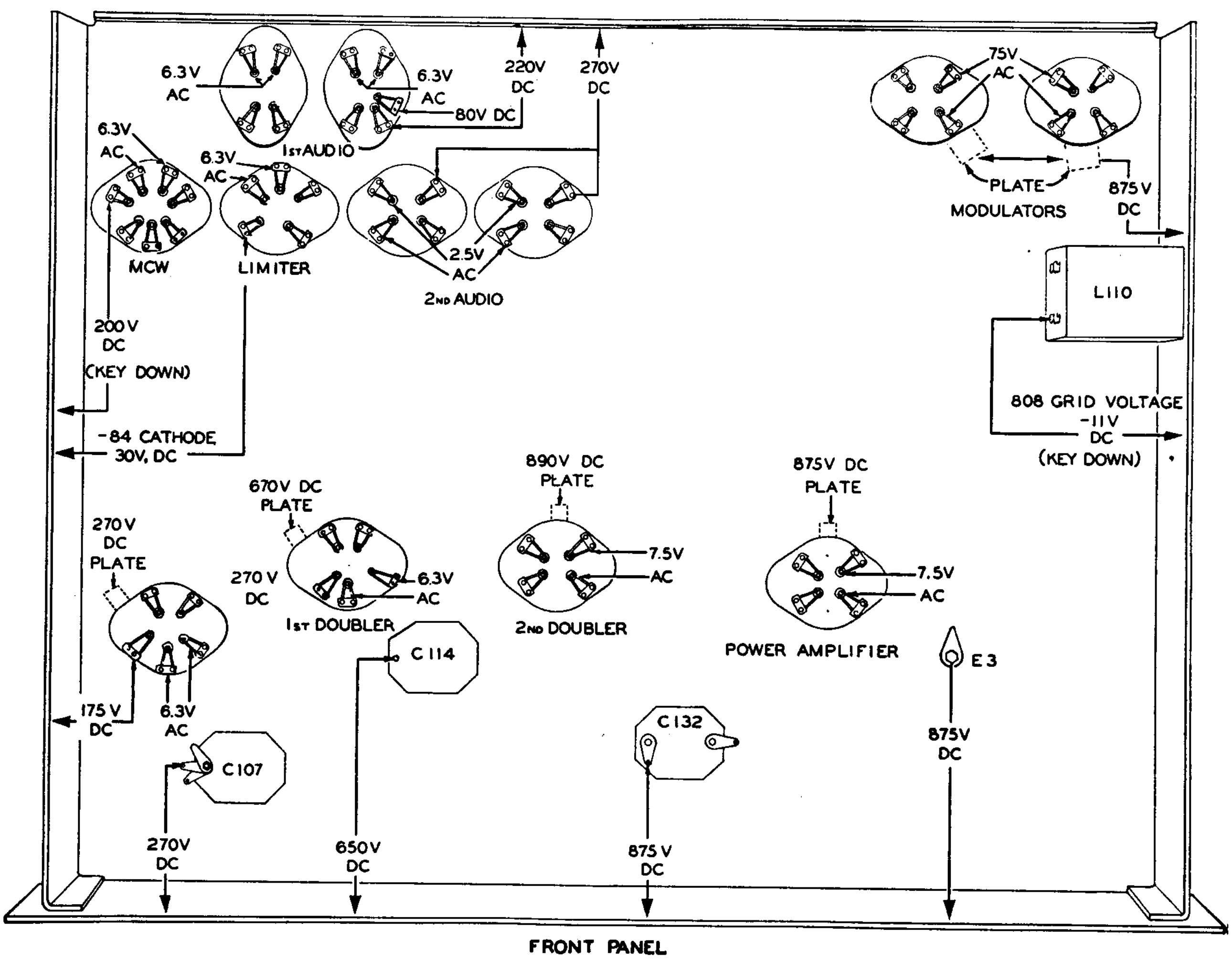
TRANSMITTER TUBE OPERATING VOLTAGES

The following table gives the operating voltages of the tubes in the transmitter. A 1000 ohm per volt meter should be used, connecting it between the element and the cathode or filament return of the tube with the current shut off.

Tube	Symbol	JAN	E_f	E_p	E_g	E_{sg}	I_p	I_g
Oscillator	V-101	−807	6.3	270		200	35	.3
1st Doubler	V-102	−807	6.3	610	100	250	60	.5
2nd Doubler	V-103	−808	7.5	870	340		75	14
Power Amplifier	V-104	−808	7.5	860	210		115	35
1st A-F Amplifier	V-109, V-110	−6D6	6.3	240	5*	80	2*	
2nd A-F Amplifier	V-107, V-108	−2A3	2.5	220	50		32	
Modulators	V-105, V-106	−808	7.5	870	10		85*	20*
A-F Oscillator	V-111	−6A6	6.3	260			8	
Modulation Limiter	V-112	−84	6.3	31				

* Indicates measurement made with 100 per cent modulation.

TRANSMITTER VOLTAGE CHECKING DIAGRAM



CAUTION: It is impossible to be too careful in making voltage tests on the transmitter. The voltages involved are dangerous to human life and every possible precaution must be taken to prevent receiving dangerous electric shocks. In testing the higher voltages as used in the power tubes and modulators all test connections should be made with power off. Before testing the lower voltage portions of the circuits it is well to remove the high voltage plate current fuse from the motor generator terminal box to prevent the high voltage potentials from reaching any portion of the circuit.

TRANSMITTER POINT-TO-POINT RESISTANCE CHART

READINGS TAKEN WITH TRANSMITTER DISCONNECTED AND OUT OF CASE.

TERMINAL	OHMS
1 to ground	0
2 to ground	open
2 to T-103-4 K-103 operated	0
3 to ground R-125 removed	155,000
3 to X-111-3 or 1 R-125 replaced	8,400
3 to ground	6,100
4 to ground	100
5 to term 8	open
6 to term 7	1.6
11 to ground	4,000
12 to term 13	34
14 to term 15	0.022
14 to K-102-1 and 2	0
14 to K-101-1 and 2	0
14 to X-109-1 and 2	0
14 to X-110-1 and 2	0
14 to X-111-1 and 2	0
14 to X-112-1 and 2	0
14 to X-114-1 and 2	0
16 to ground K-101 operated	2,600
16 to ground K-101 and S-101 operated	0
17 to ground	132

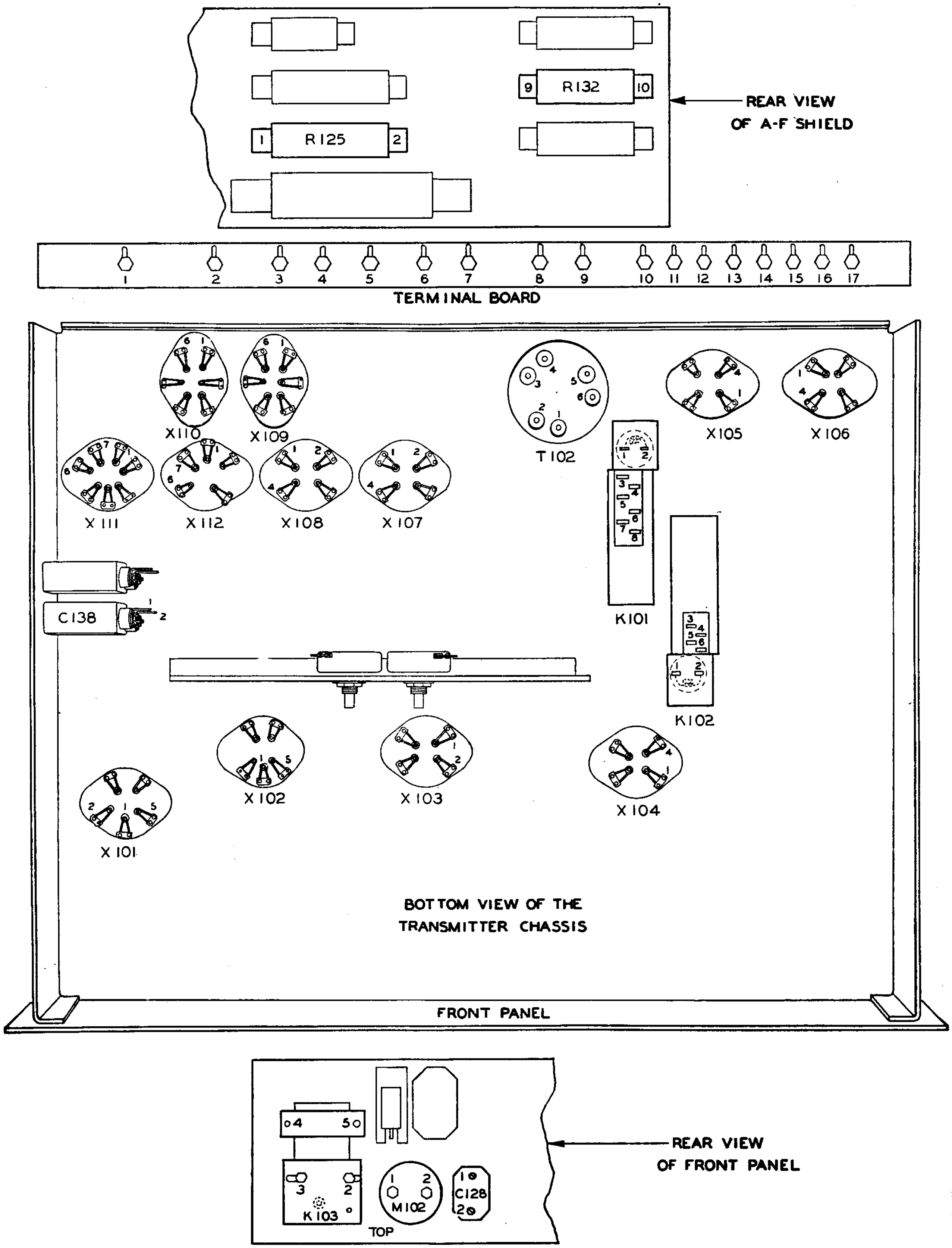
TRANSFORMER	OHMS
T-103-4 to X-105 plate	53
T-103-4 to X-106 plate	63
T-103-4 to X-104 plate	91
T-103-4 to X-103 plate	0.2
T-103-4 to ground	104,000
T-103-4 to X-102 plate	4,000
T-102-2 to terminal 3 K-104 operated	0
T-102-2 to ground	3,600
T-102-2 to ground R-132 removed	11,600

RESISTOR R-132 SHOULD BE OUT FOR TESTS BELOW

T-102-2 to X-102-3	0
T-102-2 to X-101 plate	0
T-102-2 to X-101-3	5,600
T-102-2 to X-107-3	245
T-102-2 to X-108-3	280
T-102-2 to X-109-3	3,100
T-102-2 to X-110-3	3,400
T-102-2 to X-111-7	1,600

TERMINAL	OHMS
GROUND	
to X-109-1 and 2	open
to X-109-5 and 6	330
to X-109-4 and X-110-4	5,900
to X-109 Grid Clip	67
to X-110 Grid Clip	71
to X-110 Grid Clip K-101 operated	1.8 megs
to X-107-4 and X-108-4	39,000
to X-105-4	70
to X-106-4	74
to X-107-1 and 2 and X-108-1 and 2	1,600
to X-105-1 and 2 and X-106-1 and 2	0
to X-112-3 and 4 K-101 operated	1.8
to X-112-3 and 4 K-101 normal	0
to X-112-5	4,900
to X-111-4	570,000
to X-111-4 K-102 operated	100,000
to X-111-5	39
to X-111-6	56,000
to X-102-4	100,000
to X-102-5 S-106 on operate	500
to X-103-1 and 2 S-106 on operate	0
to X-103 Grid Clip S-106 on operate	25,000
to X-104 Grid Clip S-106 on operate	6,300
to X-104-1 and 2 S-106 on operate	38
to X-113-2 S-106 on operate	0
X-113-1 to X-113-2	100,000
C-138-2 to ground R-108 clockwise	55,000
C-138-2 to ground R-108 counter-clockwise	45,000

TRANSMITTER RESISTANCE & CONTINUITY DIAGRAM



TRANSMITTER ADJUSTMENTS OF NEUTRALIZER

On the transmitter chassis there are located four controls which are preset at the factory and will not require further adjustment unless they are accidentally thrown out of adjustment or certain component parts are changed because of failure. If it does become necessary to readjust these controls, the following procedure should be strictly adhered to:

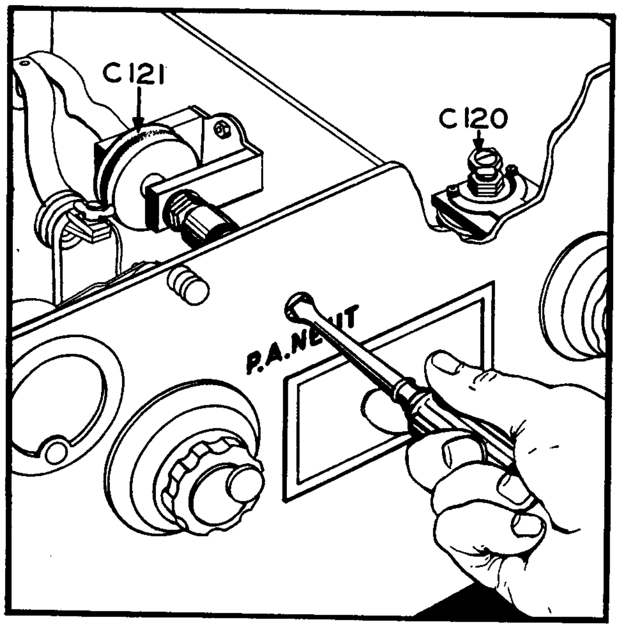
BALANCING CAPACITOR, C120

The function of this capacitor is to balance the output capacitance of the amplifier tube V103, which is connected across only part of the coil L103, the balancing capacitor being connected across an equal and opposite section of the coil. Consequently, the neutralizing voltage and grid exciting voltage are kept equal over the entire frequency range, eliminating the need for adjustment of the neutralizing capacitor.

Capacitor C120 should be set at a point where neutralization is constant over the entire frequency range of the transmitter. Adjust the neutralizing capacitor with the transmitter tuned to 80 MC. Then retune the transmitter to 60 MC with the proper crystal inserted in the holder and check to see if PA stage is still neutralized. If not, readjust C120 till neutralization is obtained at this lower frequency and check this setting with the transmitter retuned to the higher 80 MC band. When properly adjusted, approximately half open, neutralization will be obtained at both ends of the frequency range of the transmitter.

NEUTRALIZING CAPACITOR, C121

This capacitor requires no adjustment over the entire frequency range once having been set properly.

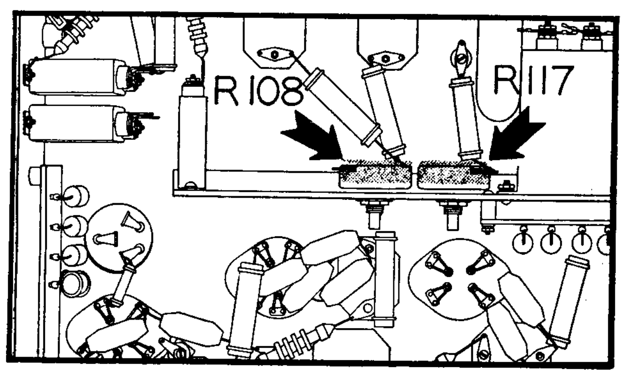


Should it become necessary to adjust this unit proceed as follows. Insert a crystal of the highest frequency available, preferably 80 MC. Remove the plate voltage from the PA tube by disconnecting the bus-wire jumper which connects from capacitor C126 to the ceramic feed through insulator. Tune the oscillator, first and second doubler circuits for maximum PA grid current, using the tune position of the TUNE-OPERATE switch S106. Throw the switch to the OPERATE position and tune the PA dial slowly through the normal resonance position. If the setting of the neutralizing capacitor is incorrect, the PA grid current will dip as the PA dial passes through resonance. Open the lid of transmitter and loosen the lock nut on capacitor C121. Using a screwdriver as shown in the illustration, adjust the capacitor C121 until the PA grid current shows no change when the PA dial is tuned through resonance. During this procedure, it may be necessary to retune the second doubler dial for maximum PA grid current before making the final adjustment of the neutralizing capacitor. Replace the bus-wire jumper to capacitor C126 and tighten the lock nut on capacitor C121.

VARIABLE RESISTOR, R108

WARNING: OBSERVE HIGH VOLTAGE PRECAUTIONS WHEN MAKING THIS ADJUSTMENT.

Resistor R108 is part of the multiplier used with modulation meter M103 and must be properly adjusted to obtain correct reading on this meter. It



is located underneath the chassis on the large bracket which is fastened to the middle of the chassis. The correct procedure is to measure the modulation on a cathode-ray oscilloscope. Using an external oscillator (1000 cycles) connected to the input terminals of the transmitter. This is best arranged by disconnecting leads from pins 12 and 13 at rear of transmitter and running leads from disconnected wires to oscillator output. The transmitter chassis can be slid into its case for testing. Adjust the audio input until the oscilloscope indicates 100 per cent modulation. Then slide transmitter out of case and make trial settings of R108 until meter reads 100 per cent.

Great care should be used in making this measurement. If improperly connected, a false indication of 100 per cent modulation may be obtained on the oscilloscope. Use an oscilloscope on which terminals leading directly to the tube deflecting plates are available. Connect a tuned circuit (coil and small variable capacitor) across the vertical deflecting plates of the tube. Couple loosely to the tank coil in the transmitter, preferably by a link coupling; that is, a twisted-pair transmission line passed through louvre inside of transmitter housing with a couple of turns of wire connected at each end. Tune this circuit until maximum deflection is obtained on the oscilloscope, adjusting the coupling, if necessary, to obtain a picture of the desired size. Use an external source of synchronizing voltage. The 115 volt, 60 cycle ship supply will be satisfactory if no suitable audio oscillator is available. Connect directly to the horizontal deflecting plates of the cathode-ray tube. Do not use the amplifier in the oscilloscope. One hundred per cent modulation is obtained when the picture on the oscilloscope shows a closed envelope, that is, when the valleys of the upper and lower sine waves just meet along the horizontal center line on the oscilloscope. If 60 cycles is used for synchronization, the input signal must be varied somewhere in the range of 500 to 1000 cycles to obtain a synchronized picture. If an external a-f oscillator is used for this purpose, the a-f input frequency should be set at 1000 cycles and the synchronizing oscillator varied to obtain the proper picture.

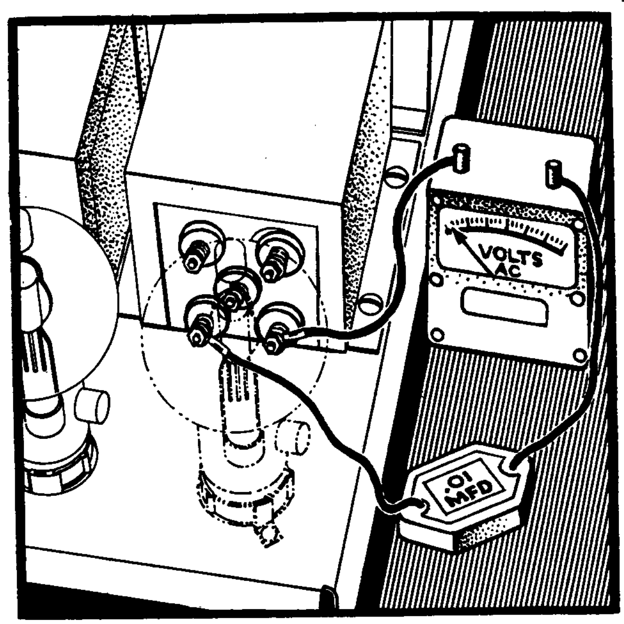
As an alternative to the above procedure, when no oscilloscope is available, the audio-frequency modulating voltage may be measured with a rectifier type a-c voltmeter (1000 ohms/volt) and the modulation meter then calibrated against this voltage. Use a meter having a 1000-volt scale and use a high-voltage blocking capacitor (0.1 mfd or greater) in series with the meter to protect it against the d-c plate voltage. Connect to terminals 4 and 6 on the modulation transformer T103 as shown and adjust the a-f input voltage (1000 cycles) until the voltmeter reads 625 volts. Then set the resistor R108 to the point where the modulation meter indicates 100 per cent. After adjusting modulation meter as above, the leads should be reconnected to terminals 12 and 13.

POTENTIOMETER, R117

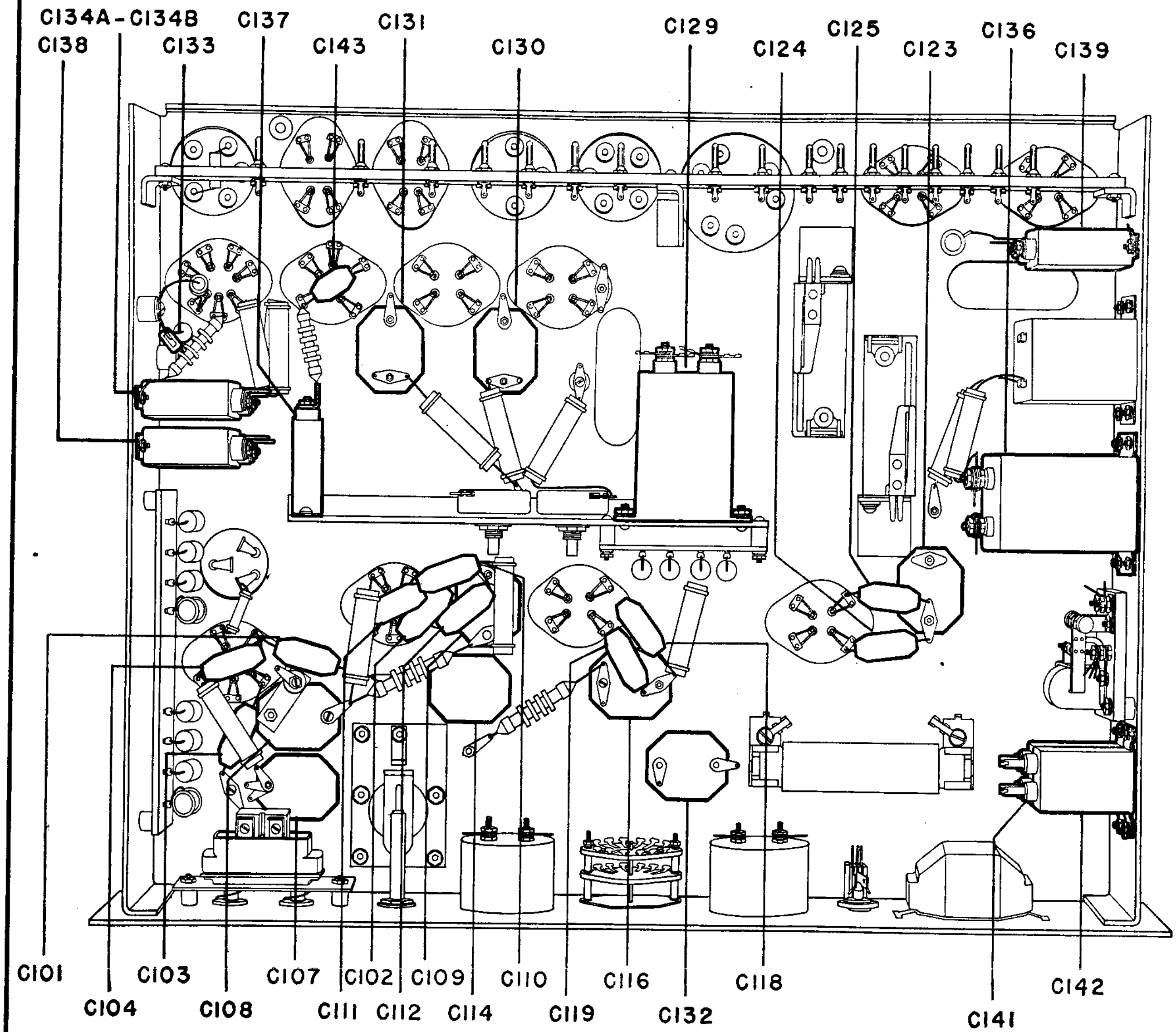
This control regulates the voltage output of the audio oscillator modulating the carrier for MCW transmission.

Should modulation fall below normal, and a check of the type -6A6 tube V111 prove it in good condition, it may be necessary to adjust this potentiometer to obtain full modulation. This can be done by the trial and error method. Sliding the transmitter chassis out far enough to make a trial setting, slipping it back into place and after warming up the tubes, press the telegraph key and read modulation from the meter on the panel. Two or three trials should be sufficient to get the proper adjustment.

To facilitate making the above adjustments it is advisable to disconnect the antenna lead to the receiver so the transmitter chassis can be slid in and out without trouble. Before checking each adjustment, allow tubes to warm up well and operate the transmitter by means of the test switch except in the case of checking the modulation for the MCW transmission.



CAPACITOR DIAGRAM
BOTTOM VIEW OF TRANSMITTER CHASSIS



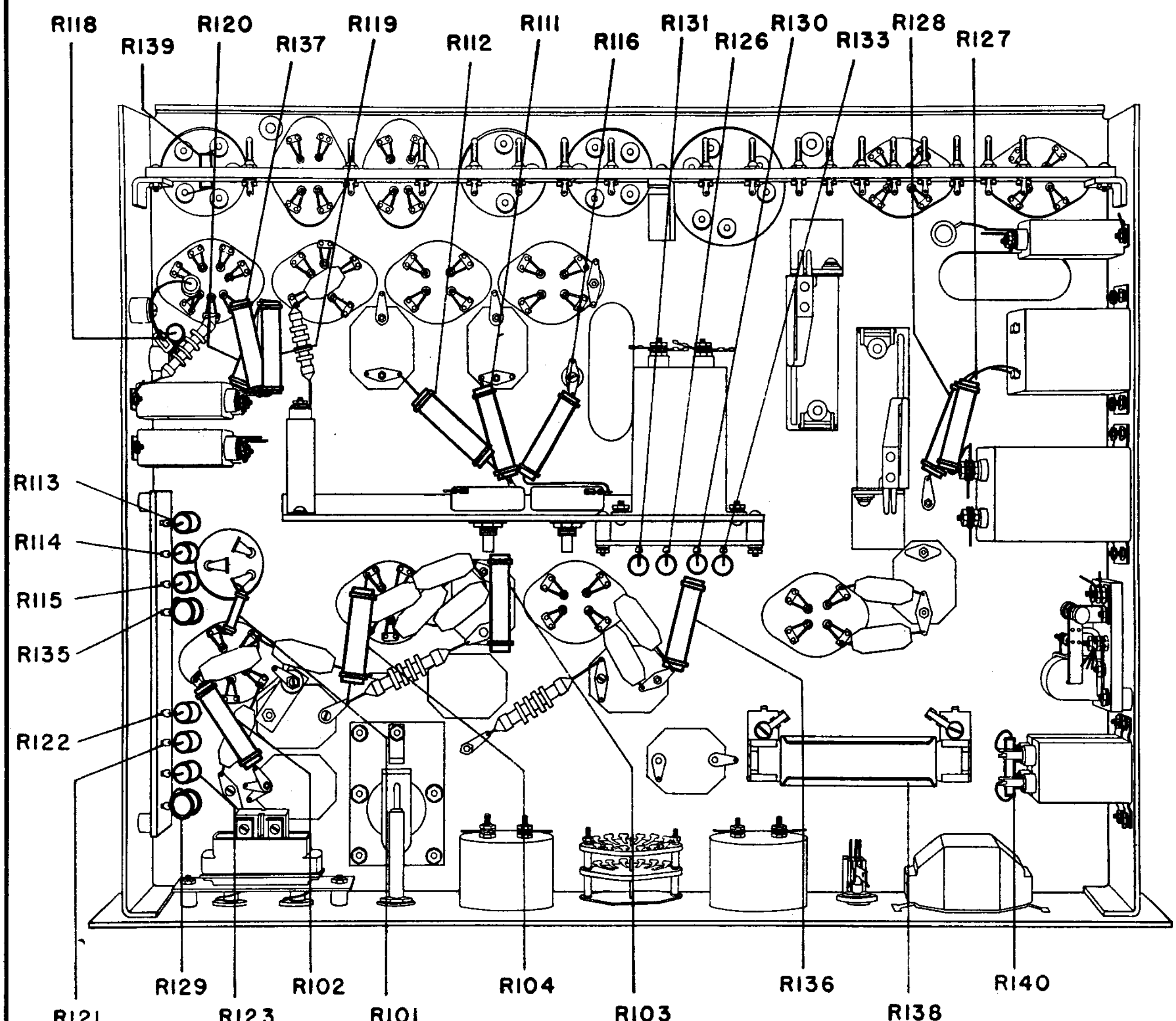
CAPACITY IN MICRO-MICROFARADS

Unless Otherwise Noted

C101	3900	C109	5000	C118	3900	C131	5000	C137	0.1 mfd
C102	3900	C110	3900	C119	3900	C132	5000	C138	1 mfd
C103	3900	C111	3900	C123	5000	C133	3900	C139	1 mfd
C104	3900	C112	3900	C124	3900	C134A	0.5 mfd	C141	1.15 mfd
C107	5000	C114	5000	C125	3900	C134B	0.5 mfd	C142	1.15 mfd
C108	100	C116	5000	C129	8 mfd	C136	14 mfd	C143	100
				C130	5000				

RESISTOR DIAGRAM

BOTTOM VIEW OF TRANSMITTER CHASSIS



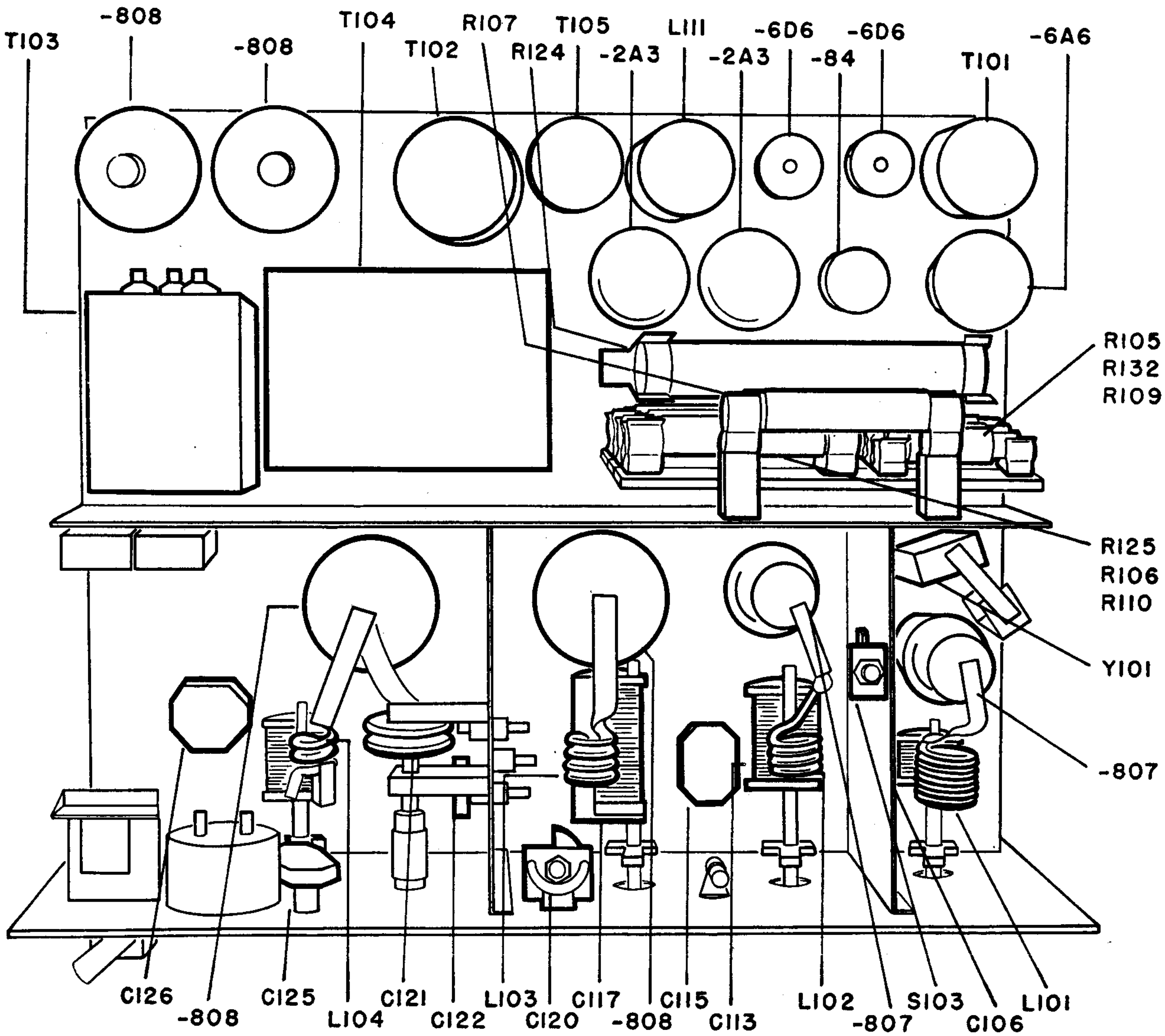
RESISTANCE IN OHMS

Unless Otherwise Noted

R101	100,000	R113	330	R120	1.8 meg	R127	47	R135	2,700
R102	56,000	R114	6,800	R121	5,600	R128	56	R136	150,000
R103	100,000	R115	12,000	R122	15,000	R129	33,000	R137	100,000
R104	22	R116	3,900	R123	27,000	R130	5,600	R138	1,000
R111	39,000	R118	56,000	R126	390	R131	680	R139	5,600
R112	39,000	R119	470,000			R133	3,300	R140	330

DIAGRAM OF CIRCUIT COMPONENTS

TOP VIEW OF TRANSMITTER CHASSIS



CAPACITY IN MICRO-MICROFARADS

C106	75 max	C120	3 to 15
C113	50 max	C121	2.1 to 10
C115	500	C122	500
C117	33 per section	C125	3900
		C126	37

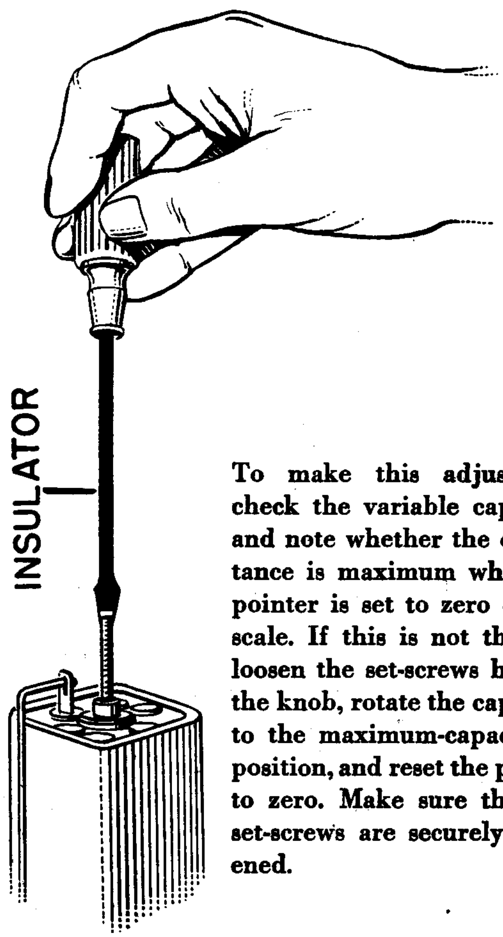
RESISTANCE IN OHMS

R104	22	R109	5,000
R105	500	R110	1,600
R106	25,000	R124	100,000
R107	4,000	R132	4,000

RADIO RECEIVER MAINTENANCE

RADIO FREQUENCY ALIGNMENT

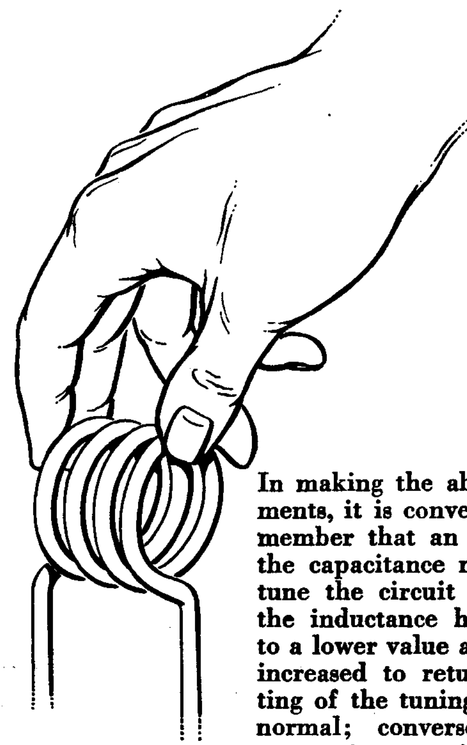
Due to the fact that all of the radio-frequency circuits are separately tuned, no alignment difficulties will be experienced. Should any of the circuits become misadjusted so that their tuning capacitors do not cover the specified range, it may be necessary to adjust their inductance.



To make this adjustment, check the variable capacitor and note whether the capacitance is maximum when the pointer is set to zero on the scale. If this is not the case loosen the set-screws holding the knob, rotate the capacitor to the maximum-capacitance position, and reset the pointer to zero. Make sure that the set-screws are securely tightened.

Refer to the calibration chart and select a frequency, preferably near the high-frequency end of the range. Insert the proper crystal holder for this frequency into the crystal socket and adjust the various tuning controls to the values shown on the chart. Connect a test oscillator, tuned to the frequency selected, to the input; check the tuning of the various controls and note the deviation between their correct and recorded settings. The oscillator and doubler tuning controls may be returned to their correct settings by turning the adjusting screws protruding from the tops of the respective shield cans as shown in the illustration.

In the case of the antenna, link, and detector circuits, the inductance may be changed to permit the proper setting of the tuning control by spreading the turns to reduce or squeezing the turns to increase the inductance of the respective tuning coils.



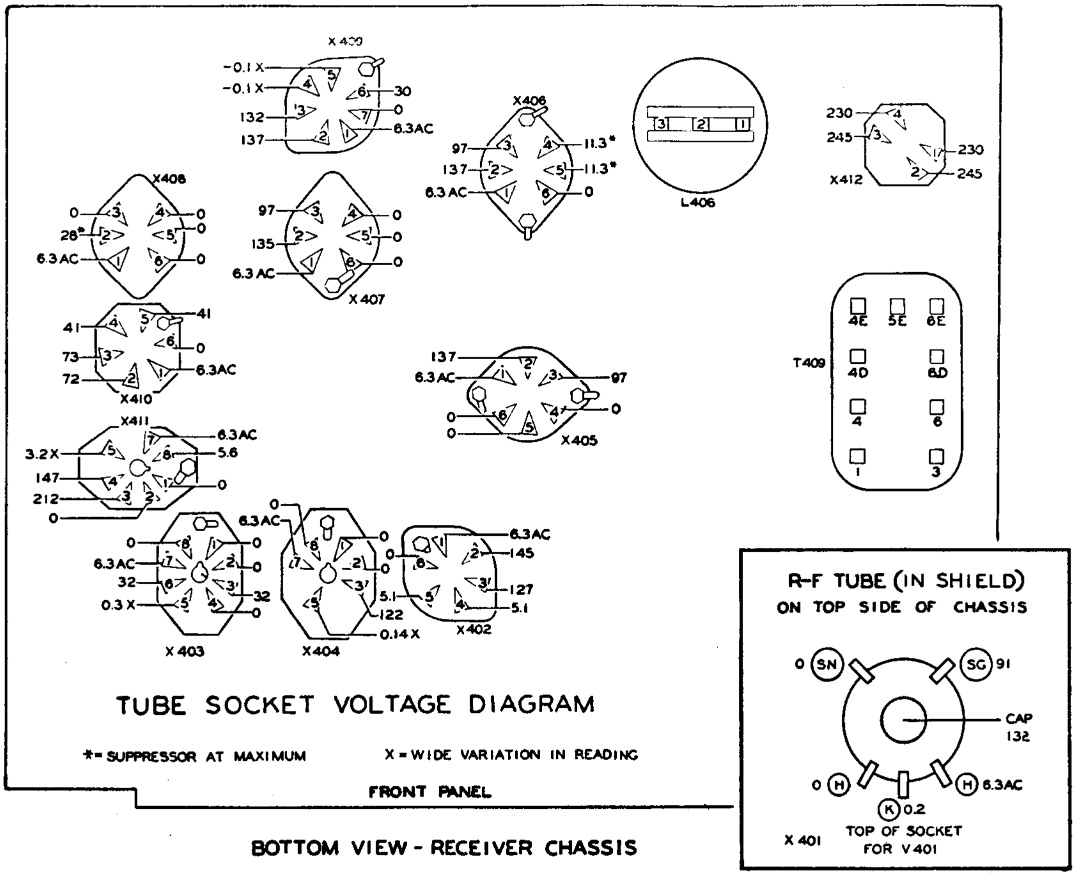
In making the above adjustments, it is convenient to remember that an increase in the capacitance necessary to tune the circuit means that the inductance has changed to a lower value and must be increased to return the setting of the tuning control to normal; conversely, a decrease in capacitance indicates the opposite effect and the inductance must be decreased accordingly.

CHECKING SENSITIVITY OF RECEIVER

The following table shows the approximate inputs (modulated 30 per cent at 1000 cycles) required to produce standard output (two watts into a 600-ohm non-inductive resistance). These values will be found to vary considerably for different receivers but will serve as a guide as to the receiver operation. In general, the inputs will be somewhat less than those stated if the receiver is normal.

INPUT TO:	MICROVOLTS
Third i-f amplifier grid	350,000
Second i-f amplifier grid	200,000
First i-f amplifier grid	800
First detector grid	300
R-F amplifier grid	10
Dummy antenna	5

Conditions of measurement are: Noise suppressor at "OFF"; volume control at "10"; dummy antenna 50-ohm non-inductive resistance; a capacitor of at least 0.1 mfd in series with the lead to the signal generator. A record of the values found on a given receiver will often be found valuable when trouble is encountered.



TUBE SOCKET VOLTAGE CHECK

The receiver has been carefully adjusted and aligned by the manufacturer before shipment and should maintain these adjustments over a long period of time. However, to insure optimum performance, periodical tests and readjustment as outlined in the maintenance chart at the beginning of this section are advisable. Should trouble occur, no adjustments should be changed, particularly those of the intermediate frequency circuits until it has been definitely established that the difficulty is not due to external causes or normal deterioration of the tubes. Improper voltages, defective fuses or auxiliary equipment often give rise to conditions that may be blamed on the receiver. Every effort should be made to have any major adjustments and repairs made in a laboratory well equipped with the necessary servicing tools and test equipment.

Few instruments other than those found on standard test sets such as the Navy Model OE Radio Receiver Analyzing Equipment are required in locating most of the troubles that may be encountered in this equipment. The necessary individual instruments that would be required are as follows:

TEST OSCILLATOR—A test oscillator with a frequency range from 5 to 80 megacycles with provision for accurate frequency calibration.

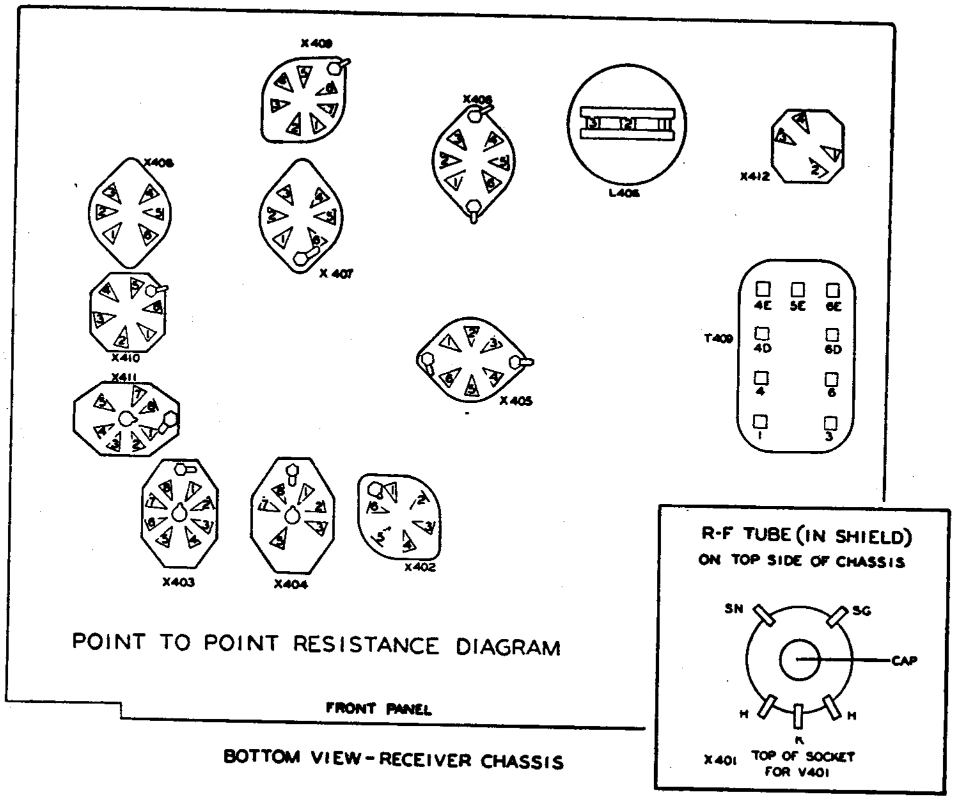
DIRECT CURRENT VOLTMETER—A multi-range meter, 1000 volts maximum with an internal resistance of 1000 ohms per volt with an accuracy of 2 per cent.

OHM-METER—An instrument having a range up to 3 megohms will serve all purposes.

In case of failure of the receiver it is advisable to check carefully the operating control settings of the unit. The crystal may have failed in the oscillator of the heterodyne oscillator circuit. Tuning controls may have been jarred out of position or a tube may have failed. If proper maintenance procedure is followed the gradual deterioration of the tubes will be checked constantly but vibration may at any time put a tube out of service. Should it be finally determined that the trouble is in the receiver itself, one or more of its components having failed, it will be necessary to test the unit either by making voltage readings or by point-to-point resistance tests.

For the purpose of making these tests two diagrams follow. One shows the voltage between various points in the circuit and the ground, the other showing point-to-point resistances of the receiver to locate defective resistors or coil windings. These tests can be made by pulling the receiver chassis from the case and standing it on edge, leaving the leads attached to the posts marked 110 volt 60 cycle to supply current while voltage tests are made.

NOTE: Extreme care must be taken in making the voltage tests as voltages dangerous to human life are encountered.



BOTTOM VIEW-RECEIVER CHASSIS

RECEIVER RESISTANCE AND CONTINUITY CHART

RESISTANCE MEASURED FROM TERMINAL 2 ON L406

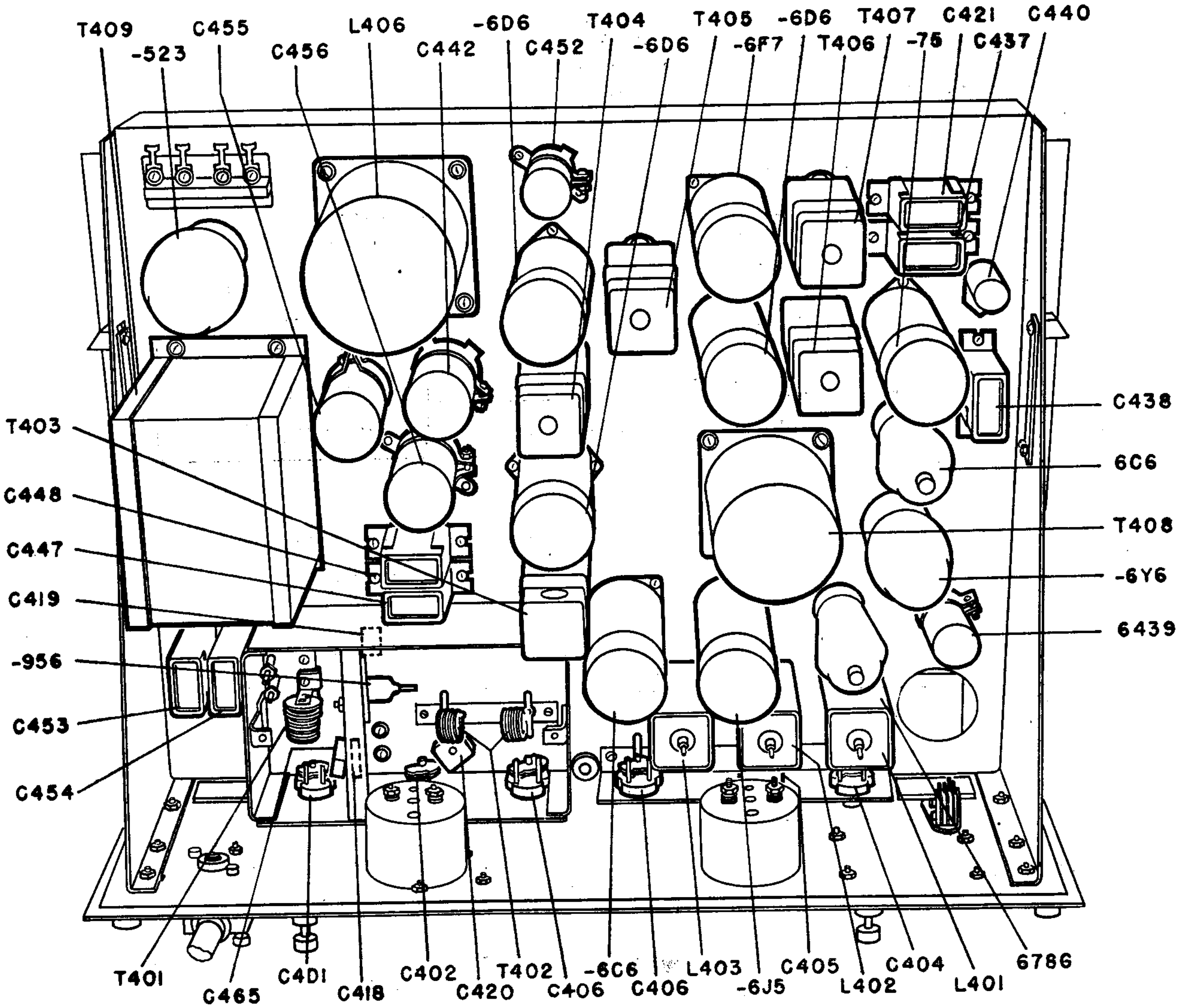
PIN	SOCKET	CIRCUIT	OHMS
Cap	X-401	R-F plate	2,200
2	X-401	R-F screen	13,000
2	X-402	1st Det. plate	2,200
3	X-402	1st Det. screen	69,000
6	X-403	Osc. plate	23,000
3	X-403	1st Dblr. plate	23,000
3	X-404	2nd Dblr. plate	2,500
2	X-405	1st I-F plate	2,200
3	X-405	1st I-F screen	13,000
2	X-406	2nd I-F plate	2,200
3	X-406	2nd I-F screen	13,000
2	X-407	3rd I-F plate	2,200
3	X-407	3rd I-F screen	23,000
2	X-408	Noise Supp. plate	110,000
2	X-409	AVC Amp. plate	2,200
3	X-409	AVC Amp. screen	7,800
2	X-410	1st A-F plate	560,000
3	X-410	1st A-F screen	2.2 megs
3	X-411	Output plate	180
4	X-412	Output screen	950
		Ground	13,000

RESISTANCE MEASURED TO GROUND FROM—

PIN	SOCKET	CIRCUIT	OHMS
Cap	X-401	1st R-F grid	1.6 megs
5	X-401	1st R-F cathode	4.6
Cap	X-402	1st Det grid	0
5	X-402	1st Det cathode	4,700
5	X-403	Osc. grid	56,000
8	X-403	Osc. cathode	5
Cap	X-403	1st Dblr. grid	100,000
4	X-403	1st Dblr. cathode	0
5	X-404	2nd Dblr. grid	100,000
8	X-404	2nd Dblr. cathode	0
Cap	X-405	1st I-F grid	1.6 megs
5	X-405	1st I-F cathode	2,500
Cap	X-406	2nd I-F grid	1.6 megs
5	X-406	2nd I-F cathode	3,500
Cap	X-407	3rd I-F grid	1.8 megs
5	X-407	3rd I-F cathode	0
Cap	X-408	Noise Supp. grid	1.3 megs
5	X-408	Noise Supp. cathode	0
3&4	X-408	2nd Det plate	0.32 megs
Cap	X-409	AVC Amp. grid	1.3 megs
6	X-409	AVC Amp. cathode	3,600
4&5	X-409	AVC Det plate	0.64 megs
Cap	X-410	1st A-F grid	1.1 megs
5	X-410	1st A-F cathode	4,500
5	X-411	Output grid	0.56 meg
8	X-411	Output cathode	100
		Terminal No. 5E of T-409	78

DIAGRAM OF CIRCUIT COMPONENTS

TOP VIEW OF RECEIVER CHASSIS



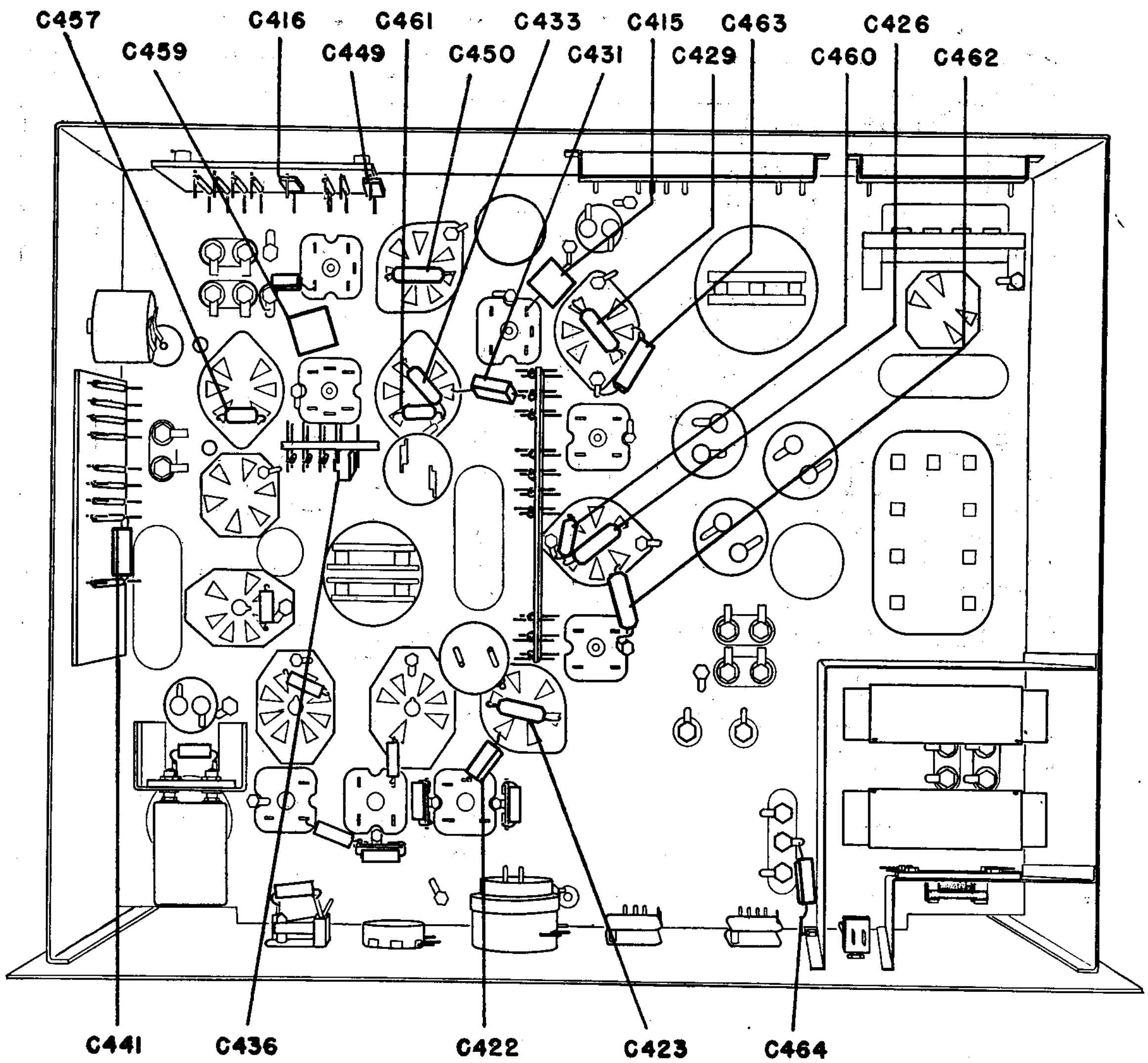
CAPACITY IN MICRO-MICROFARADS

Unless Otherwise Noted

C401 .....2.5 to 14	C418 2000	C437B ..0.125 mfd	C447A ..0.125 mfd	C453B ....0.5 mfd
C402 .....2.5 to 14	C419 2000	C438A ..0.125 mfd	C447B ..0.125 mfd	C454A ....0.5 mfd
C403 ......3 to 26	C420 2000	C438B ..0.125 mfd	C448A ..0.125 mfd	C454B ....0.5 mfd
C404 ......3 to 41	C421A ..0.125 mfd	C439 ......10 mfd	C448B ..0.125 mfd	C455 ......10 mfd
C405 ......3 to 37	C421B ..0.125 mfd	C440 ......0.1 mfd	C452 ......50 mfd	C456 ......20 mfd
C406 ......3 to 30	C437A ..0.125 mfd	C442 ......10 mfd	C453A ....0.5 mfd	C465 ....2000 mfd

CAPACITOR DIAGRAM

BOTTOM VIEW OF RECEIVER CHASSIS

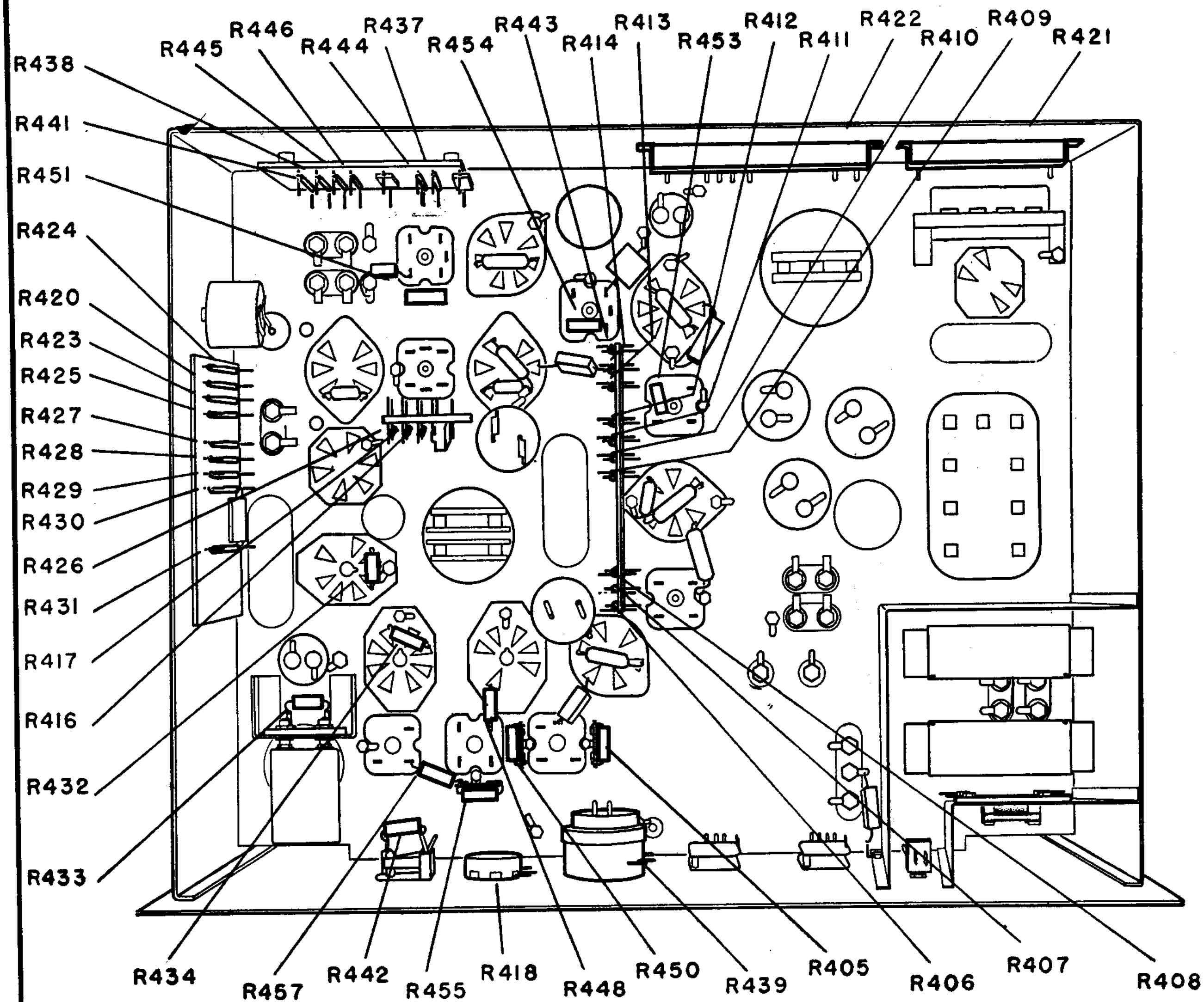


CAPACITY IN MICRO-MICROFARADS

C415	5,000	C429	3,900	C449	5,000	C461	680
C416	5,000	C431	5,000	C450	3,900	C462	3,900
C422	5,000	C433	3,900	C457	680	C463	10,000
C423	3,900	C436	10,000	C459	5,000	C464	5,000
C426	3,900	C441	10,000	C460	680		

RESISTOR DIAGRAM

BOTTOM VIEW OF RECEIVER CHASSIS



RESISTANCE IN OHMS
Unless Otherwise Noted

R405	4,700	R416	22,000	R422F	55	R431	5,600	R444	3,300
R406	68,000	R417	1,200	R423	2.2 Meg	R432	100	R445	1.2 Meg
R407	1,200	R418	250,000	R424	470,000	R433	56,000	R446	560,000
R408	1 Meg	R420	1.2 Meg	R425	100,000	R434	10	R448	56
R409	10,000	R421	600	R426	1 Meg	R437	270	R450	1,500
R410	1,200	R422A	1,700	R427	1,200	R438	6,800	R451	100,000
R411	1 Meg	R422B	7,100	R428	120,000	R439	3,500	R453	33,000
R412	10,000	R422C	2,300	R429	2.2 Meg	R441	1,200	R454	33,000
R413	1,200	R422D	1,000	R430	560,000	R442	10,000	R455	22,000
R414	1 Meg	R422E	23			R443	1 Meg	R457	270

TUBE DATA FOR TBS RECEIVER

NOTE: ALL TUBES SUPPLIED WITH THE EQUIPMENT OR AS SPARES ON THE EQUIPMENT CONTRACT, SHALL BE USED IN THE EQUIPMENT PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

Weak signals are the usual symptom of worn-out vacuum tubes and, under most conditions, it is usually the best policy to suspect the vacuum tubes as the most probable source of trouble. All radio receiving equipment is subject to a gradual decrease in performance through the aging of vacuum tubes. Due to the gradual nature of this condition it is difficult to recognize except by the fact that with signals of somewhat constant intensity the input meter will show a gradual decrease in indicated input to the receiver over a relatively long period of time. To compensate for this deficiency it will usually be found necessary to advance the volume control from time to time. It is good practice to check all of the tubes in the receiver at periodic intervals and replace those which fall below the minimum limits of transconductance or emission indicated in the tabulation of "Tube Characteristics." After tubes have been tested, paste a sticker on the glass bearing the date of test and either the transconductance or the emission current as determined.

With the antenna lead from transmitter disconnected from the receiver and all of the frequency-determining circuits ("Antenna," "Link," etc.) tuned to resonance, advance the "VOLUME CONTROL" to maximum. A relatively high and steady noise level should be heard in the phones. With all the controls adjusted as above, reduce the "VOLUME CONTROL" to "0." A barely audible hum, previously inaudible over the tube noise, should now be heard. During the above tests, the "NOISE SUPPRESSOR" control must be in its "OFF" position. Failure of this test indicates that the receiver is inoperative and the tubes should be changed before looking farther for the trouble.

If a reliable Standard Signal Generator is available, the sensitivity of the receiver should be measured as previously described. If the sensitivity falls below ten microvolts for two watts output, the tubes should be changed.

NOTE: A LOSS IN SENSITIVITY DOES NOT NECESSARILY INDICATE THAT TROUBLES OTHER THAN WORN-OUT TUBES DO NOT EXIST, BUT UNDER ANY CONDITION THE TUBES SHOULD BE CHANGED BEFORE DISTURBING ANY OF THE INTERNAL RECEIVER ADJUSTMENTS.

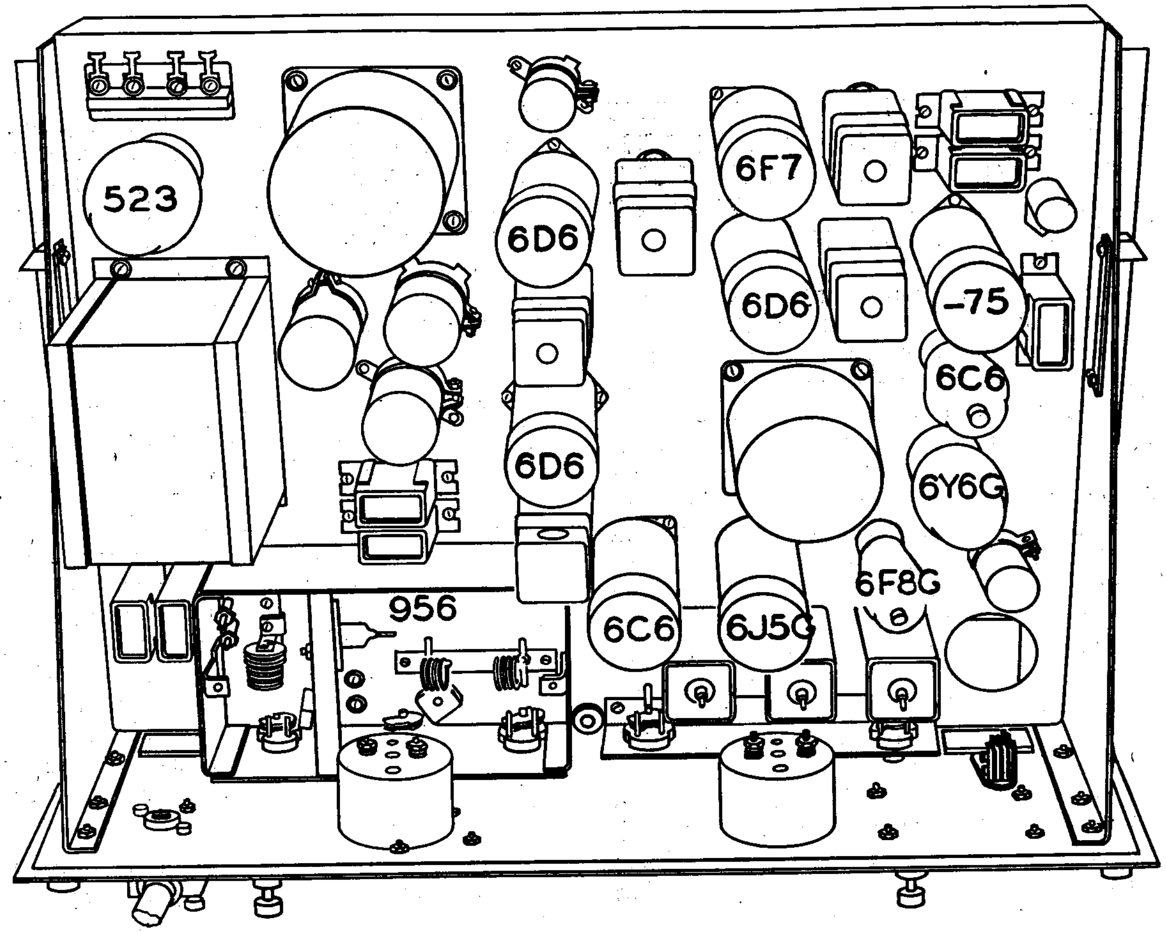
If no signals are receivable with the equipment or if the sensitivity is still poor after changing all of the vacuum tubes, check the voltages at the various tube sockets. Prior to making the measurements, the receiver should be operated at nominal voltage (115 volts) with all tubes in sockets for a warm-up period of at least ten minutes. Refer to the tabulation entitled "Tube Socket Voltages" for the normal values.

The voltages at the various socket terminals should conform to within ± 15% (approximately) to those shown in the "Tube Socket Voltages" table, measured under the following conditions: Receiver in normal operative condition with antenna disconnected; line voltage 115 volt a-c; volume control at "10"; Noise Suppressor at "off"; A.V.C. "Time Constant" switch at "12"; Input "Meter Switch" at "1"; all d-c voltages measured to heater (ground). Due to the change in load when one tube is removed, the voltages measured at the tube sockets (or through the Model OE Analyzer cable) are somewhat higher than the corresponding values shown in the following tabulation of "Tube Operating Voltages and Currents."

The tabulation of "Tube Operating Voltages and Currents" are average operating voltage and current values (tolerance ± 20% except for very low values) as obtained by measurement with a Model OE Radio Receiver Analyzing Equipment. Readings to be taken under the test conditions indicated in connection with determining tube socket voltages. During these measurements with the Model OE Radio Receiver Analyzing Equipment, the lowest possible voltmeter scale should be used, as follows:

D-C Voltage	Meter Scale	Resistance	D-C Voltage	Meter Scale	Resistance
0/1	0/1	20,000	10/25	0/25	500,000
1/2.5	0/2.5	50,000	25/50	0/50	1,000,000
2.5/5	0/5	100,000	50/100	0/100	2,000,000
5/10	0/10	200,000	100/250	0/250	5,000,000

If the voltage at any terminal fails to check with the value indicated in the table on page 22, it is an indication of a faulty connection, circuit components or a short circuit which should be located and remedied. If the voltages are correct, test the audio amplifier by touching the grid of the first audio amplifier tube with the finger. If a squeal or loud hum is heard in the headphones, the audio amplifier is operating satisfactorily. If no result is obtained by touching the grid, check the audio amplifier circuits for open or faulty connections.



TUBE SOCKET VOLTAGES

Tube Type	Function	Plate	Screen	Supp.	Cathode	Grid	Heater (A-C)
−956	1st R-F	155**	126**	0*	0*	Neg.**‡	6.2**
−6F8-G	Oscillator	145			0	0	6.2
	1st Doubler	145			0	0	
−6J5, −6J5-GT, −6J5-G	2nd Doubler	152			0	0	6.2
−6C6	1st Det.	148	146	0	0	0	6.2
−6D6	1st I-F	152	123	0	0	Neg.‡	6.2
		158§	130§	9.7§	9.7§	Neg.‡§	
−6D6	2nd I-F	152	123	0	0	Neg.‡	6.2
		158	130	9.7	9.7	Neg.‡§	
−6D6	3rd I-F	152	153	0	0	Neg.	6.2
−6F7	AVC, Pentode	151	151		−.33	Neg.	6.2
	Triode	−0.1				−0.1	
−75	2nd Det. Diode	0			0	Pos.‡	6.2
	Noise Supp. Triode	38§			0§	Pos.‡§	
−6C6	1st A-F	130	67*	41	41	6.1†	6.2
		141§	72§	46§	46§	4.8†§	
−6Y6-G	2nd A-F	255	157		0	−2.0†	6.2
−5Z3	Rectifier	Plate to Plate—510 A-C Each Plate to Ground—255 A-C					5.2

**Voltmeter prods only by tilting tube in socket. No adapter available for OE Equipment.

§"NOISE SUPPRESSOR" on "10".
‡Negligibly small—values well below 0.1 volt.

*100 volt scale.
†10 volt scale.

TUBE OPERATING VOLTAGES AND CURRENTS

Tube Type	Function	Plate P (E)	Plate (MA)	Screen (E)	Screen (MA)	Supp. (E)	Cath. (E)	Grid (E)	Heater (E) (A-C)
−956	1st R-F	140**	6.6	90	1.4	0	0.07	−0.2‡‡	6.1**
−6F8-G	Oscillator	35	2.6				0	−0.28	6.1
	1st Doubler	35	2.4				0	−0.32	
−6J5, −6J5-GT, −6J5-G	2nd Doubler	116	15.5				0	−0.14‡#	6.1
−6C6	1st Det.	146	0.98	130	0.22	5.5	5.6	0	6.1
−6D6	1st I-F	136	7.8	96	2.0	0	0	−0.2‡	6.1
		156§	1.5§	126§	0.32§	12.5§	12.5§	Neg.*§	
−6D6	2nd I-F	136	7.8	96	2.0	0	0	−0.2	6.1
		156§	1.5§	126§	0.32§	12.5§	12.5§	Neg.‡§	
−6D6	3rd I-F	134	8.3	97	2.1	0	0	−0.25‡‡	6.1
−6F7	AVC-Pentode	134	6.5	131	2.1		30	1.6†	6.1
	AVC-Triode	0.1	0					−0.6	
−75	2nd Det. Diodes	Neg.‡	0				0	−0.6	6.1
	Noise Supp. Triode	29§	0.12§				0§	−0.4§	
−6C6	1st A-F	64*	0.12	61*	0.03	42	42	6.1†	6.1
		141§	0§	72§*	0§	45§	45§	4.8†§	
−6Y6-G	2nd A-F	212	54	147	2.2		6.0	−3.2†	6.1
5-Z3	Rectifier	Each Plate 250 A-C	Each Plate 65	Heater to Ground 250 D-C					4.9

**Voltmeter prods only by tilting tube in socket. No adapter available for OE Equipment.

‡Negligibly small—values well below 0.1 volt.

‡‡Very wide variation.

§"NOISE SUPPRESSOR" on "10".

#NOT oscillating.

*100 volt scale

†10 volt scale

TUBE CHARACTERISTICS

Tube Type	Filament Voltage (V)	Filament Current (A)	Plate Voltage (V)	Grid Bias (V)	Screen Voltage (V)	Plate Current (ma)	Screen Current (ma)	A-C Plate Resistance (ohms)	Voltage Amplification Factor (mu)	Transconductance (micromhos) Normal	Minimum	Emission IS (ma)	Test Volt
−956	6.3	0.15	250	−3	100	5.5	1.8	800,000	1440	1800	1300	20	15
−6F8-G	6.3	0.6	250	−8		9.0*		7,700*	20*	2600*	2400	40*	30
−6J5, −6J5-GT, −6J5-G	6.3	0.3	250	−8		9.0		7,700	20	2600	2400	40	30
−6C6	6.3	0.3	250	−3	100	2.0	0.5	1,000,000	1500	1225	1000	100	50
−6D6	6.3	0.3	250	−3	100	8.2	2.0	800,000	1280	1600	1325	100	50
−6F7	6.3	0.3	100	−3		3.5		16,000	8	500	350	20	50
Triode													
Pentode	6.3	0.3	250	−3	100	6.5	1.5	850,000	900	1100	900	50	50
−75	6.3	0.3	250	−2		0.9		91,000	100	1100	900	30	30
Triode													
Diode	6.3	0.3	10			0.8						0.8	10
−6Y6-G	6.3	1.25	200	−14	135	61.0	2.2	18,300		7100	5700	150	25
−5Z3	5.0	3.0										200**	75**

FOR CONDENSER-INPUT FILTER

A-C Plate Voltage per Plate (r.m.s.): 250 volts

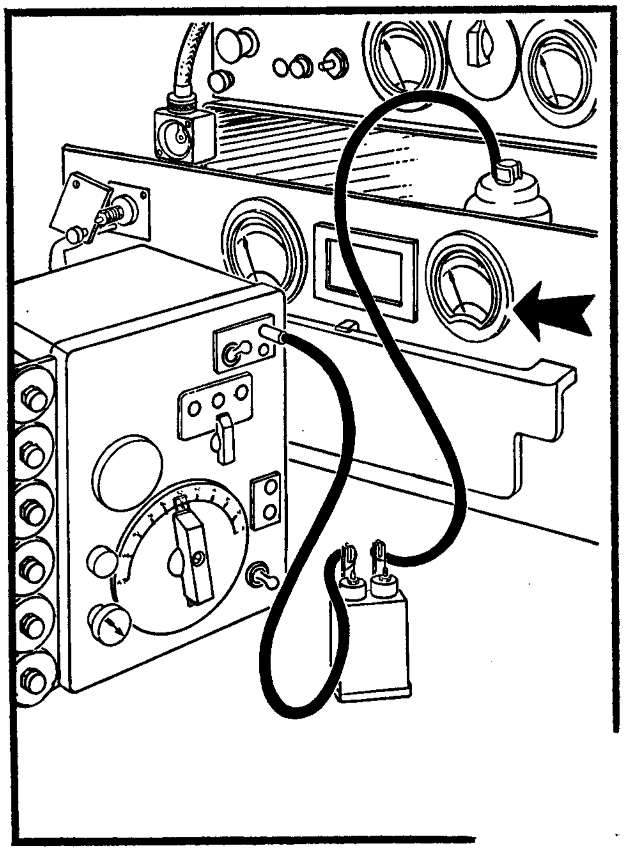
D-C Output Current: 225 ma (max.)

*(Each Triode)

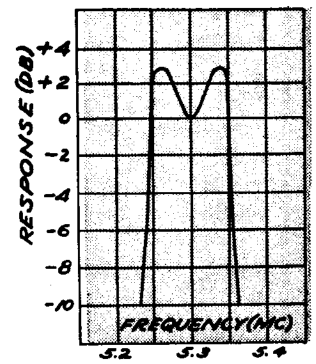
**(Each Diode)

ALIGNMENT OF THE INTERMEDIATE AMPLIFIER

The intermediate-frequency amplifier utilizes four interstage transformers (T403 to T406 inclusive) in the signal channel and a fifth transformer (T407) in the a-v-c channel to couple the associated a-v-c amplifier and rectifier. All of these transformers involve double-peak tuning to obtain a broad pass band. Accurate alignment of the various transformers is extremely difficult to accomplish unless the proper equipment is available to perform the operation. Due to the difficulty in properly aligning the i-f circuits, the original adjustments should not be disturbed until it has been definitely determined that the circuits are out of alignment.



Alignment of the i-f circuits may be checked by coupling a test oscillator such as a General Radio type 605B tuned to 5.3 mc to the grid of the first detector tube. The test oscillator is to be 30% modulated at 1000 cycles. The input should be adjusted to produce an output meter reading not greater than — 6db with the "VOLUME CONTROL" at maximum. When the test oscillator is tuned to either side of the resonant frequency, the output from the receiver will increase then decrease. The points of maximum output should occur at approximately 5.255 mc and 5.345 mc. The amplitude of the two peaks should be approximately equal and 3 db above the dip at the center of the selectivity curve as shown. During the above test, the "NOISE SUPPRESSOR" control must be in the "OFF" position and the crystal removed from the receiver.



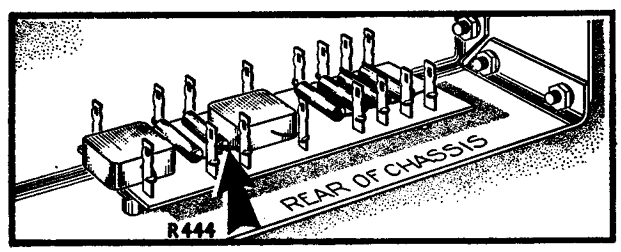
OVERALL I-F SELECTIVITY

NOTE

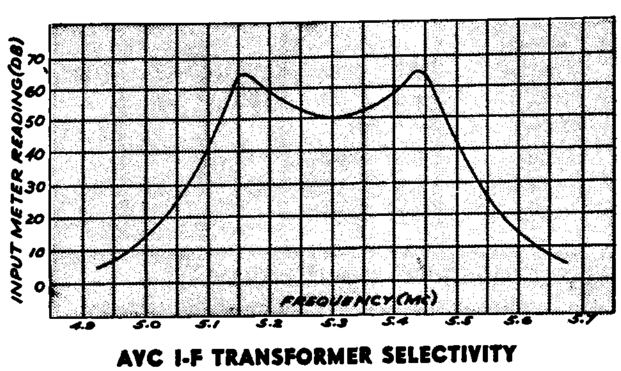
If the two peaks are more than 50 kc apart and less than 6 db above the dip, no attempt should be made to realign the i-f circuits in the field.

TUNING METER METHOD

If this check shows the need of i-f alignment, check the a-v-c i-f transformer (T407) next by coupling the test oscillator to the grid of the a-v-c



tube (V409) through a 0.1 mfd capacitor and short circuit the a-v-c voltage delay resistor (R444) on small resistor panel at rear of receiver as shown in illustration. It will be necessary to use a relatively high value of input to the grid. Set the input "METER SWITCH" to position 1 and proceed to check the a-v-c i-f transformer alignment, using the "INPUT METER" as a tuning indicator, and slowly tune the test oscillator through resonance. The selectivity of this transformer is shown. It is important that this curve be symmetrical. The two peaks

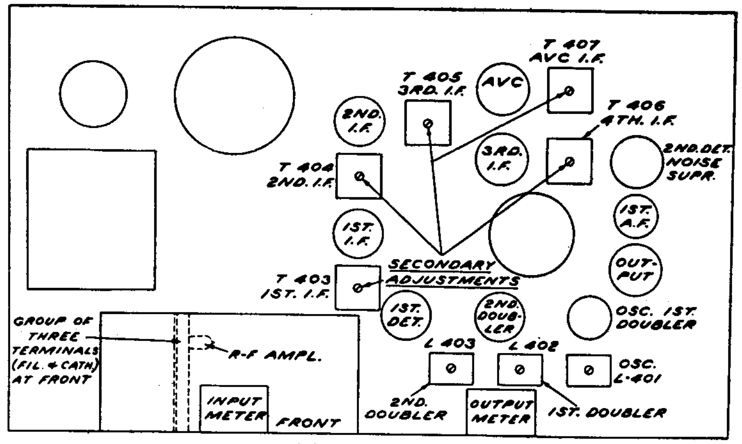


AVC I-F TRANSFORMER SELECTIVITY

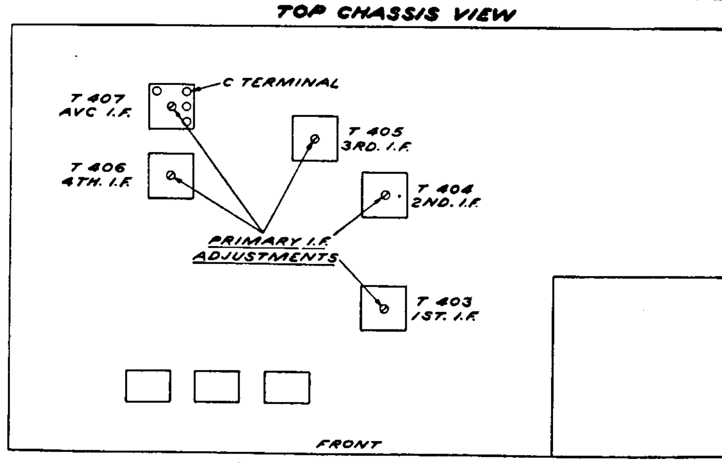
should occur at approximately 5.15 mc and 5.45 mc, should be approximately equal and 15 db above the dip.

Unless the above check shows that the transformer is definitely out of alignment, no attempt should be made to realign it. If it is necessary to realign the transformer, set the test oscillator to the low-frequency peak (5.155 mc) and align the transformer by means of primary and secondary adjusting screws with an insulated screwdriver using the "INPUT METER" as an indicator.

Refer to diagram of receiver chassis for location of the adjustment screws for both primary and secondary of the i-f transformers. All of the secondary adjustments are on top of the transformers while those for the primary are located underneath. During the process of alignment, frequent checks must be made to determine that the peaks and dip in the selectivity curve occur at the proper points and are of the proper relative amplitudes. These checks will necessitate checking the approximate selectivity after each adjustment is made and then readjusting the circuits; this cut and try procedure must be repeated until the proper selectivity curve is obtained.

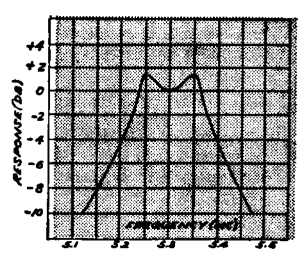


TOP CHASSIS VIEW



BOTTOM CHASSIS VIEW M-421247

Next couple the test oscillator to the grid of the last i-f amplifier through a capacitor of at least 0.1 mfd. Check the alignment of the last i-f transformer (T406) by slowly tuning the test oscillator through resonance, using the output meter as the tuning indicator. Two peaks should occur at approximately 5.25 mc and 5.35 mc, the minimum point of the dip between these two peaks should occur at 5.3 mc and the height of the peaks should be approximately 1.5 db above the dip, as shown.

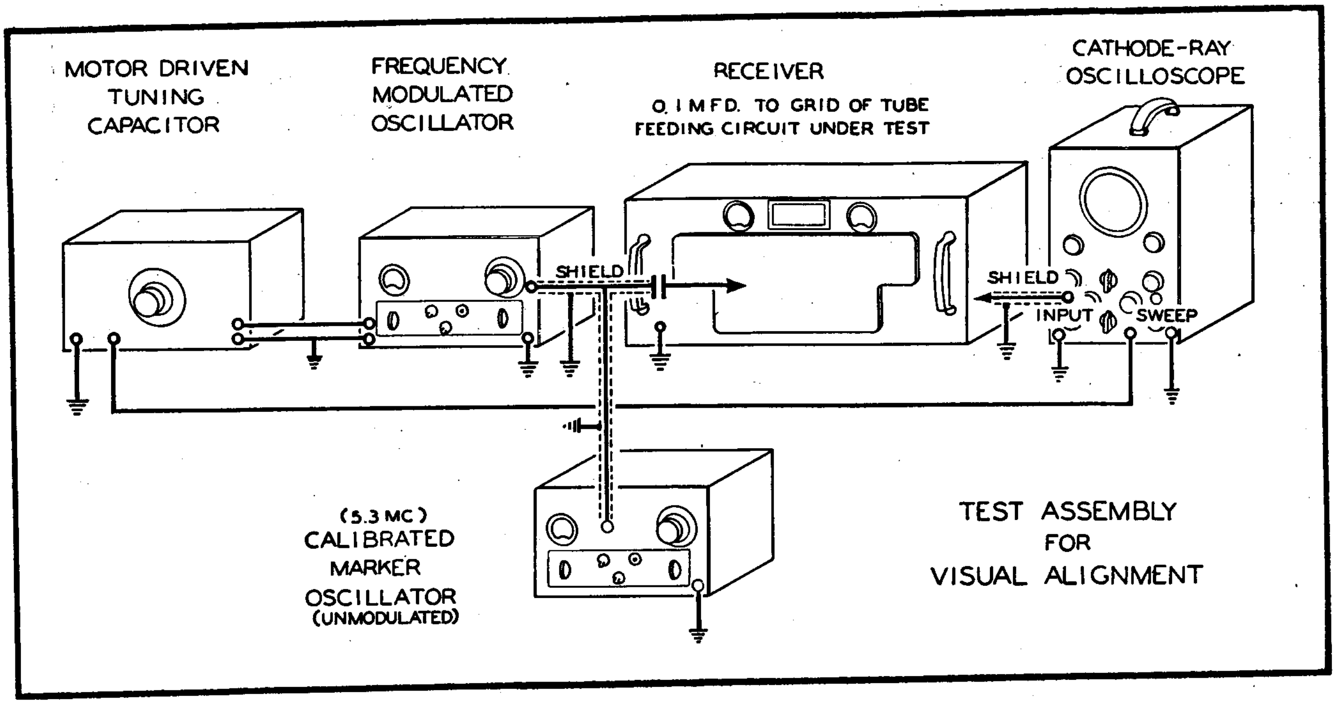


FOURTH I-F TRANSFORMER SELECTIVITY

The input to the last i-f grid should be of such a value that will produce an output of not more than — 6db from the receiver with the "VOLUME CONTROL" at its maximum position. No attempt should be made to realign the transformer unless the above check definitely shows it to be out of alignment.

Repeat the above procedure for each of the i-f transformers, always making sure that each transformer is aligned so that the center of the dip between its two peaks occurs at 5.3 mc. When the i-f amplifier is correctly aligned, an approximately symmetrical selectivity curve will be obtained and there should be no tendency for one side of the curve to flare out more than the other.

The above alignment procedure, due to the difficulty and time required to secure proper alignment of the receiver, is not recommended. It should be attempted only when equipment is not available for proceeding in the simplified and more accurate method known as visual alignment.



VISUAL ALIGNMENT

With this method, the selectivity curve of either an individual i-f transformer or of the complete i-f amplifier is reproduced on the screen of a cathode-ray oscilloscope and any change in the tuning of the circuits is instantly seen on the screen.

The following equipment is required for use in the visual alignment of the i-f amplifier:

1 A test oscillator capable of having its frequency modulated approximately 500 kc at a rate of at least 20 cycles per second such as the General Radio type 605B. Frequency modulation may be obtained by means of an external motor-driven capacitor. A small alternator driven by the motor provides the synchronizing voltage.

2 A cathode-ray oscilloscope with provision for external synchronizing of the sweep oscillator such as an RCA 715A or 158.

3 A marker oscillator or other source of unmodulated radio frequency, the accuracy of which is known to be within 0.1 per cent.

Set up and connect the test equipment to the receiver as shown. Set the frequency of the unmodulated marker oscillator to 5.3 mc. Also adjust the frequency-modulated test oscillator for a mean frequency of 5.3 mc, by varying the frequency-control dial until the beats between the two oscillators coincide on the screen of the oscillograph.

First check the alignment of the a-v-c i-f transformer (T407), connect the test oscillator to the grid of the a-v-c tube (V409), and short circuit the associated voltage delay resistor (R444). Remove the connection from terminal "C" on the a-v-c i-f transformer and connect the lead from the input terminal of the oscillograph to this terminal.

CAUTION

ALWAYS KEEP THE OUTPUT FROM THE FREQUENCY MODULATED TEST OSCILLATOR WELL BELOW THE VALUE THAT CAUSES OVERLOADING, AND THE OUTPUT OF THE UNMODULATED MARKER OSCILLATOR AT A VALUE THAT WILL JUST GIVE AN INDICATION OF THE BEATS BETWEEN THE TWO OSCILLATORS.

The illustration at A shows in a general way the type of figure appearing on the screen when the oscillators are properly adjusted as to frequency and the transformer is not too badly mistuned. Incorrect set-

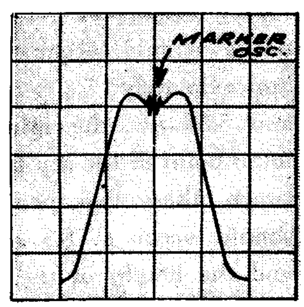


FIGURE A

tings of the oscillators may give patterns on the screen as shown at B and C. In the former the sweep frequency is about half of the correct figure and should be increased to make the patterns lap. An incorrect adjustment of the frequency modulated oscillator will result in a pattern of the type shown at C. A few trial adjustments of the two oscillators after they have operated a few minutes to reach proper operating temperatures will enable one to rapidly make the proper adjustments to obtain the correct figure on the oscilloscope screen.

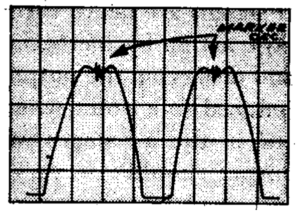


FIGURE B

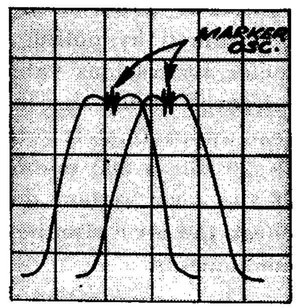


FIGURE C

If realignment is found to be necessary, proceed to align the a-v-c transformer by tuning the primary and secondary adjustment screws. It is advisable to adjust the primary and secondary of the transformer simultaneously, always aligning for the highest amplitude that is consistent with correct pattern shape. After the correct pattern for this transformer has been obtained as shown at D, reconnect the wire on terminal "C" of the a-v-c i-f transformer and remove the short circuit from resistor R444.

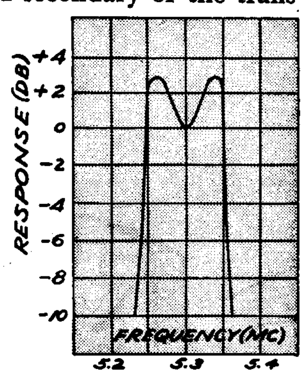


FIGURE D

Next connect the input terminal of the cathode-ray oscilloscope to the ungrounded side of the volume control R418 using shielded leads. Check each i-f transformer individually in turn, and if necessary, realign in the manner indicated, starting with the last; by connecting the lead from the test oscillators to the grid of the amplifier tube just preceding the transformer under test. Avoid any capacity coupling to other i-f grids. Figure shown at E will appear when all the i-f transformers are properly adjusted. During the above test the a-v-c time constant switch should be set at position 1.

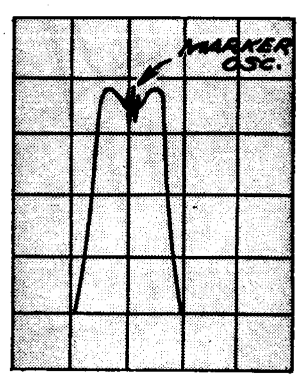


FIGURE E

MISALIGNMENT

The patterns F and G may appear on the screen due to misalignment of the transformers or improper setting of the test oscillators. Figure F may result from the primary and secondary being tuned to a frequency different from that desired. Figure G indicates that the primary and secondary are tuned to different frequencies.

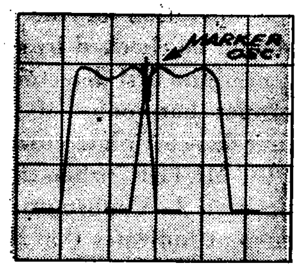


FIGURE F

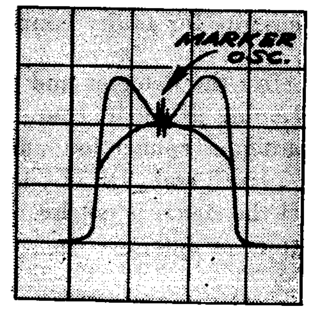


FIGURE G

CHECKING OSCILLATOR AND TUNING CIRCUITS

Should it be found that the i-f amplifier stages are operating correctly, couple the test oscillator loosely to the grid of the first detector and adjust the test oscillator output to the correct channel frequency for the crystal that is plugged in the receiver.

If the signal is heard in the output, it indicates that the crystal oscillator and doubler stages are operating satisfactorily. Should no signal be heard in the output, either the crystal oscillator or one of the doubler stages is not operating properly.

Check the operation of the crystal oscillator by varying its tuning control through resonance and noting whether or not there is a dip in the plate current of the oscillator tube as indicated on the input meter when the input "METER SWITCH" is in position 3.

If no dip is observed, plug a different crystal in the oscillator circuit and look for the dip in plate current as the tuning control is varied over its range.

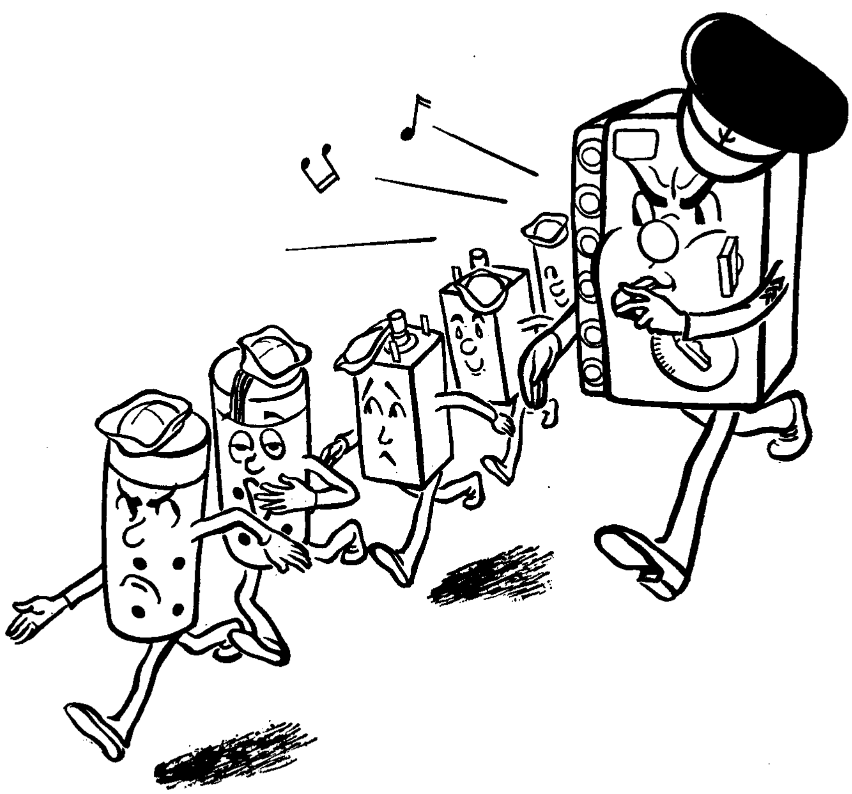
If there is a dip in the plate current when using the second crystal, it indicates that the original crystal is defective and must be replaced with one known to be good. If no dip occurs with the second crystal, the circuit should be checked for faulty or short-circuited connections.

With the crystal oscillator functioning properly, the operation of the first and second doublers should be checked by noting the rise in plate current of the first detector when they are tuned to the proper harmonics of the crystal frequency. The first detector plate current is indicated by the "INPUT METER" when the "METER SWITCH" is in position 2. A substantial rise in the detector plate current indicates that the doubler stages are operating correctly. If no rise is noted in the detector plate current, examine the first and second doubler circuits for faulty connections or defective tubes.

After the detector and oscillator circuits are functioning properly, connect the test oscillator to the antenna connection and tune the "ANTENNA," "LINE" and "DETECTOR" controls to resonance. If the signal is not heard, check for faulty connections or defective components in the r-f section.

If signals are heard through the receiver, check the a-v-c action by increasing the input to the receiver and observing the output. With the volume control reduced to a point where overloading does not occur in the a-f stages with high input signals, the output should rise very rapidly when the input is increased from zero to approximately five microvolts. For inputs greater than five microvolts and up to 100,000 microvolts, the output should remain within three db of the output at five microvolts. The action of the a-v-c circuits may also be determined by noting the readings of the input meter for various values of signal input. A five microvolt input should cause the input meter to read approximately zero db; a 50 microvolt signal, + 20 db; a 500 microvolt signal, + 40 db, etc. If the a-v-c system does not function correctly, check the a-v-c circuits for faulty connections and components.

The above testing procedure should locate any defect in the operation of the circuit components of the receiver and indicate action to be taken to return the equipment to precision performance.



SERVICING THE CONTROL UNITS

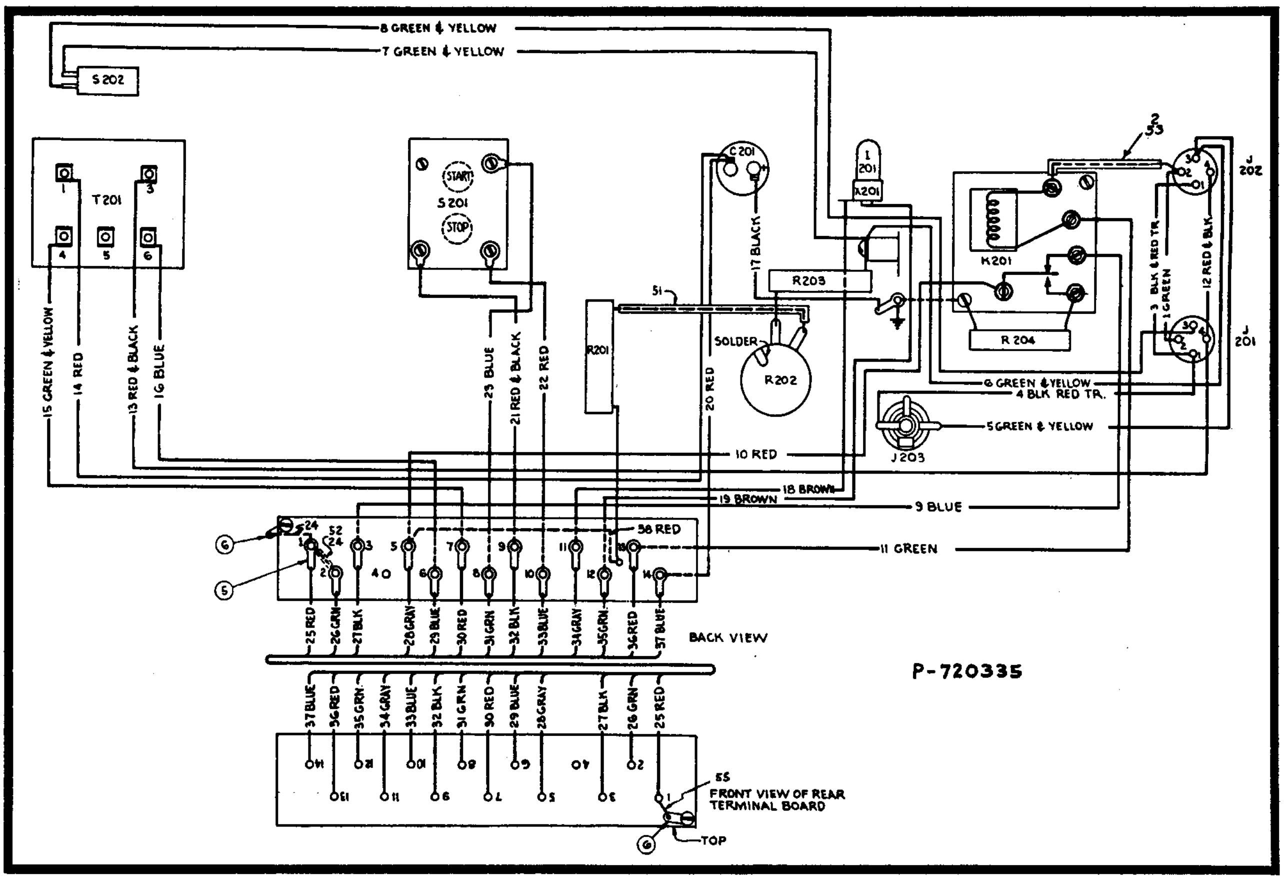
Since two control units are furnished in each installation it is usually a simple matter to trace trouble to the unit responsible for defects in operation. Should either unit be suspected, the other unit should be operated to determine if the same type of failure is experienced with both of them.

Low or wavering sound level in the loudspeaker may be due to poor contact in the relay in the unit and cleaning of the contacts or increasing spring tension should eliminate the trouble.

A check of the various components of the unit with an ohmmeter will usually locate any other trouble that may develop. The voltage output of the microphone transformer T201 may be checked with a high resistance rectifier type a-c voltmeter having a 10-volt scale connected across terminals 6 and 7 of the control unit, connections of which are shown in the illustration. When speaking into the microphone in a fairly loud tone of voice, the voltmeter should indicate a kick of about 5 volts. If the indicated voltage is low, replace the handset with another and repeat the test.

The electrolytic capacitor C201 should also be examined to make sure the terminal marked in red is grounded. Should the connections be reversed the capacitor will be ruined. Deterioration of this capacitor will result in the carrier being hum modulated, which is an indication of its failure.

At inspection periods recommended in the service chart all dust should be blown out of the unit, particularly on the terminal board where accumulations of dust or moisture may partially short circuit the connections.

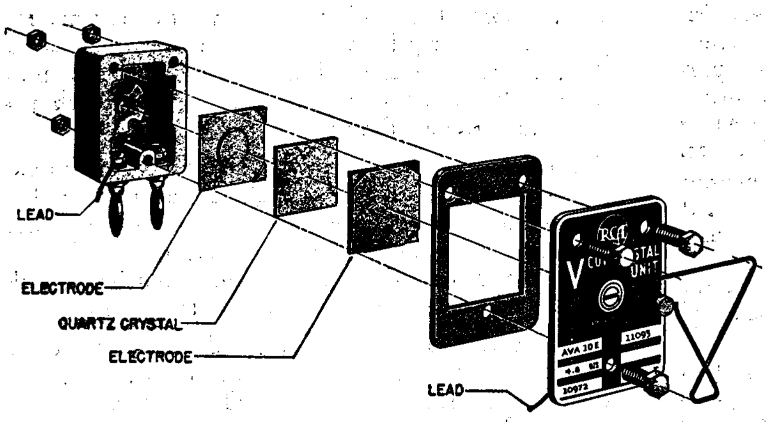


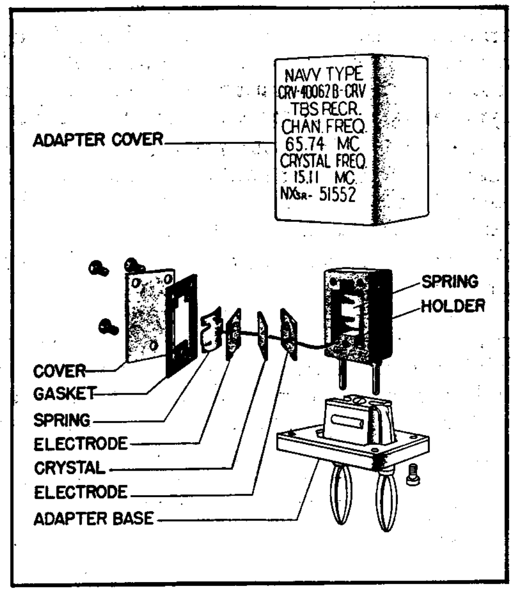
ANTENNA INSPECTION

The antenna should be inspected periodically for mechanical damage to the assembly. Proper operation of the equipment cannot be obtained if any of the horizontal rods or the vertical section is broken off or badly bent out of shape. If the insulator at the base of the vertical section is cracked or broken, water may seep into the inductive stub section in the supporting pole and cause weakening of the signal or improper operation of the transmitter. This insulator cannot be replaced conveniently aboard ship; if broken, the entire antenna assembly should be returned to the manufacturer.

When the antenna is painted, care should be taken to prevent any paint from being smeared over this insulator or the insulator on the end fitting. Paint is a fairly good conductor of high-frequency energy and would therefore cause a partial short-circuit at the insulator.

FAILURE OF OSCILLATOR





If the quartz crystals used with this equipment should stop oscillating, it is most probable that the quartz plate requires cleaning. After operating in the transmitter or receiver for a considerable period of time, a very thin layer of fine quartz dust may accumulate on the surface of the crystal and prevent oscillation.

NOTE

DO NOT DISMANTLE CRYSTAL HOLDERS EXCEPT IN CASE OF EMERGENCY. IF ABSOLUTELY NECESSARY, PROCEED CAREFULLY AS FOLLOWS:

For cleaning, the required materials are: Paint brush with soft bristles (1½ inch size is about right), a camel's hair brush, fresh water and either liquid soap or solid soap free from hard particles and impurities. Liquid soap is preferred. A small quantity of sealing wax is desirable to cover the adjusting screw to prevent tampering and moisture leakage. A few paper towels are needed.

To clean the crystal the procedure indicated below should be strictly followed:

1 The first step will be to break the seal over the adjusting screw in the center of the nameplate and turn this screw in a counter-clockwise direction until the electrodes rattle when the crystal unit is shaken gently. Break the wire seal and remove the three body screws.

2 Lay the holder on the table face up and remove the nameplate, turning it face down on the table. Insert a screwdriver or knife blade under the bottom electrode and lift out.

3 Lift off the top electrode and mark the back so that it may be replaced in its original position. Examine the crystal for identifying marks, such as the shape of the corners so that it may be replaced in its original position. Mark the bottom electrode. Use extreme care to avoid damage to the electrodes or crystal. Since the crystal is very thin (approximately 0.010 inch) it is quite fragile.

4 Wash the hands thoroughly. Using the paint brush, scrub the electrodes with soap and water and rinse them clean in warm fresh water. Running water should be used, if available; if not, use several changes of warm fresh water. Rinse the crystal with running water first, then wash it with soap and water, using the paint brush, and rinse it thoroughly again. Dry the electrodes and crystal with paper towels. During and after this washing, the crystals and electrodes should be handled by the edges only. No finger prints should appear on the working faces of the electrodes or on either face of the crystal.

CAUTION

All soap must be removed from the crystal. Traces of soap remaining may be enough to prevent the crystal from oscillating.

5 Brush lint and dust off the electrodes and the crystal with the camel's hair brush. Stack the parts in their original relation, then hold the assembly up to the light and look through to make sure that no dust is inside. A minute gap (about 0.001 inch or less) should show between the center button of either electrode and the adjacent face of the crystal. If dust shows here, be sure it is brushed out.

6 Reassemble the unit, making sure that the electrodes and crystal are in their original locations, with respect to the holder. The ceramic tip in the bottom of the holder must be in the hole in the center of the bottom spring. Coil any excess length of lead around the pressure-adjusting-screw bushing. Tighten the three body screws. Finally, tighten the pressure adjustment until the electrodes no longer rattle when the unit is shaken.

The transmitter may be used to adjust pressure for either the transmitter or receiver crystals. Using the spare crystal, tune the circuits for the frequency shown on the nameplate. Insert the cleaned crystal and adjust the pressure for a maximum dip in the crystal oscillator plate current. Once this is obtained, the adjusting screw should be covered with sealing wax.

A slight upward shift in frequency may be expected. This shift probably will be in the order of 400 to 600 cycles and should not be great enough to throw the crystal outside the original manufacturing tolerances.

SERVICING THE TRANSMISSION LINE

If the signal received at a distant point is weak or entirely absent, check the transmission line with an ohmmeter to determine if there is a short-circuit between the inner and outer conductors. When making this measurement, the inner conductor must be disconnected from the antenna because the antenna itself has a short to ground inside the supporting mast.

If a short-circuit or partial short-circuit occurs in the line, the following procedure may help in locating the exact position:

A Tune up the transmitter and load up the PA stage to 115 ma or as close to that as possible.

B Allow the transmitter to run with plate power applied for about ten minutes.

C Feel the line with the hand; a noticeable hot spot will occur where the short-circuit is located.

If the line develops a bad gas leak, there is a possibility of water seeping into it. If there is any evidence of a leak (pressure drops quickly), it should be located immediately and resoldered to make the line tight. Dry out the line by allowing gas to pass through the line and out the bleeder valve at the antenna end for about five minutes before closing the valve.

A spare insulator is provided for the end fittings at each end of the line. If an insulator is broken, it should be replaced in the following manner:

Remove the broken insulator from the line fitting by loosening hexagonal packing nut under terminal fitting at extreme end of line.

Melt solder holding central conductor at tip of terminal fitting by means of soldering iron or small torch, pulling terminal off center conductor and removing excess solder from hole in center of threaded terminal post.

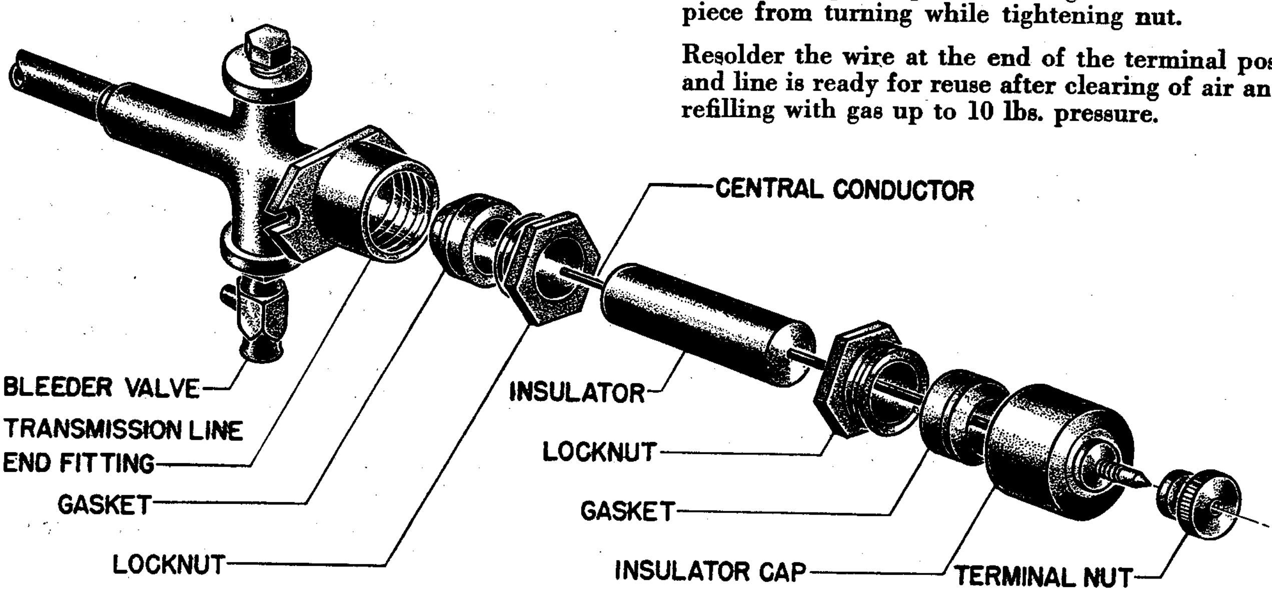
Loosen hexagonal packing nut in end fitting of line and remove insulator and gaskets.

Slip a gasket over one end of the new insulator and spread glyptal or other waterproof cement over gasket. Slip insulator and gasket over center conductor gasket end down into line fitting. Drop hexagonal packing nut over insulator and tighten into place.

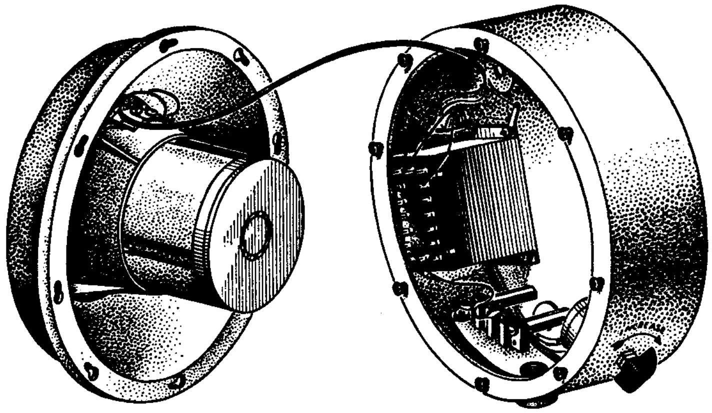
Drop the other hexagonal nut over insulator, put the remaining gasket in place on free end of insulator and coat with waterproofing compound.

Drop end terminal over center conductor on to the end of insulator and run hexagonal packing nut and gasket up into place, holding the end terminal piece from turning while tightening nut.

Resolder the wire at the end of the terminal post and line is ready for reuse after clearing of air and refilling with gas up to 10 lbs. pressure.



SERVICING LOUDSPEAKERS



Navy Type—CRV-49155
Navy Type—CMX-49155

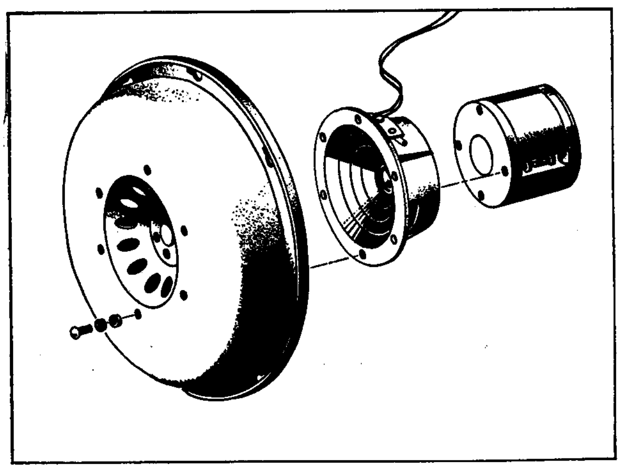
Servicing the loudspeaker generally consists of the replacement of parts which have failed in operation. The procedure for making such replacements is discussed in the following paragraphs.

Since the diaphragm is mounted in a housing, the entire housing assembly must be replaced as a unit in the event of damage in service. Proceed as follows:

Loosen the eight round head screws in the rim of the front section of the housing, rotate the latter slightly counter-clockwise to clear the screw heads, and lift off the front assembly (front section of housing with attached reproducer mechanism including the field magnet).

Disconnect the wires from the voice coil terminals and the cable stay cord from the ground terminal on the cone assembly.

Remove the four fillister-head screws with which the field magnet is attached to the cone-housing assembly and detach the field-magnet.



Remove the six screws with which the cone-housing is attached to the front section of the loudspeaker and take off the cone-housing assembly.

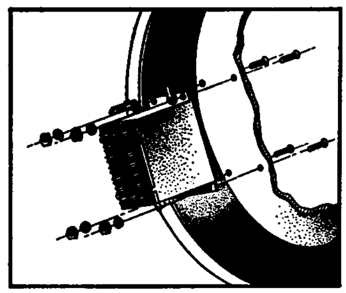
Attach the new diaphragm or housing assembly to the main housing by means of the six screws previously removed.

Attach the field-magnet to the new cone-housing by means of the four fillister-head screws.

Connect the wires to the voice coil terminals of the new assembly, and the cable stay cord to the ground terminal.

Replace the front assembly, turn clockwise, and tighten the screws.

REPLACING TRANSFORMER



Replacing the line matching transformer requires complete dismounting of the loudspeaker and can readily be done in the following manner:

Remove the front assembly by loosening the eight round-head screws in the rim of the front section of the housing, rotating the latter slightly counter-clockwise to clear the screw heads, and lift off the assembly.

Disconnect the wires from the terminals of the voice coil and the cable stay cord. The front assembly is now clear of the rear section of the housing. Remove the front assembly.

Make a sketch to show the transformer terminals and terminal markings to which the leads are connected and disconnect all the transformer leads.

Remove the rear section of the housing from its wall or bulkhead mounting by taking out the three mounting bolts.

Remove the transformer from the rear housing by taking out the four mounting screws.

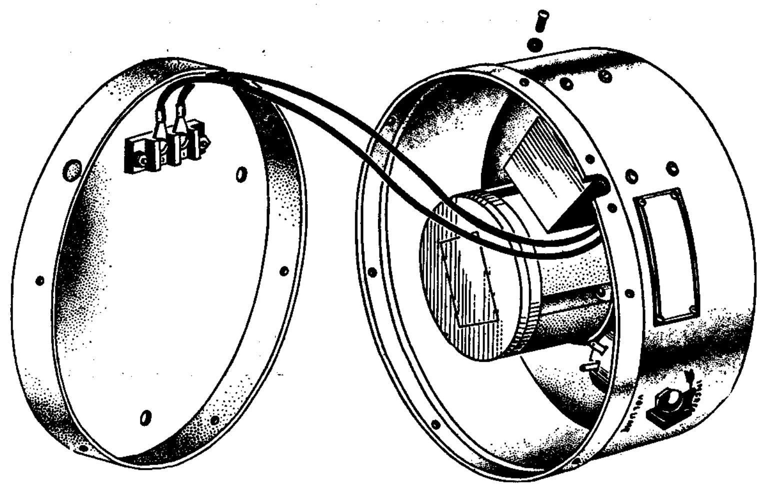
Install the new transformer in the housing by means of the screws just removed.

Solder all transformer connections according to sketch made while dismantling.

Remount rear section of loudspeaker on the wall or bulkhead.

Connect leads to voice coil on diaphragm assembly and fasten stay cord.

Replace front of loudspeaker over screw heads, twist into place and tighten screws.



LOUDSPEAKER, Navy Type CRV-49101

To dismantle the loudspeaker for repair, remove the six round-head screws in the rim of the assembly and lift off the front section of the housing.

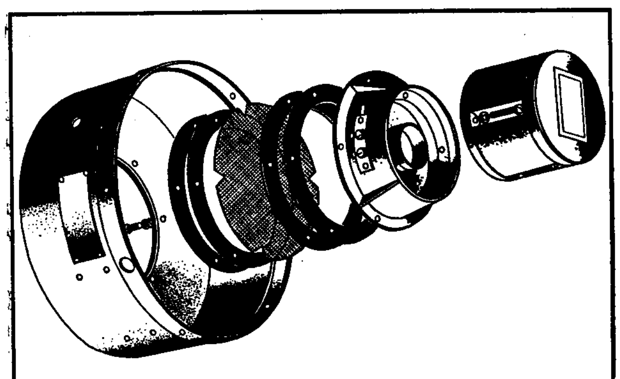
Disconnect wires leading to front section of housing from the terminal block in the rear plate attached to wall.

Lay speaker face down and remove the four fillister-head screws with which the field magnet is attached to the diaphragm housing and detach field magnet.

Disconnect wires to voice coil terminals on the diaphragm assembly.

Remove the six screws holding the diaphragm assembly to the front section of the loudspeaker and remove diaphragm assembly, taking care not to damage front screen and clamping rings.

The new diaphragm assembly can be put in place, after replacing screen and clamping rings, and the six screws replaced through the front of the loudspeaker.

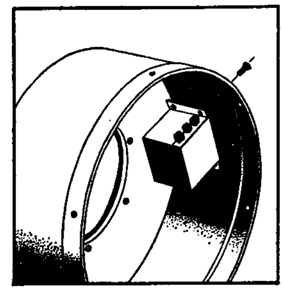


Connect the wires to the voice coil terminals, and tie stay cord and replace the field magnet.

Reconnect the leads to the terminal block and replace the front section of speaker, fastening in place with the six round-head screws in the rim.

REPLACING TRANSFORMER

To replace the loudspeaker matching transformer detach the front assembly as previously described. When the front is free of the rear section a sketch should be made showing the leads to the transformer proper.

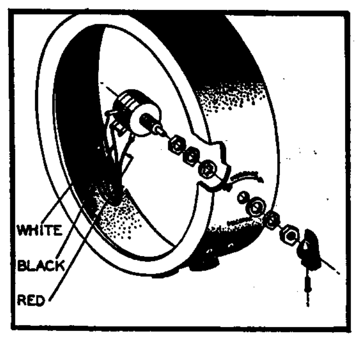


Remove the transformer from the housing by taking out the four screws holding it in place, after disconnecting the leads to the transformer terminals. Install the new transformer and make connections as sketched during dismantling.

Reconnect leads to terminal block in rear section of loudspeaker and reassemble the unit by replacing the six screws in the rim.

REPLACING VOLUME CONTROL IN EITHER SPEAKER

Remove the front section of the housing and disconnect from rear section.



Sketch the connections to the volume control and unsolder the connections.

Remove knob by loosening set screw.

Loosen hexagonal nuts holding volume control to housing and remove volume control and associated washers.

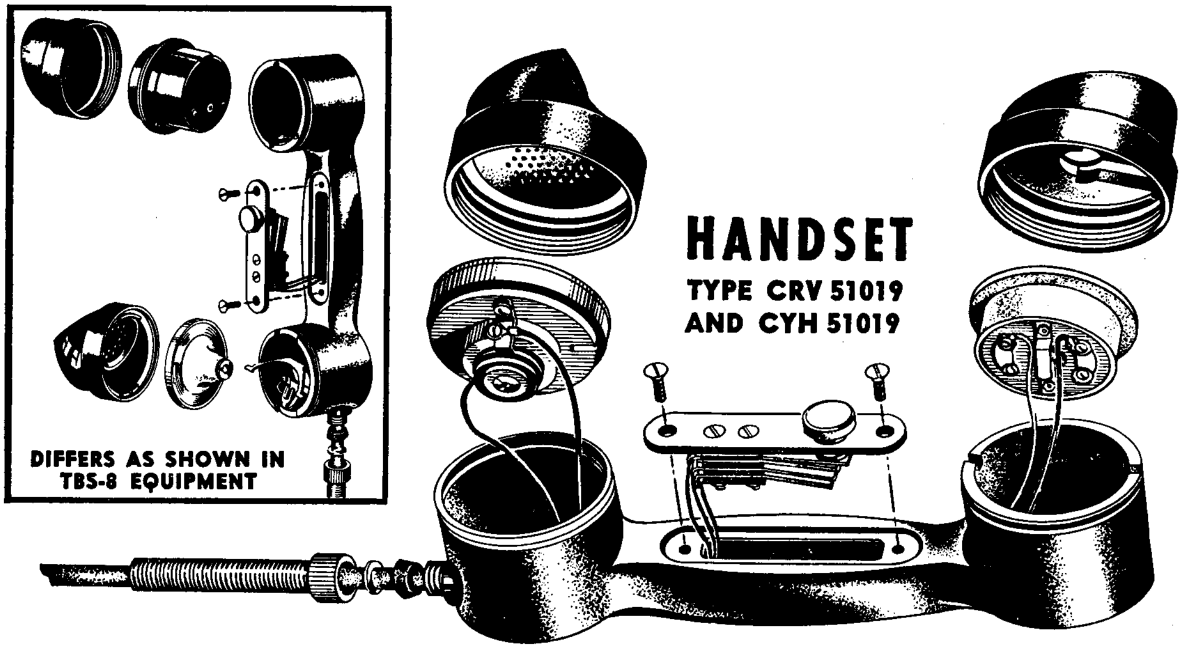
Mount new control in place with washers arranged in order of their removal and tighten hexagonal nuts.

Solder leads to volume control terminals as per sketch made while dismantling.

Replace knob on volume control shaft and so orient, when fastening with set screw, so that at midpoint of rotation the pointer on the knob will point to the front of the loudspeaker.

Reconnect the front section and mount in place, fastening with round-head screws provided.

SERVICING TELEPHONE ACCESSORIES



Should trouble develop in either the hand set or the chest set, the unit should be disconnected from the control unit and the circuit continuity between the terminals on the connector checked with an ohmmeter. The approximate value of the point-to-point resistance thus measured is indicated in the following tabulation:

POINT-TO-POINT RESISTANCE

Circuit	Terminals	Press-to-Talk Push-Button	Resistance
Microphone	1 and 4	Pressed	30 to 45 ohms
		Released	Infinite
Earphone*	1 and 3	Pressed	110 ohms
		Released	110 ohms
Transmitter Control	1 and 2	Pressed	Zero
		Released	Infinite

*Hand set only unless headphones are plugged into breast-plate jack.

If the measured resistance does not agree with the value tabulated, the defective part should be repaired or replaced. For guidance in replacing connecting cable to handset the exploded drawing above will serve in making this and other repairs to this apparatus.

REPLACING CONNECTING CABLE

To replace the connecting cable on the handset, proceed as follows:

Unscrew the retaining rings on both microphone and earpiece and remove the two screws holding Press-to-Talk switch in handle of handset.

Unsolder the leads of the connecting cable from the switch terminals and disconnect cable leads to microphone and earpiece units. Make sketch of wires disconnected, indicating wire coloring and terminal to which connected.

Unscrew cable entrance bushing cap and withdraw cable from handset.

Using the old cable as a guide, remove the outer insulation until a sufficient length of the conductors is exposed to permit reconnection inside the unit. Cut conductors to proper length and solder lugs on such leads as were fitted with lugs in the defective cable.

Remove bushing cap, metal washer and rubber packing ring and place them in the same order on the new cable as originally found.

Insert the new cable in the handset housing and attach stay cord to screw as close to the cable as possible. With the cable pulled out of the housing as far as stay cord will permit, the outside insulation of the cable should still protrude into the case.

Tighten bushing cap to hold cable in unit and proceed to reconnect leads to proper terminals, being guided by color code of wires in cable and sketch made when disconnecting.

Replace microphone and earpiece assemblies and secure in place with retaining rings. Offset projections and matching recesses in these parts assure proper assembly. Replace switch in handle of unit and tighten holding screws into place.

PRESS-TO-TALK SWITCH

To replace the push-button switch assembly, it is only necessary to remove the two retaining screws, located one at each end of the switch, after which the switch may be removed from the housing and the leads unsoldered. The leads should then be soldered to the new switch and the switch then inserted into the housing, making certain that the rubber switch cushion is in place. Secure the switch in its normal position by means of the two retaining screws.

MICROPHONE OR EARPHONE

The mechanical replacement of either unit is very similar and may be accomplished by observing the following procedure:

(1) Remove the retaining ring from the housing.

(2) Remove the mouthpiece or ear cap.

(3) Remove the unit.

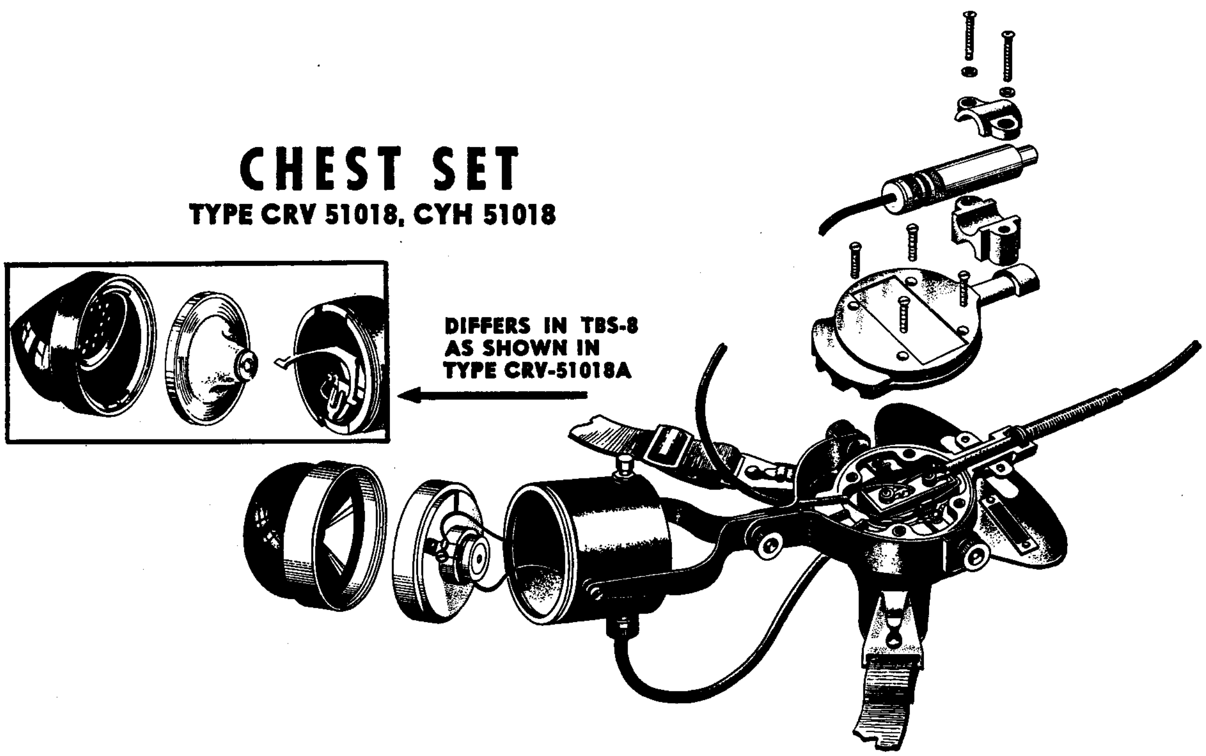
(4) Insert the new unit after connections are made.

(5) Replace the mouthpiece or ear cap and secure it in position by means of the retaining ring.

The handset furnished with the TBS-8 differed somewhat from the earlier models in that a spring terminal arrangement in the handle permits renewal of the earpiece or microphone units without disconnecting leads as shown in the illustration.

CHEST SET

TYPE CRV 51018, CYH 51018



REPLACING CONNECTING CABLE

Above are illustrated the details of the chest set assembly for guidance in making any repairs necessary.

Remove two round-head screws holding headphone jack and terminal enclosure to breast plate.

Remove four flat-head screws in cover of terminal enclosure and make sketch of connecting cable by loosening and removing associated screws.

Disconnect lugs on connecting cable by loosening and removing associated screws.

Remove flexible spring from old cable and slip over new cable.

Remove insulation from new cable to proper length and solder lugs on wires.

Make connections according to color code in sketch and replace terminal cover and four screws.

Attach headphone jack by means of clamps and two round headed screws.

CHEST SET MICROPHONE—Proceed as in the case of replacing handset microphone.

PRESS-TO-TALK SWITCH—This switch may be removed by unscrewing retaining ring from microphone mouthpiece.

Withdraw microphone from housing.

Unscrew hexagonal nut holding push button for switch in top of microphone housing.

Remove switch from housing by loosening two round-head screws holding it in place in housing.

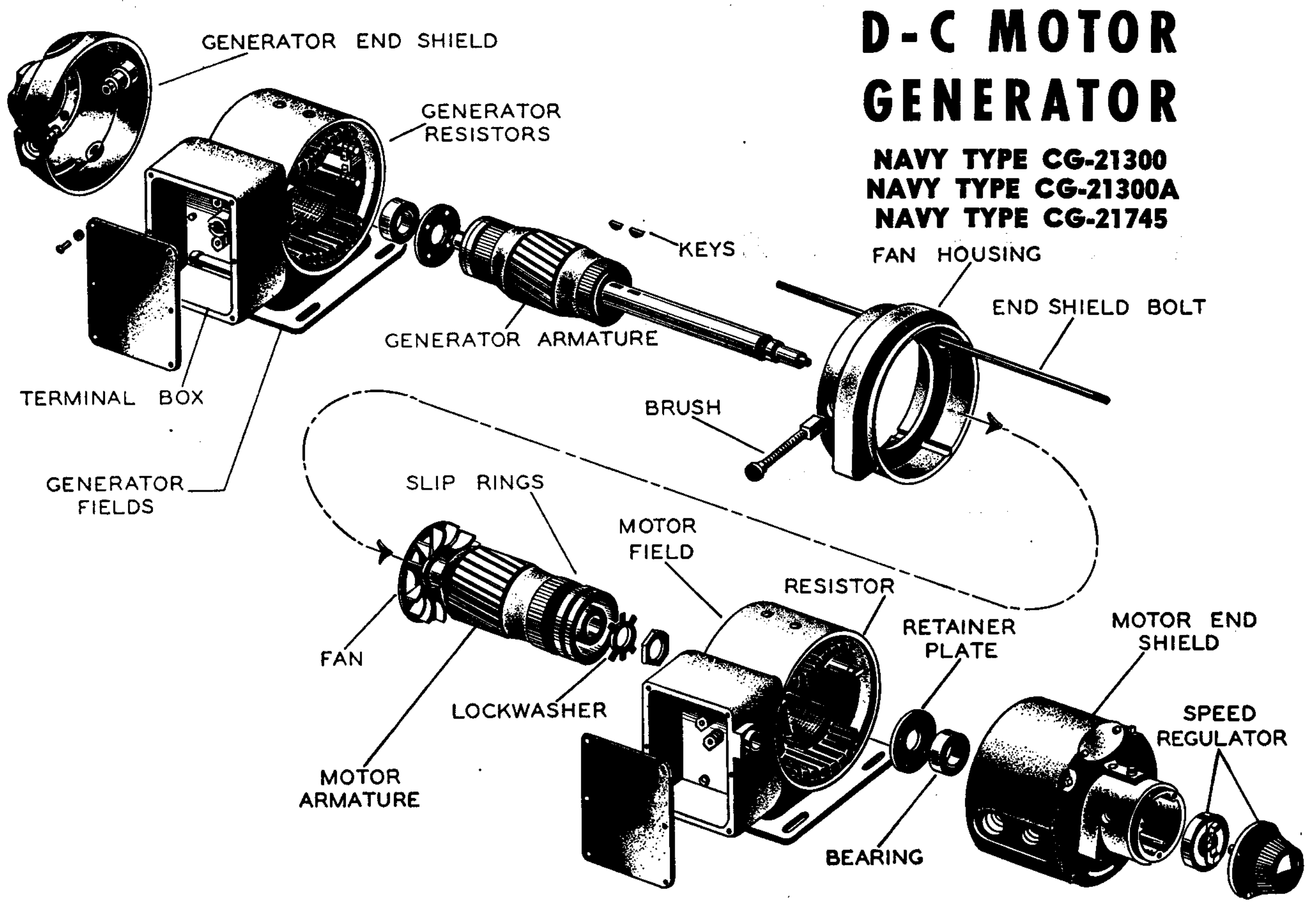
Necessary repairs or replacement can be then made and the parts reassembled in reverse order.

The chest set furnished with the TBS-8 had a modification in the switching circuit of the push button on the microphone shell with the microphone unit making spring connections within the shell rather than screw terminals in the earlier models.

MOTOR GENERATOR MAINTENANCE

D-C MOTOR GENERATOR

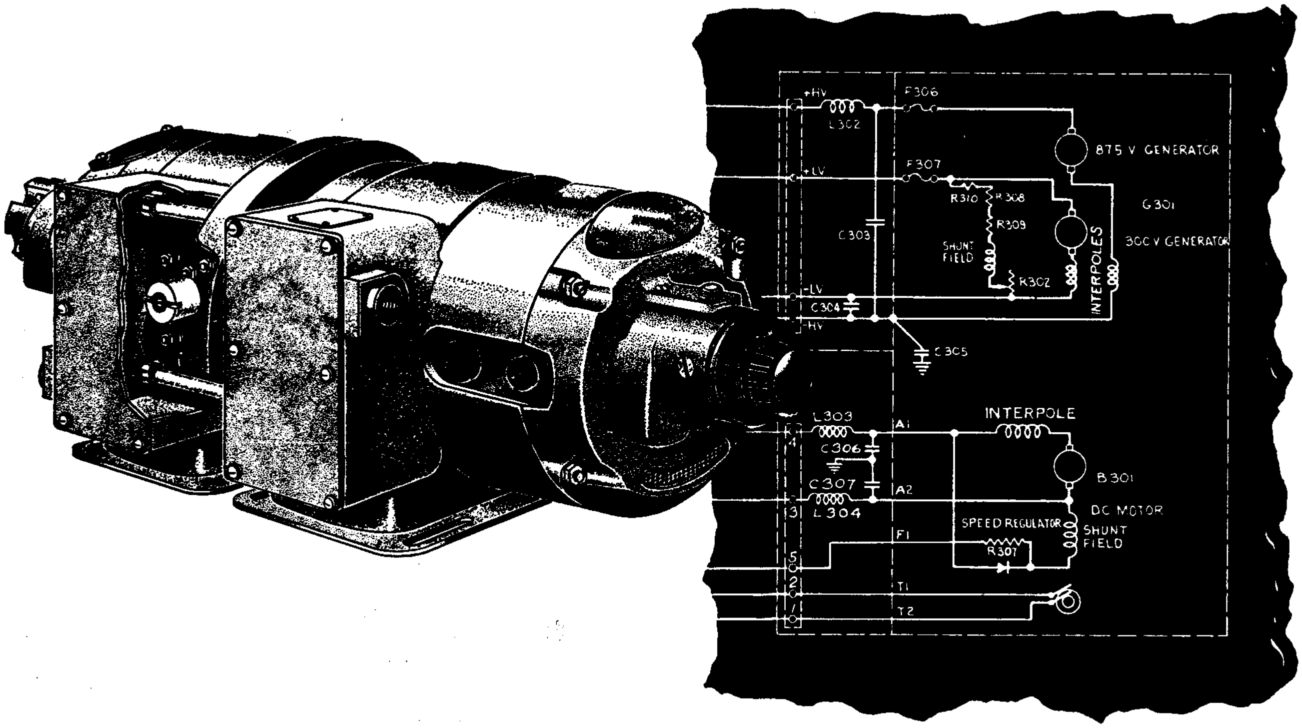
NAVY TYPE CG-21300
NAVY TYPE CG-21300A
NAVY TYPE CG-21745



Since there are two types of both the a-c and d-c operated motor generators, with the generator end of all the machines almost identical in electrical characteristic but differing slightly in mechanical details, it follows that much of the information on one machine applies more or less to all. To prevent repetition the instructions have been grouped as much as possible, but some cross reference must be made at times. Material applying to a particular type of machine is given with that machine wherever possible.

Above is shown an exploded view of the d-c motor generator as furnished with the earlier models of the TBS equipment and shows the relative order in which the various components of the unit are assembled. An external view of the same machine with its internal connections is given on the top of the page opposite. The schematic circuit of the machine and the magnetic controller used with it are given at the end of this section. These schematics will be of particular value when checking for continuity of circuits in the machine and for checking connections should it be necessary to dismantle the units for repairs or replacements. For that reason schematic circuits are given for all the types of motor generators used with TBS equipment.

Proper care of the motor generators is invariably repaid by long continued service without interruption and the first signs of trouble in the machines should be corrected without delay. Cleanliness, proper lubrication and care of the brushes if adhered to will result in perfect operation of the equipment at all times. This should be taken care of in preventive maintenance but in case of the machine showing distress by heating, these are the first points that should receive attention. Details of brush care are given in Section 5, page 13, and a lubrication chart will be found there on page 12. Check also to be sure the machine is getting proper ventilation and that the inlet air screens on the ends of the machines are not fouled up with dirt or paper drawn against the screens by the inrush of cooling air.



REPLACEMENTS AND REPAIRS TO MOTOR GENERATORS

In event of failure within the motor generator itself it should be disconnected from the magnetic controller, the machine unbolted from its mounting and moved to a bench or table to facilitate the repairs. In removing either of the end shields of the machine it will be necessary to disconnect the leads from the brush holders after the end shield has been loosened and pulled from the field housing a short distance permitted by the slack in the connecting wires. Do not strain these wires too much in the process.

It is well to remember that in d-c machines it is not necessary to remove the bearings from the motor end shield to remove the shield. In the a-c machine the screws holding the bearing retaining plate must be removed before removing the end shield as the bearing is a press fit on the shaft. This is also true of the generator bearings on all the machines.

MOTOR BEARING

To replace the bearing at the motor end of d-c machine:

Remove the four motor brushes and speed regulator brush in end shield of motor.

Remove the motor speed regulator.

Loosen the set-screw in the regulator brush contact ring, remove the ring from the brush-holder and disconnect the ring from wire by unsoldering.

Remove the four bolts from the motor end shield and loosen the latter from the stator frame. The rabbet fit at this joint may be broken by prying in the slots at the bottom with a heavy screwdriver and tapping at the top with a rawhide mallet.

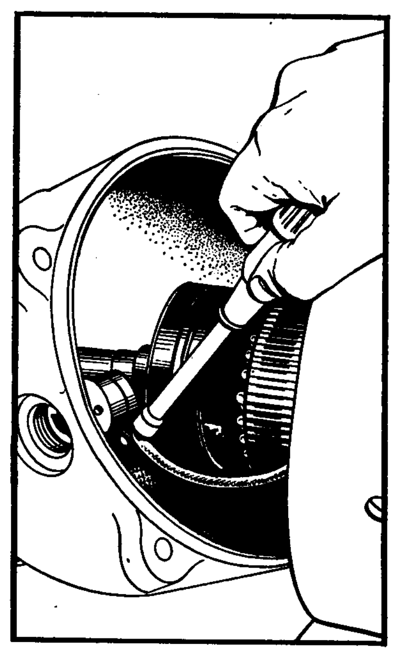
Withdraw the end shield until further motion is prevented by the internal leads (about two inches), then rotate the end shield 90 degrees and loosen the internal clamp which secures two leads against the frame.

Using a straight socket wrench, loosen the contact ring clamps on the two large brushholders and detach the clamps permitting access to connections to smaller brushholders for slipring brushes.

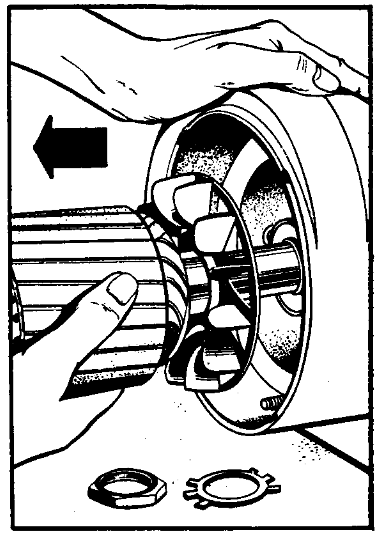
Remove the end shield completely from the motor shaft and place it at one side in a position affording access to the interior.

Remove the bearing retainer plate in end shield (held by four screws) and lift out the bearing. Note the shims and springs behind the bearing.

Insert the new bearing in position and assemble the machine in the reverse sequence.



MOTOR ARMATURE



To replace the motor armature:

Remove the four motor brushes.

Remove the motor speed regulator.

Remove the four nuts and lockwashers from the generator end shield and loosen the motor stator frame from the fan housing. It may be necessary to tap the frame and housing with a rawhide mallet to break the rabbet fit at this joint.

Slide the stator back over the armature until it is free from the machine.

Straighten the two bent-over teeth of the large lockwasher on the armature shaft and remove the large nut and lockwasher.

Slip the armature off the shaft, exercising care not to lose the two small, half-round shaft keys. The fan is attached to and is removed with the armature from the shaft.

Install the new armature and assemble the machine in the reverse sequence.

MOTOR FIELD COILS

To replace the main commutating field coils in the motor:

Remove the four motor brushes.

Remove the motor speed regulator.

Remove the motor end shield.

Remove the stator frame.

Detach the pole piece supporting the defective coil by removing the associated two large screws through the stator frame, and remove the coil from the pole piece.

Observe the coil connections and disconnect leads as required to free the coil. Some leads connect to the brush-holders in the end shield and others to the field resistor.

Install the new field coil, making certain to replace connections in the original arrangement, and assemble the machine in the reverse sequence.

NOTE: The two main field coils as furnished with the spares are connected together and so may be replaced as a pair when necessary. If only one coil is required, these may be separated by cutting the common lead, soldering and taping the connection to the other coil in the machine when installed.

MOTOR FIELD RESISTOR

To replace the motor field resistor located in the field assembly follow this procedure.

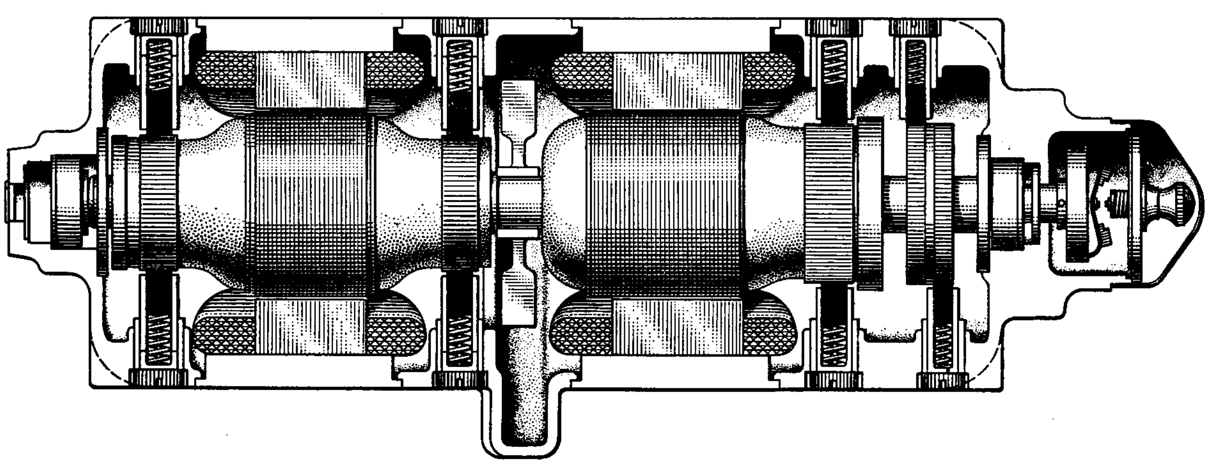
Remove the four motor brushes.

Remove the motor speed regulator.

Remove the motor field housing.

Detach the resistor by disconnecting the leads and removing the nut, lockwasher and bolt from the support clamp.

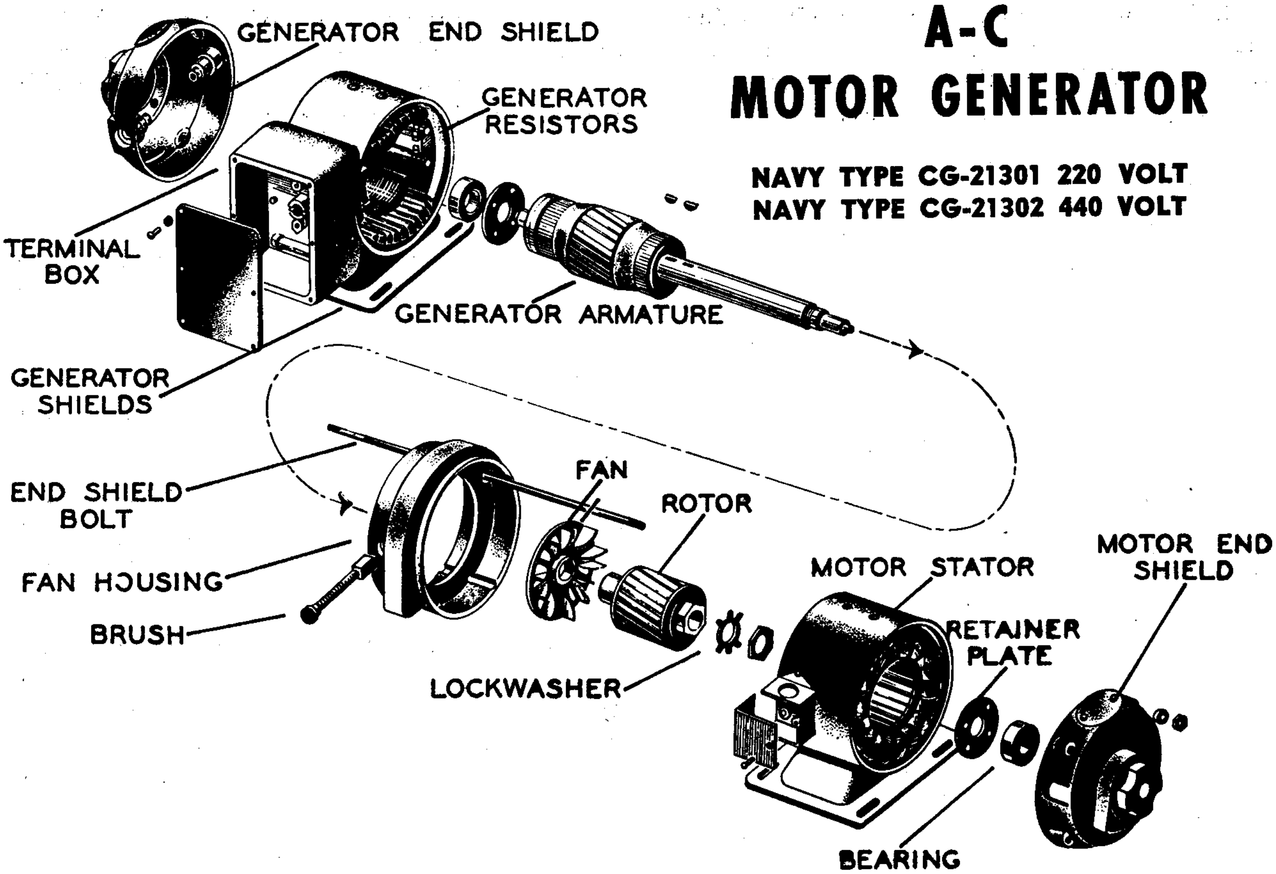
Insert the new resistor and assemble the machine in the reverse sequence.



CUT-AWAY VIEW OF D-C MOTOR GENERATOR

A-C MOTOR GENERATOR

NAVY TYPE CG-21301 220 VOLT
NAVY TYPE CG-21302 440 VOLT



The a-c motor generators furnished with the earlier models of the TBS Series are very similar in appearance to the d-c machines as will be seen in the exploded view above. The generator end is identical in appearance, but the conventional stator and squirrel cage rotor is used at the motor end of the machine. It will be noted that the fan in this model is not attached to the rotor but is mounted on a short sleeve that keys to the shaft. The rotor is demountable for replacement as in the case of the d-c motor generators previously described. No speed regulator is required as the motor speed is determined by the frequency of the supply current which should be 60 cycle to obtain the specified speed of 3400 rpm.

The method used to dismantle this equipment for repair parallels closely that described in connection with the d-c units. One chief difference to bear in mind is that the bearings on both ends are press fits on the machine shaft and the retaining plate holding them in the end shield must be loosened before the end shield can be removed from the machine.

MOTOR BEARING

To replace the bearing at the motor end:

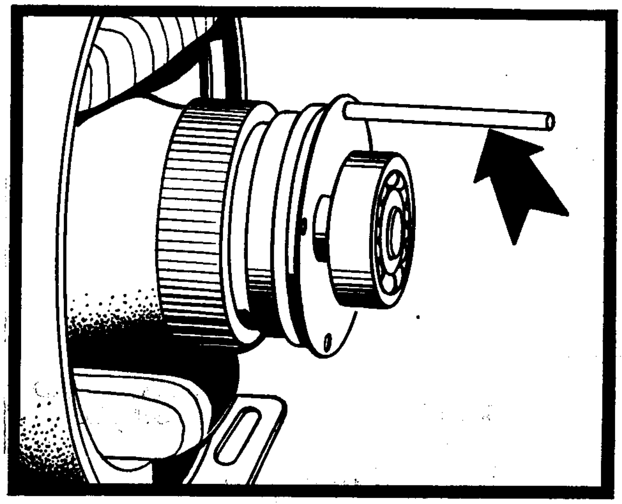
Remove the four small screws from the bearing housing on the motor end shield, releasing the bearing retainer on the armature shaft.

Remove the four bolts and lockwashers holding the motor end shield and detach the latter from the stator frame. Slots to enable prying off the end shield are located under two small plates, one on each side, held by two screws.

Remove the bearing from the armature with wheel puller to prevent damage to shaft.

Note the shims and springs inside the bearing housing.

Install the new bearing on the motor shaft, making certain that the bearing retainer and gasket are left on the shaft behind the bearing, and assemble the machine in the reverse sequence.



NOTE: To facilitate locating the small holes in the bearing retaining plate while assembling the machine. Align the holes in the gasket and bearing retainer plate and screw a long 8-32 stud into one of the holes in the plate as shown in illustration. Insert this stud into one of the holes in the end shield as the latter is being put into place and the holes will line up correctly for the insertion of the holding screws through the end shield.

MOTOR STATOR

To repair the motor stator: Remove the motor end shield.

Remove the four nuts and lockwashers from the generator end shield and loosen the motor stator frame from the fan housing. It may be necessary to tap the frame and housing lightly with a raw-hide mallet to break the rabbet fit at this joint.

Slide the stator back over the rotor until it is free from the machine.

Repair or re-wind the defective stator coil and assemble the machine in the reverse sequence.

MOTOR ROTOR

To replace the motor rotor.

Proceed as above and remove the motor stator.

Straighten the two bent over teeth of the large lockwasher on the motor shaft and remove large nut and lockwasher.

Slip the rotor off the shaft, leaving the fan in place.

Place the new rotor on the shaft, engaging the long key holding the fan sleeve in position and after replacing lockwasher and nut on the shaft, assemble the machine in the reverse order.

GENERATOR REPLACEMENTS AND REPAIRS

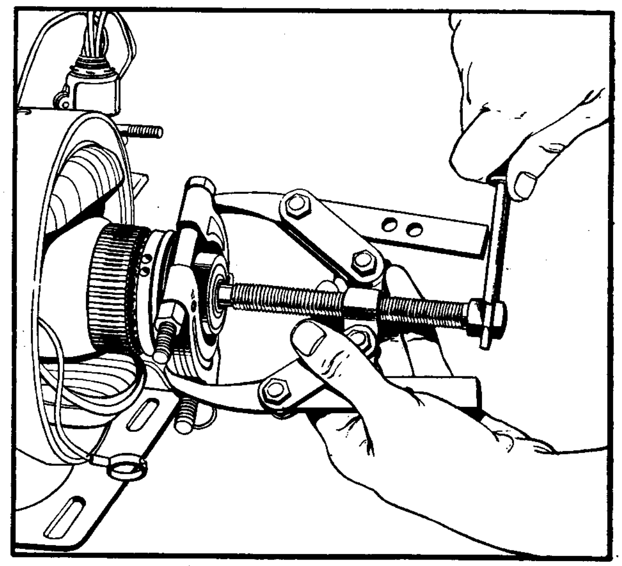
Since the generator end of both a-c and d-c machines are similar the following instructions apply to both types of motor generators.

To replace the bearing at the generator end:

Remove the two brushes from the generator end shield.

Remove the four small screws and lockwashers from the bearing housing on the generator end shield, releasing the bearing retainer on the armature shaft.

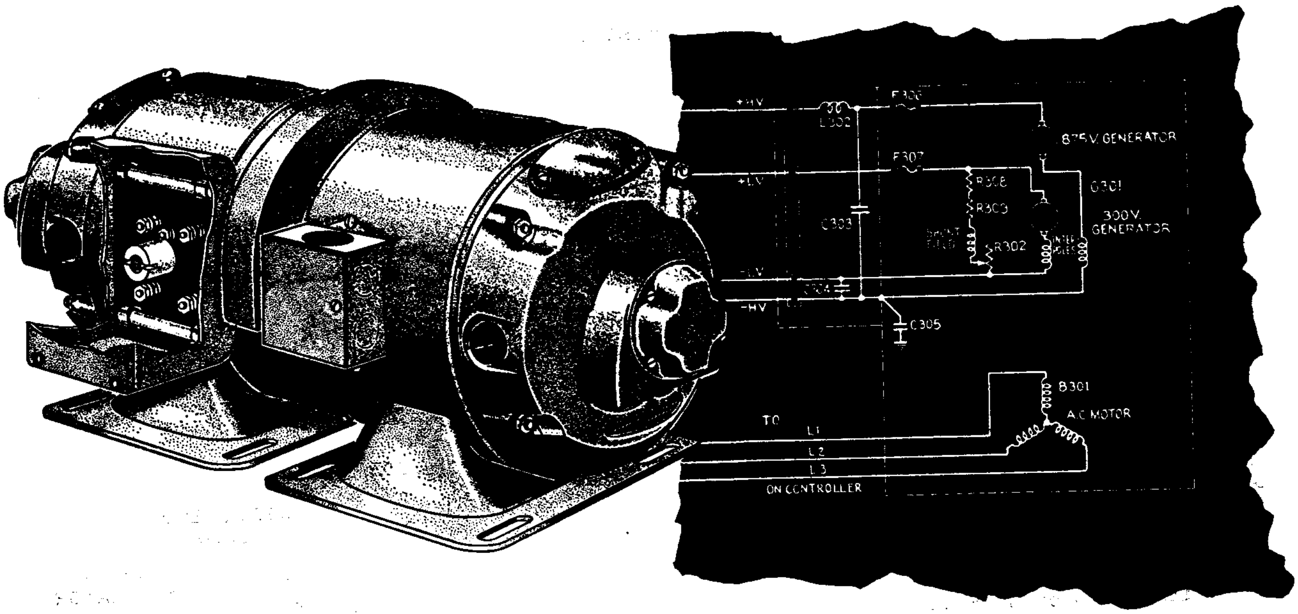
Remove the four nuts and lockwashers from the generator end shield and loosen the latter from the stator frame. The rabbet fit at this joint may be broken by prying in the slots at the bottom with a heavy screwdriver and tapping at the top with a rawhide mallet.



Slide the end shield off the armature after disconnecting lead to brush-holders and place it at one side of the machine. Note the shims and springs inside the bearing housing.

Remove the bearing from the armature, using a suitable bearing puller to disengage the press fit on the shaft as shown in illustration.

Install the new bearing, tapping it into place on the shaft with a hammer and wood block, and assemble the machine in the reverse sequence.



GENERATOR ARMATURE

To replace the generator armature:

Remove the motor armature or rotor.

Remove the generator end shield.

Remove the two brushes from the fan housing.

Withdraw the generator armature from the generator end.

Insert the new armature and assemble the machine in the reverse sequence.

GENERATOR FIELD RESISTOR

To replace the generator field resistor:

Remove the generator end shield.

Disconnect the leads to the resistor at the open end of the machine.

Remove the two screws which pass through the stator frame into the insulation strip supporting the resistor and withdraw the resistor assembly from the machine.

Remove the defective unit (or both units if the two are damaged) and install the new unit or units in the assembly.

Insert the repaired assembly and assemble the machine in the reverse sequence.

GENERATOR FIELD COILS

To replace the main or commutating field coils in the generator:

Remove the generator.

Remove the fan housing from the generator field frame, breaking the rabbet fit at this joint by tapping the former lightly with a rawhide mallet, disconnecting leads from brush-holders in fan housing.

Detach the pole piece supporting the defective coil by removing the associated two large screws through the stator frame, and remove the coil from the pole piece.

Observe the coil connections and disconnect leads as required to free the coil. Some leads connect to the brush-holders in the fan housing and in the end shield, some to the field resistor, and others to the terminal board in the junction box on the field frame. To detach leads from the terminal board, remove the box cover plate (held by six screws) and take out the four screws which secure the board inside the box. The board may now be withdrawn sufficiently to afford access to the rear for removal of the terminal lugs.

Install the new field coil, making certain to replace connections in the original arrangement, and assemble the machine in the reverse sequence.

NOTE: The main field coils for the generator, as in the case of the motor, are connected together as furnished with the spares.

If preferred, the generator field coils may be replaced without disassembling the machine to the extent indicated above. This method, however, involves cutting and splicing the leads to the brush-holders in the fan housing and so should be adopted only in cases where time is an important factor. Proceed as follows:

Remove the generator end shield.

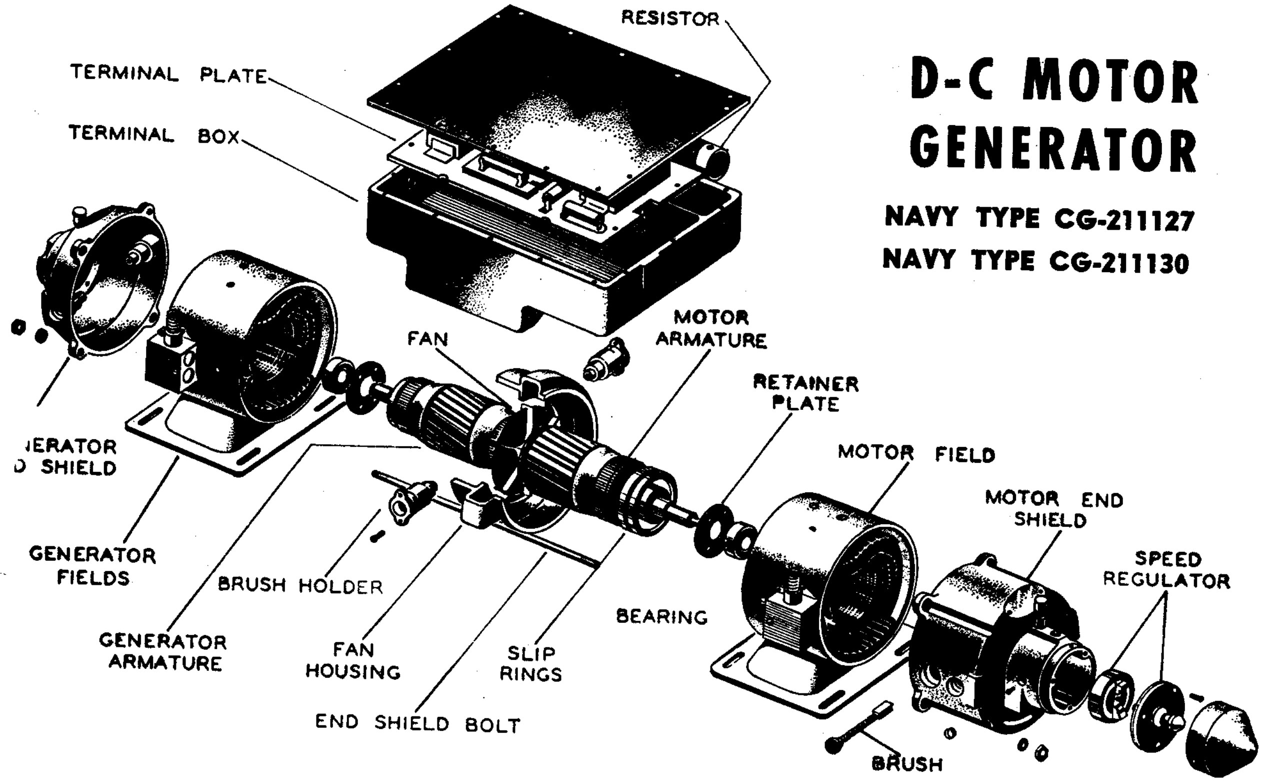
Loosen the rabbet fit between the generator stator frame and the fan housing by tapping at this joint with a rawhide mallet and slide the stator back over the armature until further motion is prevented by the leads to the brush-holders in the fan housing.

Cut the brush-holder leads and remove the stator completely from the armature.

Replace the defective field coil as indicated in the above procedure and assemble the machine in the reverse sequence.

D-C MOTOR GENERATOR

NAVY TYPE CG-211127
NAVY TYPE CG-211130



The motor generators furnished with the later models of the TBS Series are fitted with a terminal case on top of the machine, as will be noted from the illustration on the opposite page in which are mounted all the resistors and filter components of the unit. This permits the rapid testing of the circuits in the machine in case of failure and the replacement of the resistors with a minimum of trouble.

The exploded view of the d-c machine given above shows the relative position of the various parts of the machine. This motor generator differs in some details from the earlier type aside from terminal arrangement. The two armatures are rigidly attached to the shaft and must be replaced as a unit. The fan is of split construction and is removed by loosening the four screws that hold it in position on the shaft. External through bolts are used to clamp the unit together and grease cups provided on the bearings for lubrication.

The speed regulator on this machine is similar to that used on the earlier model, differing only in the control knob and discussed in that connection. It may be removed from the machine as described in the previous section for servicing or repair.

When major trouble develops inside a machine it should be disconnected and placed on a work bench to facilitate the work of dismantling. Removing the cover of the terminal box on top of the machine gives ready access to the resistors, chokes and capacitors used in the circuit. Examination and replacement of these components represent no difficulty.

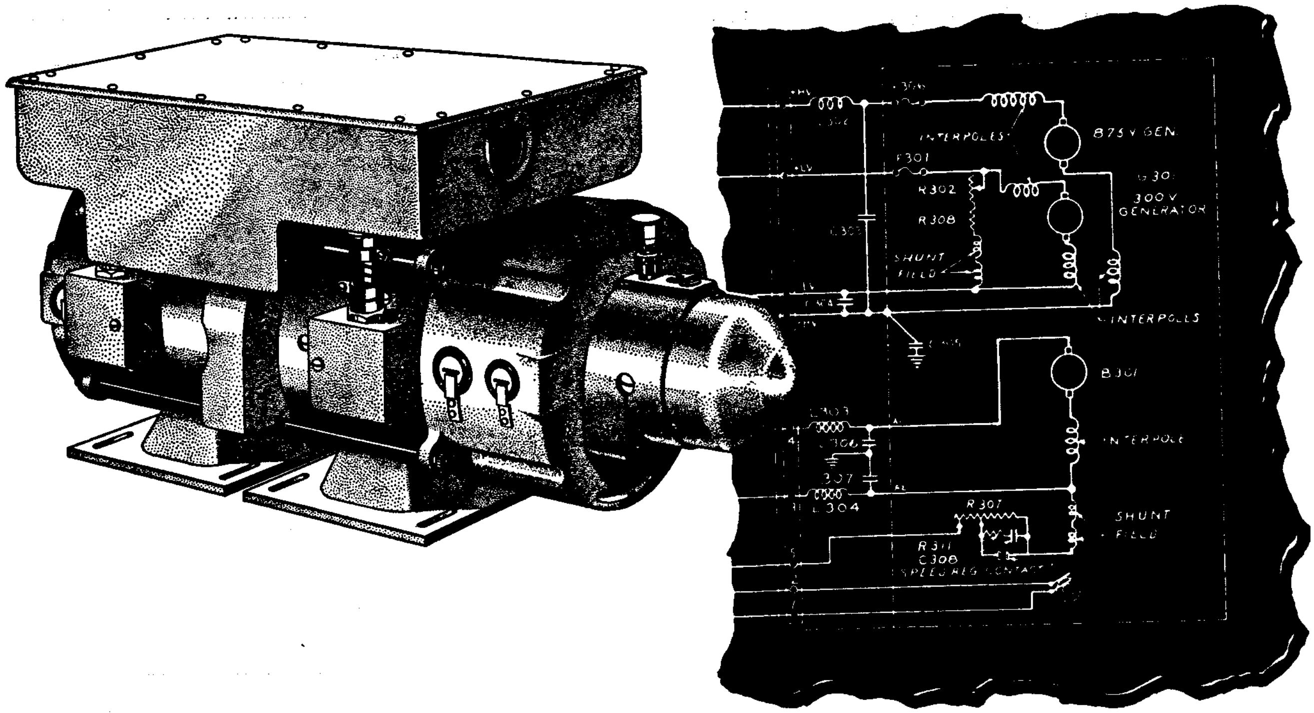
MOTOR BEARING

To replace the motor bearing, remove cover plate on speed regulator and remove speed regulator knob plate and weight mechanism as described in connection with the earlier type of d-c motor generator.

Remove the four brushes in the motor end shield. Loosen setscrew in brush holder contact ring in regulator housing and unsolder head from ring.

Remove nuts and lockwashers from through bolts holding machine together and loosen end shield. Tapping the lugs for the through bolts with a mallet will break the rabbet fit of the end shield.

Withdraw end shield until further motion is prevented by leads. Then remove leads from brush holders with straight socket wrench. This will free the end shield further so the leads may be removed from slip ring brush holders, and contact stud that extends into the speed regulator housing.



The end shield may now be removed, and the lead to the regulator brush holder pulled through the hole in the casing.

The bearing will be found in the end shield and can be removed by loosening the four screws holding the bearing retaining plate.

Insert the new bearing, making certain to replace the gasket and retaining plate in the proper order when fastening the plate in place with the four screws.

Assemble the machine in the reverse sequence, passing the lead to the speed regulator brush through the hole in the end of the end shield when replacing the motor end shield.

GENERATOR BEARING

To replace the bearing on the generator end of the machine it is necessary to remove two brush locking devices and brushes from the end shield.

Remove the four screws holding bearing retaining plate in place.

Remove four nuts and lockwashers from the through bolts holding the machine together.

The end shield may be loosened by tapping the lugs passing the through bolts and withdrawing end shield until the leads can be disconnected from the brush holders inside the shield.

Remove the end shield and the bearing will be found on the shaft.

Pull bearing from shaft with wheel puller as shown previously. Install new bearing on shaft by tapping it gently into place with wood block and hammer or rawhide mallet. Be sure the bearing retainer plate and gasket are in place on the shaft behind the bearing and that spring and washers have not fallen out of bearing recess in end shield.

Assemble machine in reverse order. A long stud threaded into one of the holes in the bearing retainer will be of great aid in aligning the holes in plate and end shield for replacing the screws as mentioned in connection with replacing generator bearings in the earlier models.

FIELD WINDINGS

Should trouble develop in the field windings of the motor generator it will be necessary to dismantle the entire assembly. This requires the removal of the terminal case on the top of the unit which is attached to both motor and generator field housings. Since this will require the disconnecting of the wires to motor and generator, the illustration showing the terminal box and connections within the machine is provided on the following page.

To remove the terminal box, disconnect leads to large resistors and remove mounting screws; the resistor may then be removed from the case.

Remove five screws holding the terminal plate in the case.

Disconnect all leads from the machine units to the terminal plate. This will mean the removal of some terminal posts and the unsoldering of leads. Mark the terminal plate where leads have been disconnected with the number marked on the wire disconnected. Remove terminal plate.

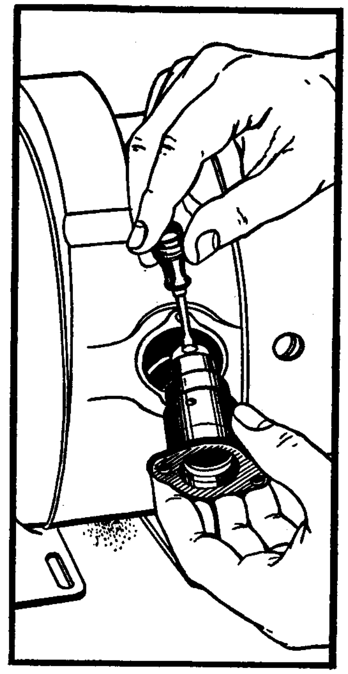
Remove the four stud bolts holding the terminal case to machine housings and lay aside cork pads found under the box.

Disconnect the clamps holding the short lengths of flexible tubing connecting terminal case with small boxes on the side of the units.

Remove terminal box, sliding the wires through the holes in the bottom of the box. Either end of the machine may be removed as found necessary by first removing the brush retainers, brushes and end shield from that portion. Then by prying between the mounting plates of the machine and tapping the housing either motor field or generator field may be removed.

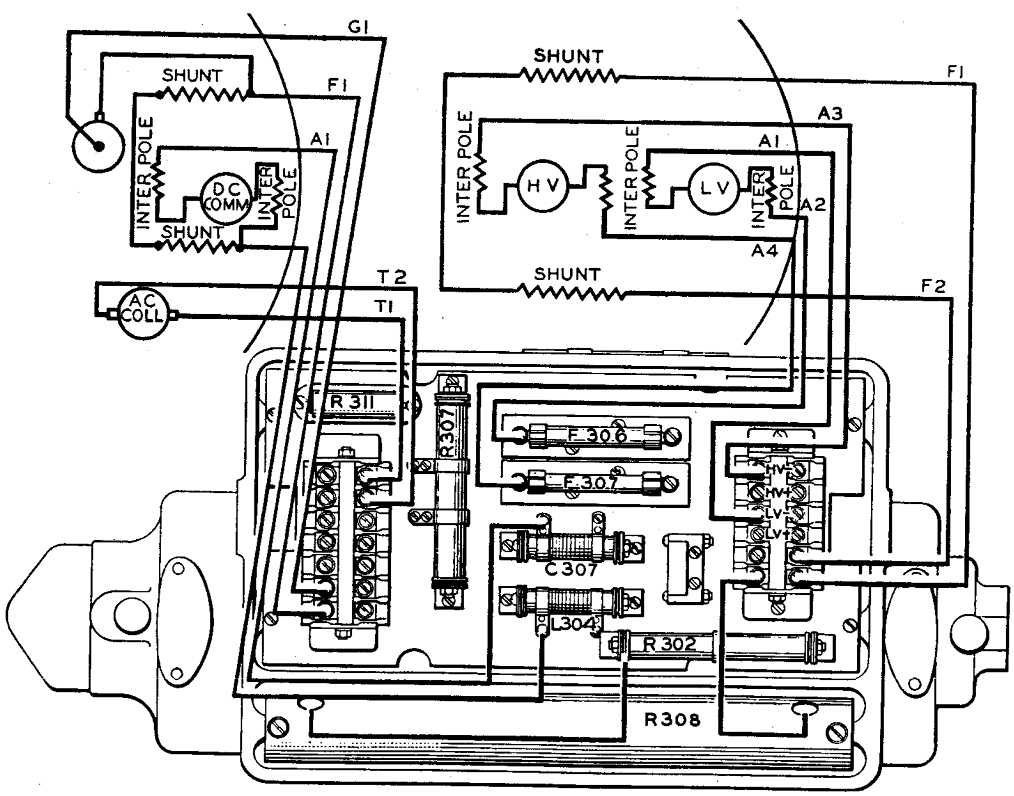
Shunt or interpole field windings can then be replaced by loosening the screws attaching the field core involved to the housing and removing from machine.

In the case of the generator field coils it may be necessary to disconnect the leads from the brush holders in the fan housing. This is done by removing the two screws holding the brush holders in place on the outside of the fan housing, pulling out the holder and disconnecting the lead as shown in the illustration.



In removing the old or defective coils careful attention should be given to the relative position of the several leads from the windings so the new coils may be installed with the correct polarity and connection made to the proper terminals. As an aid in this direction it is advisable to make a sketch showing the position of all leads to the coils before removing them from the polepieces.

The machine is to be assembled in the reverse sequence after repairs are made. In case of any doubt as to how the wires are to be reconnected to the terminals, reference can be made to the terminal box diagram where all wire markings are given.



ARMATURE

To replace the armature in this unit the following procedure is to be observed:

Remove speed regulator mechanism.

Remove terminal box as described above.

Remove all brush retainers and brushes.

Remove brush holders from fan housing and disconnect leads.

Remove end shield from generator after removing four screws in bearing retaining plate and removing four nuts and lockwashers on holding bolts.

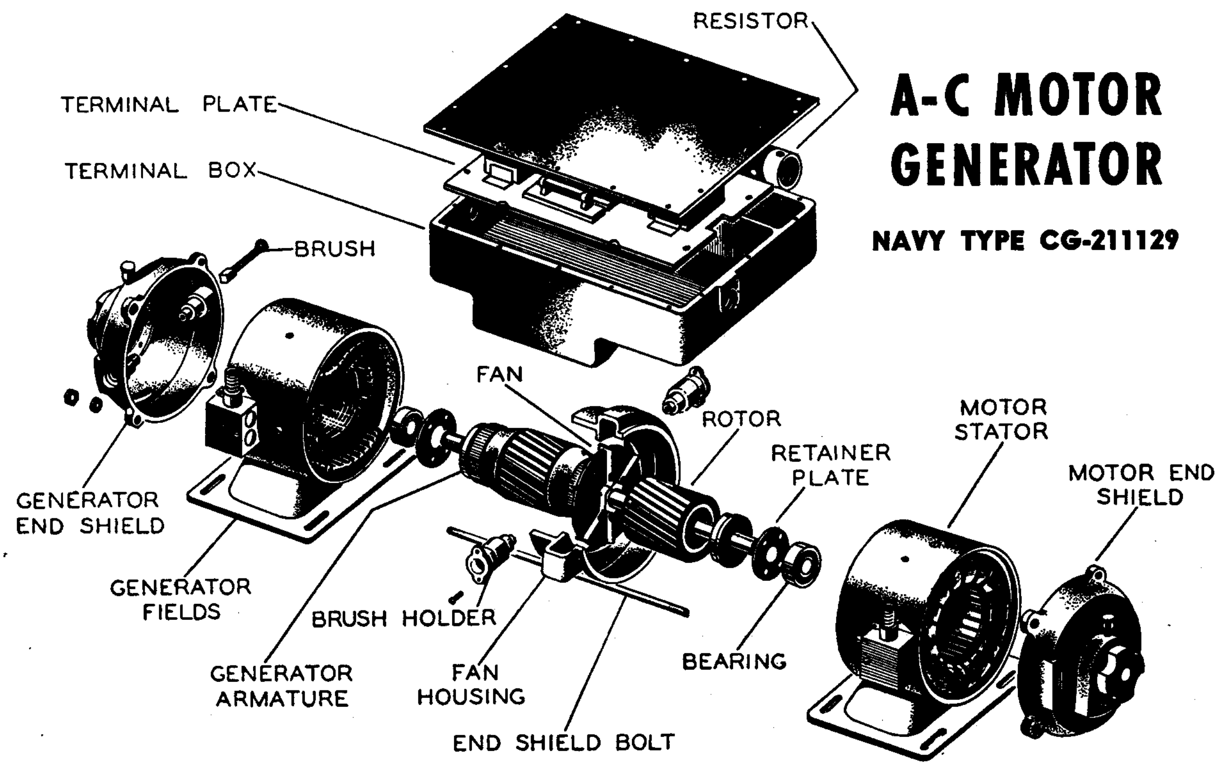
Break rabbet fit between generator field house and fan housing by prying between base plate of the two units and slide generator fields over armature.

The armature can then be pulled out of the motor housing, leaving the bearing in the motor end shield in place.

Protect the bearing on the generator end from dust and dirt, if the bearing is to be put back, while repairs are being made to the armature.

If a new armature is to be installed, the fan may be removed from the defective armature by loosening the four screws in the hub and installing on the new armature in exactly the same position it occupied in the part being discarded.

To reassemble the machine, the armature is slipped into the motor housing, the shaft being inserted through the bearing and the remainder of the machine assembled in the reverse order of the above.



A-C MOTOR GENERATOR

NAVY TYPE CG-211129

The illustration above shows an exploded view of the a-c operated motor generator of the type furnished with the latter models of the TBS Series. It too, has a terminal case mounted on top of the machine mounting the resistors and filter units used with the machine. The machine assembled is shown on the next page.

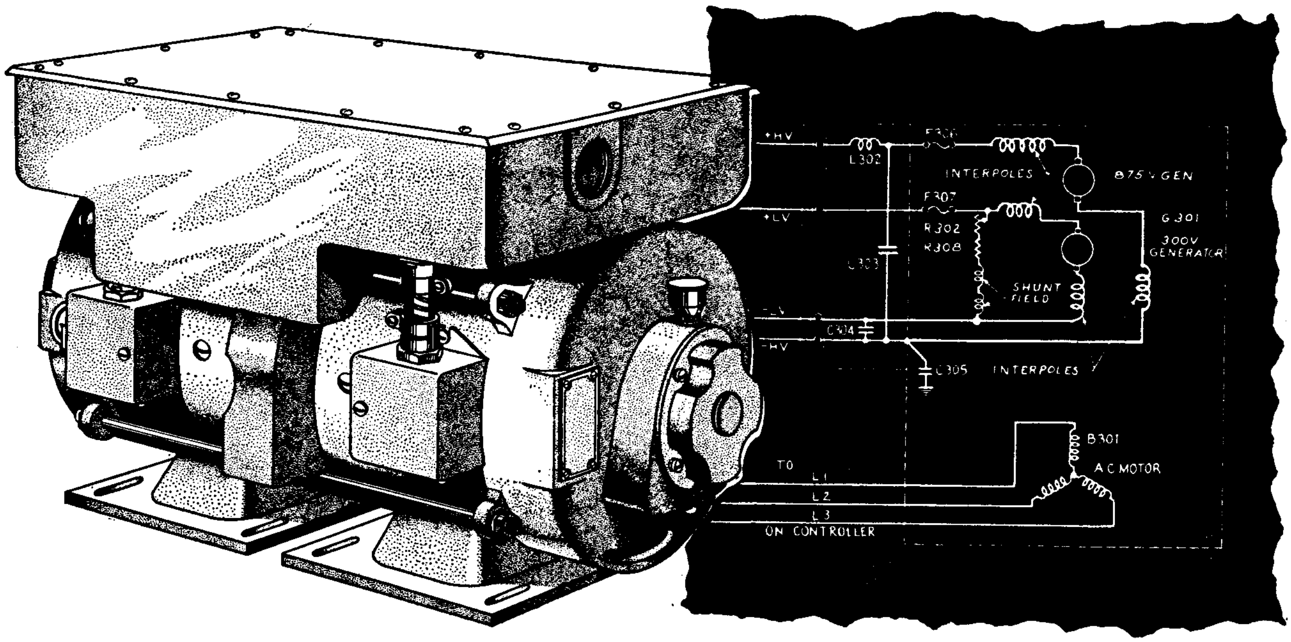
The motor is of the usual wound stator and squirrel cage rotor type which requires no brushes. There are only four brushes used in the entire machine, they being located at the generator end. The absence of brushes in the motor end simplifies replacement of defective parts in the machine.

MOTOR BEARING

To replace the bearing at the motor end it is necessary to remove the four screws in the end holding the bearing retaining plate.

Remove the four nuts and lockwashers on the through bolts of the machine and tap the lugs on the end shield lightly to loosen it for removal.

Pull the bearing from the shaft with a gear puller.



Mount the new bearing on the shaft, tapping it into place gently with a block of wood and a hammer.

In preparation for replacing the end shield, screw a stud into one of the holes in the retaining plate as previously described and replace the end shield, fitting the stud into one of the screw holes in the end shield to align the holes in the bearing retaining plates with holes in the end shield.

GENERATOR BEARING

To replace the bearing on the generator end, the brush retainer and brushes are removed from the end shield.

Continue as described previously by removing retaining plate screws and nuts from through bolts.

Tap end shield loose and disconnect leads from brush holders, removing shield completely from generator.

The bearing can then be pulled off the shaft and a new bearing mounted.

Use a long stud in reassembling the end shield in the reverse sequence given above.

STATOR WINDING

Should it become necessary to replace or repair the stator winding of the motor, the procedure is as follows:

Remove terminal box on top of the machine in the manner described in connection with the d-c motor generator on page 43. A diagram of the connections of the terminal box and machine units is shown below.

Remove end shield of motor.

Tap motor housing with a raw-hide mallet or pry between mounting pedestals of machine until stator breaks free of fan housing.

Slide stator free of rotor.

After repairing or replacing stator, the machine can be reassembled in the reverse sequence to the above.

GENERATOR FIELD WINDINGS

To replace or repair field windings of the generator it will be necessary to first remove the terminal box on top of the machine.

Remove the four brushes in the generator end shield and fan housing.

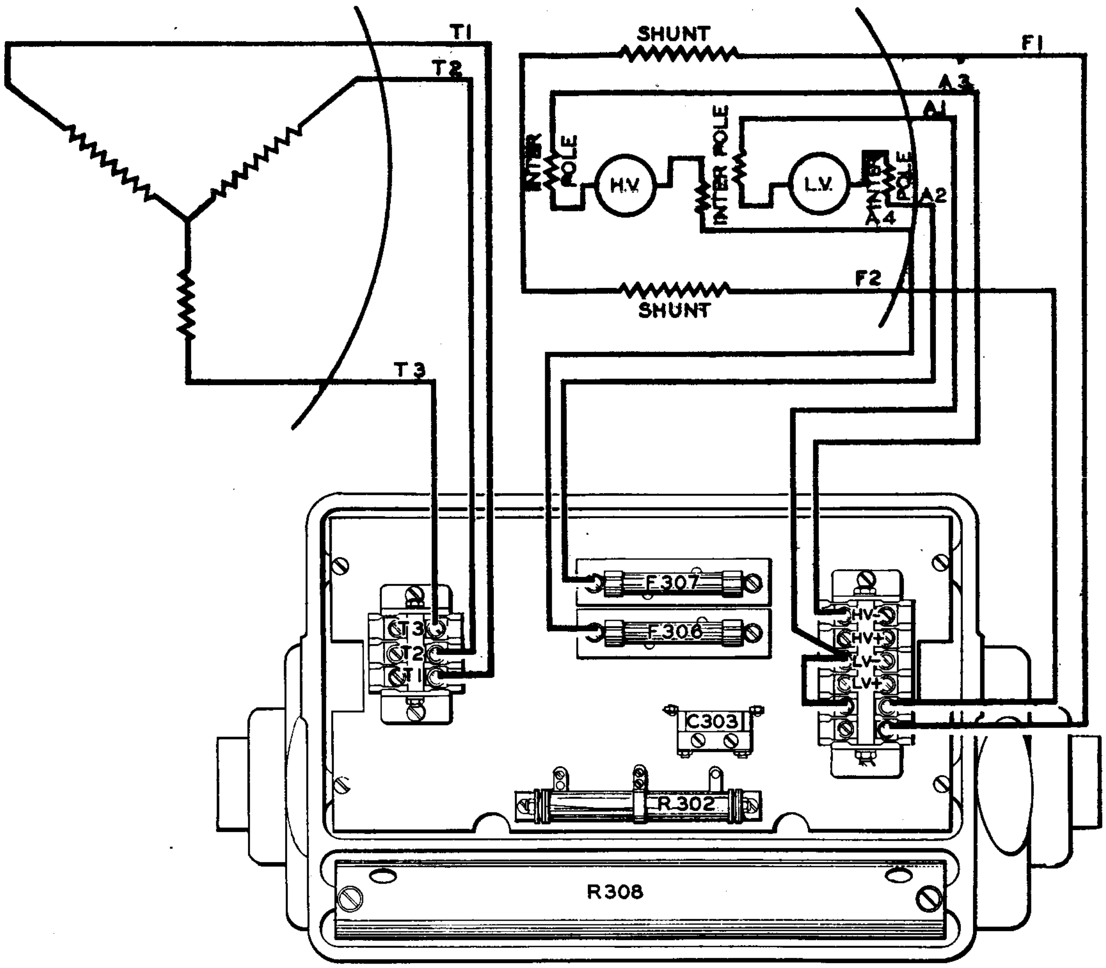
Remove the two brush holders in the fan housing and disconnect the leads.

Remove the four screws holding the bearing retaining plate and the four nuts holding the end shield in place, then remove the end shield.

The generator field housing may now be removed from the fan housing and slid off over the armature.

Replace or repair the coils as necessary, detaching the pole pieces by removing the associated screws holding them in place.

The machine is reassembled in the reverse sequence.

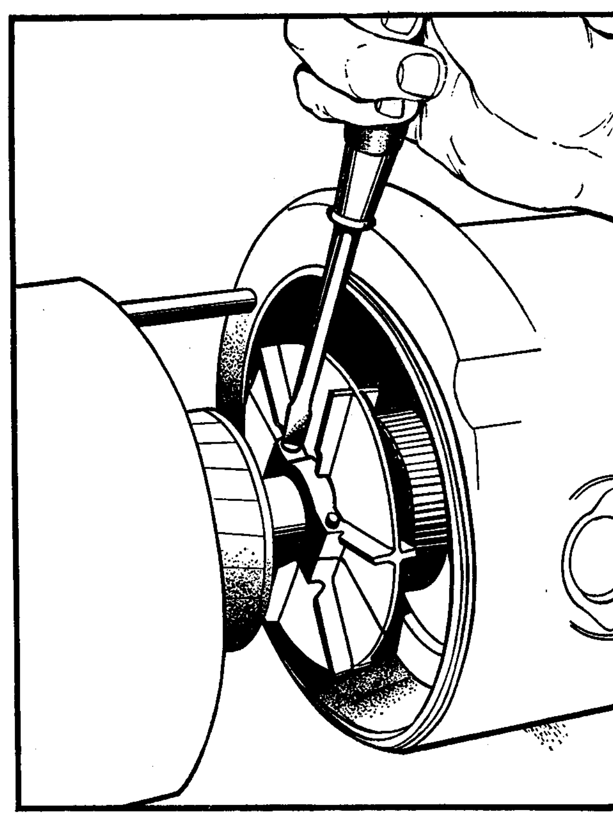


REPLACING ARMATURE

The replacing of a defective armature or its removal for repair requires a complete dismantling of the motor generator. The procedure for replacing the generator field coils should be followed up to the point where the generator stator is slid over the generator armature.

Then it will be necessary to remove the end shield of the motor by loosening the screws in the retaining plate of the bearing at the motor end and tapping the end shield of the motor loose.

The armature can then be pulled from the motor housing and will have the bearings on the ends of its shafts. If necessary to shift fan to new armature it may be removed as shown.



After the necessary repairs have been made the machine can be reassembled in the reverse sequence.

OVERHAULING THE MOTOR GENERATOR

After two years of service the motor generator should be dismantled for complete overhaul, inspection and relubrication. It is good practice to inspect the machine thoroughly for the defects mentioned here whenever the unit is pulled apart for the replacement of minor parts.

Proceed to dismantle the machine according to the instructions given under the type of machine being overhauled. Inspect each part as it is removed, clean it carefully and place in a clean place under paper.

The brushes should be examined for chipped edges and discarded if found defective, particularly if the commutator shows signs of sparking having occurred during operation. A chipped brush, by reason of reduction in contact area is usually overloaded and may result in damage to the commutator.

The end shields should have old grease removed and be given a thorough cleaning with carbon tetrachloride. Examine for loose or broken brush holders or insulating bushings. Clean ventilation openings.

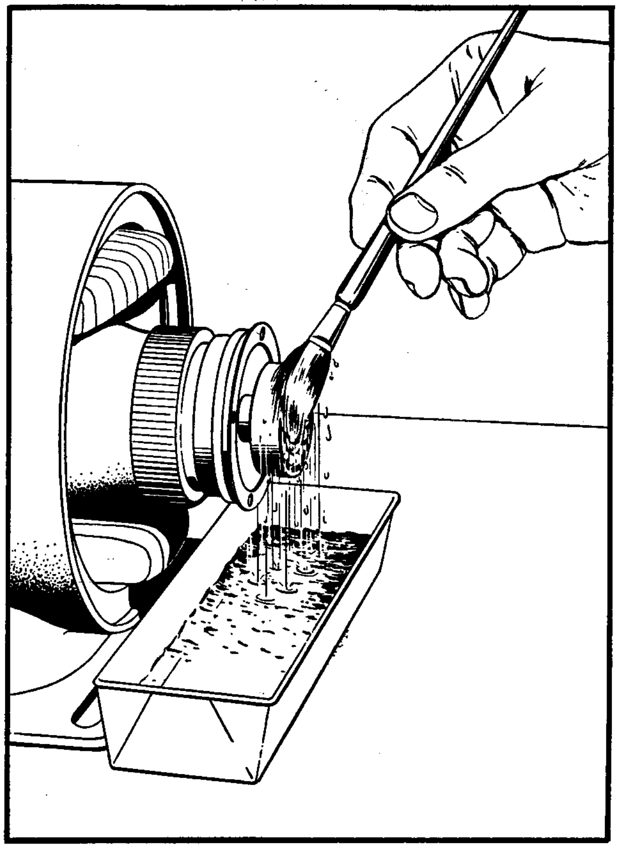
Examine field frames and stators for evidence of grease in the bottom of the frame. Remove dirt from the housing with a blower if available.

Remove grease with carbon tetrachloride if found in the housing. Check surface of windings for dry cracks that may indicate need of coating with insulating varnish. Make sure field coils are tight on the pole pieces so vibration will not wear insulation.

Inspect armature for high mica or burnt spots on the commutator and refinish if in rough or blackened condition. Do not disturb the finish if highly glazed regardless of how dark it appears. Wipe with cloth. Dust may be blown out of armature with bellows or blower.

Any signs of grease seeping out of the bearings should be noted and steps taken in reassembling to prevent it occurring again. Do not remove bearings from shaft unless they are to be replaced but wash all traces of old grease from the bearing by means of a brush and carbon tetrachloride as shown in the illustration. Wrap bearings in clean cloth to prevent entry of dust till ready to assemble the machine.

Check a-c rotors for loose or broken bars and d-c armature for loose wedge sticks that may allow loose coils. Replace or tighten.



In reassembling the machine, pack the bearings with grease meeting Navy Specification 14L3, grade C, just before putting end shields in place. If the machine has no grease cups, pack the recess in the end shield one-third full of grease. Should there be grease cups on the bearings, remove old grease from the cups and repack. After the machine is assembled, remove the grease plug from the bottom of the bearing housing and with machine running turn down cup till grease flows from plug hole. Wipe off any excess grease after machine has run several minutes longer and replace plug.

In reassembling the machine, take care not to force any parts and be certain bearing retaining plates in the end shield are pulled up snugly to prevent grease seeping into the machine. After putting the motor generator back into service watch it carefully for the first several hours of operation so any defects in assembly that might cause slight misalignment can be detected and go over the holding bolts again after unit is warmed up.

It will be necessary to readjust the speed control on the d-c units after reassembly according to directions given previously in this section. Voltage output should also be checked if parts have been replaced.

A trouble chart is appended to aid in remedying any defects noted in the operation of the power supply units.

BEARING DON'TS

DON'T REMOVE A NEW BEARING FROM ITS PACKAGE UNTIL READY TO INSTALL.

DON'T CLEAN NEW BEARINGS AS REMOVED FROM PACKAGE. PACKED BEARINGS ARE CLEANER THAN IT IS POSSIBLE TO MAKE THEM IN THE FIELD.

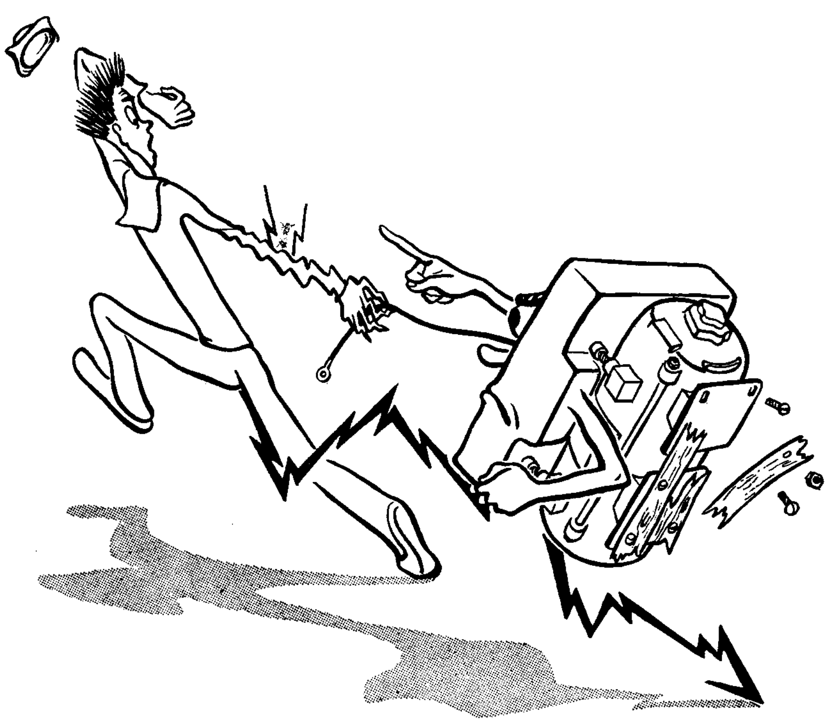
DON'T PULL A BEARING FROM A SHAFT UNLESS ABSOLUTELY NECESSARY AND THEN USE A WHEEL PULLER THAT WILL NOT APPLY PRESSURE TO THE OUTER RING OF THE BEARING.

DON'T FORGET TO TIGHTEN THE RETAINING PLATES ON THE BEARINGS, FOR A LOOSE PLATE LETS GREASE OUT AND DIRT IN.

DON'T APPLY PRESSURE TO THE OUTER RING OF THE BEARING WHILE REPLACING ON SHAFT.

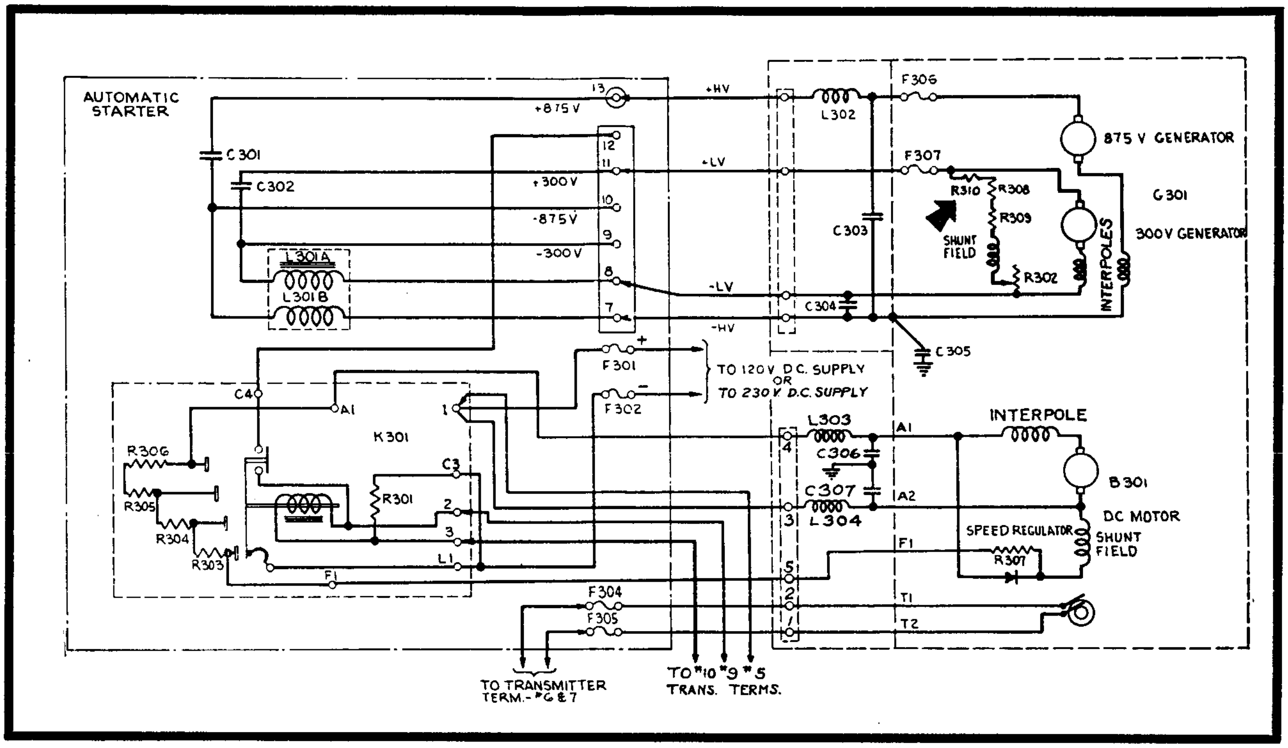
DON'T USE GREASE OTHER THAN NAVY SPECIFICATION 14L3 GRADE C.

DON'T FORGET TO KEEP THE STOCK OF SPARES IN SEALED PACKAGES AND UP TO FULL ALLOWANCE.

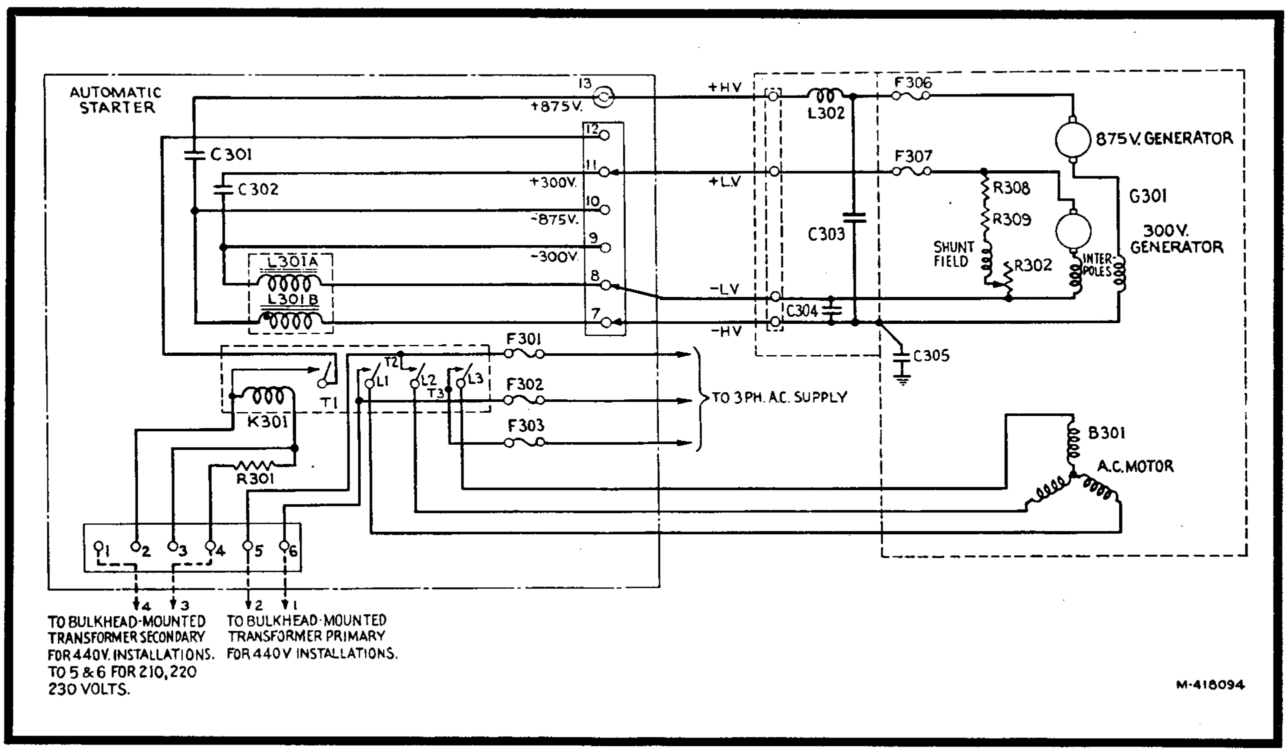


MOTOR GENERATOR TROUBLE CHART

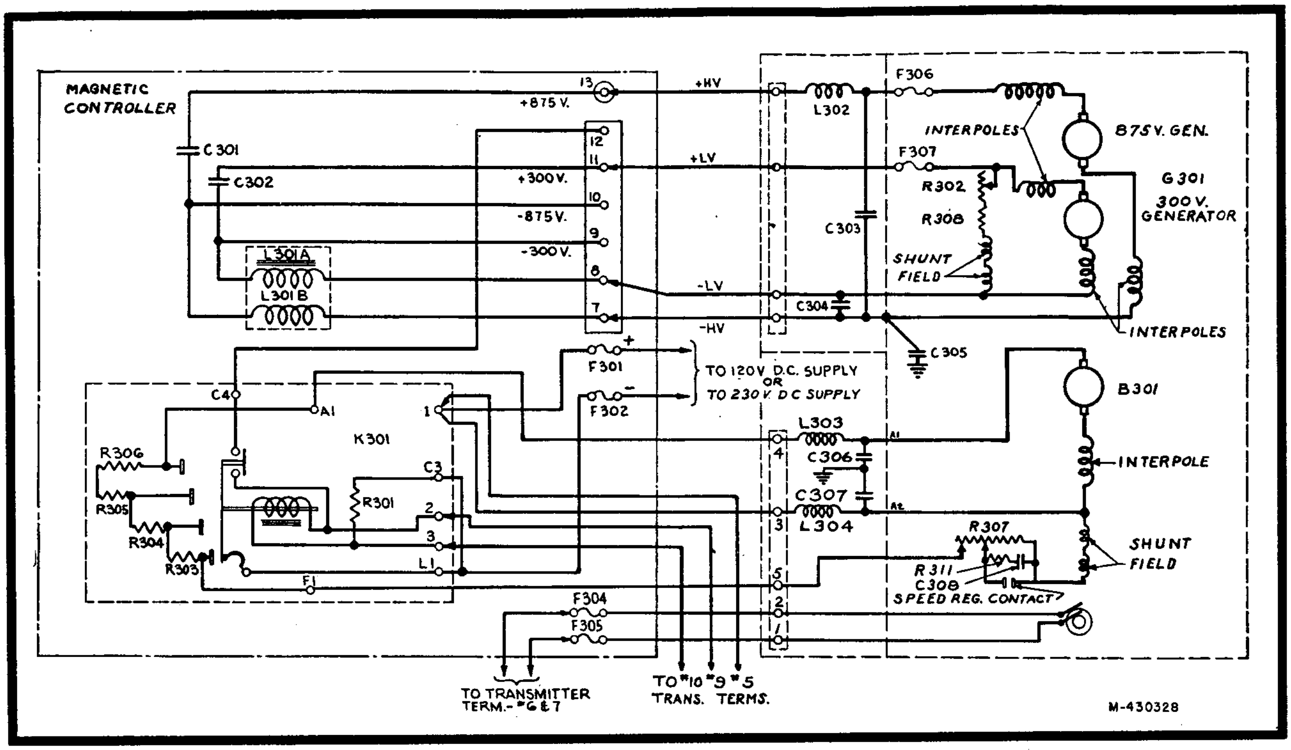
SYMPTOM	CAUSE
WILL NOT START	Power off. Check power supply and fuses. Loose connection in Magnetic Controller or control circuits.
FUSES BLOW	Machine locked. Try turning armature by hand. Field circuit open, check connections and test circuits in machine.
MACHINE NOISY	A-C machine running single phase. Check fuses and controller contacts. Excessive vibration due to loose mounting bolts, loose fan or bearings worn or broken.
RUNNING HOT	Restricted ventilation, clear air inlets and discharges. Incorrect voltage. Check voltage of supply current. Loose rotor bar. Shorted coil in armature. Check for hot spots after running a few minutes. Shorted coil in stator of A-C machine. Replace stator.
BEARINGS HOT	End shields loose. Tighten bolts. Worn or broken bearing. Replace. Bent shaft. Replace armature. Too much grease. Open drain plug and allow to work out. Foreign matter in grease. Purge bearing by forcing grease thru or remove and wash out with carbon tetrachloride and regrease. Bearings misaligned. Make certain retaining plates are tight on bearings.
RUNS TOO SLOW	Line voltage too low. Check with voltmeter. Speed regulator defective.
RUNS TOO FAST	Weak field, check for loose connections in controller and machine terminal box. Dirty contacts on D-C speed controller. Line voltage too high. Check.
BRUSHES SPARKING	Broken or sticking brushes. Replace or free in the holder. Brushes too short. Replace. Poor brush fit on armature. Replace. Insufficient pressure on brushes. Stretch spring or replace. Commutator in bad condition. Rough or eccentric. High mica or low bars. Remove armature and refinish commutator in lathe. Excessive vibration. Check mounting bolts. Weak field. Check connections for flying open circuits. Shorted coil in armature. Hot spots on armature after short run indicate this condition. Remove armature and repair or install spare.
BRUSH CHATTER OR HISSING NOISE	Excess clearance in brush holders. Replace brushes. High mica or uneven bars, usually accompanied by sparking. Remove armature and refinish commutator. Incorrect spring tension.
BRUSHES WEAR RAPIDLY	Rough commutator. Refinish. Excessive sparking. See causes under that heading.



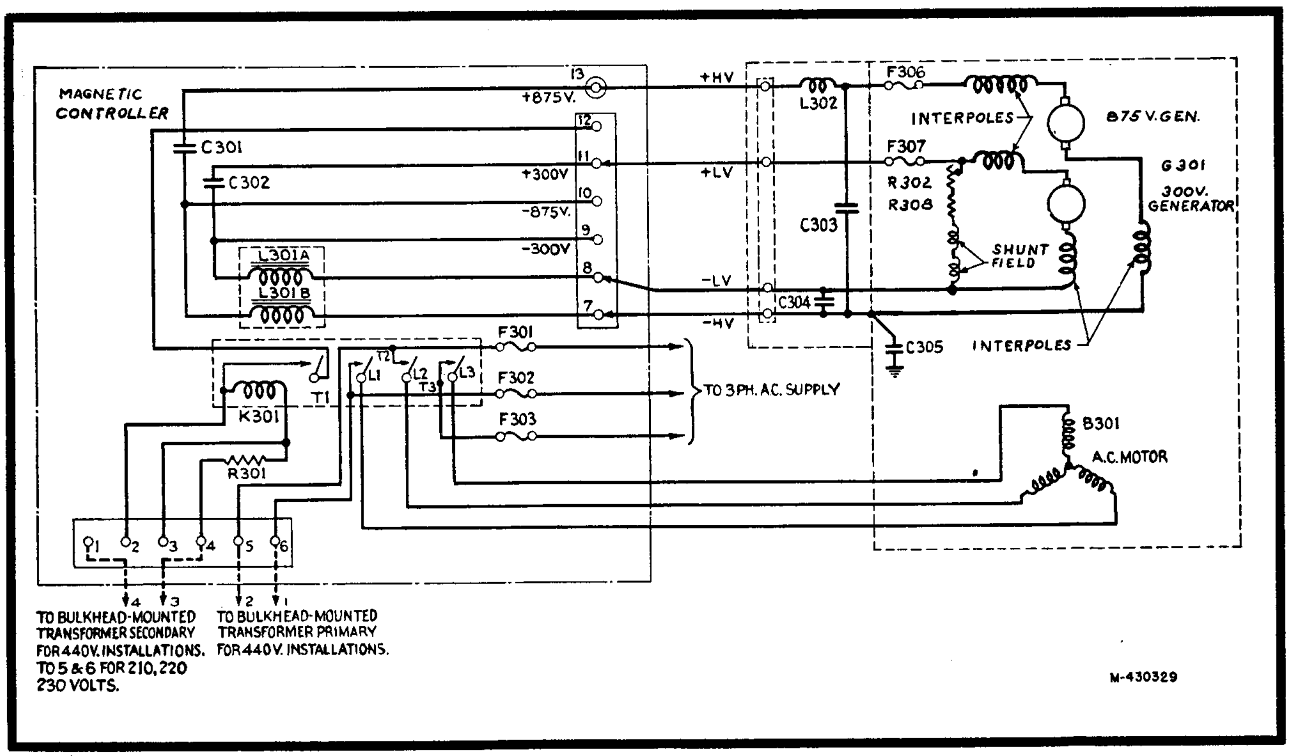
TRANSMITTER POWER SUPPLY, D-C, 120-230 VOLT (M 418309)
USED WITH TBS, TBS-1, TBS-2, TBS-3, TBS-4, AND TBS-5



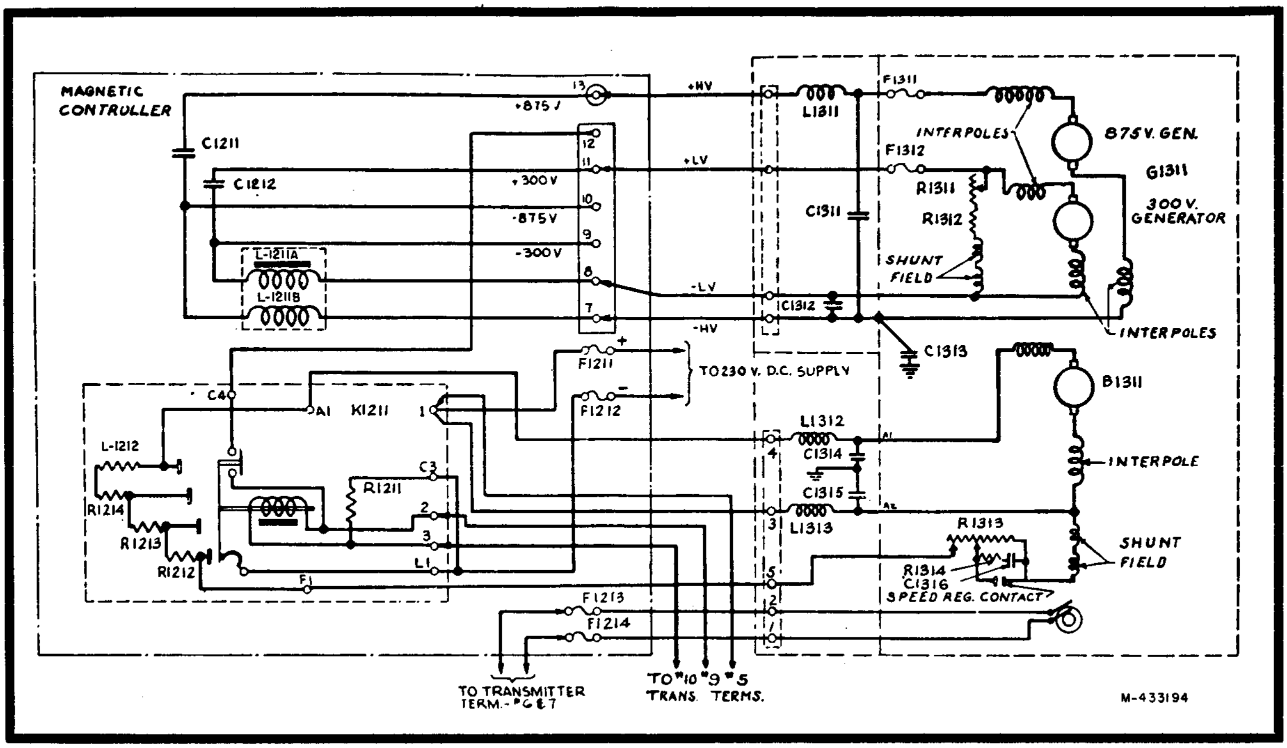
TRANSMITTER POWER SUPPLY, A-C, 220-240 VOLT (M 408094)
USED WITH TBS, TBS-1, TBS-2, TBS-3, TBS-4, AND TBS-5



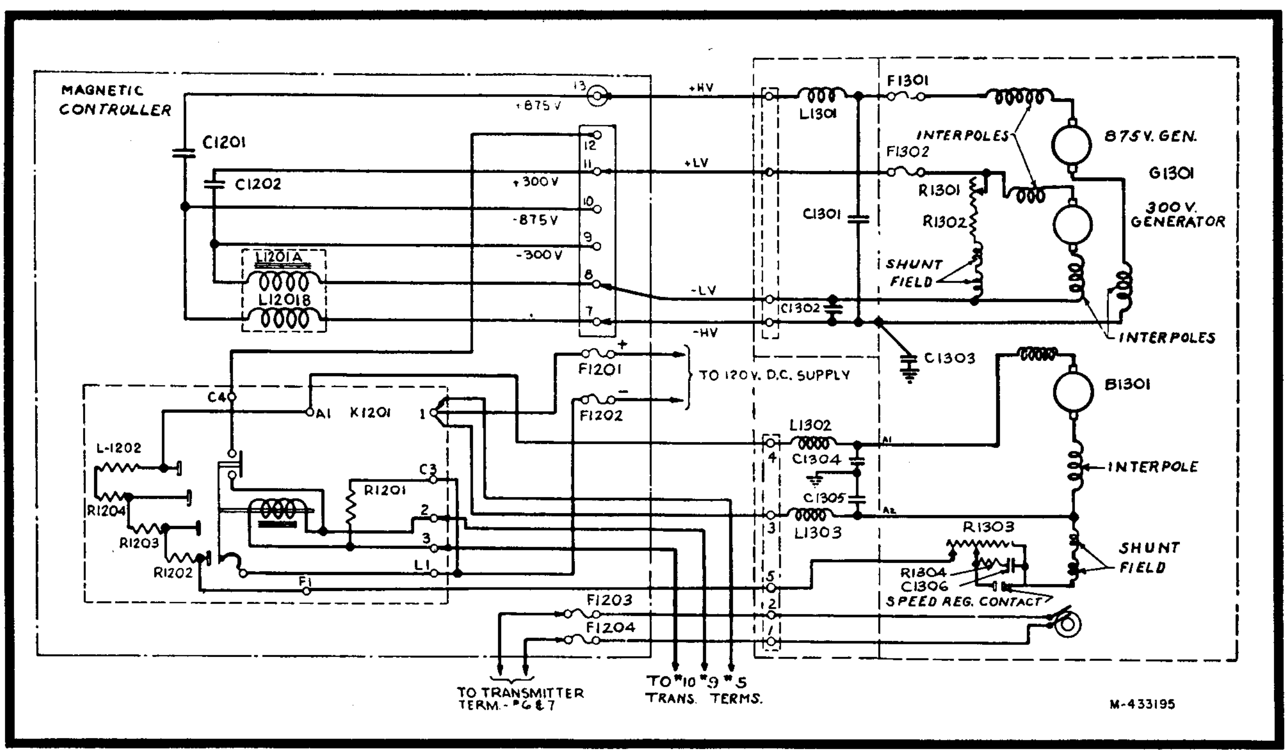
TRANSMITTER POWER SUPPLY, D-C, 120-230 VOLT (M 430328)
USED WITH TBS-6 AND TBS-7



TRANSMITTER POWER SUPPLY, A-C, 220-440 VOLT (M 430329)
USED WITH TBS-6 AND TBS-7

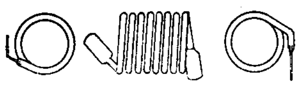
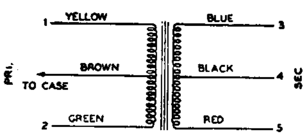
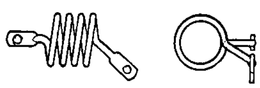
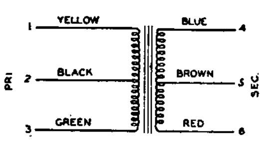
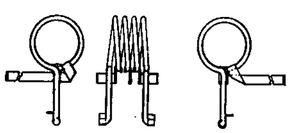
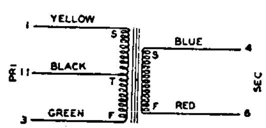


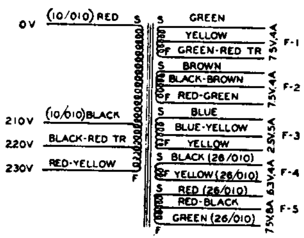
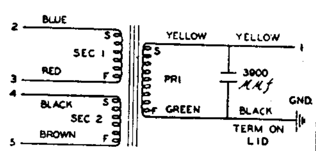
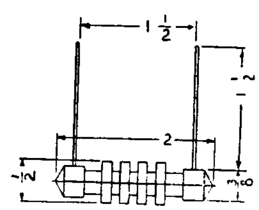
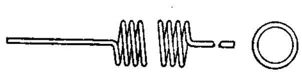
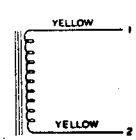
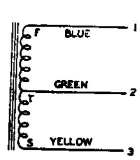
TRANSMITTER POWER SUPPLY, D-C, 220 VOLT (M 433194)
USED WITH TBS-8



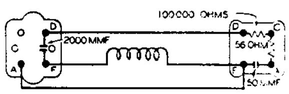
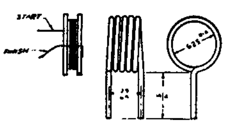
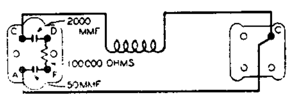
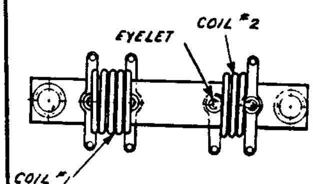
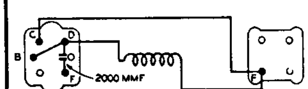
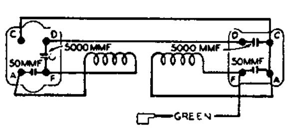
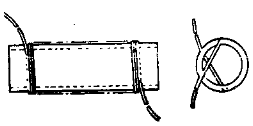
TRANSMITTER POWER SUPPLY, D-C, 120 VOLT (M 433195)
USED WITH TBS-8

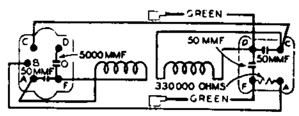
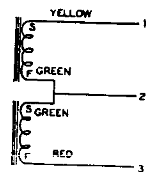
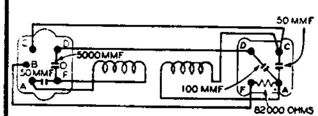
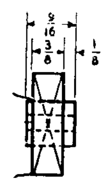
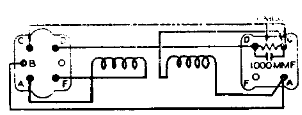
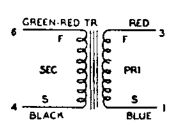
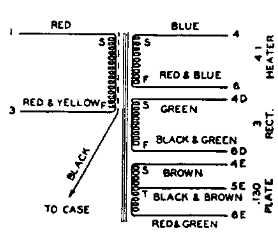
COIL DATA—TRANSMITTER

Designation Symbol	R.C.A. Part No.	DIAGRAM	Winding	Wire Size	Turns	D.C. Resistance in ohms	Impedance Ratio	Hi-Pot AC Volts	REMARKS
L-101	K-872466		Single	No. 8	8 5/16 Pitch				Inductance: 1.1 Microhenries at 20 Megacycles.
T-101	K-900544		Primary Secondary	No. 34E No. 34E	550 Tap at 275 1650 Tap at 825	37.7 140	1 to 3 ±5%	1000	Secondary Impedance: 5100 ohms minimum at 3 volts, 60 cycles, AC & 0 Amp. D.C. Polarity Additive with Term. 2 connected to Term. 3. All midtaps within 1% of neutral. Treat coils & core with wax.
L-102	K-872150		Single	No. 8	4 ¼ Pitch				Inductance: 0.33 Microhenries at 20 Megacycles.
T-102	K-900549		Primary Secondary	No. 36E No. 29E	3900 Tap at 1950 1300 Tap at 650	550 54.5		2000	Primary Impedance: 28,000 ohms minimum at 30 volts, 60 cycles AC & 0 Amps. D.C. Polarity additive with Term. 3 connected to Term. 4. Primary & secondary tap within 3% of neutral. Treat coils & core with wax.
L-103	K-872153		Single	No. 8	4 ¼ Pitch				Inductance: 0.45 Microhenries at 20 Megacycles.
T-103	K-900543		Primary Secondary	No. 29E No. 29E	2850 Tap at 1425 1675	140 101	1.7 to 1 ±5%	4000	Primary Impedance: 5200 ohms minimum at 30 volts, 60 cycles AC & .068 Amp. D.C. Primary midtap within 1% of neutral. Polarity additive with Term. 3 connected to Term. 4. Treat coils & core with Asphalt Compound.

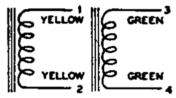
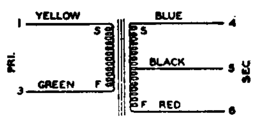
Designation Symbol	R.C.A. Part No.	DIAGRAM	Winding	Wire Size	Turns	D.C. Resistance in ohms	Impedance Ratio	Hi-Pot AC Volts	REMARKS	
L-104	K-872151		Copper Tubing PS-212	$\frac{3}{16}$ O.D. x .032	$2\frac{1}{2}$ $\frac{1}{16}$ Pitch				Inductance: 0.2 Microhenries at 40 Megacycles.	
T-104	K-900545								No Load Voltage	Full Load Voltage
			Primary	No. 19E	350 Tap at 335, 320	2.44		2500	230/220/210	
			Filament #1	0.040x 0.100 DCC	12 Tap at 6	0.25		1500	7.88 ±3%	7.5/3.75
			Filament #2	0.040x 0.100 DCC	12 Tap at 6	0.26		1500	7.88 ±3%	7.5/3.75
			Filament #3	No. 13E	4 Tap at 2	0.0085		1500	2.625 ±3%	2.5/1.25
			Filament #4	No. 13E	10	0.022		1500	6.56±3%	6.3
			Filament #5	0.055x 0.120 DCC	12 Tap at 6	0.017		1500	7.88 ±3%	7.5/3.75
									No Load current, 4 Amp. at 230 volts, 60 cycles. Polarity additive. Midtaps within 1% of neutral. Treat coils & core with asphalt compound.	
T-105	K-900546		Primary Secondary #1	No. 36E No. 36E	4700½ 750	600 127	6.25 to 1	1500	Polarity additive with green connected to blue, red to black.	
			Secondary #2	No. 36E	600	109	7.84 to 1 ±5%		Treat coils & core with wax.	
L-106, 107 L-112, 113, 114	K-872152		Grouped Single			50			Inductance: 2.46 millihenries (L-106, 107) and 2.2 millihenries (L-112, 113, 114) at 20 megacycles. Capacity: 1 mmf, current rating 125 ma. Apply one coat varnish to coils & bake one hour at 120° C. Treat with candy wax 10 minutes.	
L-108, 109	K-872149		Single	No. 18	30				Inductance: 1.73 microhenries at 40 megacycles.	
L-110	M-438311		Single	No. 30E	1850	80				
L-111	K-900548		Single	No. 37E	10,000 Tap at 5000	1800		2000	Impedance: 125,000 ohms at 3 volts, 60 cycles AC & 0 Amp. D.C. Midtap within 1% of neutral. Treat coils & core with wax.	

COIL DATA—RECEIVER

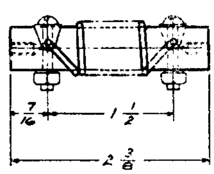
Designation Symbol	R.C.A. Part No.	DIAGRAM	Winding	Wire Size	Turns	D.C. Resistance in ohms	Impedance Ratio	Hi-Pot AC Volts	REMARKS
L-401	WW303004		Single	No. 23E	18				Inductance: Approx. 2.03 microhenries at 5580 K.C. Max. slack of approx. ½ in. in coil leads. 20 turns per inch. Cut capacitor leads short. Brush winding with cement.
T-401	M-438246		Primary Secondary	10/.0031 DSC Litz wire No. 14	6 5				Inductance: Primary: Approx. 1.1 microhenries at 8350 KC. Secondary: Approx. 0.38 microhenries at 12,900 KC. Treat with wax.
L-402	WW303004		Single	No. 23	6				Inductance: Approx. 0.632 microhenries at 10,000 KC. Max. slack of approx. ½ in. in coil leads. 20 turns per inch. Cut capacitor leads short. Brush winding with cement.
T-402	M-438282		Primary Secondary	No. 14 No. 14	5 3				Inductance: Primary: Approx. 0.36 microhenries at 13,200 KC. Secondary: Approx. 0.24 microhenries at 18,100 KC
L-403	WW303004		Single	No. 14	4¾				Inductance: Approx. 0.25 microhenries at 16,000 KC Max. slack of approx. ½ in. in coil leads. 8 turns per inch. Cut capacitor leads short. Brush winding with cement.
T-403 T-404	WW303004		Primary Secondary	No. 33E No. 33E	39 per section				Inductance: Primary and Secondary: 12 microhenries at 2290 KC 64 turns per inch. Brush winding with cement.
L-404 L-405	M-438245		Single	No. 18	69 (approx.)				Inductance: 38 microhenries at 1000 cycles. Dip in lacquer. Treat with wax.

Designation Symbol	R.C.A. Part No.	DIAGRAM	Winding	Wire Size	Turns	D.C. Resistance in ohms	Impedance Ratio	Hi-Pot AC Volts	REMARKS
T-405	WW303004			No. 33	40 per section				Inductance: Primary and Secondary: 12.4 microhenries at 2245 KC 64 turns per inch. Brush winding with cement.
L-406 A&B	K-900589		No. 1 No. 2	No. 33E No. 33E	1840 4500	130 350		1000 1000	Primary Impedance: 900 ohms (#1), 4000 ohms (#2) at 3 volts, 60 cycles, AC Treat coil & core with wax.
T-406	WW303004		Primary Secondary	No. 33E No. 33E	39½ 40				Inductance: Primary: 12.2 microhenries at 2275 KC Secondary: 12.4 microhenries at 2245 KC 64 turns per inch. Brush winding with cement.
L-407, 408, 409	K-872467		Single Bank	No. 16E	23½	.019			4 layers, 6 turns per layer. Treat coils & core with wax, hole in core free of wax.
T-407	WW303004		Primary Secondary	No. 33E No. 33E	75 61				Inductance: Primary: 34.2 microhenries at 1360 KC Secondary: 43.9 microhenries at 1200 KC Brushwindingwithcement.
T-408	K-900590		Primary Secondary	No. 34E No. 31E	1670 865	181 60	1.93 to 1 ±5%	1500 1000	Primary Impedance: 2400 ohms minimum at 3 volts, 60 cycles AC & 0.058 Amp. D.C. Polarity additive Term. 3 connected to Term. 4. Treat coils & core with wax.
T-409	K-900539								No Load Voltage / Full Load Voltage
			Primary	No. 21E	238	2.06		2500	115
			Shield	1 5/16x9½x .002	1				
			Plate	No. 29E	1070 Tap at 535	67.7		2500	517 / 490/245
			Heater	No. 16	14			2500	6.76 / 6.3
			Rectifier	No. 16	11			2500	5.31 / 5
									No load current: 35 Amp. midtaps within ±3% of neutral. Polarity additive with 3 connected to 4, 6 to 4D, 6D to 4E. Treat coils & core with asphalt compound.

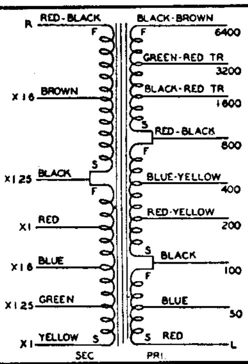
COIL DATA—MAGNETIC CONTROLLER

Designation Symbol	R.C.A. Part No.	DIAGRAM	Winding	Wire Size	Turns	D.C. Resistance in ohms	Impedance Ratio	Hi-Pot AC Volts	REMARKS
L-201 (TBS Series) L-1201 or 1211 (TBS-8)	K-900556		No. 1 No. 2	No. 25E No. 25E	1200 1200	18 18		2000 2000	Impedance: 272 ohms minimum at 3 volts, 60 cycles AC & 0.40 Amp. D.C. Treat coils & core with wax.
T-201	K-900547		Primary Secondary	No. 29E No. 29E	88 528 Tap at 264	2.38 16.7	1 to 6 ±5%	1000	Secondary Impedance: 600 ohms minimum at 3 volts, 60 cycles AC & .0085 Amp. D.C. Polarity additive with green connected to blue. Treat coils & core with wax.

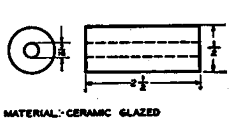
COIL DATA—MOTOR GENERATOR

Designation Symbol	R.C.A. Part No.	DIAGRAM	Winding	Wire Size	Turns	D.C. Resistance in ohms	Impedance Ratio	Hi-Pot AC Volts	REMARKS
L-303 L-304	K-872154		Single	No. 14	13½				

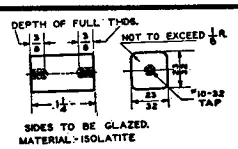
COIL DATA—SPEAKER

Designation Symbol	R.C.A. Part No.	DIAGRAM	Winding	Wire Size	Turns	D.C. Resistance in ohms	Impedance Ratio	Hi-Pot AC Volts	REMARKS
T-501	K-901060		Secondary #1 Primary #2 Primary #1 Secondary #2 Primary #3	No. 24E No. 31E No. 27E No. 20E No. 35E	65, Tap at 12, 22, 59 483, Tap at 110, 263 262, Tap at 185 42, Tap at 4 1365, Tap at 310, 735	0.525 29.4 5.55 0.151 231		1500	Full Primary Impedance: 5800 ohms minimum at 3 volts, 60 cycles AC & 0 Amp. D.C. Full Primary Resistance: .266 ohms. Full Secondary Resistance: .675 ohms. Space Factor: 85% Polarity additive with 6400 connected to X-1. Treat coils & core with wax.

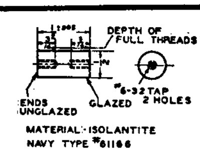
INSULATOR DATA



E 701, E 702

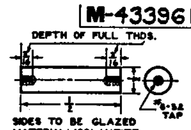


E107 K-802906-1

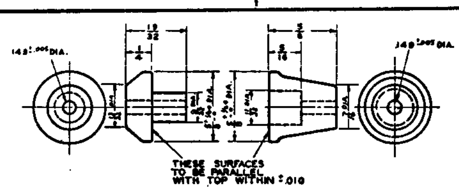


E106, E204 K-823588-1

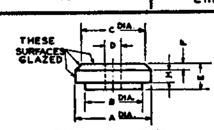
M-433961



E112 K-802900-20

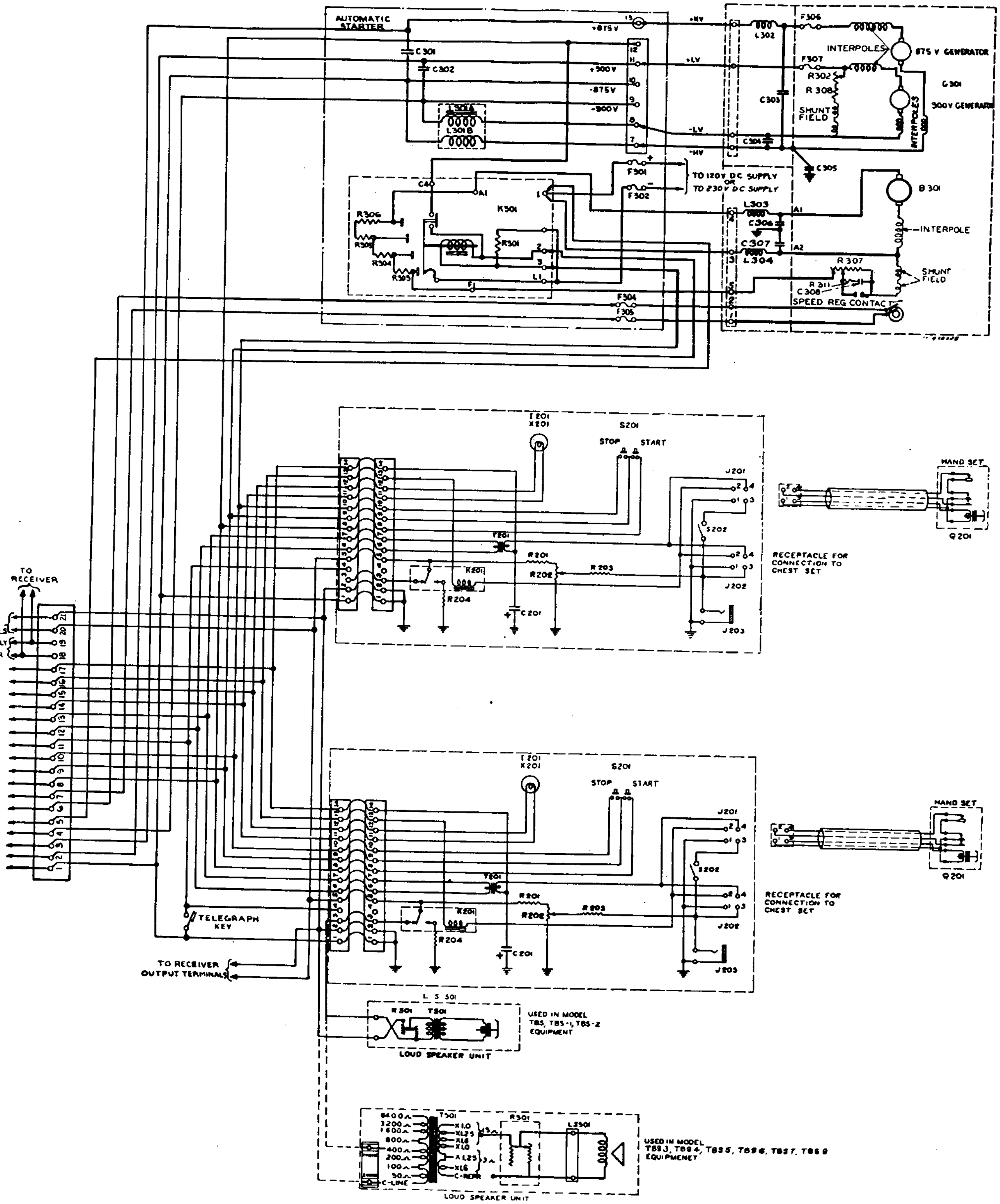


E123, E124, E109 K-671567

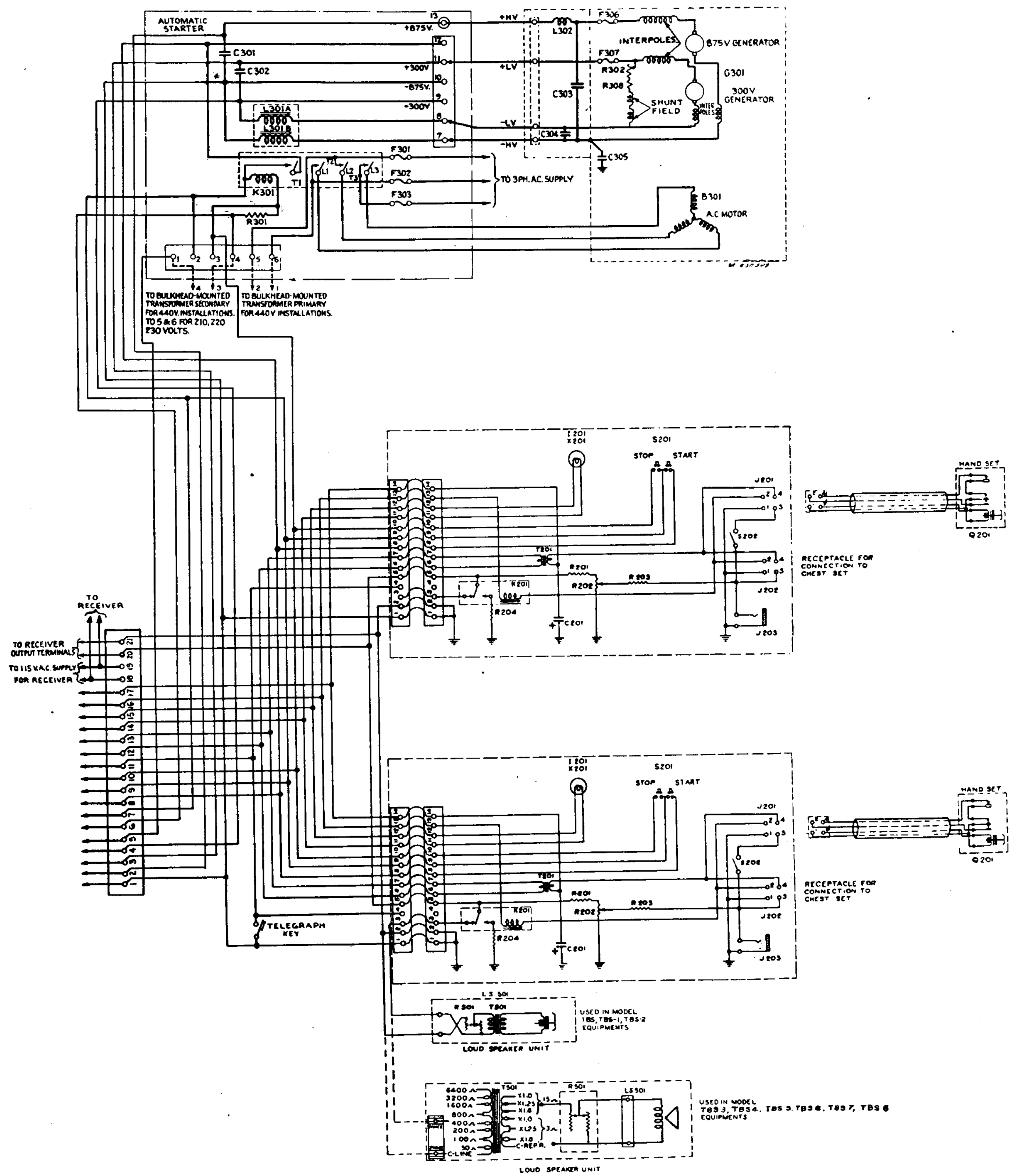


MATERIAL:-ISOLANTITE

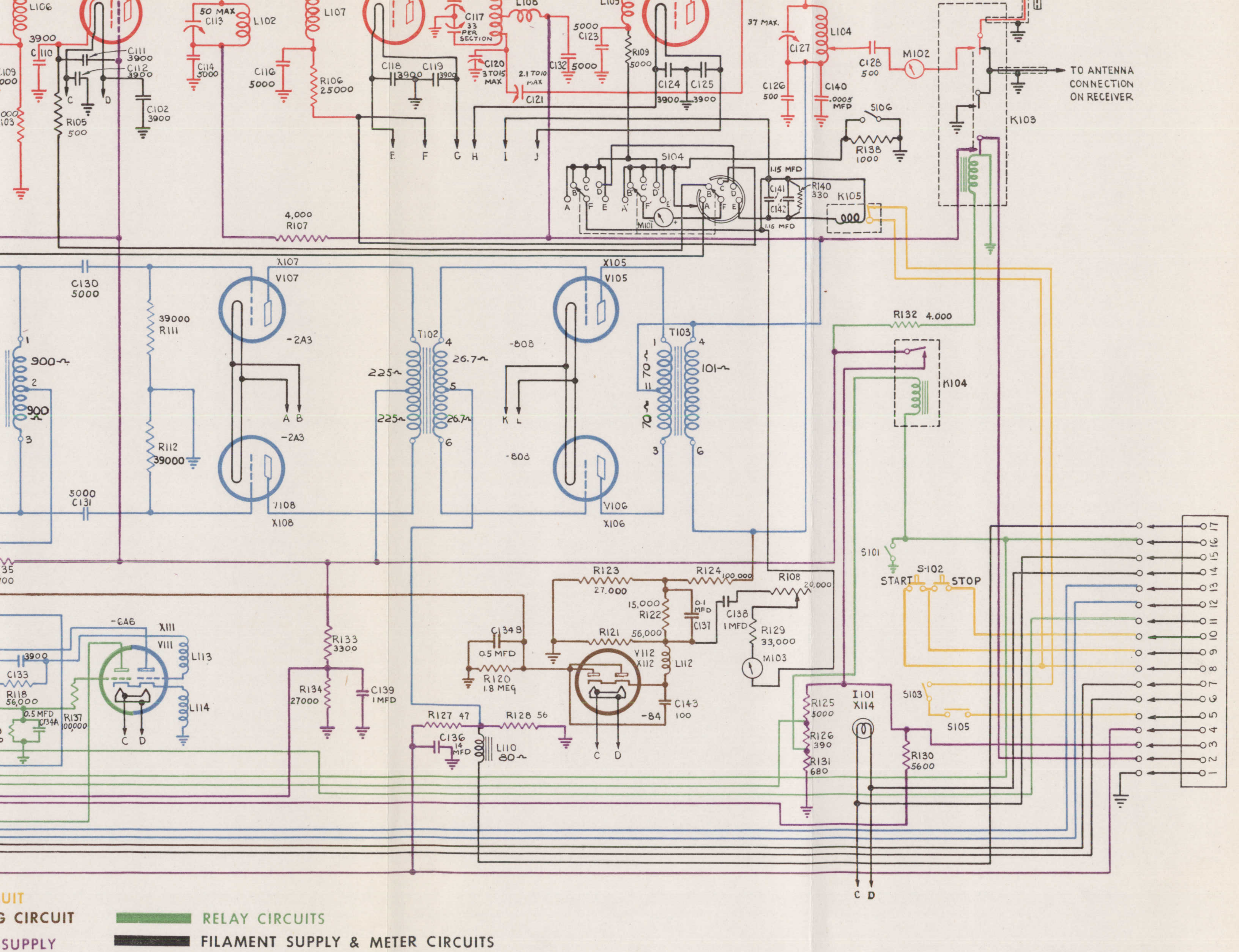
SYMBOL	PART NO.	NAVY TYPE NO.	SAME AS RCA DWG.	A	B	C	"D" HOLE	E	F	H
E402	2		K-818952	3/4	9/16	5/8	.154 DIA	1/4	1/16	1/8
E111	3	61260	K-818952	1/2	3/8	7/16	.173 DIA	.425	1/8	1/4
E108	7	61190	K-818952	5/8	[illegible]/32	9/16	.154 DIA	3/16	1/32	3/32



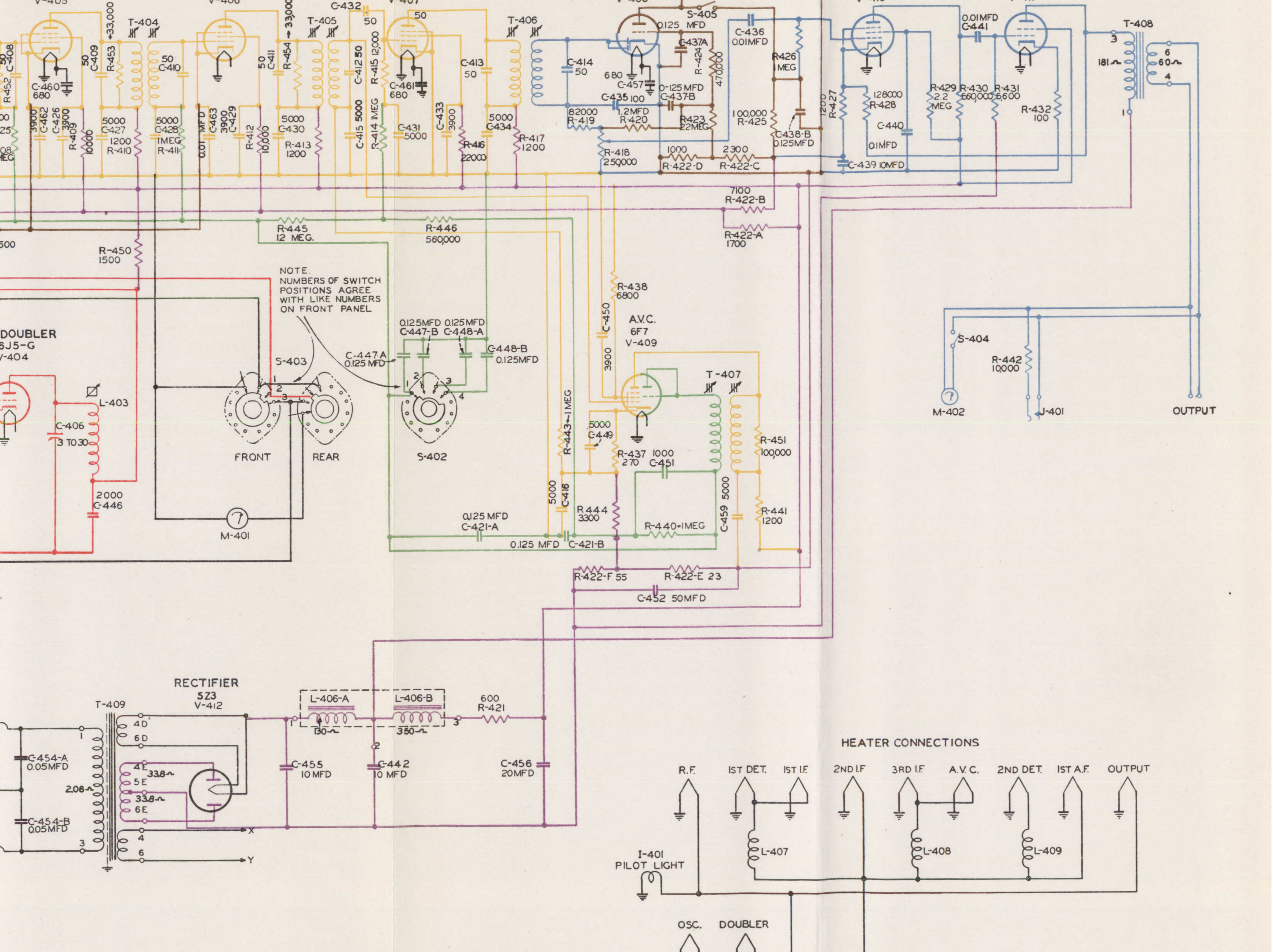
D-C POWER SUPPLY
(WW-306490)



A-C POWER SUPPLY
(WW-306504)

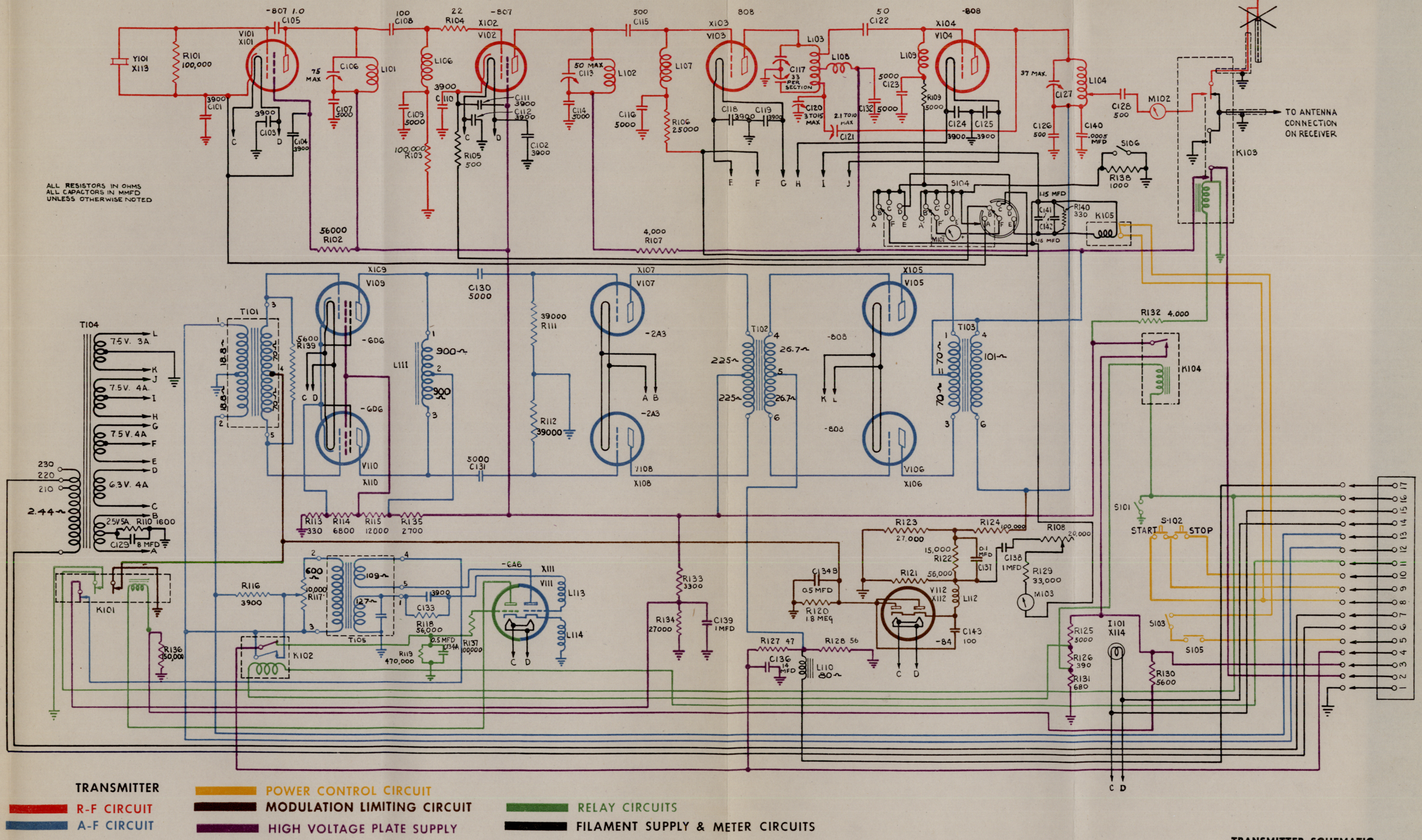


TRANSMITTER SCHEMATIC

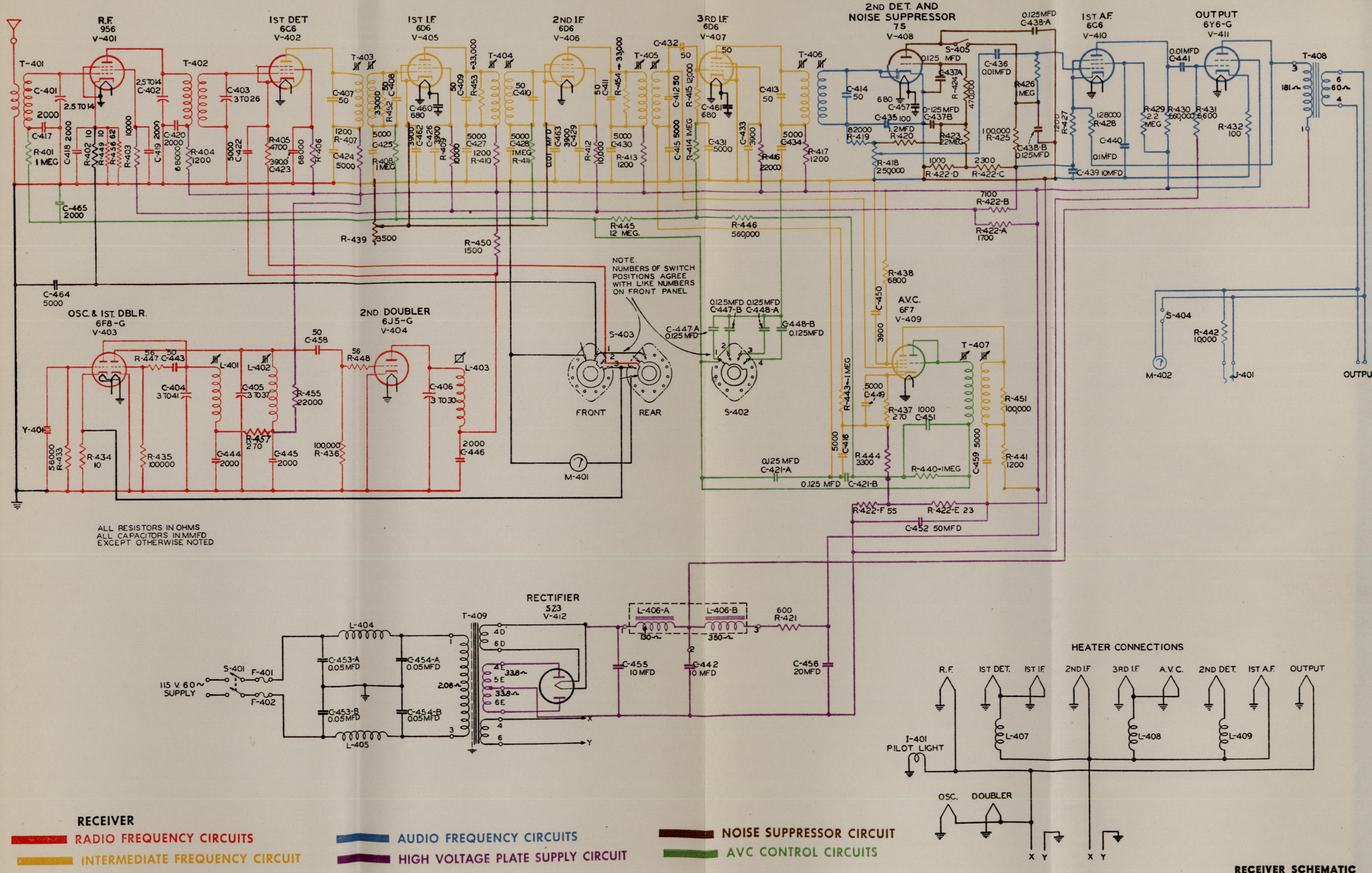


AUDIO FREQUENCY CIRCUITS

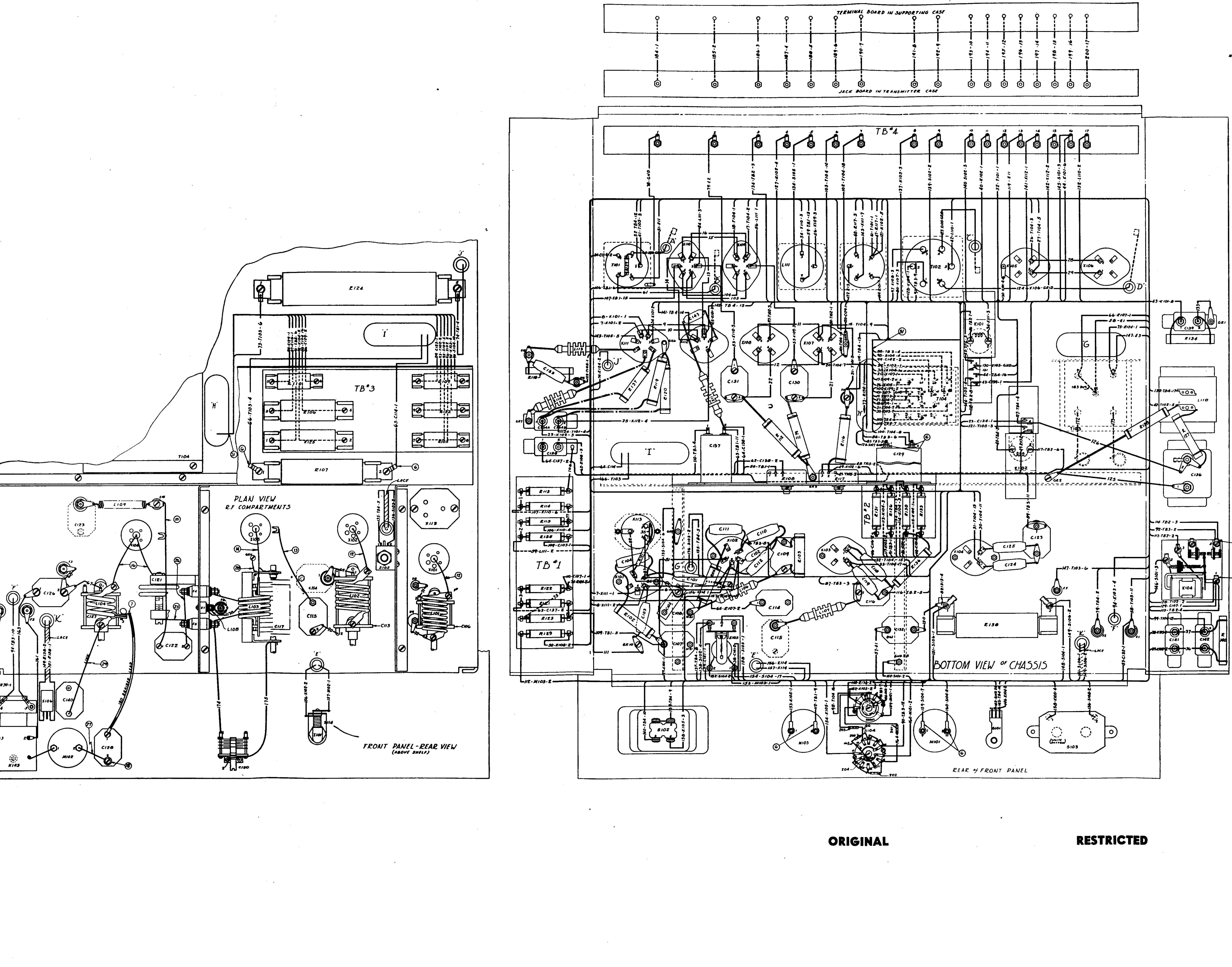
NOISE SUPPRESSOR CIRCUIT



TRANSMITTER SCHEMATIC
(T-618810)



RECEIVER SCHEMATIC
(W-308608)



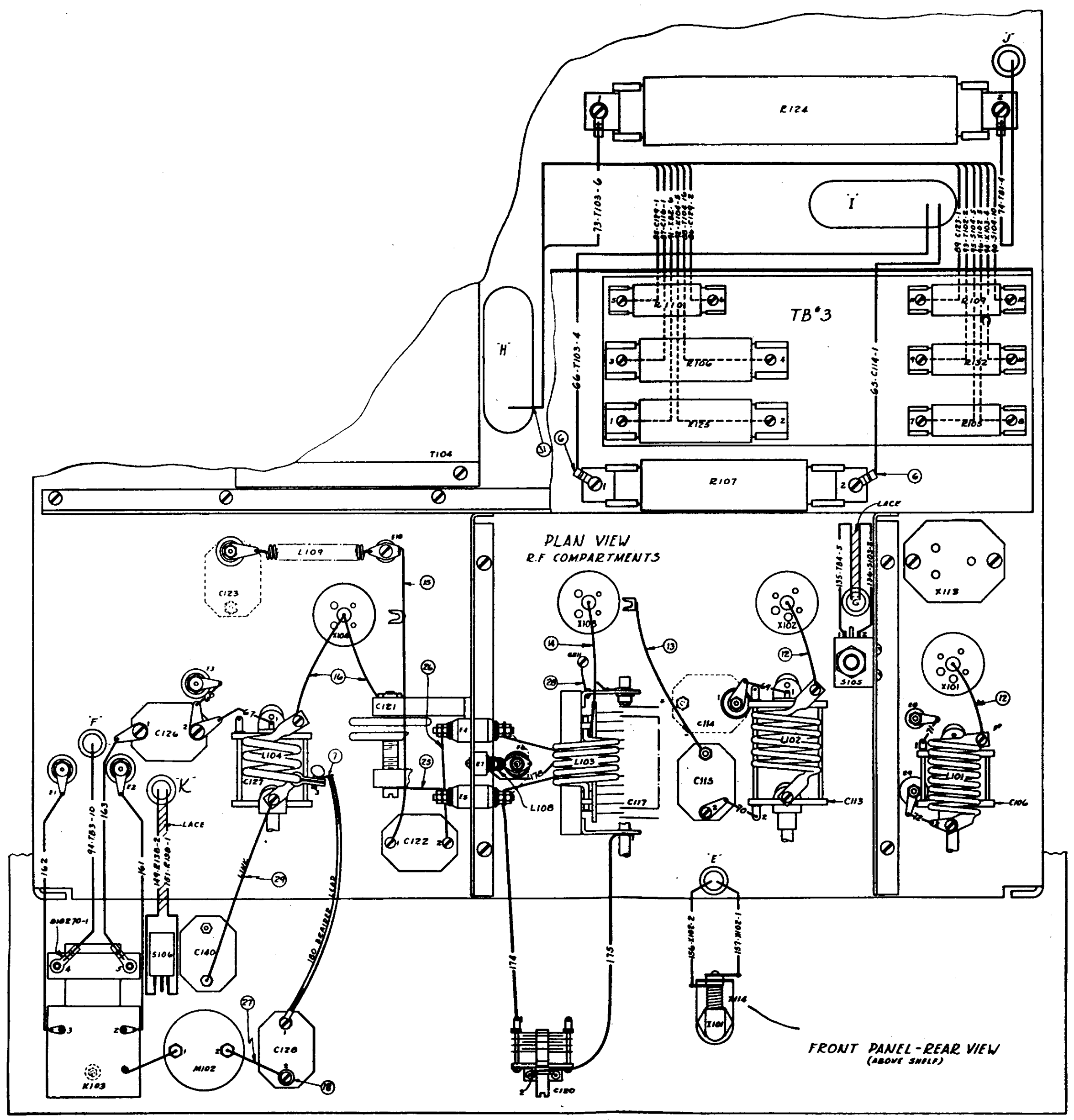
NOTE #1:- CODING AT END OF WIRES INDICATES WIRE NUMBER AND DESTINATION OF WIRE RESPECTIVELY. THUS:- 40-TB4-11 INDICATES WIRE NO. 40 RUNNING TO TERMINAL NO. 11 ON TERMINAL BOARD NO. 4; 144-T102-4 INDICATES WIRE NO. 144 RUNNING TO TERMINAL NO. 4 ON ITEM T102

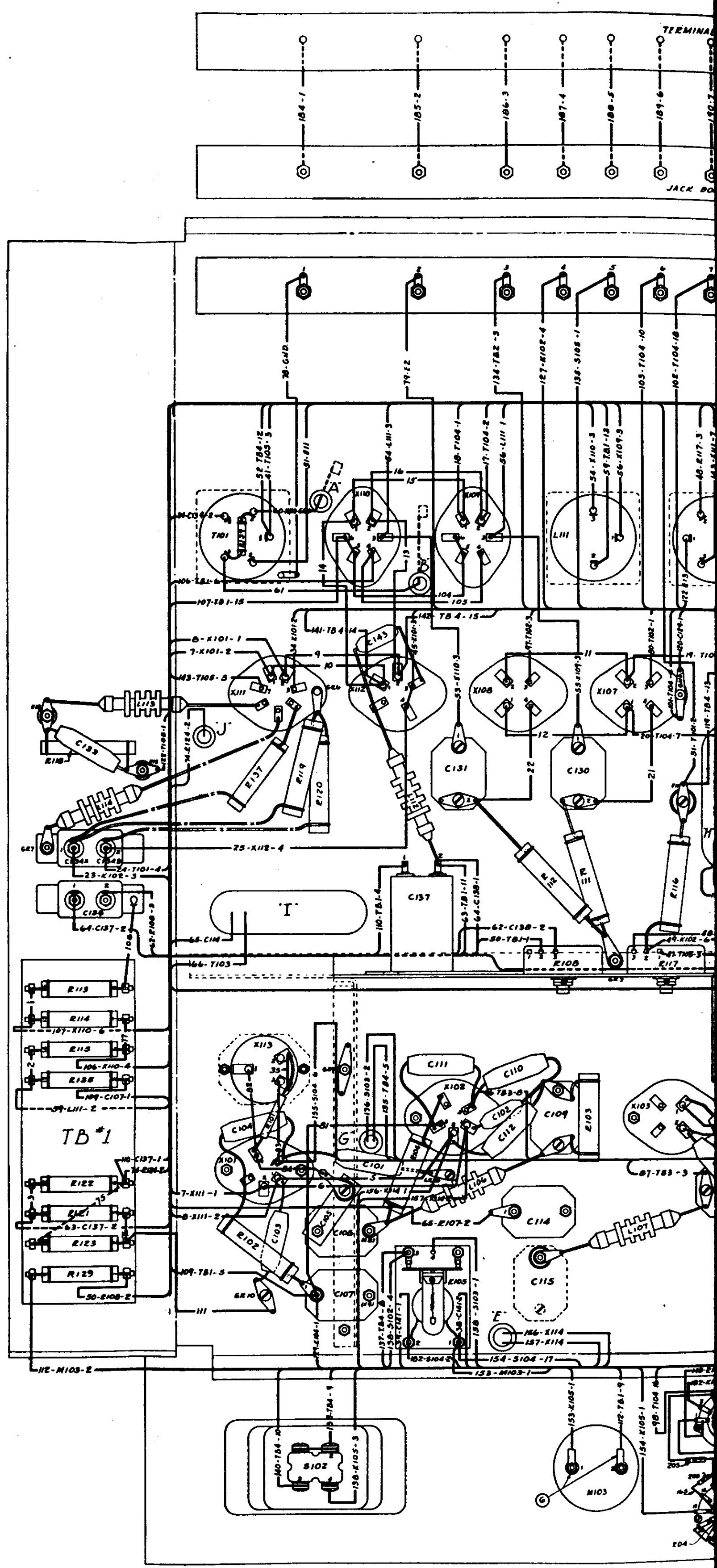
WIRE TABLE

WIRE SPEC	WIRE NO.	WIRE SPEC	WIRE NO.
P.S 503 16/.010 RUBBER & ASBESTOS COVERED YELLOW	53, 54, 55, 56, 59, 73, 74, 80, 97, 162	PS 533-7 16/010-300V. VARN CAMBRIC COVERED BLACK	[illegible]
PS 503 16/.010 RUBBER & ASBESTOS COVERED BLUE	79, 144, 147	PS 533-7 16/.010-300V VARN. CAMBRIC COVERED RED	116, 121, 132, 136, 134, 137, 139
P.S. 503 16/.010 RUBBER & ASBESTOS COVERED BLACK	172, 173	PS 533-7 16/010-300V VARN. CAMBRIC COVERED GREEN	[illegible]
PS 503 16/.010 RUBBER & ASBESTOS COVERED GRAY	89, 90, 161	PS 533-7 16/.010-300V VARN CAMBRIC COVERED BROWN	48, 52, 62
PS 503 26/.010 RUBBER & ASBESTOS COVERED RED	34, 95, 96	PS 533-7 16/010-300V VARN CAMBRIC COVERED YELLOW	49, 113, 133
PS 503 26/010 RUBBER & ASBESTOS COVERED BLUE	91, 92	PS 533-9 26/010-300V VARN CAMBRIC COVERED BLACK	3, 8, 9, 12, 13, 16, 17, 20, 100, 139, 142
PS 503 26/.010 RUBBER & ASBESTOS COVERED BROWN	60, 85, 86, 66	PS 533-9 26/010-300V VARN CAMBRIC COVERED RED	6, 7, 10, 11, 14, 15, 18, 19, 65, 110, 137, 140, 141
RS. 503 41/.010 RUBBER & ASBESTOS COVERED RED	87, 88, 102, 103	PS 533-9 26/010-300V VARN CAMBRIC COVERED BLUE	109, 129
PS 503 41/.010 RUBBER & ASBESTOS COVERED GRAY	93, 94	PS 533-9 26/.010-300V VARN. CAMBRIC COVERED RED-BLACK	112, 138
RS 503 41/.010 RUBBER & ASBESTOS COVERED BLUE	143	PS 533-11 41/010-300V. VARN CAMBRIC COVERED BLACK	24, 27, 30, 31, 32, 33, 98, 99, 101
PS 533-7 16/010-300V VARN CAMBRIC COVERED BLUE	114, 134, 148, 149	P.S 105 TINNED COPPER BUS .032 DIA	164, 165, 166
PS 333-7 16/010-300V VARN. CAMBRIC COVERED RED-YELLOW	38, 40, 46, 182	P.S 105 TINNED COPPER BUS .040 DIA.	[illegible]
P.S. 533-7 16/010-300V VARN. CAMBRIC COVERED GREEN-YELLOW	23, 43, 63, 118, 122, 146, 155, 158	PS 105 TINNED COPPER BUS .080 DIA.	[illegible]
P.S. 533-7 16/.010-300V VARN CAMBRIC COVERED RED-GREEN	39, 45	P.S. 488-9 26/010-300V ASBESTOS & COTTON BRAID COV. BLACK	184, 186-200 INCL.
P.S 533-7 16/010-300V. VARN CAMBRIC COVERED RED-BLACK	41, 57, 58, 104, 107, 154	P.S 538-11 41/.010-600V VARN. CAMBRIC COVERED BLACK	185
P.S. 533-7 16/.010-300V VARN. CAMBRIC COVERED BLACK-BROWN	47, 50, 51, 64, 78, 115, 119	R.S 50 VARNISH CAMBRIC INSULATING TUBING .042 I.D	210-268 INCL.
1/8 FLAT TINNED COPPER SHIELDING & BONDING BRAID	180		

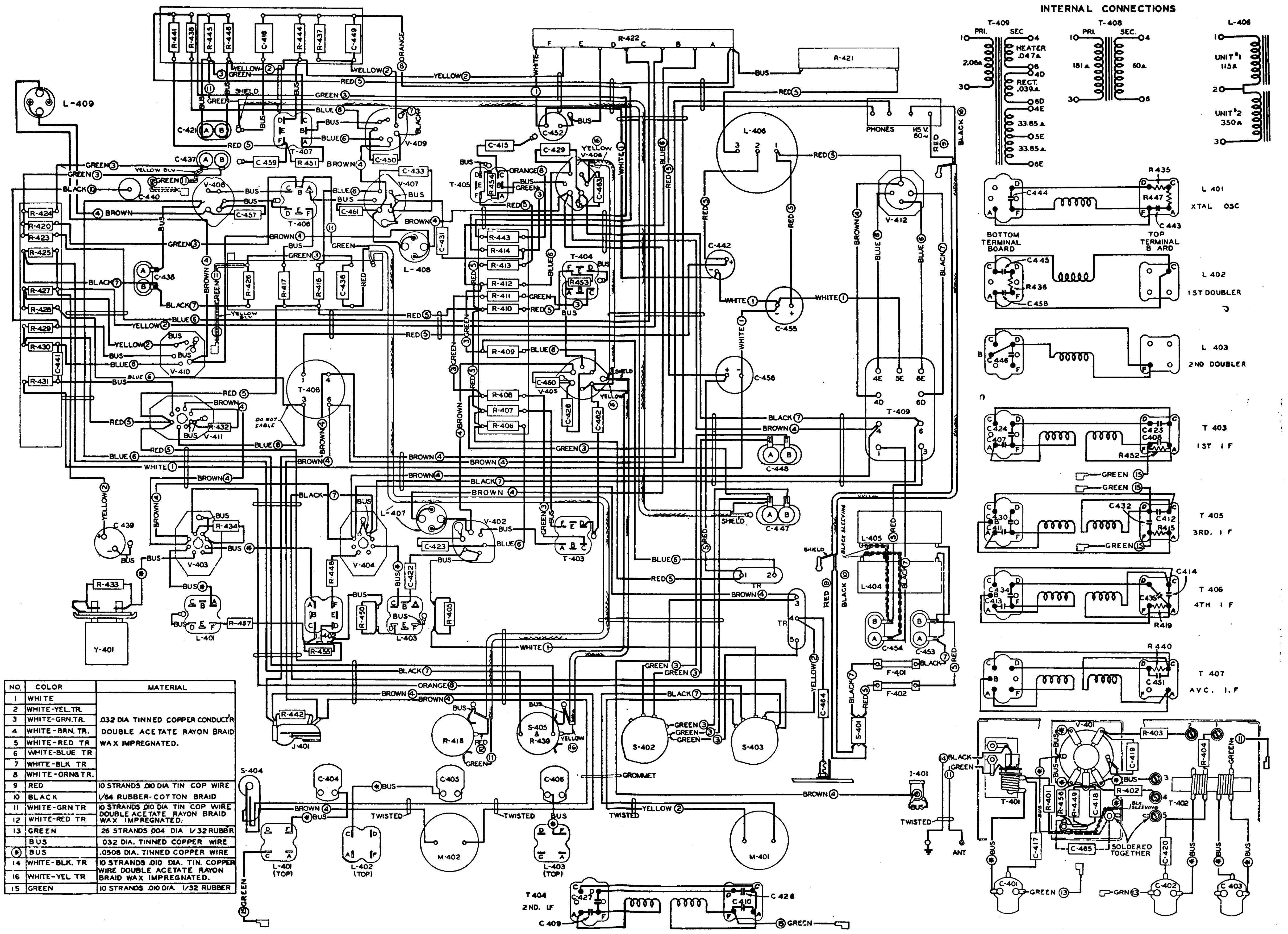
TRANSMITTER UNIT
(CONNECTI NS, WW-302475)

CORRE


PLAN VIEW
R.F COMPARTMENTS
FRONT PANEL-REAR VIEW
(ABOVE SHELF)
TB#3


TERMINAL
JACK BO
TB#1

ORIG



NO.	COLOR	MATERIAL
1	WHITE	
2	WHITE-YEL. TR.	.032 DIA TINNED COPPER CONDUCTR DOUBLE ACETATE RAYON BRAID WAX IMPREGNATED.
3	WHITE-GRN. TR.	
4	WHITE-BRN. TR.	
5	WHITE-RED TR	
6	WHITE-BLUE TR	
7	WHITE-BLK TR	
8	WHITE-ORNG TR.	
9	RED	10 STRANDS .010 DIA TIN COP WIRE
10	BLACK	1/64 RUBBER-COTTON BRAID
11	WHITE-GRN TR	10 STRANDS .010 DIA TIN COP WIRE DOUBLE ACETATE RAYON BRAID WAX IMPREGNATED.
12	WHITE-RED TR	
13	GREEN	26 STRANDS .004 DIA 1/32 RUBBR
	BUS	.032 DIA. TINNED COPPER WIRE
(B)	BUS	.0508 DIA. TINNED COPPER WIRE
14	WHITE-BLK. TR	10 STRANDS .010 DIA. TIN. COPPER WIRE DOUBLE ACETATE RAYON BRAID WAX IMPREGNATED.
16	WHITE-YEL TR	
15	GREEN	10 STRANDS .010 DIA. 1/32 RUBBER

RECEIVER UNIT
(C NNECTIONS, WW-303004)

PARTS AND SPARE PARTS

TBS SERIES

TABLE I
LIST OF MAJOR UNITS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

TBS	NOs - 60613	TBS-3	NXs - 1736	TBS-6	NXsr - 36725
TBS-1	NOs - 70095	TBS-4	NXss - 17599	TBS-7	NXsr - 38310
TBS-2	NOs - 70095	TBS-5	NXss - 18747	TBS-8	NXsr - 51552

QUAN-TITY	SYMBOL GROUP	NAVY TYPE DESIGNATION	NAME OF MAJOR UNIT	ASSEMBLY DRAWING NUMBER
1	100-199	CRV-52093	RADIO TRANSMITTER (Models TBS, TBS-1,2,3,5 and 6)	K-843806-501
		CG-52093	RADIO TRANSMITTER (Models TBS-4 and 7)	K-843806-501
		CRV-52093A	RADIO TRANSMITTER (Model TBS-8)	K-843806-501
1	400-499	CRV-46068	RADIO RECEIVER (Models TBS, TBS-1 and 2)	W-302562-501
		CG-46068	RADIO RECEIVER (Models TBS-4)	
		CRV-46068A	RADIO RECEIVER (Models TBS-5 and 6)	
		CG-46068A	RADIO RECEIVER (Model TBS-7)	
		CRV-46068B	RADIO RECEIVER (Model TBS-8)	
1	300-399	CG-21300	MOTOR GENERATOR 120 V D.C. (MODEL TBS)	P-721724-501
		CG-21300A	MOTOR GENERATOR, 120 V D.C. (Models TBS-1,2,3,4 and 5)	P-721724-501
		CG-21301	MOTOR GENERATOR, 220 V A.C. (Models TBS, TBS-3 and 4)	P-721725-501
		CG-21302	MOTOR GENERATOR, 440 V A.C. (Models TBS, TBS-1,2,3 and 5)	P-721725-502
		CG-21745	MOTOR GENERATOR, 230 V D.C. (Models TBS-3,4 and 5)	P-721724-502
		CG-211127	MOTOR GENERATOR, 120 V D.C. (Model TBS-7)	P-717756-2
	1301-1399	CG-211127	MOTOR GENERATOR, 120 V D.C. (Model TBS-8)	P-719660-1
	301-399	CG-211129	MOTOR GENERATOR, 440 V A.C. (Models TBS-6 and 7)	P-717755-1
		CG-211130	MOTOR GENERATOR, 230 V D.C. (Models TBS-6 and 7)	P-717756-1
	1301-1399	CG-211130	MOTOR GENERATOR, 230 V D.C. (Model TBS-8)	P-719661-1
1	300-399	CRV-21319	MAGNETIC CONTROLLER, 120 V D.C. (Models TBS, TBS-1,2,3 and 5)	P-717309-501
		CG-21319	MAGNETIC CONTROLLER, 120 V D.C. (Models TBS-4 and 7)	P-717309-501
	1201-1299	CRV-21319	MAGNETIC CONTROLLER, 120 V D.C. (Model TBS-8)	P-719659-501

TBS	IB-38011	TBS-3	IB-38159	TBS-6	IB-38246
TBS-1	IB-38051	TBS-4	(G.E.)	TBS-7	(G.E.)
TBS-2	IB-38116	TBS-5	IB-38211	TBS-8	IB-38331

TABLE I (Continued)
LIST OF MAJOR UNITS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

QUANTITY	SYMBOL GROUP	NAVY TYPE DESIGNATION	NAME OF MAJOR UNIT	ASSEMBLY DRAWING NUMBER
	301-399	CRV-21320	MAGNETIC CONTROLLER, 220/440 V A.C. (Models TBS, TBS-1,2,3,5 &6)	P-717312-501
		CG-21320	MAGNETIC CONTROLLER, 220/440 V A.C. (Model TBS-7)	P-717312-501
		CRV-21804	MAGNETIC CONTROLLER, 230 V D.C. (Models TBS-3,5 and 6)	P-717309-502
		CG-21804	MAGNETIC CONTROLLER, 230 V D.C. (Models TBS-4 and 7)	P-717309-502
	1201-1299	CRV-21804	MAGNETIC CONTROLLER, 230 V D.C. (Model TBS-8)	P-717658-501
2	201-299	CRV-23135	REMOTE CONTROL UNIT (Models TBS, TBS-1,2,3,5,6 and 8)	K-843615-501
		CG-23135	REMOTE CONTROL UNIT (Models TBS-4 and 7)	K-843615-501
2	201-299	CRV-51019	HANDSET (Models TBS, TBS-1,2,3,5 and 6)	P-720305-502
		CYH-51019	HANDSET (Models TBS-4 and 7)	P-720305-502
		CRV-51019A	HANDSET (Model TBS-8)	K-172169-501
1	501-599	CRV-49101	LOUDSPEAKER (Models TBS, TBS-1 and 2)	ML-303107-501
		CRV-49155	LOUDSPEAKER (Models TBS-3 and 5)	K-880776-1
		CMX-49155	LOUDSPEAKER (Models TBS-4,6,7 and 8)	K-880776-1
1	601-699	CRV-66015	ANTENNA SURFACE TYPE (Models TBS, TBS-1,2,3,5,6 and 8)	P-720364-501
		CPD-66015	ANTENNA SURFACE TYPE (Models TBS-4 and 7)	P-720364-501
1	601-699	CRV-66016	ANTENNA SUBMARINE TYPE (Models TBS, TBS-1,2 and 3)	P-720365-501
1	801-899	CRV-51018	MICROPHONE CHEST SET (Models TBS, TBS-1,2,3,5 and 6)	P-720304-501
		CYH-51018	MICROPHONE CHEST SET (Models TBS-4 and 7)	P-720304-501
		CRV-51018A	MICROPHONE CHEST SET (Model TBS-8)	P-720304-503
2	901-999		STOWAGE HOOK	T-161374-501
1	1001-1099		JUNCTION BOX	M-420429-501
1	700-799		TRANSMISSION LINE KIT (80') (Models TBS, TBS-1, TBS-2, TBS-3)	K-854548-1
1			TRANSMISSION LINE KIT (120') (Models TBS, TBS-1,2,3,4,5,6,7 and 8)	K-854548-10

TABLE II
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

TBS	NOs -60613	TBS-3	NXs -1736	TBS-6	NXsr-36725
TBS-1	NOs -70095	TBS-4	NXss-17599	TBS-7	NXsr-38310
TBS-2	NOs -70095	TBS-5	NXss-18747	TBS-8	NXsr-51552

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		STRUCTURAL PARTS					
*A-101	Shock Mount for Bottom of Chassis	2-1/4" square plate, 1" thick, 15 lbs. load rating at 1/16" deflection			27	#200P-15	K-892997-1
*A-102	Shock Mount for Bottom of Chassis	2-1/4" square plate, 1" thick, 20 lbs. load rating at 1/16" deflection			27	#200P-20	K-892997-2
*A-103	Case Cover for A-104	Brass, 0.064" thick, 1-5/16" x 1-5/16" overall dimensions, 2 holes, 0.173" dia.			1		K-843733-1
*A-104	Case Connector for Transmitter and Receiver	Aluminum alloy sand casting, threaded 3/4"-20 threads, 1-1/4" x 1-9/16" overall dimensions, 1/2" dia. hole on top, 1" dia. hole in body			1		K-843703-1
*A-401	Shock Mount for Bottom of Chassis	1-3/4" square plate, 5/8" thick, 12 lb. load rating at 1/16" deflection, 1-3/8" between mounting holes			27	Cat. #150P-12	K-883488-1
*A-402	Right-Hand Door Assembly for Access to Crystal	Consisting of: aluminum door, 0.128" thick, 2-15/64" long, 1-55/64" wide, brass knob and pin, bushing, brass latch 0.091" thick, spring washer, aluminum plate, rubber stop, hinges and assembling hardware			1		K-850908-501
*A-403	Left-Hand Door Assembly for Access to Fuses	Consisting of: aluminum door, 0.128" thick, 2-15/64" long, 1-55/64" wide, brass knob and pin, bushing, brass latch 0.091" thick, spring washer and assembling hardware			1		K-850908-502
*A-404	Bracket for Noise Suppressor Control (R-439)	Brass, 0.064" thick, 1-1/2" long, 7/8" wide, 13/32" dia. hole			1		K-815838-1

* *SPARE PARTS furnished, refer to TABLE IV for quantities.*

TBS	IB-38011	TBS-3	IB-38159	TBS-6	IB-38246
TBS-1	IB-38051	TBS-4	(G.E.)	TBS-7	(G.E.)
TBS-2	IB-38116	TBS-5	IB-38211	TBS-8	IB-38331

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		STRUCTURAL PARTS (Continued)					
*A-405	Case Connector for Receiver and Transmitter	Same as A-104					
*A-406	Case Cover for A-405	Same as A-103					
*A-601	Antenna Assembly, Destroyer Type	4 ground rods 48" long and 3 quarter-wave radiating rods of 33", 38-3/8" and 44" lengths, each used for particular frequency, antenna body 60" high, assembling hardware, 3 band frequency range 60 to 80 megacycles	-66015		1		P-720364-501
*A-602	Antenna Assembly, Submarine Type	1 ground rod 99" long, 3 quarter-wave radiating rods of 28-1/4", 34-3/4", 41-7/8" lengths, each used for particular frequency, antenna body 18-1/4" high, assembling hardware, 3 band frequency range 60 to 80 megacycles	-66016		1		P-720365-501
*A-701	Transmission Line Nitrogen Flask	Flask, 1 qt. size, including dry nitrogen gas to 1800 lbs. max. pressure per sq. in. at 70°F. normal pressure fitted with valve suitable for discharging minute quantities of gas into transmission line, flask to withstand max. pressure of 3000 lbs./sq. in.			1		K-884960-3
A-901	Hand Set Holder	Stowage hook, 5-13/16" high, consisting of cradle, 1-1/4" radius for hand set, with insulated roller, springs, and mounting			1		T-161374-501

* *SPARE PARTS furnished, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MOTORS					
*B-301	Drive and Filament Voltage Supply for G-301	Motor, 120 v d.c., 1 h.p., 3600 r.p.m., starting current 125 amps., full load current 9.6 amps., shunt wound, ball bearing, 40°C. temp. rise, a-c take-off from motor 170 watts, 0.78 amp., 220 v (TBS, TBS-1, TBS-2, TBS-3, TBS-4, TBS-5)	-21300 -21300A		18	5BC66AB865	K-860272-1
*B-301	Drive and Filament Voltage Supply for G-301	Motor, 210,220,230 v a.c., 3 phase, 60 cycles 1 h.p., 3450 r.p.m., starting current 21 amps., full load 2.7 amps., induction wound, ball bearing, 40°C. temp. rise, insulation test voltage 1750 (TBS, TBS-3, TBS-5)	-21301		18	5K67BC603	K-860273-1
*B-301	Drive and Filament Voltage Supply for G-301	Motor, 440 v a.c., 3 phase, 60 cycles, 1 h.p., 3450 r.p.m., starting current 10.5 amps., full load current 1.4 amps., induction wound, ball bearing, insulation test voltage 2250, 40°C. temp. rise (TBS, TBS-1, TBS-2, TBS-3, TBS-5)	-21302		18	5K67BC580	K-860274-1
*B-301	Drive and Filament Voltage Supply for G-301	Motor, 230 v d.c., 1 h.p., 3600 r.p.m., starting current 65 amps., full load current 5.0 amps., shunt wound, ball bearing, insulation test voltage 1750 v, 40°C. temp. rise, a-c take-off from motor 170 watts, 0.78 amp., 220 v (TBS-3, TBS-4, TBS-5)	-21745		18	5BC66AB1333	K-875578-1
*B-301	Drive and Filament Voltage Supply for G-301	Motor, 120 v d.c., 1 h.p., 3600 r.p.m., starting current 12.5 amps., full load current 9.6 amps., shunt wound, ball bearing, 40°C. temp. rise, a-c take-off from motor 170 watts, 0.77 amp., 220 v (TBS-7)	-211127		18	5BC66AB1525	P-717756-2
*B-301	Drive and Filament Voltage Supply for G-301	Motor, 440 v a.c. 3 phase, 60 cycles, 1 h.p., 3450 r.p.m., starting current 10.5 amps., full load current 1.4 amps., induction wound, ball bearing insulation test voltage 1880, 50°C. temp. rise (TBS-6, TBS-7)	-211129		18	5K67BC1293	P-717755-1
*B-301	Drive and Filament Voltage Supply for G-301	Motor, 230 v d.c., 1 h.p., 3600 r.p.m., starting current 65 amps., full load current 5.0 amps., shunt, wound, ball bearing, insulation, test voltage 1460, 50°C. temp. rise, a-c take-off from motor 170 watts, 0.77 amp., 220 v (TBS-6, TBS-7)	-211130		18	5BC66AB1526	P-717756-1
*B-1301	Drive and Filament Voltage Supply for G-1301	Same as B-301 (TBS-8)	-211127				
*B-1311	Drive and Filament Voltage Supply for G-1301	Same as B-301 (TBS-8)	-211130				

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MOTORS (Continued)					
*B-301A	Armature for CG-21300	Armature, complete, for 120 v d.c.			18	5LY57AB6	K-860256-1
*B-301A	Armature for CG-21300A	Armature, complete for 120 v d.c.			18	8160056AB1	M-427877-70
*B-301A	Armature for CG-21301,-21302	Armature, complete, for 220/440 v a.c.			18	5LY57AB2	M-427877-87
*B-301A	Armature for CG-21745	Armature, complete, for 230 v d.c.			18	5IY57AB10	K-875577-1
*B-301A	Armature for CG-21745	Armature, complete, for 230 v d.c.			18	8160056AC1	M-427877-71
*B-301A	Armature for CG-211127	Armature, complete, 440 v a.c.			18	8167844AC1	M-427877-2
*B-301A	Armature for CG-211129	Armature, complete, for 230 v d.c.			18	8167844AB1	M-427877-3
*B-301A	Armature for CG-211130	Armature, complete, for 120 v d.c.			18	8167844AA1	M-427877-1
*B-1301A	Armature for CG-211127	Same as B-301A					
*B-1311A	Armature for CG-211130	Same as B-301A					
*B-301B	Ball Bearing for CG-21300, -21300A,-21301,-21302, -21745	Ball bearing			18	V-5831955AA	K-860256-2

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MOTORS (Continued)					
*B-301B 1301B 1311B	Ball Bearing for CG-211127, -21129,-21130	Ball bearing			18	5855279AC1	M-427877-12
*B-301C	Motor Brush Assembly for CG-21300,-21300A,-21745	Brush, spring, pigtail and terminal			18	M-5057458AA18	K-860256-4
*B-301C 1301C 1311C	Motor Brush Assembly for CG-21127,-211130,-211127	Brush, spring, pigtail and terminal			18	8100097AB6	M-427877-14
*B-301D	Regulator Brush Assembly for CG-21300,-21300A,-21745	Brush, spring, pigtail and terminal			18	M-5033779AA11	K-860256-6
*B-301D 1301D 1311D	Regulator Brush Assembly for CG-211127,-211130	Brush, spring, pigtail and terminal			18	5863334AG8	M-427877-15
*B-301E	Motor Brush Holder for CG-21300,-21300A,-21745	Brush holder and insulation			18	K-5049837AB2	K-860256-8
*B-301E 1301E 1311E	Motor Brush Holder for CG-211127,-211130	Brush holder and insulation			18	8100089AD2	M-427877-18
*B-301F	Regulator Brush Holder for CG-21300,-21300A,-21745, -211127	Brush holder and insulation			18	K-5085034AA1	K-860256-10
*B-301F 1301F 1311F	Regulator Brush Holder for CG-211127,-211130	Brush holder and insulation			18	5869394AD1	M-427877-19
*B-301G	Motor Springs for CG-21300, -21300A,-21745	Springs			18	K-5855781	K-860256-12

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MOTORS (Continued)					
*B-301H	Regulator Springs for CG-21300,-21300A,-21745	Springs			18	K-1744224	K-860256-14
*B-301J	Motor Coil for CG-21300,-21300A	Main field coil			18	5BC66AB865	K-860256-16
*B-301J	Motor Coil for CG-21745	Main field coil			18	5BC66AB1333	K-875577-16
*B-301J	Motor Coil for CG-21300, -21300A,-21745	Main field coil			18	8169733AA1	M-427877-73
*B-301J 1301J 1311J	Motor Coil for CG-211127, -211130	Main field coil			18	8167845AA1	M-427877-7
*B-301K	Motor Interpole Coil for CG-21300,-21300A	Commutating field coil			18	5BC66AB865	K-860256-21
*B-301K	Motor Interpole Coil for CG-21300,-21300A	Commutating field coil			18	8169738AA1	M-427877-76
*B-301K	Motor Interpole Coil for CG-21745	Commutating field coil			18	5BC66AB1333	K-875577-21
*B-301K	Motor Interpole Coil for CG-21745	Commutating field coil			18	8169740AA1	M-427877-86
*B-301K 1301K 1311K	Motor Interpole Coil for CG-211127,-211130	Commutating field coil			18	8169392AA1	M-427877-11
*B-301L 1301L 1311L	Cap for Motor Brush Holder CG-211127,-211130	Brush holder cap			18	5895854AA2	M-427877-23
*B-301M 1301M 1311M	Cap for Regulator Brush Holder for CG-211127,-211130	Brush holder cap			18	5863338AB1	M-427877-24

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MOTORS (Continued)					
*B-301N 1301N 1311N	Washer for Motor for CG-211127, -211130	Washer, prenite			18	5895849AA1	M-427877-27
*B-301P 1301P 1311P	Washer for Regulator for CG-211127,-211130	Washer, prenite			18	5861433AA1	M-427877-28
		CAPACITORS					
*C-101	Oscillator Cathode By-pass Capacitor	Molded, fixed, mica, 3900 mmfd ±20%, 400 v d.c. working, toothpick			1		M-86013-516
*C-102	2nd Doubler Filament By-pass Capacitor	Same as C-101					
*C-103	Oscillator Filament By-pass Capacitor	Same as C-101					
*C-104	Oscillator Screen By-pass Capacitor	Same as C-101					
C-105	Oscillator Plate Grid Feedback Capacitor	Variable, ceramic base, air, 1 mmfd, 1000 v d.c. working			1		K-843678-501
*C-106	Oscillator Plate Tuning Capacitor	Variable, ceramic, base, air trimmer, 11 plates, single spaced, capacity 75 mmfd max., shaft 0.250"dia. x 1/2" long			19		K-838607-2
*C-107	Oscillator Plate By-pass Capacitor	Molded, fixed, mica, Faradon, 0.005 mfd ±20%, 2500 v d.c. working	-48409-20	RE 48A 112Q RE 48A 154F	1	AF Faradon	K-35485-16

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		CAPACITORS (Continued)					
*C-108	Oscillator and 1st Doubler Coupling Capacitor	Molded, fixed, mica, Faradon, 0.0001 mfd ±20%, 5000 v d.c. working	-48001	RE 48A 112Q RE 48A 154F	1	AF Faradon	K-35485-4
*C-109	1st Doubler Grid By-pass Capacitor	Same as C-107	-48409-20				
*C-110	1st Doubler Cathode By-pass Capacitor	Same as C-101					
*C-111	1st Doubler Screen By-pass Capacitor	Same as C-101					
*C-112	1st Doubler Filament By-pass Capacitor	Same as C-101					
*C-113	1st Doubler Plate Tuning Capacitor	Variable, ceramic base, air trimmer, 19 plates, double spaced, max. capacity 50 mmfd, 4 mmfd min., less stop pin, shaft 0.250" dia. x 1/2" long	-482241		19		K-838609-5
*C-114	1st Doubler Plate By-pass Capacitor	Same as C-107	-48409-20				
*C-115	1st and 2nd Doubler Coupling Capacitor	Molded, fixed, mica, Faradon, 0.0005 mfd ±20%, 5000 v d.c. working	-48401-20	RE 48A 112Q RE 48A 154F	1	AF Faradon	K-35485-8
*C-116	2nd Doubler Grid By-pass Capacitor	Same as C-107	-48409-20				
*C-117	2nd Doubler Plate Tuning Capacitor	Variable, ceramic base, air trimmer, 2 sections, each 11 plates, double spaced, 31 mmfd max. per section, shaft 0.250" dia. x 1/2" long			19		K-843673-3
*C-118	2nd Doubler Filament By-pass Capacitor	Same as C-101					
*C-119	2nd Doubler Filament By-pass Capacitor	Same as C-101					
*C-120	2nd Doubler Plate Balancing Capacitor	"Trim-air" midget, 3 mmfd to 15 mmfd, 9 plates, 0.070" air gap, with mounting brackets and stub shaft with screwdriver slot	-48626		9	ZT-15-AS	K-883482-1
*C-121	Power Amplifier Neutralizing Capacitor	Variable, air, 2.1 mmfd to 10 mmfd			19	N-10	K-854504-1

* *SPARE PARTS furnished, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		CAPACITORS (Continued)					
*C-122	2nd Doubler and Power Amplifier Coupling Capacitor	Molded, fixed, mica, Faradon, 0.00005 mfd ±20%, 5000 v d.c. working	-48038-20	RE 48A 112Q RE 48A 154F	1	AF Faradon	K-35485-3
*C-123	Power Amplifier Grid By-pass Capacitor	Same as C-107	-48409-20				
*C-124	Power Amplifier Filament By-pass Capacitor	Same as C-101					
*C-125	Power Amplifier Filament By-pass Capacitor	Same as C-101					
*C-126	Power Amplifier Plate By-pass Capacitor	Same as C-115	-48401-20				
*C-127	Power Amplifier Plate Tuning Capacitor	Variable, ceramic base, air trimmer, 11 plates, double spaced, max. capacity 31 mmfd, less stop pin			19		K-838609-4
*C-128	Antenna Coupling Capacitor	Same as C-115	-48401-20				
*C-129	Audio Driver Filament Return By-pass Capacitor	Oil filled, paper, single section, 8 mfd ±20%, 500 v d.c. working	-482238		1		P-72028-511
*C-130	Audio Driver Grid Coupling Capacitor	Same as C-107	-48409-20				
*C-131	Audio Driver Grid Coupling Capacitor	Same as C-107	-48409-20				
*C-132	2nd Doubler Plate By-pass Capacitor	Same as C-107	-48409-20				
*C-133	Audio Oscillator Grid By-pass Capacitor	Molded, fixed, mica, 3900 mmfd ±10%, 400 v d.c. working, toothpick			1		M-86013-546
*C-134A *C-134B	Carrier Cutoff Delay Circuit Charging Capacitor Modulator Limiter Delay Circuit Charging Capacitor	Fixed, oil filled, paper, 2 sections, each section 0.5 mfd ±10%, 250 v d.c. working, each section grounded to case	-48554-10	RE 13A 488	1		P-721074-53
C-135	Not Used						
*C-136	Modulator Bias Filter Capacitor	Fixed, oil filled, paper, single section, 14 mfd ±20%, 50 v d.c. working			1		P-72028-514

* SPARE PARTS furnished, refer to TABLE IV for quantities.

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		CAPACITORS (Continued)					
*C-137	Modulator Limiter Circuit A-F By-pass Capacitor	Fixed, oil filled, paper, single section, 0.1 mfd ±10%, 500 v d.c. working	-48552-10	RE 13A 488	1		P-721074-51
*C-138	Modulator Meter D-C Blocking Capacitor	Fixed, oil filled, paper single section, 1.0 mfd ±10%, 250 v d.c. working	-48553-10	RE 13A 488	1		P-721074-52
*C-139	Audio Oscillator Plate By-pass Capacitor	Same as C-138	-48553-10				
*C-140	Power Amplifier Plate By-pass Capacitor	Same as C-115	-48401-20				
*C-141	Power Amplifier Overload Relay By-pass Capacitor	Fixed, oil filled, paper, single section, 1.75 mfd ±20%, 50 v d.c. working	-481716	RE 48A 110P	1		P-72044-501
*C-142	Power Amplifier Overload Relay By-pass Capacitor	Same as C-141	-481716				
*C-143	Modulator Limiter R-F By-pass Capacitor	Molded, fixed, mica, 100 mmfd ±10%, 400 v d.c. working, toothpick	-48761		1		M-86012-547
*C-201	Microphone Power Supply Filter Capacitor	Dry electrolytic, 25 mfd +100% -10%, 25 v d.c. working			1		M-86021-2
*C-301	High Voltage Plate Supply Ripple Filter Capacitor	Fixed, pyranol, 3.0 mfd, 1000 v d.c. working	-481733		18	Cat.#23-F-12	M-418141-12
*C-302	Low Voltage Plate Supply Ripple Filter Capacitor	Fixed, pyranol, 5.0 mfd, 220 v d.c. working			18	Cat.#26-F-110	K-881403-1
*C-303	R.F. By-pass Capacitor	Molded, fixed, mica, 0.01 mfd ±20%, 1200 v d.c. working, (TBS-6, & 7)			18	8167086AA-P1 Type H-25	M-427877-30
*C-303	R.F. By-pass Capacitor	Molded, fixed, faradon, 0.01 mfd ±20% 1200 v d.c. working, (TBS, TBS-1,2,3,4,& 5)	-48643		18	V-5835319AA Model F	M-427877-78
♀*C-304	R.F. By-pass Capacitor	Molded, fixed, mica, 3900 mmfd ±20%, 400 v d.c. working, (TBS, TBS-1,2,3,4,& 5), toothpick			18	V-5835320AA	M-427877-79

W2

** SPARE PARTS furnished, refer to TABLE IV for quantities.*
♀ Capacitors having a tolerance as specified or less may be used.

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		CAPACITORS (Continued)					
*C-304	R.F. By-pass Capacitor	Molded, fixed, mica, 0.003 mfd ±10%, 800 v d.c. working for 220/440 v a.c. equipment (TBS-6, & 7)			18	8106460AA-P4	M-427877-31
*C-305	R.F. By-pass Capacitor	Same as C-304 used on respective model					
*C-306	D.C. Motor Filter Capacitor	Same as C-304 used on respective model					
*C-307	D.C. Motor Filter Capacitor	Same as C-304 used on respective model					
*C-308	Motor Speed Regulator Capacitor	Molded, fixed, pyranol, 10 mfd for 120 v d.c. (Cat.#26F412) (TBS-7)		RE 13A 488C	18	8128988AA-P1	M-427877-33
*C-308	Motor Speed Regulator Capacitor	Molded, fixed, pyranol, 3 mfd for 230 v d.c. (TBS-6, & 7)		RE 13A 488C	18	8167010AB-P1	M-427877-34
*C-401	"ANTENNA" Tuning Capacitor	Variable, low loss, wax dip, ceramic base, air trimmer, 2.5 mmfd min. to 14 mmfd max. ±10%, 2 stator and 2 rotor plates, silver plated rotor contact spring, shaft 0.250" dia. x 5/8" long			19	APC	K-850873-1
*C-402	"LINK" Tuning Capacitor	Variable, low loss, wax dip, ceramic base, air trimmer, 2.5 mmfd min. to 14 mmfd max. ±10%, 2 stator and 2 rotor plates, silver plated rotor contact spring, shaft 0.250" dia. x 5/8" long			19	APC	K-850873-5
*C-403	"DETECTOR" Tuning Capacitor	Variable, low loss, wax dip, ceramic base, air trimmer, 3.0 mmfd min. to 26 mmfd max. ±10%, 3 stator and 4 rotor plates, silver plated rotor contact spring, shaft 0.250" dia. x 5/8" long			19	APC	K-850873-3
*C-404	"OSCILLATOR" Tuning Capacitor	Variable, low loss, wax dip, ceramic base, air trimmer, 3.0 mmfd min. to 41 mmfd max. ±10%, 5 stator and 6 rotor plates, silver plated rotor contact spring, shaft 0.250" dia. x 5/8" long			19	APC	K-850873-4
*C-405	"1st DOUBLER" Tuning Capacitor	Variable, low loss, wax dip, ceramic base, air trimmer, 3.0 mmfd min. to 37 mmfd max. ±10%, 5 stator and 5 rotor plates, silver plated rotor contact spring, shaft 0.250" dia. x 5/8" long			19	APC	K-850873-6

* *SPARE PARTS furnished, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		CAPACITORS (Continued)					
*C-406	"2nd DOUBLER" Tuning Capacitor	Variable, low loss, wax dip, ceramic base, air trimmer, 3.0 mmfd min. to 30 mmfd max. ±10%, 4 stator and 4 rotor plates, silver plated rotor contact spring, shaft 0.250" dia. x 5/8" long			19	APC	K-850873-2
*C-407	1st I-F Transformer Primary Tuning Capacitor	Fixed, ceramic, wax impregnated, 50 mmfd ±2-1/2%, 500 v d.c. working (Part of T-403)			10		K-85522-3
*C-408	1st I-F Transformer Secondary Tuning Capacitor	Same as C-407 (Part of T-403)					
*C-409	2nd I-F Transformer Primary Tuning Capacitor	Same as C-407 (Part of T-404)					
*C-410	2nd I-F Transformer Secondary Tuning Capacitor	Same as C-407 (Part of T-404)					
*C-411	3rd I-F Transformer Primary Tuning Capacitor	Same as C-407 (Part of T-405)					
*C-412	3rd I-F Transformer Secondary Tuning Capacitor	Same as C-407 (Part of T-405)					
*C-413	2nd Detector Transformer Primary Tuning Capacitor	Same as C-407 (Part of T-406)					
*C-414	2nd Detector Transformer Secondary Tuning Capacitor	Same as C-407 (Part of T-406)					
*C-415	3rd I-F Grid By-pass Capacitor	Molded, fixed, mica, 5600 mmfd ±10%, 500 v d.c. working	δCM35B562K	δ'C75.3-1942	1		P-722026-557
*C-416	AVC Grid Filter Capacitor (Part of E-422)	Same as C-415	δCM35B562K				
*C-417	R-F Grid Filter Capacitor	Molded, fixed, mica, 2000 mmfd ±10%, 500 v d.c. working, low loss type.	-48856-B10	RE 48A 143F RE 48A 154F	13	1W-L	K-837955-3
*C-418	R-F Cathode By-pass Capacitor	Same as C-417					
*C-419	R-F Screen Grid By-pass Capacitor	Same as C-418	-48856-B10				
*C-420	R-F Plate By-pass Capacitor	Same as C-417	-48856-B10				

* *SPARE PARTS furnished, refer to TABLE IV for quantities.*
δ *American War Standard Type Number.*
δ' *American War Standard Specification.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		CAPACITORS (Continued)					
*C-421A B	AVC Filter Capacitor AVC Filter Capacitor	Fixed, paper, oil filled, 2 sections, 0.125/0.125 mfd +10% -3%, 500 v d.c. working, each section grounded to case, (Former dwg. was P-72025-509)	-48795	RE 13A 488	1		P-72039-505
*C-422	Heterodyne Coupling Capacitor	Same as C-415	δCM35B562K				
*C-422	Heterodyne Coupling Capacitor	Fixed, molded, mica, 5000 mmfd, ±10%, 500 v d.c. working (Used on TBS,TBS-1,2,3,4,5, & 7)	-481037-B10	RE 48A 143F RE 48A 154F	13	1W-5D5LL 1W-L	K-837955-5
*C-423	1st Detector Screen Grid By-pass Capacitor	Fixed, molded, mica, 3900 mmfd ±10%, 500 v d.c. working	δCM35B392K	∂C75.3-1942	1		P-722026-553
*C-424	1st Detector Plate By-pass Capacitor	Same as C-415 (Part of T-403)	δCM35B562K				
*C-425	1st I-F Grid Filter Capacitor	Same as C-415 (Part of T-403)	δCM35B562K				
*C-426	1st I-F Screen Grid By-pass Capacitor	Same as C-423	δCM35B392K				
*C-427	1st I-F Plate By-pass Capacitor	Same as C-415 (Part of T-404)	δCM35B562K				
*C-428	2nd I-F Grid Filter Capacitor	Same as C-415 (Part of T-404)	δCM35B562K				
*C-429	2nd I-F Screen Grid By-pass Capacitor	Same as C-423	δCM35B392K				
*C-430	2nd I-F Plate By-pass Capacitor	Same as C-415 (Part of T-405)	δCM35B562K				
*C-431	3rd I-F Grid Filter Capacitor	Same as C-415	δCM35B562K				
*C-432	3rd I-F Grid Coupling Capacitor	Same as C-407 (Part of T-405)					
*C-433	3rd I-F Screen Grid By-pass Capacitor	Same as C-423	δCM35B392K				
*C-434	3rd I-F Plate By-pass Capacitor	Same as C-415 (Part of T-406)	δCM35B562K				
*C-435	Diode Detector By-pass Capacitor	Molded, fixed, mica, 100 mmfd ±10%, 500 v d.c. working (Part of T-406)	-48674 δCM20B101K	RE 48A 148C RE 48A 154F ∂C75.3-1942	1 •		P-722001-573
*C-436	1st A-F Coupling Capacitor	Molded, fixed, mica, 10,000 mmfd ±10%, 300 v d.c. working	δCN40B103K	∂C75.3-1942	1		P-722035-563

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*
δ *American War Standard Type Number.*
∂ *American War Standard Specification.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		CAPACITORS (Continued)					
*C-437A	Noise Suppressor Grid By-pass Capacitor	Same as C-421A&B	-48795				
B	Noise Suppressor Grid By-pass Capacitor						
*C-438A	Noise Suppressor Plate By-pass Capacitor	Same as C-421A&B	-48795				
B	1st A-F Grid Filter Capacitor						
*C-439	1st A-F Cathode By-pass Capacitor	Dry electrolytic, 10 mfd +100% -10%, 100 v d.c. working			1		M-86021-3
*C-440	1st A-F Screen Grid By-pass Capacitor	Paper foil, metal case, 0.1 mfd ±20%, 200 v d.c. working			1		M-80376-506
*C-441	Output Grid Coupling Capacitor (Part of E-420)	Same as C-436	δCM40B103K				
*C-442	Rectifier Filter Input Capacitor	Dry, electrolytic, 10 mfd +75% -10%, 350 v d.c. working			1		M-86021-8
*C-443	1st Doubler Grid Coupling Capacitor	Same as C-407 (Part of L-401)					
*C-444	Oscillator Plate By-pass Capacitor	Same as C-417 (Part of L-401)	-48856-B10				
*C-445	1st Doubler Plate By-pass Capacitor	Same as C-417 (Part of L-402)	-48856-B10				
*C-446	2nd Doubler Plate By-pass Capacitor	Same as C-417 (Part of L-403)	-48856-B10				
*C-447A	AVC Time Constant Capacitor	Same as C-421A&B	-48795				
B	AVC Time Constant Capacitor						
*C-448A	AVC Time Constant Capacitor	Same as C-421A&B	-48795				
B	AVC Time Constant Capacitor						
*C-449	AVC I-F Amplifier Cathode By-pass Capacitor (Part of E-422)	Same as C-415	δCM35B562K				
*C-450	AVC I-F Amplifier Screen Grid By-pass Capacitor	Same as C-423	δCM35B392K				

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*
δ *American War Standard Type Number.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		CAPACITORS (Continued)					
*C-451	AVC Rectifier Filter Capacitor	Molded, fixed, mica, 1000 mmfd ±10%, 500 v d.c. working (Part of T-407)	-48983-B20 δCM30B102K		1		P-722017-559
*C-452	Bias Filter Capacitor	Dry, electrolytic, 50 mfd +100% -10%, 15 v d.c. working			1		M-86021-6
*C-453A B	A-C Line R-F Filter Capacitor A-C Line R-F Filter Capacitor	Fixed, paper, oil filled, 2 sections, 0.5/0.5 mfd ±15%, 400 v d.c. working, each section grounded to case	-481161		1		P-72024-509
*C-454A B	A-C Line R-F Filter Capacitor A-C Line R-F Filter Capacitor	Same as C-453A&B	-481161				
*C-455	Rectifier Filter Capacitor	Same as C-442					
*C-456	Rectifier Filter Capacitor	Dry, electrolytic, 20 mfd +75% -10%, 300 v d.c. working			1		M-86021-7
*C-457	2nd Detector Heater By-pass Capacitor	Molded, fixed, mica, 680 mmfd ±10%, 500 v d.c. working, max. operating temp. 85°C.	δCM25B681K	∂C75.3-1942	1		P-722008-593
*C-458	2nd Doubler Grid Coupling Capacitor	Same as C-407 (Part of L-402)					
*C-459	AVC I-F Plate Filter Capacitor	Same as C-415	δCM35B562K				
*C-460	1st I-F Heater By-pass Capacitor	Same as C-457	δCM25B681K				
*C-461	3rd I-F Heater By-pass Capacitor	Same as C-457	δCM25B681K				
*C-462	1st I-F Cathode By-pass Capacitor	Same as C-423	δCM35B392K				
*C-463	2nd I-F Cathode By-pass Capacitor	Same as C-436	δCM40B103k				
*C-464	R-F Input Meter By-pass Capacitor	Same as C-415	δCM35B562K				
*C-465	R-F AVC Filter Capacitor	Same as C-417	-48856-B10				
*C-1201	High Voltage Plate Supply Ripple Filter Capacitor	Same as C-301 (TBS-8)	-481733				

W2

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*
δ *American War Standard Type Number.*
∂ *American War Standard Specification.*

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		CAPACITORS (Continued)					
*C-1202	Low Voltage Plate Supply Ripple Filter Capacitor	Same as C-302 (TBS-8)					
*C-1211	High Voltage Plate Supply Ripple Filter Capacitor	Same as C-301 (TBS-8)	-481733				
*C-1212	Low Voltage Plate Supply Ripple Filter Capacitor	Same as C-302 (TBS-8)					
*C-1301	R.F. By-pass Capacitor	Same as C-303 (Dwg.#M-427877-30) (TBS-8)	-48643				
*C-1302	R.F. By-pass Capacitor	Same as C-304 (Dwg.#M-427877-31) (TBS-8)					
*C-1303	R.F. By-pass Capacitor	Same as C-304 (Dwg.#M-427877-31) (TBS-8)					
*C-1304	D.C. Motor Filter Capacitor	Same as C-304 (Dwg.#M-427877-31) (TBS-8)					
*C-1305	D.C. Motor Filter Capacitor	Same as C-304 (Dwg.#M-427877-31) (TBS-8)					
*C-1306	Motor Speed Regulator	Same as C-308 (Dwg.#M-427877-33) (TBS-8)					
*C-1311	R.F. By-pass Capacitor	Same as C-303 (Dwg.#M-427877-30) (TBS-8)	-48643				
*C-1312	R.F. By-pass Capacitor	Same as C-304 (Dwg.#M-427877-31) (TBS-8)					
*C-1313	R.F. By-pass Capacitor	Same as C-304 (Dwg.#M-427877-31) (TBS-8)					
*C-1314	D.C. Motor Filter Capacitor	Same as C-304 (Dwg.#M-427877-31) (TBS-8)					
*C-1315	D.C. Motor Filter Capacitor	Same as C-304 (Dwg.#M-427877-31) (TBS-8)					
*C-1316	Motor Speed Regulator	Same as C-308 (Dwg.#M-427877-34) (TBS-8)					

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MISCELLANEOUS ELECTRICAL PARTS					
E-101	Resistor Board for R-105,106, 109,110,125,132	Laminated insulation, 1/4" thick, 9" long x 3-1/2" wide			1		K-843751-1
E-102	Resistor Board Assembly for R-113,114,115,121,122,123, 129,135	Bakelite board 1/8" thick, 7-1/4" long x 2-9/16" wide, mounting 8 resistors, 16 terminal lugs E-104, brass eyelets, and other hardware			1		M-418226-501
E-103	Resistor Board Assembly for R-126,130,131,133	Bakelite board, 1/8" thick, 3-7/8" long x 2-9/16" wide, mounting 4 resistors, 8 terminal lugs E-104, brass eyelets, and other hardware			1		K-843789-501
E-104	Terminal Lug for Resistor Boards E-102,103	Brass strip, hard, 0.02" thick, bent at 30° angle (Part of E-101 and E-103)			1		K-61854-1
E-105	Terminal Board Assembly for Transmitter	Bakelite terminal board, 5/16" thick, 20-13/16" long x 1-1/2" wide, mounting 17 jacks J-101, 17 plugs P-101, 17 terminal lugs E-120, 17 terminal lugs E-122, and hardware			1		P-717250-501
*E-106	Stand-off Insulator for Capacitors and Inductances	Ceramic, 1/2" long, 1/2" O.D., both ends tapped #6-32 threads for 3/16"	-61166	RE 13A 317	22		K-823568-1
*E-107	Stand-off Insulator for R-107,138	Square post, steatite, 1-1/4" long, tapped at both ends, #10-32 threads for 3/8"	-61306		22 63 293	334 1080 R-571	K-802906-1
*E-108	Bushing Insulator for C-107, 114,132	Ceramic, 3/16" long, 5/8" O.D., 15/32" body O.D., 0.154" I.D.	-61190	RE 13A 317	22		K-818952-7
E-109	Feed-Through Insulator for R-124	Assembly consisting of: male and female porcelain bushing insulators E-123 and E-124, with brass stud #6-32 threads x 2", and other hardware			1		K-99018-503
*E-110	Stand-off Insulator for C-108,115	Ceramic, 11/16" long, 1/2" dia., both ends tapped #6-32 threads for 1/4"	-61172	RE 13A 317	22		K-823568-7
*E-111	Bushing Insulator for C-121,122,132	Ceramic, 0.425" long, 1/2" O.D., 3/8" body O.D., 0.173" I.D.	-61260	RE 13A 317	22		K-818952-3
*E-112	Stand-off Insulator	Ceramic, cylindrical post, 1/2" long, 1/2" O.D., both ends tapped #6-32 threads for 3/16"	-61166		22	397-L1/2	K-802900-20
*E-113	Tube Cap Connector for V-101, 102	Assembly consisting of: flexible copper connector, 3-1/2" long and contact 0.128" dia.			1		K-854595-501
*E-114	Tube Cap Connector for V-103	Assembly consisting of: flexible copper connector, 3-1/2" long, 3/8" wide and 0.0159" thick, and contact 0.128" dia.			1		K-854595-502

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MISCELLANEOUS ELECTRICAL PARTS (Continued)					
*E-115	Tube Cap Connector for V-103	Assembly consisting of: flexible copper connector 4-3/4" long, 1/2" wide and 0.0159" thick and tin plate contact 0.159" dia.			1		K-854598-501
*E-116	Tube Cap Connector for V-104	Assembly consisting of: two flexible copper connectors 3/4" and 4-3/16" long respectively, contact 0.128" dia. and one terminal			1		K-854602-501
*E-117	Tube Cap Connector for V-104	Assembly consisting of: two flexible copper connectors 4-1/2" and 3-1/8" long respectively, contact 0.159" dia.			1		K-854613-501
*E-118	Tube Cap Connector for V-105, 106	Grid clip, 11/32" I.D., 3/8" wide, 27/32" overall length			483	Type 24	K-801165-1
*E-119	Tube Cap Connector for V-109, 110	Grid clip, 17/32" I.D., 1/2" wide, 27/32" overall length			483	Type 12	K-801165-2
*E-120	Terminal Lug for E-105	Shakeproof, bronze tinned, 0.018" thick, bent at 30° angle, screw #6			599	Cat. #2103-6	K-30042-1
E-121	Mounting Bracket for Relays K-101,102	Galvanized or cadmium plated steel, 0.107" thick, 1-1/4" wide, bent at 90° angle with eight holes 1/4" dia. and one hole 11/32" dia.			79		K-841069-4
E-122	Terminal Lug for E-105	Brass, 0.064" thick, bent at 90° angle, make from K-811691-1			1		K-843681-1
*E-123	Male Portion of Feed-Through Insulator E-109	Glazed white porcelain, 1/4" head, 5/8" O.D., 11/32" neck 9/32" O.D., 0.149" hole for feed-through conductor			98	Cat. #458	K-871587-1
*E-124	Female Portion of Feed-Through Insulator E-109	Glazed white porcelain, body 5/8" long, tapered 5/8" to 7/16" dia. with 5/16" recess 11/32" dia., 0.149" hole for feed-through conductor			98	Cat. #458	K-871587-3
E-125	Connection Terminal Lug	Shakeproof, bronze, tinned, 0.018" thick, bent at 30° angle, screw #6			599	Cat. #2110-6	K-30042-6
E-126	Dial Knob for Transmitter, Oscillator, 1st and 2nd Doubler and Power Amplifier	Assembly consisting of 2-1/16" dia. bakelite knob, 7/8" long, with insert and thumbscrew			402	#S-311-64-25-B-BB-L	K-823000-501
E-127	Insulating Strip for Relays K-101,102	Bakelite, 0.016" thick, 1-7/32" long, 1-5/32" wide, with 1 hole 0.302" dia. and 6 holes 0.169" dia.			79		K-841069-3
E-128	Terminal Lug for Grounding Resistors	Bronze tinned, 0.018" thick, bent at 30° angle, shakeproof, screw #8			599	Cat. #2103-8	K-30042-3

** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MISCELLANEOUS ELECTRICAL PARTS (Continued)					
E-129	Connection Terminal Lug	Bronze tinned, 0.018" thick, bent at 30° angle, shake-proof, screw #8			599	Cat. #2110-8	K-30042-7
E-130	Connection Terminal Lug	Bronze, hot tin dipped, for #10 screw			599	Cat. #2108-10	K-821313-4
E-131	Connection Terminal Lug	Bronze, hot tin dipped, for #6 screw			599	Cat. #2108-6	K-821313-2
E-132	Push Button for Relay K-105	Black bakelite, 9/16" dia., 5/16" long, to accommodate 1/4" dia. shaft and 0.136" dia. setscrew			28		K-860226-1
E-133	Pointer Knob for Plate and Grid Current Meter Switch	Black, 1-1/4" long, 5/8" high, for 1/4" shaft, with #8-32 thread setscrew, cadmium plated			402	Type #366	K-818739-1
E-134	Terminal for Wiring Material	Lug type, brass, hot tin dipped, 0.025" thick, 25/32" long, with hole 0.180" dia.			1		K-8431-1
E-135	Terminal for Wiring Material	Lug type, copper, hot tin dipped, 0.036" thick, 15/16" long, with hole 0.196" dia.			521	Cat. #2041	K-818337-9
E-136	Terminal for Wiring Material	Hard copper, 0.031" thick, 5/16" wide, 9/16" long with hole 0.170" dia.			1		K-818352-7
E-137	Terminal for Wiring Material	Brass, 0.031" thick, 23/32" long, 11/32" wide, with hole 13/64" dia.			760	Cat. #105	K-818270-1
*E-138	Washer for Sockets X-101,102, 103,104,105,106,107,108,109, 110,111,112	Paper, insulating, 3/32" thick, 5/16" dia. with hole 0.144" dia.			1		K-59111-3
E-201	Terminal Board Assembly	Consisting of a bakelite board 3/8" thick, 8" long and 3" wide, mounting 14 brass terminals 0.064" thick, bent at 45° angle, and hardware			1		M-420401-501
E-202	Terminal Board Assembly	Consisting of a stencilled bakelite board 3/8" thick, 8" long and 3" wide, mounting 14 brass terminals 0.064" thick, bent at 45° angle, 1 shakeproof terminal lug, and hardware			1		M-420401-502
E-203	Volume Control Knob	Molded knob 1-1/8" dia., 11/16" long, for 1/4" shaft, tapped for 2 setscrews #6-32 x 1/4"			496		K-838604-502
*E-204	Stand-off Insulator for R-203	Same as E-106	-61166				
E-205	Terminal	Same as E-137					
E-206	Terminal Lug	Shakeproof, bronze tinned, 0.018" thick, screw #10			599	Cat. #2101-10	K-30042-4
*E-303	Fuse Block	Ferrule, single fuse type, ceramic base, 1-30 amps.			23	Cat.#3937	K-870043-1
*E-303	Fuse Block	Ferrule, double fuse type, 1-30 amps.			23	Cat.#1917	K-881388-1
*E-304	Fuse Block for Motor Generator	Special fuse block			18	8135378AA2	M-427877-41
*E-305	Fuse Clip	Fuse clip			18	5831965AA	M-427877-77
*E-401	Receiver Fuse Board Assembly Mounting Fuses F-401,402	Laminated phenolic, insulated fuse board, 1/8" thick, 2-1/8" long, 1-27/32" wide, with shield, 4 clips, 4 terminals and assembling hardware			1		K-880887-501

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MISCELLANEOUS ELECTRICAL PARTS (Continued)					
*E-402	Bushing Insulator for Antenna Post	Isolantite, 1/4" high, 3/4" O.D., 9/16" body O.D., 0.154" I.D.	-61208	RE 13A 317	22		K-818952-2
*E-403	Insulated Mounting for Headphone Jack	Laminated, cloth base, 1/8" thick, 1-3/4" long, 1" wide, 25/64" dia., center hole, 1-3/8" between mounting holes			1		K-850879-1
E-404	Washer, Centering, Insulating Mounting for Headphone Jack	Laminated, 1/32" thick, 7/16" I.D., 11/16" O.D.			1		K-59111-37
*E-405	Insulation for Main Rectifier Socket	Phenolic, insulating material, 15/16" dia. hole, 1/32" thick, 1-9/16" long x 1-9/16" wide		17-P-5 Type PBG	1		K-59839-1
*E-406	Insulator for Power Amplifier Socket	Octal shape, bakelite, paper base, 15/16" dia. hole, 1/32" thick, 2-1/4" long, 1-1/2" wide			690		K-841826-2
*E-407	Washer, Insulating for 1st and 2nd Doubler Sockets	Same as E-138					
*E-408	Tube Shield for V-402,404,405, 406,407,408,409	Aluminum, 0.015" thick, 1.591" I.D., 1.657" O.D., 3-1/2" long			82	Cat. #B-704 or #B-709	K-833405-4
*E-409	Shield Cap for V-402,404,405, 406,407,408,409	Aluminum, 0.020" thick, 1-5/8" I.D., 1-1/4" high			82	Cat. #B-903	K-850869-7
*E-410	Shield Base for V-402,405,406, 407,408,409	Aluminum, 0.025" thick, 1-7/32" I.D., 1-21/32" O.D., 1/2" high, 1.843" between mounting holes			82	Cat. #B-803	K-850869-1
*E-411	Grid Clip for T-403,404,405	Steel to snap on tight on glass tube, grid connection 9/16" long, 3/8" wide			760	Cat. #154	K-79834-1
E-412	Insulation for Rectifier Filter Capacitors C-442,455,456	Laminated, cloth base, 1/64" thick, 4-5/16" long, 1" wide			1		K-850902-1
*E-413	Spacer for Terminal on R-F Unit Assembly	Ceramic base, impregnated, 0.116" thick, 0.375" O.D., 0.1495" I.D.		RE 13A 317 Grade G	22		K-829954-2
E-414	Spacer for Terminal on R-F Unit Assembly	Ceramic base, impregnated, 0.085" thick, 0.375" O.D., 0.180" I.D.		RE 13A 317 Grade G	22		K-829954-3
*E-415	Input-Output Terminal Board Assembly	Terminal board mounting 4 terminal assemblies, 8 rivets, 115 v, 60 cycles output			1		K-850905-501
*E-416	Spade Terminal on Input-Output Terminal Board E-415	Brass, 0.032" thick, 13/16" long			1		K-806765-1
*E-417	Terminal Board Assembly for L-402,403	Bakelite board mounting two brass terminals			11	Cat. #1520	K-81641-3

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MISCELLANEOUS ELECTRICAL PARTS (Continued)					
*E-418	Receiver Knob for Antenna, Link, Detector, 1st and 2nd Doubler, Oscillator, Volume Control, Noise Suppressor, AVC Time Constant and Input Meter Switch	Assembly consisting of: pointer and black phenolic knob 1" dia., with tapped hole for #8-32 setscrew			1		K-815104-509
*E-419	Terminal Lug	Brass, 0.020" thick, bent at 90° angle			1		K-60106-6
*E-420	Resistor Board Assembly for R-420,423,424,425,427,428, 429,430,431,C-441	Laminated insulation, 5-27/32" long, 1-5/8" wide, 1/16" thick, cloth base, mounting 9 resistors, 1 capacitor, 3 spacers, 2 brass eyelets, 18 half terminals and 2 bushings			1		P-720171-502
*E-421	Resistor Board Assembly for R-406,407,408,409,410,411, 412,413,414,443	Laminated insulation, 5-27/32" long, 1-5/8" wide, 1/16" thick, cloth base, mounting 10 resistors, 6 brass eyelets, 20 full terminals, 2 bracket assemblies and spacers			1		P-720171-501
*E-422	Resistor Board Assembly for R-437,438,441,444,445,446 C-416,449	Laminated insulation, 4-1/8" long, 1-5/8" wide, 1/16" thick, cloth base, mounting 6 resistors, 2 capacitors, 2 spacers, 2 bushings, and 16 half terminals			1		P-720171-504
*E-423	Resistor Board Assembly for R-416,417,426 and C-436	Laminated insulation, 2-1/16" long, 1-5/8" wide, 1/16" thick, cloth base, mounting 3 resistors, 1 capacitor, 9 full terminals, 4 brass eyelets, and 2 bracket assemblies			1		P-720171-503
*E-424	Terminal Lugs for A-405	Brass, 0.020" thick, bent at 30° angle			1		K-60106-4
*E-425	Terminal Board Assembly for J-401	Bakelite board mounting one brass terminal			11	Cat. #1512	K-81641-1
*E-426	Terminal	Lug type, brass, 0.180" dia. hole, 25/32" long, hot tin dipped finish			1		K-8431-1
*E-427	Grid Clip for V-401	Phosphor bronze for acorn tube, 0.010" thick, 0.669" long, 0.090" wide			552 553		K-99046-1
*E-428	Grid Clip	Steel, to fit tightly over metal tube or octal base, "G" tube, 11/16" long, 1/4" wide			11	Part #6005	K-79834-2
E-429	Insulating Tubing	Non-inflammable, flexible, yellow color, 0.106" I.D., 11" long			1		K-850988-50
E-430	Tubing	Varnished, black, 0.066" I.D., 3" long			1		K-850988-51

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MISCELLANEOUS ELECTRICAL PARTS (Continued)					
E-431	Terminal Lug for L-407,408	Copper, 0.020" thick, 1-1/8" long, 3/8" wide, with 1 hole 0.170" dia. and 1 hole 3/32" dia.			521	Cat. #4035	K-823061-1
*E-432	Shield Base for V-404	Aluminum, 0.025" thick, 1-3/8" I.D., 1-21/32" O.D., 1/2" high, 1.843" between mounting holes			82	Cat. #B-803	K-850869-6
*E-433	Insulation	Laminated, cloth base, 1/64" thick, 4-5/16" long, 1" wide			1		K-850902-1
*E-434	Insulation	Laminated, phenolic, natural, 12" x 6" x 1/8"			649a	Type 17-P-5 PBE Form S	K-885326-1
*E-435	Insulator	Laminated phenolic, natural, 1" dia. x 1/2" long			656	Type 17-P-5 PBE Form R	K-885325-1
*E-436	Insulator	Laminated phenolic, natural 1/2" dia. x 12" long			656	Type 17-P-5 PBE Form R	K-885325-2
*E-437	Insulator	Polystyrene rod, 1" dia. x 6" long			90a	XMS-10,023	K-885325-3
E-501	Terminal	Brass, 0.020" thick, 0.313" wide, hot tin dipped			599	Cat. #2523-6	K-67592-8
E-502	Terminal	Copper, tinned, 3/8" wide, 1-11/32" long, 0.032" thick, hole 0.196" dia.		47-C-2	1		P-171446-3
E-503	Terminal Board Assembly for T-501	Same as E-425					
E-504	Terminal Board Assembly	Vul. fiber board, 2-1/4" long, 5/8" wide, 1/16" thick, mounting solder coated terminals 21/32" long, 0.031" thick, bent at 60° angle with #6-32 cadmium plated steel screws 5/16" long			1		K-845018-501
E-505	Pointer Knob for Volume Control	Same as E-133 (Part of R-501)					
*E-701	Insulator for Transmitter End of Transmission Line	Ceramic, 3/32" I.D., 1/2" O.D., 2-1/2" long			165	Type #341	K-854548-11
*E-702	Insulator for Antenna End of Transmission Line	Same as E-701, except dwg. no.					K-854548-12
E-1201	Terminal	Copper, hot tin dipped, 0.039" thick, 1-1/16" overall length, hole 0.257" dia.			521	Cat. #2050	K-818337-2
E-1202	Terminal Block	Block 4-3/8" long, 1-1/2" wide, 1-5/32" high with 6 terminals stencilled 7, 8, 9, 10, 11 and 12, with 4 corner holes 3/16" dia.			35	Class 9008 Type R-6	M-429635-2
*E-1203	Fuse Block	Same as E-303 (Dwg. #881388-1)					
E-1204	Block for Reactor Pack	3-1/2" long, 1-1/4" wide, 1/2" greatest thickness, 3 holes 0.199" dia.			1		K-855960-1
E-1205	Terminal	Same as E-135					
*E-1304	Fuse Block	Special (TBS-8)			18	8135378AA2	M-427877-41
*E-1314	Fuse Block	Same as E-1304					

** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		PROTECTIVE DEVICES					
*F-301	Line Protection Fuse for A-C Magnetic Controller	Cartridge, ferrule type, renewable, 25 amps., 600 v, for 220/440 v a.c. equipment			8	Cat. #7260	K-99109-6
*F-301A	Fuse Link for F-301	Renewable link, 25 amps., 600 v for 220/440 v a.c. equipment			8	Cat. #7360	K-99109-36
*F-301	Line Protection Fuse for D-C Magnetic Controller	Cartridge, ferrule type, renewable, 25 amps., 250 v, for 120/230 v d.c. equipment			8	Cat. #7060	K-99108-6
*F-301A	Fuse Link for F-301	Renewable link, 25 amps., 250 v for 120/230 v d.c. equipment			8	Cat. #7160	K-99108-36
*F-302	Line Protection Fuse for A-C Magnetic Controller	Same as F-301, Dwg. K-99109-6					
*F-302A	Fuse Link for F-302	Same as F-301A, Dwg. K-99109-36					
*F-302	Line Protection Fuse for D-C Magnetic Controller	Same as F-301, Dwg. K-99108-6					
*F-302A	Fuse Link for F-302	Same as F-301A, Dwg. K-99108-36					
*F-303	Line Protection Fuse for A-C Magnetic Controller	Same as F-301, Dwg. K-99109-6					
*F-303A	Fuse Link for F-303	Same as F-301A, Dwg. K-99109-36					
*F-304	Filament Supply Fuse for D-C Magnetic Controller	Same as F-301, Dwg. K-99108-6					
*F-304A	Fuse Link for F-304	Same as F-301A, Dwg. K-99108-36					
*F-305	Filament Supply Fuse for D-C Magnetic Controller	Same as F-301, Dwg. K-99108-6					
*F-305A	Fuse Link for F-305	Same as F-301A, Dwg. K-99108-36					
*F-306	Low Voltage Plate Supply Fuse	Fuse, 1/2 amp., 1000 v, 2.95" long, 0.5" ferrule dia., (Part of G-301)			18	V-5831963AA	M-427877-40
*F-307	High Voltage Plate Supply Fuse	Same as F-306					
*F-401	A-C Line Fuse	Glass cartridge type, 3 amps., 250 v, 1-1/4" long 1/4" ferrule dia.			26	3AG	K-55544-4
*F-402	A-C Line Fuse	Same as F-401					
*F-1201	Line Protection Fuse for D-C Magnetic Controller	Same as F-301, Dwg. K-99108-6					

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		PROTECTIVE DEVICES (Continued)					
*F-1201A	Fuse Link for F-1201	Same as F-301A, Dwg. K-99108-36					
*F-1202	Line Protection Fuse for D-C Magnetic Controller	Same as F-301, Dwg. K-99108-6					
*F-1202A	Fuse Link for F-1202	Same as F-301A, Dwg. K-99108-36					
*F-1203	Filament Supply Fuse for D-C Magnetic Controller	Same as F-301, Dwg. K-99108-6					
*F-1203A	Fuse Link for F-1203	Same as F-301A, Dwg. K-99108-36					
*F-1204	Filament Supply Fuse for D-C Magnetic Controller	Same as F-301, Dwg. K-99108-6					
*F-1204A	Fuse Link for F-1204	Same as F-301A, Dwg. K-99108-36					
*F-1211	Line Protection Fuse for D-C Magnetic Controller	Same as F-301, Dwg. K-99108-6					
*F-1211A	Fuse Link for F-1211	Same as F-301A, Dwg. K-99108-36					
*F-1212	Line Protection Fuse for D-C Magnetic Controller	Same as F-301, Dwg. K-99108-6					
*F-1212A	Fuse Line for F-1212	Same as F-301A, Dwg. K-99108-36					
*F-1213	Filament Supply Fuse for D-C Magnetic Controller	Same as F-301A, Dwg. K-99108-6					
*F-1213A	Fuse Link for F-1213	Same as F-301A, Dwg. K-99108-36					
*F-1214	Filament Supply Fuse for D-C Magnetic Controller	Same as F-301, Dwg. K-99108-6					
*F-1214A	Fuse Link for F-1214	Same as F-301A, Dwg. K-99108-36					
*F-1301	Low Voltage Plate Supply Fuse	Same as F-306					
*F-1302	High Voltage Plate Supply Fuse	Same as F-306					
*F-1311	Low Voltage Plate Supply Fuse	Same as F-306					
*F-1312	High Voltage Plate Supply Fuse	Same as F-306					

** SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		GENERATORS					
*G-301	Plate Voltage Supply Generator (Combined with B-301)	Generator, high voltage 306 watts, 0.350 amp., 875 v, low voltage 60 watts, 0.200 amp., 300 v, shunt wound, ball bearing, insulation test voltage 2750 (750 v after filter capacitors are connected), 40°C temp. rise. (TBS, TBS-1, TBS-2, TBS-3, TBS-4, TBS-5)	-21300 -21300A		18	5LY57AB6	K-860272-1
*G-301	Plate Voltage Supply Generator (Combined with B-301)	Generator, high voltage 306 watts, 0.350 amp., 875 v, low voltage 60 watts, 0.200 amp., 300 v, shunt wound, ball bearing, insulation test voltage 2750 (750 v after filter capacitors are connected), 40°C temp. rise. (TBS, TBS-3, TBS-5)	-21301		18	5LY57AB5	K-860273-1
*G-301	Plate Voltage Supply Generator (Combined with B-301)	Generator, high voltage, 306 watts, 0.350 amp., 875 v, low voltage 60 watts, 0.200 amp., 300 v, shunt wound, ball bearing, insulation test voltage 2750 (750 v after filter capacitors are connected), 40°C temp. rise. (TBS, TBS-1, TBS-2, TBS-3, TBS-5)	-21302		18	5LY57AB2	K-860274-1
*G-301	Plate Voltage Supply Generator (Combined with B-301)	Generator, high voltage, 306 watts, 0.350 amp., 875 v, low voltage 60 watts, 0.200 amp., 300 v, shunt wound, ball bearing, insulation test voltage 2750 (750 v after filter capacitors are connected), 40°C temp. rise. (TBS-3, TBS-4, TBS-5)	-21745		18	5LY57AB10	K-875578-1
*G-301	Plate Voltage Supply Generator (Combined with B-301)	Generator, high voltage, 306 watts, 0.350 amp., 875 v, low voltage 60 watts, 0.200 amp., 300 v, shunt wound, ball bearing, insulation test voltage 2750 (750 v after filter capacitors are connected), 40°C temp. rise. (TBS-7)	-211127		18	5BC66AB1522	P-717756-2
*G-301	Plate Voltage Supply Generator (Combined with B-301)	Generator, high voltage, 306 watts, 0.350 amp., 875 v, low voltage 60 watts, 0.200 amp., 300 v, shunt wound, ball bearing, insulation test voltage 2750 (750 v after filter capacitors are connected), 50°C temp. rise. (TBS-6, TBS-7)	-211129		18	5BC66AB1520	P-717755-1
*G-301	Plate Voltage Supply Generator (Combined with B-301)	Generator, high voltage, 306 watts, 0.350 amp., 875 v, low voltage 60 watts, 0.200 amp., 300 v, shunt wound, ball bearing, insulation test voltage 2750 (750 v after filter capacitors are connected), 50°C temp. rise. (TBS-6, TBS-7)	-211130		18	5BC66AB1523	P-717756-1
*G-1301	Plate Voltage Supply Generator (Combined with B-1301)	Same as G-301 (TBS-8)	-211127				
*G-1311	Plate Voltage Supply Generator (Combined with B-1311)	Same as G-301 (TBS-8)	-211130				

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		GENERATORS (Continued)					
*G-301A	Armature for CG-21300,-21300A	Same as B-301A					
*G-301A	Armature for CG-21301,-21302	Same as B-301A					
*G-301A	Armature for CG-21745	Same as B-301A					
*G-301A	Armature for CG-211127	Same as B-301A					
*G-301A	Armature for CG-211129	Same as B-301A					
*G-301A	Armature for CG-211130	Same as B-301A					
*G-1301A	Armature for CG-211127	Same as B-301A					
*G-1311A	Armature for CG-211130	Same as B-301A					
*G-301B	Ball Bearing for CG-21300, -21300A,-21301,-21302, -21745	Same as B-301B					
*G-301B 1301B 1311B	Ball Bearing for CG-211127, -211129,-211130	Same as B-301B					
*G-301C	Generator Brush Assembly for CG-21300,-21300A,-21301, -21302,-21745	Brush, spring, pigtail and terminal			18	M-5052405-AC12	K-860256-3
*G-301C 1301C 1311C	Generator Brush Assembly for CG-211127,-211129,-211130	Brush, spring, pigtail and terminal			18	5869390AH3	M-427877-13
*G-301D	Collector Brush Assembly for CG-21300,-21300A,-21745	Brush, spring, pigtail and terminal			18	M-5052405-AA19	K-860256-5
*G-301D 1301D 1311D	Collector Brush Assembly for CG-211127,-211130	Brush, spring, pigtail and terminal			18	5869390AH4	M-427877-16

* *SPARE PARTS furnished, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		GENERATORS (Continued)					
*G-301E	Generator Brush Holder for CG-21300,-21300A,-21301, -21302,-21745	Brush holder and insulation			18	K-5049935AL7	K-860256-7
*G-301E 1301E 1311E	Generator Brush Holder for CG-211127,-211129,-211130	Brush holder and insulation			18	5869388AM1	M-427877-17
*G-301F	Collector Brush Holder for CG-21300,21300A,-21745	Brush holder and insulation			18	K-5049935AR1	K-860256-9
*G-301F 1301F 1311F	Collector Brush Holder for CG-211127,-211130	Brush holder and insulation			18	5869388AN1	M-427877-20
*G-301G	Generator Springs for CG-21300, -21300A,-21301,-21302,-21745	Springs			18	K-5824865	K-860256-11
*G-301H	Gollector Springs for CG-21300, -21300A,-21745	Springs			18	K-3533302	K-860256-13
*G-301J	Generator Coil for CG-21300, -21300A	Main field coil			18	5LY57AB6	K-860256-15
*G-301J	Generator Coil for CG-21745	Main field coil			18	5LY57AB10	K-875577-15
*G-301J	Generator Coil for CG-21300, -21300A,-21745	Main field coil			18	8169733-AA1	M-427877-73
*G-301J	Generator Coil for CG-21301, -21302	Main field coil			18	8160055-AA1	K-860256-23
*G-301J	Generator Coil for CG-21301, -21302	Main field coil			18	8160055-AA1	M-427877-72
*G-301J 1301J 1311J	Generator Coil for CG-211127, -211130	Main field coil			18	8167846AB1	M-427877-4
*G-301J	Generator Coil for CG-211129	Main field coil			18	8167880AA1	M-427877-5

* *SPARE PARTS furnished, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		GENERATORS (Continued)					
*G-301K	Generator Interpole Coil for CG-21300,-21300A	Commutating field coils			18	5LY57AB6	K-860256-20
*G-301K	Generator Interpole Coil for CG-21300,-21300A,21301, -21302,-21745	Commutating field coils			18	8169734AA1	M-427877-74
*G-301K	Generator Interpole Coil for CG-21301,-21302	Commutating field coil			18	8160055AA1	K-860256-24
*G-301K	Generator Interpole Coil Plate Voltage Supply for CG-21745	Commutating field coil			18	5BC66AB1333	K-875577-20
*G-301K 1301K 1311K	Generator Interpole Coil for CG-211127,-211130	Commutating field coil			18	8169391AA1	M-427877-8
*G-301K	Generator Interpole Coil for CG-211129	Commutating field coil			18	8169394AA1	M-427877-9
*G-301M 1301M 1311M	Cap for Generator and Collector Brush Holder for CG-211127, -211129,-211130	Brush holder cap			18	5898031AA2	M-427877-22
*G-301P 1301P 1311P	Washer for Generator and Collector for CG-211127, -211129,-211130	Washer, prenite			18	5855002AA1	M-427877-26

* *SPARE PARTS furnished, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MISCELLANEOUS HARDWARE					
*H-201	Knurled Nut	Brass, straight knurl, 1/16" thick, threaded 15/32"-32 threads, 19/32" O.D.			1		K-60514-1
*H-401	Lock Nut	Brass, 1/16" thick, tapped 15/32"-32 threads, 9/16" O.D., double chamfer			1		K-818921-1
*H-402	Knurled Nut	Same as H-201					
*H-403	Handle for Receiver	Brass, 4-3/4" long, 1-3/16" high			46 3078 740		K-12124-1
*H-404	Case Screw	Brass, threaded #6-32 threads for 3/8", 1-5/8" overall length, knurled handle			1		K-854205-1
*H-405	Case Nut	Brass, threaded #6-32 threads, 5/16" O.D., 3/16" thick			1		K-854205-3
		INDICATING DEVICES					
*I-101	Standby Pilot Lamp	Miniature bayonet base, 6.3 v, 0.25 amp., 1.6 watts, bulb T-3-1/4 clear			18	Mazda #44	K-61114-15
*I-101	Standby Pilot Lamp	Miniature screw base, 6.3 v, 0.15 amp., 0.94 watts, bulb T-3-1/4 clear (TBS only)			18	Mazda #40	K-61114-2
*I-201	Standby Pilot Lamp	Same as I-101 (Dwg. K-61114-15)					
*I-201	Standby Pilot Lamp	Same as I-101 (Dwg. K-61114-2) (TBS only)					
*I-401	Pilot Lamp to Indicate Power "ON"	Same as I-101 (Dwg. K-61114-15)					

** SPARE PARTS furnished, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		JACKS, RECEPTACLES & JUNCTION BOXES					
*J-101	Jack for E-105	Complete with terminal and nut, threaded 1/4"-28 threads, body length 17/32" plated			23	Cat. #74	K-99015-3
J-102	Jack for Crystal Holder Base	Complete with terminal and nut, threaded 1/4"-28 threads, body length 1/2" plated			304	Type 274-J	K-99015-1
*J-201	Handset Receptacle	Chassis, connector, 4 contacts, female, not grounded, knurled nut, threaded 13/16"-28 threads, polarized			6	PC4F	M-420410-1
*J-202	Chestset Receptacle	Same as J-201					
*J-203	Headphone Jack	Single, closed circuit, complete with hex. nut and washer	-49008		702	2-A	K-7862660-2
*J-401	Connection for Headphone	Jack, nickel plated brass frame, complete with nut, (Cat. #255), and washer (Cat. #226), 3/4" long			28	Cat. #701	K-833759-3
J-402	Crystal Connector (Part of X-413)	Same as J-102					
J-403	Crystal Connector (Part of X-413)	Same as J-102					
*J-801	Headset Jack on Chestset	Two-way extension, 3-11/32" overall length			28	Cat. #100-A	K-854220-1
		ELECTROMAGNETIC CONTACT DEVICES					
*K-101	Phone-MCW Switching Relay	Horizontal type, right arm, 3 break contacts, consisting of coil K-101A and contacts K-101B			79	D-282282	P-713837-530
*K-101A	Coil for Phone-MCW Switching Relay (K-101)	Bakelite, impregnated, 21,300 turns AWG #39 SSC wire, single, one winding, d-c resistance 3000 ohms			79	D-282282	M-415604-17
*K-101B	Contact for Phone-MCW Switching Relay (K-101)	Horizontal type, 3 sets of palladium contacts, 2-1/2" long, 27/32" high, 23/32" wide, overall dimensions			1		K-880966-1
*K-102	MCW Keying Relay	Horizontal type, right arm, 1 break contact and 1 make contact, consisting of coil K-102A and contacts K-102B			79	K-282282	P-713837-528
*K-102A	Coil for MCW Keying Relay (K-102)	Same as K-101A					
*K-102B	Contact for MCW Keying Relay (K-102)	Horizontal type, 4 contacts, 2-1/2" long, 23/32" wide, 13/16" high, overall dimensions			79		K-880965-1

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		ELECTROMAGNETIC CONTACT DEVICES (Continued)					
*K-103	Antenna Transfer and High Voltage Plate Power Switching Relay	Transmit and receive, 5 contacts, 3 break-make, consisting of coil K-103A and contacts K-103B, together with 2 brackets, cover, coil bracket and guide assembly plunger, support, spring, strap, coil plug, 4 bushing insulators, 2 contact assemblies, 2 spacers, contact arm, terminal board, 4 insulators, bushing, stud contact, 4 copper connectors, 5 terminals, plate and assembling hardware			25		P-721538-501
*K-103A	Coil for Antenna Transfer and High Voltage Plate Power Switching Relay, (K-103)	12,200 turns AWG #37 E wire, d-c resistance 1100 ohms (TBS-3,4,5,6,7 and 8 only)			25	Cat. #257	K-883493-1
*K-103A	Coil for Antenna Transfer and High Voltage Plate Power Switching Relay, (K-103)	10,300 turns AWG #38 wire, d-c resistance 1140 ohms (TBS, TBS-1, TBS-2 only)			1		K-900555-501
*K-103B	Contact for Antenna Transfer and High Voltage Plate Power Switching Relay (K-103)	Assembly consisting of two contacts, contact arm, stud contact and contact assembly			1		K-860239-502
*K-104	Low Voltage Plate Power Switching Relay	Control, 1 make contact, bakelite base, consisting of coil K-104A, and contacts K-104B			24	Type #2230538	K-843567-2
*K-104A	Coil for Low Voltage Plate Power Switching Relay	Operates on 5 ma at 10 v d.c., d-c resistance of coil approx. 1950 ohms			24		K-843567-3
*K-104B	Contact for Low Voltage Plate Power Switching Relay	Two contacts, one round and one flat			24		K-880967-501
*K-105	Power Amplifier Overload Relay	Trip relay 3" long, 2" wide, 2" deep, overall dimensions			25	Type 1040-R	K-860214-1
*K-105A	Coil for Power Amplifier Overload Relay	Coil, resistance 43 ohms ±5%, nominal tripping current 140 ma d.c.			25		K-860214-2
*K-105B	Contact for Power Amplifier Overload Relay	Contact arm and 1 contact			25		K-880964-501
*K-201	Loudspeaker Switching Relay	Same as K-104					
*K-201A	Coil for Loudspeaker Switching Relay	Same as K-104A					
*K-201B	Contact for Loudspeaker Switching Relay	Same as K-104B					

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MAGNETIC CONTROLLERS					
*K-301	D-C Motor Starting Contactor, Four Step	Automatic motor starter, d.c., 1-1/2 h.p., 230 v d.c., 4 points of acceleration, 3 wire control less low voltage and overload protection, 115 v, coil to operate in series with resistor from 230 v d.c.	-21804		35	Cat. #EQ-1024 -G2 Class 7107 Type B1	K-881400-1
*K-301	A-C Motor Starting Contactor	Contactor, 3 pole, 440 v with 220 v, coil for 3 wire control to operate in series with a resistor from 220 v a.c.	-21320		35	Cat. #EQ-1018 -G1 Dwg. #2073-C7 Class 8502	K-881402-1
*K-301	D-C Motor Starting Contactor, Four Step	Automatic motor starter, d.c., 1-1/2 h.p., 120 v d.c., 4 points of acceleration, 3 wire control less low voltage and overload protection, 55 v coil to operate in series with resistor from 120 v d.c.	-21319		35	Cat. #EQ1024 -G1 Class 7107 Type B1	K-881401-1
*K-301A	Contact Finger for CRV-21319, or CRV-21804	Four contacts, part of set of seven arcing contacts (Formerly K-301A, Dwg. No. K-860257-1)			35	Part 751-G12	K-880962-1
*K-301B	Contact Finger for CRV-21319, or CRV-21804	One contact, part of set of seven arcing contacts (Formerly K-301A, Dwg. No. K-860257-1)			35	Part 1445-G2	K-880962-2
*K-301C	Contact Terminal for CRV-21319, or CRV-21804	One terminal, part of set of seven arcing contacts (Formerly K-301A, Dwg. No. K-860257-1)			35	Part 1445-G9	K-880962-3
*K-301D	Contact Terminal for CRV-21319, or CRV-21804	One terminal, part of set of seven arcing contacts (Formerly K-301A, Dwg. No. K-860257-1)			35	Part 1445-G14	K-880962-4
*K-301E	Sliding Brush Contact for CRV-21319 or CRV-21804	Sliding brush contact, carbon, part of set of two sliding brushes (Formerly K-301B, Dwg. No. K-860257-2)			35	Part 751-X48	K-880962-5
*K-301F	Sliding Brush Contact for CRV-21319 or CRV-21804	Sliding brush contact, copper, part of set of two sliding brushes (Formerly K-301B, Dwg. No. K-860257-2)			35	Part 751-X47	K-880962-6
*K-301G	Finger Spring for CRV-21319 or CRV-21804	Three finger springs, part of set of six springs (Formerly K-301C, Dwg. No. K-860257-3)			35	Part 751-G10	K-880962-7
*K-301H	Finger Spring for CRV-21319 or CRV-21804	One finger spring, part of set of six springs (Formerly K-301C, Dwg. No. K-860257-3)			35	Part 751-G9	K-880962-8
*K-301I	Finger Spring for CRV-21319 or CRV-21804	One finger spring, part of set of six springs (Formerly K-301C, Dwg. No. K-860257-3)			35	Part 1445-X9	K-880962-9
*K-301J	Return Spring for CRV-21319 or CRV-21804	One return spring, part of set of six springs (Formerly K-301C, Dwg. No. K-860257-3)			35	Part 750-X22	K-880962-10
*K-301K	Coil for CRV-21319	Coil (Formerly K-301D, Dwg. No. K-860257-4)			35	Part 751-S1-W26	K-880962-20

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MAGNETIC CONTROLLERS (Continued)					
*K-301L	Contact Finger for CRV-21320	Three contact fingers, part of set of 12 arcing contacts (Formerly K-301A, Dwg. No. K-860270-1)			35	Part 2073-G2	K-880963-1
*K-301M	Contact for CRV-21320	Six contacts, part of set of 12 arcing contacts (Formerly K-301A, Dwg. No. K-860270-1)			35	Part 2073-G1	K-880963-2
*K-301N	Contact for CRV-21320	One contact, part of set of 12 arcing contacts (Formerly K-301A, Dwg. No. K-860270-1)			35	Part 1487-G8	K-880963-3
*K-301O	Contact for CRV-21320	One contact, part of set of 12 arcing contacts (Formerly K-301A, Dwg. No. K-860270-1)			35	Part 1487-G15	K-880963-4
*K-301P	Contact and Spring Assembly for CRV-21320	One contact and spring assembly, part of set of 12 arcing contacts (Formerly K-301A, Dwg. No. K-860270-1)			35	Part 1487-G9	K-880963-5
*K-301Q	Spring for CRV-21320	Three springs, part of set of 4 springs (Formerly K-301B, Dwg. No. K-860260-2)			35	Part 1487-X39	K-880963-6
*K-301R	Spring for CRV-21320	One spring, part of set of 4 springs (Formerly K-301B, Dwg. No. K-860270-2) (Used on Models TBS-3,4,5,6,7, and 8)			35	Part 2073-X3	K-880963-7
*K-301S	Coil for CRV-21320	Coil (Formerly K-301D, Dwg. No. K-860270-3)			35	Part 1487-S1-S29B	K-880963-9
*K-301T	Coil for CRV-21804	Coil (Formerly K-301D, Dwg. No. K-860257-14)			35	Part 751-S1-W29	K-880962-21
*K-301W	Spring for CRV-21320	One spring, part of set of 4 springs (Formerly K-301B, Dwg. No. K-860270-2) (Used on Models TBS, TBS-1,2)			35	Part 1487-D39-X1	K-880963-14
*K-1201	D.C. Motor Starting Contactor, Four Step	Same as K-301 (TBS-8 only)	-21319				
*K-1201A	Contact Finger	Same as K-301A					
*K-1201B	Contact Finger	Same as K-301B					
*K-1201C	Contact Terminal	Same as K-301C					
*K-1201D	Contact Terminal	Same as K-301D					
*K-1201E	Sliding Brush Contact	Same as K-301E					
*K-1201F	Sliding Brush Contact	Same as K-301F					
*K-1201G	Finger Spring	Same as K-301G					
*K-1201H	Finger Spring	Same as K-301H					

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MAGNETIC CONTROLLERS (Continued)					
*K-1201I	Finger Spring	Same as K-301I					
*K-1201J	Return Spring	Same as K-301J					
*K-1201K	Coil	Same as K-301K					
*K-1211	D.C. Motor Starting Contactor, Four Step	Same as K-301 (TBS-8 only)	-21804				
*K-1211A	Contact Finger	Same as K-301A					
*K-1211B	Contact Finger	Same as K-301B					
*K-1211C	Contact Terminal	Same as K-301C					
*K-1211D	Contact Terminal	Same as K-301D					
*K-1211E	Sliding Brush Contact	Same as K-301E					
*K-1211F	Sliding Brush Contact	Same as K-301F					
*K-1211G	Finger Spring	Same as K-301G					
*K-1211H	Finger Spring	Same as K-301H					
*K-1211I	Finger Spring	Same as K-301I					
*K-1211J	Return Spring	Same as K-301J					
*K-1211T	Coil	Same as K-301T					
		INDUCTANCES					
*L-101	Oscillator Plate Tank Coil	Self-supporting inductor, r-f, coil of 8 turns AWG #8 tinned copper wire, left-hand wound, both ends swaged, 1" I.D., approx. 1-25/32" overall length, See Winding Data, Section VII			1		K-877212-1
*L-102	1st Doubler Plate Tank Coil	Self-supporting inductor, r-f, coil of 4 turns AWG #8 tinned copper wire, left-hand wound, both ends swaged, 7/8" I.D., approx. 2-11/32" overall length, See Winding Data, Section VII			1		K-843688-1
*L-103	2nd Doubler Plate Tank Coil	Inductor, r-f, coil of 4 turns AWG #8 tinned copper wire, right-hand wound, 1/4" pitch, 1" I.D., approx. 18" developed length, 3 terminals and 2 soft copper strip connectors, 0.0201" thick, See Winding Data, Section VII			1		K-843677-501
*L-104	Power Amplifier Plate Tank Coil	Self-supporting inductor, r-f, coil of 2-1/2 turns AWG #20 x 3/16" O.D. wall thick copper tubing, right-hand wound, 7/16" pitch, 13/16" I.D., approx. 1-5/8" overall length, See Winding Data, Section VII			1		K-843689-1
L-105	Not Used						
*L-106	1st Doubler Grid Choke Coil Assembly	Isolantite mounting, continuous universal winding, 4 sections, pigtail connections, impregnated, capacity 1 mmfd, d-c resistance 50 ohms, current rating 125 ma, inductance 2-1/2 millihenries, See Winding Data, Section VII	-47122		483	Type #100	K-834206-2
*L-107	2nd Doubler Grid Choke Coil Assembly	Same as L-106	-47122				

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		INDUCTANCES (Continued)					
*L-108	2nd Doubler Plate Feed Choke Coil Assembly	Self-supporting choke coil, impregnated, coil of 30 turns AWG #18 tinned copper wire, wound right-hand 3/8" I.D., 42" developed length, See Winding Data, Section VII			1		K-843674-1
*L-109	Power Amplifier Grid Choke Coil Assembly	Same as L-108					
*L-110	Microphone Power Supply Filter Reactor Assembly	Potted in case, hi-pot test 1500 v, impedance 1600 ohms min. measured at 3 v, 60 cycles a.c. and 0.050 amp. d.c., d-c resistance 80 ohms ±10% at 25°C.; See Winding Data, Section VII			1	RT-514	M-68994-502
*L-111	Impedance Coupling Reactor, Speech Amplifier to Audio Driver Stage	Reactor, interstage, oil hermetically sealed, hi-pot test 2000 v, total impedance 125,000 ohms min. measured at 3 v, 60 cycles a.c. and 0 amp. d.c.; See Winding Data, Section VII	-30471		1		K-900548-501
*L-112	Modulator Limiter Circuit R-F Filter Choke	Same as L-106	-47122				
*L-113	Audio Oscillator R-F Filter Choke	Same as L-106	-47122				
*L-114	Carrier Delay Circuit R-F Filter Choke	Same as L-106	-47122				
*L-301A 301B	High and Low Voltage Plate Supply Filter Reactor Assembly	Reactor pack consisting of 2 identical reactors potted in case inductance 0.8 henry, a-c impedance 272 ohms min. at 3 v, 60 cycles a.c. and 0.40 amp. d.c., hi-pot test 2000 v, d-c resistance 18.0 ohms at 25°C.; See Winding Data, Section VII			1		K-900556-501
*L-302	High Voltage Plate Supply R-F Filter Choke	Choke, ohmite, 5.4 microhenries, d-c current rating 1000 ma, d-c resistance 0.85 ohms			18	5835321AA	M-427877-38
*L-303	D-C Motor Filter Choke	Choke, 10 turns of 0.064" dia. E wire on 9/16" dia. tube, close wound, See Winding Data, Section VII			18	8167068AA-P1	M-427877-39
*L-304	D-C Motor Filter Choke	Same as L-303					
*L-401	Tuned Circuit Inductor for Oscillator	Transformer, crystal oscillator, assembly consisting of: 1 coil, 18 turns AWG #23 E copper wire wound 20 threads per inch on 1/2" dia. form with start and finish extending 3", mounted in can with C-443,444, R-435,447, core and stud assembly and terminal board, See Winding Data, Section VII			1		P-720172-501
*L-402	Tuned Circuit Inductor for 1st Doubler	Transformer, assembly consisting of: 1 coil, 6 turns AWG #23 E copper wire, wound 20 threads per inch on 1/2" dia. form with start and finish extending 3", mounted in can with C-445,458 and R-436, core and stud assembly and terminal board, See Winding Data, Section VII			1		P-720172-502

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		INDUCTANCES (Continued)					
*L-403	Tuned Circuit Inductor for 2nd Doubler	Transformer, assembly consisting of: 1 coil, 4-3/4 turns AWG #14 bare soft copper wire, wound 8 threads per inch on 1/2" dia. form grooved with 6-1/2" threads with start and finish extending 3", mounted in can with C-446, core and stud assembly and terminal board, See Winding Data, Section VII			1		P-720172-503
*L-404	A-C Line R-F Filter Choke	Coil, approx. 69 turns AWG #18 E copper wire, single layer, close wound right hand on 1" dia. laminated insulated coil form, 4" long		17-P-5 Type PBG	1		M-407170-501
*L-405	A-C Line R-F Filter Choke	Same as L-404					
*L-406A B	1st Section of Main D-C Filter 2nd Section of Main D-C Filter	Transformer consisting of: 2 iron core reactors, potted in case, reactor #1: hi-pot test 1000 v a.c., min. impedance 900 ohms measured at 3 v, 60 cycles a.c., and 0.110 amp. d.c., d-c resistance 115 ohms ±7-1/2% at 25°C., reactor #2: hi-pot test 1000 v a.c., impedance 4000 ohms min. measured at 3 v, 60 cycles a.c. and 0.050 amp. d.c., d-c resistance 350 ohms ±7-1/2% at 25°C.; See Winding Data, Section VII			1		K-900589-501
*L-407	R-F Filter Choke, 1st Detector and 1st I-F Amplifier Heater Circuit	Coil, d-c resistance 0.019 ohms at 25°C., inductance of 15.7 mh ±10% at 1.0 v, 1000 cycles, (Spare part Dwg. No. is K-900676-504); See Winding Data, Section VII			1		K-900676-501
*L-408	R-F Filter, 3rd I-F and AVC I-F Amplifier Heater Circuit	Same as L-407 except symbols (Spare part Dwg. No. is K-900676-504)			1		K-900676-503
*L-409	R-F Filter, 2nd Detector Heater Circuit	Same as L-407 except symbols and length of stud, (Spare part Dwg. No. is K-900676-505)			1		K-900676-502
*L-1201A B	High & Low Voltage Plate Supply Filter Reactor Assembly	Same as L-301A,301B					
*L-1202	D-C Step Starter Coil	Coil wound on 5/8" dia. spool, 2-1/8" long for 120/230 d.c. equipment, (Formerly K-301K, R-306, 1205,1206)			35	#751-S72-W14	K-880962-11
*L-1211A B	High & Low Voltage Plate Supply Filter Reactor Assembly	Same as L-301A&B					
*L-1212	D-C Step Starter Coil	Same as L-1202 (Formerly K-301K, R-306,1215,1216)					
*L-1301	High Voltage Plate Supply R-F Filter Choke	Same as L-302					

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		INDUCTANCES (Continued)					
*L-1302	D-C Motor Filter Choke	Same as L-303					
*L-1303	D-C Motor Filter Choke	Same as L-304					
*L-1311	High Voltage Plate Supply R-F Filter Choke	Same as L-302					
*L-1312	D-C Motor Filter Choke	Same as L-303					
*L-1313	D-C Motor Filter Choke	Same as L-304					
		ELECTRICAL MEASURING INSTRUMENTS					
*M-101	R-F Plate and Grid Current Meter	Milliammeter, d-c scale 0-200 ma, 2-1/2" round type, flanged bakelite case with anti-glare glass, factory calibration for non-magnetic panel	-22064	17-I-12	18	Type DW-41	M-427681-1
*M-102	R-F Transmission Line Current Meter	Ammeter, r-f scale 0-4 amps., low loss back plate for operation at 60-80 mc, 2-1/2" round type, flanged bakelite case with anti-glare glass, factory calibration for non-magnetic panel	-22024	17-I-12	18	Type DW-44	M-427681-2
*M-103	Per Cent Modulation Indicator Meter	Voltmeter, rectifier type, 0-25 v movement, scale calibrated 0-100% in equal divisions, 2-1/2" round type, flanged bakelite case with anti-glare glass, factory calibration for non-magnetic panel			18	Type DW-46	M-427681-3
*M-401	Input and Tuning Meter	D-C milliammeter, full scale 3 ma, 1-120 db, 2-1/2" flush type, calibrated in db, plus at zero position, minus at full scale, current to be correct within ±5% of full scale deflection			18	DW-4X	K-850862-1
*M-402	Output Meter	A-C voltmeter, rectifier type, 2-1/2" flush type, full scale 48.80 v, resistance 500 ohms per volt, scale -16 to +3 db with minus at zero position and plus at full scale, a-c resistance 24,400 ohms ±5% at 25°C., measured at 1000 cycles, voltage to be correct within ±5% of full scale deflection			18	DW-4X	K-850855-1
		MISCELLANEOUS MECHANICAL PARTS					
*O-101	Coupling for C-117	Insulated, flexible, cross shaped, 1-9/32" square, 1-1/16" long, 0.2525" I.D.			23		K-843141-1
*O-102	Retainer Spring for Crystal	Phosphor bronze, 0.032" dia., 4 active turns, 5/8" free length			1		K-860235-1

* *SPARE PARTS FURNISHED refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MISCELLANEOUS MECHANICAL PARTS (Continued)					
*O-103	Coupling for C-121	Insulated, steatite block with brass extensions for 1/4" shaft, 9/16" smaller dia., 45/64" larger dia., 1-1/4" overall length, two #8-32 cup point setscrews			23	Cat.#252	K-880947-1
*O-104	Push Button Spring for K-105	Phosphor bronze, 0.0159" dia., 23 active turns, wind right hand, 1-7/8" free length			1		K-856136-1
*O-105	Tube Clamp for V-109,110 and 112	Stainless steel, 1-5/32" dia.			126	926-A-2	K-888964-501
*O-106	Tube Clamp for V-101,102,103, 104,105,106,107,108 and 111	Stainless steel, 1-3/8" dia.			126	926-C-2	M-438114-5
O-107	Knob for Support Case	Molded, 1-1/8" dia., 3/4" long, for 1/4" shaft, with 2 setscrews #6-32 x 1/4"			496		K-838604-501
O-201	Clamp for Cable	Brass, 0.064" thick, 2-1/4" overall length, 1/2" wide, 1-3/4" between mounting holes 0.228" dia., 5/8" high, 9/16" radius			1		K-854207-1
*O-202	Clamp for C-201	Steel, cadmium plated, 0.037" thick, 1" I.D., 1-7/16" between mounting holes, 3/4" high			28 761	Cat.#105-1	K-844039-2
*O-301	Grease Cup for Motor Generator	Grease cup			18	5852859AA2	M-427877-42
*O-302	Grease Cup and Relief Fitting for Motor Generator	Grease cup and relief fitting			18	8124237AA2	M-427877-43
*O-303	Grease Cup and Relief Fitting for Motor Generator	Grease cup and relief fitting			18	8124237AA2	M-427877-44
*O-304	Grease Relief Fitting for Motor Generator	Greas relief fitting			18	8104245AA1	M-427877-45
*O-305	Gasket Cover for Motor Generator	Gasket, cover, fiber packing		33-P-22	18	5895834AB1	M-427877-47
*O-306	Gasket for Motor Generator	Gasket, cork		32-C-5	18	8167060AA-P2	M-427877-48
*O-307	Rotating Parts Assembly for Speed Regulator	Assembly of weights, springs, and assembly of mounting hub and slip ring			18	8109968AC9	M-427877-50
*O-308	Adjusted Mechanical Assembly for Speed Regulator	Assembly consisting of: contact adjusting screw, contact clip, cover plate, and adjusting knob			18	8124116AC2	M-427877-51
*O-309	Adjusting Mechanical Assembly for Speed Regulator	Adjusting mechanical assembly			18	8124116AA3	M-427877-85

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MISCELLANEOUS MECHANICAL PARTS (Continued)					
*O-401	Spring for Chassis Stop	Phosphor bronze, extra hard, 0.064" thick, 3" long, 5/8" wide, 2 holes 0.128" dia., 2 holes 0.173" dia.			1		K-850922-1
*O-402	Clamp for Capacitors C-442.455, 456	Steel, cadmium plated, 0.037" thick, 1-3/8" I.D., 1-27/32" between mounting holes, 3/4" high			28 761	Cat.#106-1	K-844039-1
*O-403	Clamp for Capacitors C-439 and 452	Same as O-202					
*O-404	Clamp for Capacitors C-421,437, 438,447,448,453 and 454	Stainless steel, 1-13/16" high, 1-11/32" wide, 0.025" thick			1		K-77973-3
*O-405	Cable Clamp	Steel, 0.050" thick, 5/16" wide, 0.149" hole, inner radius 3/32"			1		K-17301-19
*O-406	Cable Clamp	Steel, 0.050" thick, 5/16" wide, 0.170" hole, inner radius 3/32"			1		K-17301-21
O-407	Tube Clamp for V-411	Stainless steel, 1-3/8" dia., (TBS-8 Only)			126		M-438114-6
O-408	Tube Clamp for V-402 and 403	Stainless steel, 1-5/32" dia. (TBS-8 Only)			126		M-438114-7
O-409	Tube Clamp for V-412	Stainless steel, 1-3/8" dia. (TBS-8 Only)			126		M-438114-8
O-1001	Junction Box	Aluminum alloy, 2-1/2" x 1-7/16" x 4-1/2" with aluminum cover 4-1/2" x 2-1/2" and 4 holes 0.228" dia. and brass rod bushing, 3/4" long, 3/4"-20 threads, 1 hole 1" dia., one hole 13/16" dia., 3 holes 0.228" dia., 4 holes #10-24 threads tapped 3/8" deep			1		M-420429-501
*O-1305	Gasket Cover for Motor Generator	Same as O-305, (TBS-8 Only)					
*O-1306	Gasket for Motor Generator	Same as O-306, (TBS-8 Only)					
*O-1307	Rotating Parts Assembly for Speed Regulator	Same as O-307, (TBS-8 Only)					
*O-1308	Adjusted Mechanical Assembly for Speed Regulator	Same as O-308, (TBS-8 Only)					
*O-1315	Gasket Cover for Motor Generator	Same as O-305, (TBS-8 Only)					
*O-1316	Gasket for Motor Generator	Same as O-306, (TBS-8 Only)					

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		MISCELLANEOUS MECHANICAL PARTS (Continued)					
*O-1317	Rotating Parts Assembly for Speed Regulator	Same as O-307, (TBS-8 Only)					
*O-1318	Adjusted Mechanical Assembly for Speed Regulator	Same as O-308, (TBS-8 Only)					
		PLUGS					
*P-101	Plug Connector for E-105	Banana type, including contact springs, 3/32" thick nut, threaded #6-32 threads			23	Cat.#75-A	K-99025-4
*P-201	Connector for Handset	4-prong male, polarized, for 0.385" O.D. cable			6	MC4M	M-420410-2
*P-801	Connector for Chestset	Same as P-201					
		MICROPHONES					
*Q-201	Microphone and Receiver Handset	Assembly consisting of: mouthpiece, earpiece, 40 ohm carbon button microphone, receiver unit rated 600 ohms at 1000 v, press-to-talk microphone switch, all housed in molded composition shell, 4 conductor cable, 4' long and terminated in a polarized connector	-51019		1		P-720305-502
Q-501	Cone Microphone Housing Assembly for Loudspeaker	Assembly consisting of: a brass cast housing 6" dia., 1-37/64" long, with cone assembly, centering web 3-1/4" dia., laminated insulating diaphragm, and voice coil 89-1/2 turns #32 B & S enameled aluminum wire, bare dia. 0.008", enameled dia. 0.009", length of wire 450", resistance of coil 10.5 ohms at 25° C., suspension ring, pad ring and other hardware			1		M-420300-501
Q-801	Chest Microphone	Assembly consisting of: microphone and cable assembly chest plate assembly, chest plate strap assembly, transmitter arm assembly, 2 clamps, 2 swivel arms, bottom clamp, jack, junction box, junction box cover, terminal board assembly, plug and cable assembly, cable assembly, top clamp, plug	-51018		1		P-720304-501

* *SPARE PARTS FURNISHED, refer to TABLE IV, for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		RESISTORS					
*R-101	Oscillator Grid Resistor	Composition, fixed, insulated, pigtail terminals, 100,000 ohms ±10%, 1 watt	-63288	RE 13A 372G	4		K-78728-86
*R-102	Oscillator Screen Resistor	Composition, fixed, radial leads, pigtail terminals, 56,000 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-83
*R-103	1st Doubler Grid Resistor	Composition, fixed, radial leads, pigtail terminals, 100,000 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-86
*R-104	1st Doubler Grid Feed Resistor	Composition, fixed, radial leads, pigtail terminals, 22 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-42
*R-105	1st Doubler Cathode Resistor	Fixed, wire wound, ferrule type, 500 ohms ±10%, 10 watts	-63005		21		K-99026-28
*R-106	2nd Doubler Grid Resistor	Fixed, wire wound, ferrule type, 25,000 ohms ±10%, 18 watts			21		K-99028-45
*R-107	2nd Doubler Plate Feed Resistor	Fixed, wire wound, ferrule type, 4000 ohms ±10%, 18 watts	-63083F	RE 13A 372	1		T-620340-554
*R-108	Modulation Meter Multiplier Resistor	Variable, wire wound, potentiometer, 20,000 ohms 4 watts, linear, round shaft 25/32" long, 0.248" O.D., insulated contact arm, threaded 3/8"-32 threads for 3/8"	-631045	RE 13A 492C	28	Cat. #M20MP	M-418173-3
*R-109	Power Amplifier Grid Resistor	Fixed, wire wound, ferrule type, 6300 ohms ±10%, 10 watts			21		K-99026-39
*R-110	Audio Driver Filament Return Resistor	Fixed, wire wound, ferrule type, 1600 ohms ±10%, 10 watts			21		K-99026-33
*R-111	Audio Driver Grid Resistor	Composition, fixed, radial leads, pigtail terminals, 39,000 ohms ±5%, 2 watts	-63426	RE 13A 372G	4		K-78724-197
*R-112	Audio Driver Grid Resistor	Same as R-111	-63426				
*R-113	Speech Amplifier Voltage Divider Resistor	Composition, fixed, radial leads, pigtail terminals, 330 ohms ±5%, 2 watts	-63426	RE 13A 372G	4		K-78724-147
*R-114	Speech Amplifier Voltage Divider Resistor	Composition, fixed, radial leads, pigtail terminals, 6800 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-72
*R-115	Speech Amplifier Voltage Divider Resistor	Composition, fixed, radial leads, pigtail terminals, 12,000 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-75
*R-116	Audio Oscillator Output Feed Resistor	Composition, fixed, radial leads, pigtail terminals, 3900 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-69

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		RESISTORS (Continued)					
*R-117	Audio Oscillator Output Level Control Resistor	Variable, wire wound, potentiometer, 10,000 ohms, 4 watts, linear, round shaft, insulated contact arm threaded 3/8"-32 threads for 3/8" ("M" type)	-631064	RE 13A 492C	28	Cat. #M10MP	M-418173-4
*R-118	Audio Oscillator Grid Leak Resistor	Composition, fixed, 56,000 ohms ±10%, 1 watt, insulated, pigtail terminals	-63288	RE 13A 372G	4		K-78728-83
*R-119	Carrier Delay Circuit Resistor	Composition, fixed, radial leads, pigtail terminals, 470,000 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-94
*R-120	Modulation Limiter Delay Circuit Resistor	Composition, fixed, radial leads, pigtail terminals, 1.8 megohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-101
*R-121	Modulation Limiter Voltage Divider Resistor	Composition, fixed, radial leads, pigtail terminals, 5600 ohms ±5%, 2 watts	-63426	RE 13A 372G	4		K-78724-177
*R-122	Modulation Limiter Voltage Divider Resistor	Composition, fixed, radio leads, 8200 ohms ±5%, 2 watts	-63426	RE 13A 372G	4		K-78724-181
*R-123	Modulation Limiter Voltage Divider Resistor	Composition, fixed, radial leads, pigtail terminals, 27,000 ohms ±5%, 2 watts	-63426	RE 13A 372G	4		K-78724-193
*R-124	Modulation Limiter Voltage Divider Resistor	Fixed, wire wound, ferrule type, 100,000 ohms ±5%, 38 watts			21		K-883481-1
*R-125	Relay Feed Voltage Divider Resistor	Fixed, wire wound, ferrule type, 5,000 ohms ±10%, 18 watts			21		K-99028-38
*R-126	Relay Feed Voltage Divider Resistor	Composition, fixed, radial leads, 390 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-57
*R-127	Power Amplifier Grid Bias Voltage Divider Resistor	Wire wound, pigtail terminals, 50 ohms ±10%, 10 watts			32	"Brown Devil" Ohmite	K-844908-4
*R-128	Modulation Grid Bias Voltage Divider Resistor	Same as R-127					
*R-129	Modulation Meter Multiplier Resistor	Composition, fixed, radial leads, pigtail terminals, 33,000 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-80
*R-130	Phone-MCW Relay Series Resistor	Composition, fixed, radial leads, pigtail terminals, 5600 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-71
*R-131	Relay Feed Voltage Divider Resistor	Composition, fixed, radial leads, pigtail terminals, 680 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-60

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		RESISTORS (Continued)					
*R-132	Transmit-Receive Relay Series Resistor	Fixed, wire wound, ferrule type, 4000 ohms ±10%, 10 watts	-631025	RE 13A 372G	1		T-620340-704
*R-133	Audio Oscillator Voltage Divider Resistor	Composition, fixed, radial leads, 1500 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-64
*R-134	Audio Oscillator Voltage Divider Resistor	Wire wound, lug and wire terminals, 25,000 ohms ±10%, 10 watts	-63606-10	RE 63A 101A Style 1-3/4 RPT	32	"Brown Devil" Ohmite	K-844908-5
*R-135	Speech Amplifier Voltage Divider Resistor	Composition, fixed, radial leads, pigtail terminals, 2700 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-67
*R-136	Phone-MCW Parallel Resistor	Composition, fixed, radial leads, pigtail terminals, 150,000 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-88
*R-137	Carrier Delay Circuit R-F Filter	Same as R-103	-63474				
*R-138	Tune-Operate Switching Circuit Filament Return Resistor	Fixed, wire wound, ferrule type, 1000 ohms ±10%, 18 watts			21		K-90028-31
*R-139	Audio Input Transformer Load Resistor	Composition, fixed, insulated, pigtail terminals, 5600 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	4		K-78727-71
*R-140	Overload Relay Shunt Resistor	Same as R-113	-63426				
*R-201	Volume Control Series Resistor	Composition, fixed, 10,000 ohms ±10%, 2 watts, radial leads, pigtail terminals	-63474	RE 13A 372G	4		K-78724-74
*R-202	Volume Control Potentiometer	Wire wound, 1000 ohms, 4 watts, linear, round shaft threaded 3/8"-32 for 3/8" ("M" Type)	-631109	RE 13A 492C	28	Cat. #M1MP	M-418173-1
*R-203	Receiver Unit Series Resistor	Composition, fixed, 560 ohms ±10%, 2 watts, radial leads, pigtail terminals	-63474	RE 13A 372G	4		K-78724-59
*R-204	Audio Output Load Resistor	Same as R-203	-63474				
*R-301	Contactor Coil Series Resistor	800 ohms, for 230 v d.c. motor generator (Part of K-301) (formerly K-301P Dwg. #K-860257-10)			35	PX1-800	K-880962-16
*R-301	Contactor Coil Series Resistor	200 ohms, for 120 v d.c. motor generator (Part of K-301) (formerly K-301L Dwg. #K-860257-5)			35	PX1-200	K-880962-12
*R-301	Contactor Coil Series Resistor	Ohmite, 150 ohms, for 220/440 v a.c. motor generator (Part of K-301) (formerly K-301K Dwg. #K-860270-4)			35	PM92-12-1	K-880963-8

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		RESISTORS (Continued)					
*R-302	Generator Field Resistor	1000 ohms, 50 watts (Part of G-301), ohmite Cat. #0572 (TBS-5,6,7 & 8)			18	5895465AB-P21	M-427877-52
*R-302	Generator Field Rheostat	160 ohms, 25 watts (Part of G-301) (TBS, TBS-1,2,3 & 4)			18	5835315AA	M-427877-84
*R-303	D-C Step Starter Resistor	12.5 ohms for 230 v d.c. motor generator (Part of K-301) (formerly K-301Q, Dwg. #K-860257-11)			35	PX1-12.5	K-880962-17
*R-303	D-C Step Starter Resistor	3.2 ohms for 120 v d.c. motor generator (Part of K-301) (formerly K-301M, Dwg. #K-860257-6)			35	PX1-3.2	K-880962-13
*R-304	D-C Step Starter Resistor	6.4 ohms for 230 v d.c. motor generator (Part of K-301) (formerly K-301R, Dwg. #K-860257-12)			35	PX1-6.4	K-880962-18
*R-304	D-C Step Starter Resistor	1.25 ohms for 120 v d.c. motor generator (Part of K-301) (formerly K-301N, Dwg. #K-860257-7)			35	PX1-1.25	K-880962-14
*R-305	D-C Step Starter Resistor	2.0 ohms for 230 v d.c. motor generator (Part of K-301) (formerly K-301S, Dwg. #K-860257-13)			35	PX1-2.0	K-880962-19
*R-305	D-C Step Starter Resistor	0.8 ohms for 120 v d.c. motor generator (Part of K-301) (formerly K-301O, Dwg. #K-860257-8)			35	PX1-.08	K-880962-15
*R-306	Not Used	See L-1202,1212					
*R-307	Motor Speed Regulator Resistor	1500 ohms, 50 watts for 230 v d.c. motor generator (Part of B-301) ohmite Cat. #0573			18	5895465AE2	M-427877-54
*R-307	Motor Speed Regulator Resistor	400 ohms, 50 watts for 120 v d.c. motor generator (Part of B-301) ohmite Cat. #056BC			18	5895465AE1	M-427877-53
*R-307	Motor Speed Regulator Resistor	300 ohms, 57 watts for 120 v d.c. motor generator (Part of B-301)			18	8100568AB3	M-427877-81
*R-307	Motor Speed Regulator Resistor	1200 ohms, 57 watts for 230 v d.c. motor generator (Part of B-301)			18	8100568AB4	M-427877-82
*R-308	Generator Field Resistor	Globar, 550 ohms for all voltage motor generators (TBS-5,6,7, 8) (Part of G-301)			18	8127261AA4	M-427877-35
*R-308	Generator Field Resistor	Globar, 275 ohms, 80 watts for all voltage motor generators (TBS, TBS-1,2,3,4) (Part of G-301)			18	5895116AG-P5	M-427877-83
*R-309	Generator Field Resistor	Same as R-308 Dwg. #M427877-83 (Part of G-301)					
*R-310	Generator Field Resistor	Wire wound, bracket type, 350 ohms, 22 watts (Part of G-301)			18	8100568AB2	M-427877-80
*R-311	Generator Field Resistor	100 ohms ±10%, 25 watts for 230 v d.c. motor generator (Part of G-301) ohmite Cat. #O-0200F			18	8160446AA3	M-427877-37

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		RESISTORS (Continued)					
*R-311	Generator Field Resistor	25 ohms ±10%, 25 watts for 120 v d.c. motor generator (Part of G-301) ohmite Cat. #O-0200C			18	8160446AA2	M-427877-36
*R-401	R-F Amplifier Control Grid Filter Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 1 megohm ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-98
*R-402	Input Meter Series Resistor	Low power, fixed, molded, phenolic, wire wound, insulated, pigtail terminals, 10 ohms ±10%, 1/2 watt	-63678-10	RE 13A 372G	21	BW-1/2	K-857034-5
*R-403	R-F Amplifier Screen Grid Filter Resistor	Fixed, composition, insulated, pigtail terminals, 10,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-74
*R-404	R-F Amplifier Plate Filter Resistor	Fixed, composition, insulated, pigtail terminals, 1200 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-63
*R-405	1st Detector Cathode Bias Resistor	Fixed, composition, insulated, pigtail terminals, 4700 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-70
*R-406	1st Detector Screen Grid Filter Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 68,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-84
*R-407	1st Detector Plate Filter Resistor	Same as R-404	-63360				
*R-408	1st I-F Amplifier Control Grid Filter Resistor	Same as R-401	-63360				
*R-409	1st I-F Amplifier Screen Grid Filter Resistor	Same as R-403	-63360				
*R-410	1st I-F Amplifier Plate Filter Resistor	Same as R-404	-63360				
*R-411	2nd I-F Amplifier Control Grid Filter Resistor	Same as R-401	-63360				
*R-412	2nd I-F Amplifier Screen Grid Filter Resistor	Same as R-403	-63360				
*R-413	2nd I-F Amplifier Plate Filter Resistor	Same as R-404	-63360				
*R-414	3rd I-F Amplifier Control Grid Filter Resistor	Same as R-401	-63360				
*R-415	3rd I-F Amplifier Control Grid Coupling Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 330,000 ohms ±10%, 1/2 watt, (Part of T-405)	-63360	RE 13A 372G	21	BT-1/2	K-850981-92

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		RESISTORS (Continued)					
*R-416	3rd I-F Amplifier Screen Grid Filter Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 22,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-78
*R-417	3rd I-F Amplifier Plate Filter Resistor	Same as R-404	-63360				
*R-418	Volume Control	Potentiometer, 250,000 ohms ±20%, 1/2 watt, threaded 3/8"-32 for 5/16", 0.250" dia. round shaft, 23/32" long, "C" taper	-631137-20		21	CS	K-850909-1
*R-419	2nd Detector Filter Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 82,000 ohms ±10%, 1/2 watt, (Part of T-406)	-63360	RE 13A 372G	21	BT-1/2	K-850981-85
* R-420	Noise Suppressor Filter Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 1.2 megohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-99
* R-421	Rectifier Output Voltage Dropping Resistor	Fixed, molded, wire wound, insulated, 600 ohms ±10%, 4 watts			21	MW-3	K-850979-1
*†R-421	Rectifier Output Voltage Dropping Resistor	Assembly consisting of laminated insulation board, six terminals and three resistors in parallel, 1800 ohms ±10%, 2 watts (K-251930-65)			1		M-440521-501
* R-422	Rectifier Output Voltage Driver and Bleeder Resistor	Fixed, molded, wire wound, insulated, tapped; Part A - 1700 ohms ±10%, 1 watt Part B - 7100 ohms ±10%, 1 watt Part C - 2300 ohms ±10%, 1 watt Part D - 1000 ohms ±10%, 0.5 watt Part E - 23 ohms ±20%, 0.5 watt Part F - 55 ohms ±10%, 1.2 watts			21	MW-5	K-850858-1
*†R-422	Rectifier Output Voltage Driver and Bleeder Resistor	Assembly consisting of laminated insulation board, 16 terminals and 8 resistors in series: Part A - 1800 ohms ± 5%, 1 watt (K-251414-165) Part B - 3900 ohms ±10%, 1 watt (K-251414-69) Part C - 3300 ohms ±10%, 1 watt (K-251414-68) Part D - 2200 ohms ± 5%, 1 watt (K-251414-167) Part E - 1000 ohms ±10%, 1 watt (K-251414-62) Part F - 22 ohms ±10%, 1 watt (K-251414-42) Part G - Two 27 ohm ±10%, 1 watt resistors in series (K-251414-43)			1		M-440521-502
* R-423	Noise Suppressor Grid Delay Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 2.2 megohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-102
* R-424	Noise Suppressor Grid Filter Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 470,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-94

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*
† *Can be used as alternate.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		RESISTORS (Continued)					
* R-425	Noise Suppressor Plate Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 100,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-86
* R-426	1st A-F Control Grid Coupling Resistor	Same as R-401	-63360				
* R-427	1st A-F Cathode Resistor	Same as R-404	-63360				
* R-428	Inverse Feed-Back Coupling Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 120,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-87
*R-429	1st A-F Amplifier Screen Grid Voltage Dropping Resistor	Same as R-423	-63360				
*R-430	1st A-F Amplifier Plate Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 560,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-95
*R-431	Power Amplifier Control Grid Coupling Resistor	Same as R-430	-63360				
*R-432	Power Amplifier Cathode Bias Resistor	Low power, fixed, molded, wire wound, insulated, pigtail terminals, 100 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BW-1/2	K-857034-11
*R-433	Oscillator Grid Leak Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 56,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-83
*R-434	Oscillator Cathode Input Meter Shunt Resistor	Same as R-402	-63678-10				
*R-435	1st Doubler Grid Leak Resistor	Same as R-425 (Part of L-401)	-63360				
*R-436	2nd Doubler Grid Leak Resistor	Same as R-425 (Part of L-402)	-63360				
*R-437	AVC I-F Amplifier Cathode Bias Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 270 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-55
*R-438	AVC I-F Amplifier Screen Grid Filter Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 6800 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-72
*R-439	Noise Suppressor Control	Potentiometer, wire wound, insulated shaft 25/32" long x 0.250" dia., 3500 ohms ±10%, 2-1/2 watts, 750 ohms first 50% from switch operating end (includes S-405)	-631136	RE 13A 492C	40		K-850864-1
*R-440	AVC Rectifier Load Resistor	Same as R-401 (Part of T-407)	-63360				
*R-441	AVC I-F Amplifier Plate Filter Resistor	Same as R-404	-63360				

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		RESISTORS (Continued)					
*R-442	Headphone Series Dropping Resistor	Same as R-403	-63360				
*R-443	AVC I-F Amplifier Control Grid Filter Resistor	Same as R-401	-63360				
*R-444	AVC Delay Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 3300 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-68
*R-445	AVC Voltage Divider Resistor	Same as R-420	-63360				
*R-446	AVC Voltage Divider Resistor	Same as R-430	-63360				
*R-447	1st Doubler Control Grid Parasitic Resistor	Low power, fixed, molded, wire wound, insulated, pigtail terminals, 56 ohms ±10%, 1/2 watt (Part of L-401)	-63678-10	RE 13A 372G	21	BW-1/2	K-82283-47
*R-448	2nd Doubler Control Grid Parasitic Resistor	Same as R-447	-63678-10				
*R-449	R-F Amplifier Cathode "Input Meter" Shunt Resistor	Same as R-402	-63678-10				
*R-450	2nd Doubler Plate Filter Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 1500 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-64
*R-451	T-407 Primary Loading Resistor	Same as R-425 (Part of T-407)	-63360				
*R-452	T-403 Secondary Loading Resistor	Fixed, composition, wax impregnated, insulated, pigtail terminals, 33,000 ohms ±10%, 1/2 watt (Part of T-403)	-63360	RE 13A 372G	21	BT-1/2	K-850981-80
*R-453	T-404 Primary Loading Resistor	Same as R-452 (Part of T-404)	-63360				
*R-454	T-405 Secondary Loading	Same as R-452 (Part of T-405)	-63360				
*R-455	Oscillator and 1st Doubler Voltage Dropping Resistor	Same as R-416	-63360				
*R-456	R-F Amplifier Cathode "Input Meter" Shunt Resistor	Low power, fixed, molded, wire wound, wax impregnated, insulated, pigtail terminals, 62 ohms ±5%, 1/2 watt	-63678	RE 13A 372G	21	BW-1/2	K-857034-9
*R-457	Oscillator and 1st Doubler Voltage Dropping Resistor	Same as R-437	-63360				

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		RESISTORS (Continued)					
*R-501	Volume Control Potentiometer	Resistor, variable, "L" pad attenuator, dual section, R1 of 14.7 ohms, R2 of 75 ohms, provides a 15 ohm input with a 15 ohm load, 40 db attenuation logarithmetically with rotation, complete with hardware and knob impedance 14.7 ohms, rated 4 watts, linear taper	-632163		28	L-15	K-183290-1
R-1201	Capacitor Coil Series Resistor	Same as R-301, Dwg. #K-880962-12 (Part of K-1201)					
R-1202	D-C Step Starter Resistor	Same as R-303, Dwg. #K-880962-13 (Part of K-1201)					
R-1203	D-C Step Starter Resistor	Same as R-304, Dwg. #K-880962-14 (Part of K-1201)					
R-1204	D-C Step Starter Resistor	Same as R-305, Dwg. #K-880962-15 (Part of K-1201)					
R-1205	Not Used	See L-1202					
R-1211	Capacitor Coil Series Resistor	Same as R-301, Dwg. #K-880962-16 (Part of K-1211)					
R-1212	D-C Step Starter Resistor	Same as R-303, Dwg. #K-880962-17 (Part of K-1211)					
R-1213	D-C Step Starter Resistor	Same as R-304, Dwg. #K-880962-18 (Part of K-1211)					
R-1214	D-C Step Starter Resistor	Same as R-305, Dwg. #K-880962-19 (Part of K-1211)					
R-1215	Not Used	See L-1212					
R-1301	Generator Field Resistor	Same as R-302, Dwg. #M-427877-52					
R-1302	Generator Field Resistor	Same as R-308, Dwg. #M-427877-35					
R-1303	Motor Speed Regulator Resistor	Same as R-307, Dwg. #M-427877-53					
R-1304	Motor Field Resistor	Same as R-311, Dwg. #M-427877-36					
R-1311	Generator Field Resistor	Same as R-302, Dwg. #M-427877-52					
R-1312	Generator Field Resistor	Same as R-308, Dwg. #M-427877-35					
R-1313	Motor Speed Regulator Resistor	Same as R-307, Dwg. #M-427877-54					
R-1314	Motor Field Resistor	Same as R-311, Dwg. #M-427877-37					
		SWITCHES					
*S-101	Test Switch, Plate Voltage Control	Push-button, single pole, make contact, non-locking, complete with red bakelite knob, nut and washer	-24047		28	Cat. #2001	K-821506-3

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		SWITCHES (Continued)					
*S-102	Motor Generator "Stop-Start" Switch	Push-button control, momentary contact, two buttons, one black marked "start," one red marked "stop," both contacts normally open			35	Type B-20	K-843617-2
*S-103	Emergency Stop Switch	Tumbler, shallow porcelain cup, S.P.S.T. rated 10 amps. at 125 v, 5 amps. at 250 v			8	Cat. #5501	K-854949-2
*S-104	Plate and Grid Current Meter Switch	Selector, isolantite, wafer, 2 gang, 5 position, shaft 3/4" with 3/8"-32 threads for 3/8" positioning lug and flat on shaft			28	SPO-Y21751	M-415758-3
*S-105	Door Interlock Switch	Push-button, nickel finish, threaded 15/32"-32, momentary contact, normally open, contacts rated 3 amps. at 230 v	-24014		7	Cat. #3592	K-823087-1
*S-106	Tune Operate Switch	Toggle, S.P.S.T. rated 1 amp. at 250 v d.c. and 3 amp. at 125 v d.c., threaded 15/32"-32 for 15/32", silver plated contacts	-24000	RE 24AA 118A	7	#20994-ET	M-420278-1
*S-201	Motor Generator "Start-Stop" Switch	Same as S-102 except for start-stop buttons			35	Type B-20	K-843617-1
*S-202	Handset "On-Off" Switch	Same as S-106	-24000				
*S-401	Power "Off-On" Switch	Toggle switch, D.P.S.T., insulated, threaded 15/32"-32 for 15/32" contacts silver plated, rated 1 amp. at 250 v d.c. add 3 amps. at 125 v d.c.	-24001		7		M-413702-7
*S-402	AVC Time Constant Control Switch	Rotary tap switch, wafer type, S.P., 1 section, 4 position, shaft 23/32" long x 0.250" dia., 3/8"-32 threads for 5/16", all terminals and contacts silver plated			31	Type H	M-420265-1
*S-403	Oscillator and 1st Detector Meter Tuning Switch	Rotary tap switch, wafer type, D.P., 1 section, 3 position, shaft 23/32" long x 0.250" dia. 3/8"-32 threads for 5/16", all terminals and contacts silver plated			31	Type H	M-420266-1
*S-404	Output Meter Switch	Push-button, S.P., make contact, locking type switch, with nickel-plated brass frame, complete with washer and nut			28	Cat. #2001-L	K-850856-1
* S-405	Noise Suppressor Control Switch	S.P.S.T., incorporated in R-439			40		K-850864-1

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		TRANSFORMERS					
*T-101	Audio Input Transformer	Transformer compound and oil filled, hermetically sealed, ratio 1 to 3 ±5% from full primary to full secondary, See Winding Data, Section VII			1		K-900544-501
*T-102	Driver Transformer	Compound and oil filled, hermetically sealed, ratio 3 to 1 ±5% from full primary to full secondary See Winding Data, Section VII			1		K-900549-501
*T-103	Modulation Transformer	Potted in case, ratio 1.7 to 1 ±5% from full primary to full secondary, mid-tap to be within 1% of neutral, hi-pot test 4000 v, primary impedance 5200 ohms min. at 30 v, 60 cycles a.c. and 0.068 amp. d.c., additive polarity with finish or primary connected to start of secondary, induced voltage 1200 v, 500 cycles on secondary Primary: 2850 turns AWG #29 E wire, tapped at 1425 turns, wound 119 turns per layer over 0.050" thick kraft spool 29/32" x 1-9/16" x 1-15/16" long, wire traverse 1.562", insulation between layers 1 turn 0.003" kraft paper, over coil 3 turns 0.010" argelac, d-c resistance, pri. 140 ±10%, sec. 101 ±10%, at 25°C., coil build 0.468" Secondary: 1675 turns AWG #29 E wire, wound 110 turns per layer over primary, wire traverse 1.562", insulation between layers 1 turn 0.003" kraft paper, over coil 3 turns 0.010" argelac, d-c resistance 101 ohms ±7-1/2% at 25°C., coil build 0.272" Iron core stacked 1-1/2" with 0.003" air gap, See Winding Data, Section VII			1		K-900543-501
*T-104	Filament Transformer	Transformer, potted in case consisting of one primary and five filaments rated as follows: Winding / No Load Voltage / Full Load Voltage / Rated Current (Amps.) / Hi-pot Voltage Pri. / 230/220/210 / / / 2500 Fil.#1 / 7.88 ±3% / 7.5/3.75 / 4.0 / 1500 Fil.#2 / 7.88 ±3% / 7.5/3.75 / 4.0 / 1500 Fil.#3 / 2.625 ±3% / 2.5/1.25 / 5.0 / 1500 Fil.#4 / 6.56 ±3% / 6.3 / 4.0 / 1500 Fil.#5 / 7.88 ±3% / 7.5/3.75 / 8.0 / 1500 Max. core loss 12 watts; max. exciting current 0.4 amp. at 230 v, 60 cycles; induced voltage 920 v, 500 cycles, See Winding Data, Section VII			1		K-900545-501

* SPARE PARTS FURNISHED, refer to TABLE IV for quantities.

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		TRANSFORMERS (Continued)					
*T-105	Audio Oscillator Transformer	Transformer oil and compound hermetically sealed, ratio 6.25 to 1 ±5% from pri. to sec. #1, 7.84 to 1 ±5% from pri. to sec. #2, hi-pot test 1500 v, adjusted for 1000 cycles output, with molded, fixed capacitor, 3900 mmfd ±5%, 400 v d.c. working, across start and finish of primary winding, See Winding Data, Section VII			1		K-900546-501
*T-201	Microphone to 600 Ohm Line Transformer	Transformer potted and sealed in case, ratio 1 to 6 ±5% from pri. to sec., sec. impedance 600 ohms min. at 3 v, 60 cycle, a.c. and 0.0085 amp. d.c., hi-pot test 1000 v, additive polarity with pri. finish connected to sec. start, See Winding Data, Section VII			1		K-900547-501
*T-301	Line Step-Down Transformer	Transformer, 440/220 v a.c., 0.250 kva rating, test voltage 2500; pri.: 440 v, 0.6 amp., 60 cycles, 15.5 ohms d.c. test voltage 2500; sec.: 220 v, 1.14 amps., 4.7 ohms d.c., 2500 v test, See Winding Data, Section VII	-30445		68	Type CF #25354	K-860271-501
*T-401	Antenna Transformer	R-F transformer assembly consisting of: 2 coils mounted in same horizontal and vertical planes, vertical plane being 5/8" from base to center line of coils; pri.: 6 turns of 10 strands AWG #40 DS litz wire, parallel lay, wound over mineral wax impregnated, unglazed steatite ceramic form 5/8" dia., start and finish of coils to extend 1-1/2", coil and form to be wax impregnated; sec.: 5 turns AWG #14 bare wire wound 11 turns per inch with 5/8" inside coil dia., start and finish to be spaced 29/64" and to extend 5/8" from coil, coil to be silver-plated 0.0002" thick, See Winding Data Section VII			1		M-420271-501
*T-402	R-F Interstage Transformer	Special r-f transformer assembly consisting of: a base, 2 hex. spacers, 7 terminals, and 2 coils mounted in same horizontal and vertical planes, the vertical plane being 5/8" from the base to center line of coils, unglazed steatite form; coil #1: same as sec. coil of T-401; coil #2: same as coil #1 except 3 turns, See Winding Data, Section VII			1		K-850579-501
*T-403	1st I-F Transformer	Transformer assembly, consisting of: terminal board, 2 core and stud assemblies, 2 coils spaced 0.281" apart, each coil 39 turns AWG #33 E wire wound 64 threads per inch on 1/2" dia. form with start and finish extending 3", mounted in can with C-407, 408,424,425 and R-452, See Winding Data, Section VII			1		P-720166-501

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		TRANSFORMERS (Continued)					
*T-404	2nd I-F Transformer	Transformer assembly, consisting of: terminal board, 2 core and stud assemblies, 2 coils same as T-403, mounted in can with C-409,410,427,428 and R-453 See Winding Data, Section VII			1		P-720166-505
*T-405	3rd I-F Transformer	Transformer assembly, consisting of: terminal board and two terminals, 2 core and stud assemblies, 2 coils spaced 0.250" apart, each coil 40 turns AWG #33 E wire wound 64 threads per inch on 1/2" dia. form with start and finish extending 3", mounted in can with C-411,412,430,432 and R-415,454 See Winding Data, Section VII			1		P-720166-502
*T-406	2nd Detector I-F Transformer	Transformer assembly, consisting of: terminal board, 2 core and stud assemblies, 2 coils spaced 0.312" apart, coil #1, 39-1/2 turns, coil #2, 40 turns AWG #33 E wire wound 64 threads per inch on 1/2" dia. form with start and finish extending 3", mounted in can with C-413,414,434,435 and R-419 See Winding Data, Section VII			1		P-720166-503
*T-407	AVC I-F Transformer	Transformer assembly consisting of: terminal board, 2 core and stud assemblies, 2 coils spaced 0.500" apart, coil #1, 61 turns, coil #2, 75 turns AWG #35 E wire close wound on 1/2" dia. form with start and finish extending 3", mounted in can with C-451, R-440,451, See Winding Data, Section VII			1		P-720166-504
*T-408	Audio Output Transformer	Transformer potted in case, ratio 1.93 to 1 ±5%, hi-pot test 1500 v pri. and 1000 v sec., pri. impedance at 3 v, 60 cycles a.c. and 0.058" amp. d.c., 2400 ohms min.; See Winding Data, Section VII			1		K-900590-501
*T-409	Power Transformer	Transformer potted in case, 4 windings, no load voltage, pri. 115 v, plate 517 v ±3%, heater 6.76 v ±3%, rectifier 5.31 v ±3%; full load voltage, plate 400/245, heater 6.30 v, rectifier 5 v; rated current plate 0.130 amp., heater 4.1 amps., rectifier 3 amps.; hi-pot test 2500 v all windings; max. core loss 10 watts; max. exciting current 0.35 amp. at 115 v, 60 cycles a.c.; induced voltage 460 v, 400 cycles, midtap to be within ±3% of neutral; See Winding Data, Section VII			1		K-900539-501
*T-501	Speaker Matching Transformer	Transformer, output potted in case consisting of: three pri. and two sec., ratio 19.7 to 1 from full pri. to full sec., hi-pot test 1500 v, pri. impedance 5800 ohms min., measured at 3 v, 60 cycles a.c. and 0 amp. d.c., resistance: full pri. 266 ohms, full sec. 0.675 ohm, See Winding Data, Section VII			1		K-901060-501

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		VACUUM TUBES					
*V-101	R-F Crystal Oscillator Tube	Transmitting beam power amplifier, medium 5 pin base, micanol, small metal cap, heater current 0.9 amp. at 6.3 v a.c. or d.c., plate dissipation 25 watts	-807	RE 13A 600A	1a	-807	
*V-102	R-F 1st Doubler Tube	Same as V-101	-807				
*V-103	R-F 2nd Doubler Tube	R-F power amplifier, oscillator, class B modulator, medium 4 pin phenolic bayonet base, medium metal top cap, small metal side cap, filament current 4.0 amps. at 7.5 v a.c. or d.c., plate dissipation 50 watts	-808	RE 13A 600A	1a	-808	
*V-104	R-F Power Amplifier Tube	Same as V-103	-808				
*V-105	Modulator Tube	Same as V-103	-808				
*V-106	Modulator Tube	Same as V-103	-808				
*V-107	Audio Driver Tube	Power amplifier triode, glass, medium 4 pin base, filament current 2.5 amps. at 2.5 v a.c. or d.c.	-2A3	RE 13A 600A	1a	-2A3	
*V-108	Audio Driver Tube	Same as V-107	-2A3				
*V-109	Speech Amplifier Tube	Triple grid, super control amplifier, small 6 pin phenolic base, small metal cap, heater current 0.3 amp. at 6.3 v a.c. or d.c.	-6D6	RE 13A 600A	1a	-6D6	
*V-110	Speech Amplifier Tube	Same as V-109	-6D6				
*V-111	Audio Oscillator and Carrier Delay Tube	Twin amplifier, medium 7 pin phenolic base, heater current 0.8 amp. at 6.3 v a.c. or d.c.	-6A6	RE 13A 600A	1a	-6A6	
*V-112	Modulation Limiter Rectifier Tube	Full wave, high vacuum rectifier, small 5 pin phenolic base, heater current 0.5 amp. at 6.3 v a.c. or d.c.	-84	RE 13A 600A	1a	-84	
*V-401	R-F Amplifier Tube	Super-control r-f amplifier pentode, acorn type, heater current 0.15 amp. at 6.3 v a.c. or d.c., 7 terminals	-956	RE 13A 600A	1a	-956	
*V-402	1st Detector Tube	Triple grid detector amplifier, small 6 pin phenolic base, small metal cap, heater current 0.3 amp. at 6.3 v a.c. or d.c.	-6C6	RE 13A 600A	1a	-6C6	
*V-403	Oscillator and 1st Doubler Tube	Twin triode amplifier, small shell, octal 8 pin phenolic base, skirted miniature cap, heater current 0.6 amp. at 6.3 v a.c. or d.c.	-6F8-G	RE 13A 600A	1a	-6F8-G	

** SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		VACUUM TUBES (Continued)					
*V-404	2nd Doubler Tube	Detector amplifier triode, small shell, octal 6 pin phenolic base, heater current 0.3 amp. at 6.3 v a.c. or d.c.	-6J5-G -6J5-GT -6J5	RE 13A 600A	1a	-6J5-G -6J5-GT -6J5	
*V-405	1st I-F Amplifier Tube	Same as V-109	-6D6				
*V-406	2nd I-F Amplifier Tube	Same as V-109	-6D6				
*V-407	3rd I-F Amplifier Tube	Same as V-109	-6D6				
*V-408	2nd Detector and Noise Suppressor Tube	Duplex diode high-mu triode, small 6 pin phenolic base, small metal cap, heater current 0.3 amp. at 6.3 v a.c. or d.c.	-75	RE 13A 600A	1a	-75	
*V-409	AVC I-F Amplifier and Rectifier Tube	Triode pentode, small 7 pin phenolic base, small metal cap, heater current 0.3 amp. at 6.3 v a.c. or d.c.	-6F7	RE 13A 600A	1a	-6F7	
*V-410	1st A-F Amplifier Tube	Same as V-402	-6C6				
*V-411	Power Amplifier Tube	Beam power amplifier, medium shell, octal 7 pin phenolic base, heater current 1.25 amps. at 6.3 v a.c. or d.c.	-6Y6-G	RE 13A 600A	1a	-6Y6-G	
*V-412	Main Rectifier Tube	Full wave high vacuum rectifier, medium 4 pin phenolic base, filament current 3.0 amps. at 5.0 v a.c. or d.c.	-5Z3	RE 13A 600A	1a	-5Z3	
		WIRES AND CONDUCTORS					
*W-101	Antenna Transmission Line from Transmitter to Receiver Unit	Coaxial cable assembly consisting of: conduit assembly 2 brass collars, 27 ceramic beads, 4 ceramic spacers, flexible copper conductor, 168 strands 0.085" O.D., 8-1/8" long and a terminal at each end			1		M-418237-501
*W-102	Antenna Transmission Line	Coaxial cable assembly consisting of: conduit assembly 2 brass collars, 120 ceramic beads, 13 ceramic spacers, conductor, copper tinned wire, 0.102" dia., 28" long, and a terminal at each end			1		M-418237-502
*W-103	Copper Braid	Tinned copper shielded, 1/8" O.D., 7/32" I.D., 2" long, make from 844810-1			415	Cat. #1208	K-883924-145
*W-104	Wire	Tinned, soft copper conductor, braid covered, varnished cloth, insulated wire, 16/0.010, 36" long, green color, PS-533-7			1		K-883924-143
*W-105	Wire	Asbestos-covered, insulated, 26/0.01, 8" long, black color, PS-503			1		K-883924-144

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		WIRES AND CONDUCTORS (Continued)					
*W-401	Cable for AVC Lead	Shielded cable consisting of: wire, white covered, with green tracer, 10 strands AWG #30 lenz push-back, hook-up wire with a tinned copper braided shielding and black glazed cotton braid outer covering. 25" overall length			1		M-420311-501
*W-402	Cable for 1st Audio Input	Shielded cable consisting of: 2 wires, one white covered, with red tracer, 10 strands AWG #30 lenz push-back hook-up wire, 19" long; second wire white covered, with green tracer, 10 strands, AWG #30 lenz push-back, hook-up wire, 21" long, tinned copper braided shielding, and black glazed cotton braid outer covering			1		M-420311-502
*W-403	Cable for Power Input	Shielded cable consisting of: 2 wires, one red covered, 10 strands AWG #30 tinned copper wire, rubber insulated, 1/64" radius, 22" long, the second black covered, 10 strands AWG #30 tinned copper wire, rubber insulated 1/64" radius, 21" long, tinned copper braided shielding, black, glazed cotton braid outer covering			1		M-420311-503
*W-404	Cable for V-405 Cathode Noise Suppressor Circuit	Shielded cable consisting of: wire, white covered, with yellow tracer, 10 strands, AWG #30 lenz push-back, hook-up wire, closed braided shielding, black glazed, cotton braid outer covering, 8-3/8" long			1		K-871944-1
*W-405	Cable for V-406 Cathode Noise Suppressor Circuit	Shielded cable consisting of: wire, white covered, with yellow tracer, 10 strands, AWG #30 lenz push-back, hook-up wire, close braided shielding, black glazed, cotton braid outer covering, 12" long			1		K-871944-2
*W-406	Wiring for Receiver	Wire, green, 10 strands, AWG #30 tinned copper wire, rubber insulated, 3" long			1		K-880730-141
*W-407	Wiring for Receiver	Wire, green, 26 strands, AWG #38 tinned copper wire, rubber insulated, 5" long			1		K-880730-142
*W-408	Wiring for Receiver	Wire, white with yellow tracer, solid AWG #20 lenz, low loss, push-back, hook-up wire, 78" long			416		K-880730-143
*W-409	Wiring for Receiver	Wire, white, solid AWG #20 lenz, low loss, push-back, hook-up wire, 63" long			416		K-880730-123
*W-410	Wiring for Receiver	Wire, white with green tracer, solid AWG #20 lenz, low loss, push-back, hook-up wire, 140" long			416		K-880730-124
*W-411	Wiring for Receiver	Wire, white with brown tracer, solid AWG #20 lenz, low loss, push-back, hook-up wire, 289" long			416		K-880730-125

** SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		WIRES AND CONDUCTORS (Continued)					
*W-412	Wiring for Receiver	Wire, white with red tracer, solid AWG #20 lenz, low loss, push-back, hook-up wire, 190" long			416		K-880730-126
*W-413	Wiring for Receiver	Wire, white with blue tracer, solid AWG #20 lenz, low loss, push-back, hook-up wire, 146" long			416		K-880730-127
*W-414	Wiring for Receiver	Wire, white with black tracer, solid AWG #20 lenz, low loss, push-back, hook-up wire, 133" long			416		K-880730-128
*W-415	Wiring for Receiver	Wire, white with orange tracer, solid AWG #20 lenz, low loss, push-back, hook-up wire, 43" long			416		K-880730-129
*W-416	Wiring for Receiver	Wire, white with green tracer, 10 strands, AWG #30 lenz, low loss, push-back, hook-up wire, 22" long			416		K-880730-130
*W-417	Wiring for Receiver	Wire, white with black tracer, 10 strands, AWG #30 lenz, low loss, push-back, hook-up wire, 6" long			416		K-880730-131
*W-418	Wiring for Receiver	Bus wire, AWG #16, tinned, soft copper wire, 29" long			1		K-880730-133
*W-419	Wiring for Receiver	Bus wire, AWG #20, tinned, soft copper wire, 56" long			1		K-880730-132
*W-420	Receiver Wire Insulation	Varnished tubing, black 0.042" dia. x 4-1/2" long			107a		K-880730-139
*W-421	Receiver Wire Insulation	Insulating tubing, 106" I.D. x 11" long			107a		K-880730-140
W-501	Cable Assembly for Loudspeaker Microphone	Cable, 0.250" dia., Navy type DCP-1/2 - T1, 12-3/4" long, strip and tin 4 ends, two terminals 5/8" long, 5/16" wide, 0.025" thick, hot tin dipped copper, hole 0.170" dia.		15C1	1		K-187013-501
*W-701	Transmission Line Fittings	Consisting of: two end seals with bleeder valve and 0-30 lb. pressure gauge, nitrogen flask, inner and outer conductor couplings, hose adapter and shut-off valve, flask fitting, outlet hose with fittings and clamps, flask handle, bleeder valve key, varnished tubing, and insulating washer			165		K-884960-501
		SOCKETS					
*X-101	R-F Crystal Oscillator Tube Socket	Wafer type, 5 contact, alsimag base, 1-27/32" hole centers		RE 49AA 311A	23	"J" Code #225	K-843314-2
*X-102	R-F 1st Doubler Tube Socket	Same as X-101					
*X-103	R-F 2nd Doubler Tube Socket	Wafer type, 4 contact, alsimag base, 1-27/32" hole centers		RE 49AA 311A	23	"J" Code #224	K-843314-1
*X-104	R-F Power Amplifier Tube Socket	Same as X-103					
*X-105	Modulator Tube Socket	Same as X-103					
*X-106	Modulator Tube Socket	Same as X-103					
*X-107	Audio Driver Tube Socket	Same as X-103					

* *SPARE PARTS FURNISHED. refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		SOCKETS (Continued)					
*X-108	Audio Driver Tube Socket	Same as X-103					
*X-109	Speech Amplifier Tube Socket	Wafer type, 6 contact, alsimag base, 1-27/32" hole centers		RE 49AA 311A	23	"J" Code #226	K-843314-3
*X-110	Speech Amplifier Tube Socket	Same as X-109					
*X-111	Audio Oscillator and Carrier Delay Tube Socket	Wafer type, 7 contact, alsimag base, 1-27/32" hole centers		RE 49AA 311A	23	"J" Code #227	K-843314-5
*X-112	Modulation Limiter Rectifier Tube Socket	Same as X-101					
*X-113	Crystal Holder Socket	Octagon shape, 3 contacts, mycalex insulation			247		K-834496-1
*X-114	Pilot Light Socket	Miniature bayonet base, nickel plated brass bracket, and red jewel			28	B-310R	K-815228-3
*X-114	Pilot Light Socket	Miniature screw base, red jewel (Model TBS only)			28	B-310R	K-99013-5
*X-201	Pilot Lamp Socket	Assembly consisting of bracket and bayonet type socket, terminal insulated from bracket			15		K-854542-2
*X-201	Pilot Lamp Socket	Assembly consisting of bracket and screw type socket, terminal insulated from bracket (Model TBS only)			15		K-854542-1
*X-401	R-F Amplifier Socket	5 prong, acorn type, ceramic base, 1-3/8" hole centers			19	S-900X	K-845142-2
*X-402	1st Detector Socket	6 prong, silver plated contacts, wafer type, ceramic base, 1-27/32" hole centers	-49364	RE 13A 524	23		K-856997-3
*X-403	Oscillator and 1st Doubler Socket	8 prong, silver plated contacts, wafer type, ceramic base, 1-27/32" hole centers (metal tube)			19		K-856996-6
*X-404	2nd Doubler Socket	Same as X-403					
*X-405	1st I-F Amplifier Socket	Same as X-402	-49364				
*X-406	2nd I-F Amplifier Socket	Same as X-402	-49364				
*X-407	3rd I-F Amplifier Socket	Same as X-402	-49364				
*X-408	2nd Detector and Noise Suppressor Socket	Same as X-402	-49364				

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

W2

TABLE II (Continued)
PARTS LIST BY SYMBOL DESIGNATION
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

SYMBOL DESIG.	FUNCTION	DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPEC.	MFR.	MFR. DESIG.	RCA DRAWING NUMBER
		SOCKETS (Continued)					
*X-409	AVC I-F Amplifier and Rectifier Socket	7 prong, silver plated contacts, wafer type, ceramic base, 1-27/32" hole centers	-49365	RE 13A 524	23		K-856997-4
*X-410	1st A-F Amplifier Socket	6 prong, wafer type, phenolic base, 1-3/8" hole centers, 6 tubular brass rivets	-49308	RE 49AA 304A	1		M-401806-503
*X-411	Power Amplifier Socket	8 prong, wafer type, octal shape, bakelite, cloth base 1/16" thick, 1-27/32" hole centers (metal tube)			690		K-841826-1
*X-412	Main Rectifier Socket	4 prong, wafer type, laminated, phenolic base, 1-3/8" hole centers, and 4 brass tubular rivets	-49307	17-P-5 Type FBG	1		M-401806-501
*X-413	Base for Crystal Y-401	Assembly consisting of: 2 jacks J-402 and J-403 set in a special mycalex base 1/8" thick, and bracket			1		K-856795-501
*X-414	Receptacle for Pilot Lamp I-401	Same as X-114 (Dwg. #K-815228-3)					
		CRYSTALS					
*Y-101	Oscillator Frequency Control Crystal	Quartz crystal in ceramic holder, (TBS-1,2 & 3)	-40062		1	Model AVA-10T	MI-5750-6
Y-101	Oscillator Frequency Control Crystal	Quartz crystal in ceramic holder (TBS-6,7 & 8)	-40062B		1	Type RC-2-C	MI-19455-5
*Y-401	Heterodyne Oscillator Frequency Supply Crystal	Quartz crystal in ceramic holder (TBS-1,2 & 3)	-40062		1	Model AVA-10R	MI-5750-5
Y-401	Heterodyne Oscillator Frequency Supply Crystal	Quartz crystal in ceramic holder (TBS-6,7 & 8)	-40062B		1	Type RC-2-B	MI-19455-5
		SPECIAL R-F DEVICES					
*AF-401	R-F Unit Assembly	Assembly in container consisting of: 3 variable capacitors C-401,402,403, a terminal board assembly T-402, R-F transformer assembly T-401, case assembly, cover assembly, acorn tube socket X-401, 12 ceramic spacers E-414, and two spacers E-413, 17 terminals, connection line, spring washer and assembling hardware, together with connection list including capacitors C-417,418, 419,420,465, and resistors R-401,402,403,404,434, and R-456			1		P-720135-501

* *SPARE PARTS FURNISHED, refer to TABLE IV for quantities.*

W2

TABLE III
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

TBS NOs - 60613
TBS-1 NOs - 70095
TBS-2 NOs - 70095

TBS-3 NXs - 1736
TBS-4 NXss - 17599
TBS-5 NXss - 18747

TBS-6 NXsr - 36725
TBS-7 NXsr - 38310
TBS-8 NXsr - 51552

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			MISCELLANEOUS (CLASS 10)	
2	2	2		A-101
2	2	2		A-102
3	3	3		A-103,406
3	3	3		A-104,405
4	4	4		A-401
1	1	1		A-402
1	1	1		A-403
1	1	1		A-404
1	1	1	-66015	A-601
1	1	1	-66016	A-602
1	1	1		A-701
1	1	1		A-901
1	1	1		E-101
1	1	1		E-102
1	1	1		E-103
24	24	24		E-104
1	1	1		E-105
2	2	2		E-113
1	1	1		E-114
1	1	1		E-115
1	1	1		E-116

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			MISCELLANEOUS (CLASS 10)(Continued)	
1	1	1		E-117
4	4	4		E-118
2	2	2		E-119
53	53	53		E-120
2	2	2		E-121
17	17	17		E-122
15	15	15		E-125
4	4	4		E-126
2	2	2		E-127
3	3	3		E-128
1	1	1		E-129
3	3	3		E-130
7	7	7		E-131
1	1	1		E-132
2	2	2		E-133,505
19	19	19		E-134
65	65	65		E-135
1	1	1		E-136
20	20	20		E-137,205
16	16	16		E-138,407
1	1	1		E-201

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			MISCELLANEOUS (CLASS 10) (Continued)	
1	1	1		E-202
1	1	1		E-203
2	2	2		E-206
		3		E-303
2	2			E-303 or †1203
2	2	2		E-304, †1304, †1314
4	4	4		E-305, †1305, †1315
1	1	1		E-401
7	7	7		E-408
7	7	7		E-409
6	6	6		E-410
6	6	6		E-411
3	3	3		E-412
12	12	12		E-413
2	2	2		E-414
1	1	1		E-415
4	4	4		E-416
3	3	3		E-417
10	10	10		E-418
27	27	27		E-419
1	1	1		E-420

† *Used on TBS-8 only.*

TBS IB-38011 TBS-3 IB-38159 TBS-6 IB-38246 V1
TBS-1 IB-38051 TBS-4 (G.E.) TBS-7 (G.E.)
TBS-2 IB-38116 TBS-5 IB-38211 TBS-8 IB-38331

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			MISCELLANEOUS (CLASS 10) (Continued)	
1	1	1		E-421
1	1	1		E-422
1	1	1		E-423
2	2	2		E-424
2	2	2		E-425,503
4	4	4		E-426
2	2	2		E-427
1	1	1		E-428
1	1	1		E-429
1	1	1		E-430
2	2	2		E-431
1	1	1		E-432
1	1	1		E-501
4	4	4		E-502
1	1	1		E-504
4	4	4		↑E-1201
1	1	1		↑E-1202
1	1	1		↑E-1204
4	4	4		↑E-1205
2	2	2		H-201,402
1	1	1		H-401

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			MISCELLANEOUS (CLASS 10) (Continued)	
2	2	2		H-403
2	2	2		H-404
1	1	1		H-405
2	2	2		I-101,201 (Used on TBS only)
3	3	3		I-101,201,401
4	4	4		O-101
1	1	1		O-102
1	1	1		O-103
1	1	1		O-104
3	3	3		O-105
9	9	9		O-106
1	1	1		O-107
1	1	1		O-201
3	3	3		O-202,403
1	1			O-301
1	1			O-302
		2		O-303
1	1			O-304
		1		O-305 or 309
2	2			O-305, ↑1305, ↑1315
2	2	2		O-306, ↑1306, ↑1316

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			MISCELLANEOUS (CLASS 10) (Continued)	
1	1			O-307, ↑1307, ↑1317
1	1			O-308, ↑1308, ↑1318
1	1	1		O-308
2	2	2		O-401
3	3	3		O-402
7	7	7		O-404
2	2	2		O-405
2	2	2		O-406
1	1	1		↑O-407
2	2	2		↑O-408
1	1	1		↑O-409
1	1	1		O-1001
			R-F DEVICES (CLASS 14)	
1	1	1		AF-401
			MOTORS & GENERATORS (CLASS 21)	
1			-21300 -21300A	B-301, G-301 (Used on TBS, TBS-1,2,3,4,5 only)
1				B-301A, G-301A
2				B-301B, G-301B
2				B-301C

V1

↑ *Used on TBS-8 only.*

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

MOTOR GENERATORS (CLASS 21)

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
1				B-301D
2				B-301E
1				B-301F
3				B-301G
3				B-301H
2				B-301J
2				B-301K
4				G-301C
2				G-301D
4				G-301E
2				G-301F
3				G-301G
3				G-301H
2				G-301J
2				G-301K
		1	-21301	B-301, G-301 (Used on TBS, TBS-3, TBS-5 only)
		1		B-301A, G-301A
		2		B-301B, G-301B
		4		G-301C
		4		G-301E
		3		G-301G

MOTOR GENERATORS (CLASS 21) (Cont.)

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
		2		G-301J
		2		G-301K
		1	-21302	B-301, G-301 (Used on TBS, TBS-1,2,3,and 5 only)
		1		B-301A, G-301A
		2		B-301B, G-301B
		4		G-301C
		4		G-301E
		3		G-301G
		2		G-301J
		2		G-301K
	1		-21745	B-301, G-301 (Used on TBS-3, 4 & 5 only)
	1			B-301A, G-301A
	2			B-301B, G-301B
	2			B-301C
	1			B-301D
	2			B-301E
	1			B-301F
	3			B-301G
	3			B-301H
	2			B-301J

MOTOR GENERATORS (CLASS 21) (Cont.)

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
	2			B-301K
	4			G-301C
	2			G-301D
	4			G-301E
	2			G-301F
	3			G-301G
	3			G-301H
	2			G-301J
	2			G-301K
1			-211127	B-301, G-301 (Used on TBS-7 only)
1			-211127	†B-1301, †G-1301
1				B-301A, †1301A, G-301A, †1301A
2				B-301B, †1301B, G-301B, †1301B
2				B-301C, †1301C
1				B-301D, †1301D
2				B-301E, †1301E
1				B-301F, †1301F
2				B-301J, †1301J
2				B-301K, †1301K
2				B-301L, †1301L

† *Used on TBS-8 only.*

V1

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			MOTOR GENERATORS (CLASS 21) (Cont.)	
1				B-301M, ↑1301M
2				B-301N, ↑1301N
1				B-301P, ↑1301P
4				G-301C, ↑1301C
2				G-301D, ↑1301D
4				G-301E, ↑1301E
2				G-301F, ↑1301F
2				G-301J, ↑1301J
2				G-301K, ↑1301K
6				G-301M, ↑1301M
6				G-301P, ↑1301P
		1	-211129	B-301, G-301 (Used on TBS-6, TBS-7 only)
		1		B-301A, G-301A
		2		B-301B, G-301B
		4		G-301C
		4		G-301E
		2		G-301J
		2		G-301K
		4		G-301M
		4		G-301P

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			MOTOR GENERATORS (CLASS 21) (Cont.)	
	1		-211130	B-301, ↑G-301 (Used on TBS-6,7 only)
	1		-211130	↑B-1311, ↑G-1311
	1			B-301A, ↑1311A, G-301A, ↑1311A
	2			B-301B, ↑1311B, G-301B, ↑1311B
	2			B-301C, ↑1311C
	1			B 301D, ↑1311D
	2			B-301E, ↑1311E
	1			B-301F, ↑1311F
	2			B-301J, ↑1311J
	2			B-301K, ↑1311K
	2			B-301L, ↑1311L
	1			B-301M, ↑1311M
	2			B-301N, ↑1311N
	1			B-301P, ↑1311P
	4			G-301C, ↑1311C
	2			G-301D, ↑1311D
	4			G-301E, ↑1311E
	2			G-301F, ↑1311F
	2			G-301J, ↑1311J

QUANTITY 120V D.C.	QUANTITY 220V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			MOTOR GENERATORS (CLASS 21) (Cont.)	
	2			G-301K, ↑1311K
	6			G-301M, ↑1311M
	6			G-301P, ↑1311P
			MAGNETIC CONTROLLERS (CLASS 21)	
	1		-21804	K-301, ↑1211, (Used on TBS-3 4,5,6,7 and 8)
	4			K-301A, ↑1211A
	1			K-301B, ↑1211B
	1			K-301C, ↑1211C
	1			K-301D, ↑1211D
	1			K-301E, ↑1211E
	1			K-301F, ↑1211F
	3			K-301G, ↑1211G
	1			K-301H, ↑1211H
	1			K-301I, ↑1211I
	1			K-301J, ↑1211J
	1			K-301T, ↑1211T
1			-21319	K-301, ↑1201T (Used on TBS, TBS-1,2,3,4,5,7 and 8)
4				K-301A, ↑1201A
1				K-301B, ↑1201B
1				K-301C, ↑1201C
1				K-301D, ↑1201D

↑ *Used on TBS-8 only.*

V1

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
MAGNETIC CONTROLLERS (CLASS 21) (Cont.)				
1				K-301E, †1201E
1				K-301F, †1201F
3				K-301G, †1201G
1				K-301H, †1201H
1				K-301I, †1201I
1				K-301J, †1201J
1				K-301K, †1201K
		1	-21320	K-301, (TBS,TBS-1,2,3,5,6 &7)
		3		K-301L (For TBS-3,5 & 6 only)
		6		K-301M (For TBS-3,5 & 6 only)
		1		K-301N
		1		K-301O
		1		K-301P
		3		K-301Q
		1		K-301R (Used on Models TBS-3,4,5,6,7 & 8)
		1		K-301S
		1		K-301W (Used on Models TBS, TBS-1 & 2)
ELECTRICAL MEASURING INSTRUMENTS (CLASS 22)				
1	1	1	-22024	M-102

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
MAGNETIC CONTROLLERS (CLASS 21) (Cont.)				
1	1	1	-22064	M-101
1	1	1		M-103
1	1	1		M-401
1	1	1		M-402
SWITCHES (CLASS 24)				
2	2	2	-24000	S-106,202
1	1	1	-24001	S-401
1	1	1	-24014	S-105
1	1	1	-24047	S-101
1	1	1		S-102
1	1	1		S-103
1	1	1		S-104
1	1	1		S-201
1	1	1		S-402
1	1	1		S-403
1	1	1		S-404
1	1	1		S-405
PROTECTIVE DEVICES (CLASS 28)				
4	4			F-301,302,304,305,†F1201, †1202,†1203,†1204,†F-1211 †1212,†1213,†1214

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
MAGNETIC CONTROLLERS (CLASS 21) (Cont.)				
4	4			F-301A,302A,304A,305A, †F-1201A,†1202A,†1203A, †1204A,†F-1211A,†1212A, †1213A,†1214A
		3		F-301,302,303
		3		F-301A,302A,303A
2	2	2		F-306,307,†1301,†1302,†1311, †1312
2	2	2		F-401,402
RELAYS (CLASS 29)				
1	1	1		K-101
2	2	2		K-101A,102A
3	3	3		K-101B
1	1	1		K-102
4	4	4		K-102B
1	1	1		K-103
1	1	1		K-103A (Used on TBS-3,4,5,6, 7 & 8 only)
1	1	1		K-103A (Used on TBS, TBS-1 & 2 only)
5	5	5		K-103B
2	2	2		K-104,201
2	2	2		K-104A,201A

† *Used on TBS-8 only.*

V1

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

Quantity 120V D.C.	Quantity 230V D.C.	Quantity 440/220 V D.C.	Navy Type Number	All Symbol Designations Involved
			RELAYS (CLASS 29) (Continued)	
4	4	4		K-104B, 201B
1	1	1		K-105
1	1	1		K-105A
1	1	1		K-105B
			TRANSFORMERS & REACTORS (CLASS 30)	
		1	-30445	T-301
1	1	1	-30471	L-111
1	1	1	-301309	T-501
1	1	1		T-101
1	1	1		T-102
1	1	1		T-103
1	1	1		T-104
1	1	1		T-105
1	1	1		T-201
1	1	1		T-401
1	1	1		T-402
1	1	1		T-403
1	1	1		T-404
1	1	1		T-405
1	1	1		T-406

Quantity 120V D.C.	Quantity 230V D.C.	Quantity 440/220 V D.C.	Navy Type Number	All Symbol Designations Involved
			TRANSFORMERS & REACTORS (CLASS 30) (Continued)	
1	1	1		T-407
1	1	1		T-408
1	1	1		T-409
			VACUUM TUBES (CLASS 38)	
2	2	2	-2A3	V-107, 108
1	1	1	-5Z3	V-412
1	1	1	-6A6	V-111
2	2	2	-6C6	V-402, 410
5	5	5	-6D6	V-109, 110, 405, 406, 407
1	1	1	-6F7	V-409
1	1	1	-6F8-G	V-403
1	1	1	-6J5-G -6J5-GT -6J5	V-404
1	7	1	-6Y6-G	V-411
1	1	1	-75	V-408
1	1	1	-84	V-112
2	2	2	-807	V-101, 102
4	4	4	-808	V-103, 104, 105, 106
1	1	1	-956	V-401

Quantity 120V D.C.	Quantity 230V D.C.	Quantity 440/220 V D.C.	Navy Type Number	All Symbol Designations Involved
			CRYSTALS (CLASS 40)	
1	1	1	-6200	Y-101
1	1	1	-6200B	Y-101 (TBS-6,7 & 8 only)
1	1	1	-6200	Y-401
1	1	1	-6200B	Y-401 (TBS-6,7 & 8 only)
1	1	1		X-113
1	1	1		X-413
			INDUCTANCES (CLASS 47)	
5	5	5	-47122	L-106, 107, 112, 113, 114
1	1	1		L-101
1	1	1		L-102
1	1	1		L-103
1	1	1		L-104
2	2	2		L-108, 109
1	1	1		L-110
1	1	1		L-301A&B, †1201A&B, †1211A&B
1	1	1		L-302, †1301, †1311
2	2			L-303, 304, †1302, †1303, †1312, †1313
1	1	1		L-401
1	1	1		L-402
1	1	1		L-403

† *Used on TBS-8 only.*

V1

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			INDUCTANCES (CLASS 47) (Cont.)	
2	2	2		L-404,405
1	1	1		L-406A&B
2	2	2		L-407,408
1	1	1		L-409
1				†L-1202
	1			†L-1212
			CAPACITORS (CLASS 48)	
1	1	1	-48001	C-108
1	1	1	-48038-20	C-122
4	4	4	-48401-20	C-115,126,128,140
8	8	8	-48409-20	C-107,109,114,116,123, 130,131,132
1	1	1	-48552-10	C-137
2	2	2	-48553-10	C-138,139
1	1	1	-48554-10	C-134A&B
1	1	1	-48626	C-120
	1	1	-48643	C-303, †1301, †1311
1	1	1	-48674	C-435
1	1	1	-48761	C-143
5	5	5	-48795	C-421A&B,437A&B,438A&B, 447A&B,448A&B

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			CAPACITORS (CLASS 48) (Cont.)	
6	6	6	-48856-B10	C-417,420,444,445,446,465
2	2	2	-48856-B10	C-418,419
1	1	1	-48983-B20	C-451
1	1	1	-481037-B10	C-422
2	2	2	-481161	C-453A&B,454A&B
2	2	2	-481716	C-141,142
1	1	1	-481733	C-301, †1201, †1211
1	1	1	-482238	C-129
1	1	1	-482241	C-113
3	3	3	ΩCM25B681K	C-457,460,461
6	6	6	ΩCM35B392K	C-423,426,429,433,450,462
13	13	13	ΩCM35B562K	C-415,416,422,424,425,427, 428,430,431,434,449,459, 464
3	3	3	ΩCM40B103K	C-436,441,463
11	11	11		C-101,102,103,104,110,111, 112,118,119,124,125
1	1	1		C-105
1	1	1		C-106
1	1	1		C-117
1	1	1		C-121
1	1	1		C-127
1	1	1		C-133

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			CAPACITORS (CLASS 48) (Cont.)	
1	1	1		C-136
1	1	1		C-201
1	1	1		C-302, †1202, †1212
1	1	1		C-303
2	2	2		C-304,305,306,307
2	2			C-304,305
4	4			C-304,305,306,307, †1302, †1303, †1304, †1305, †1312, †1313, †1314, †1315
		2		C-304,305,306,307, †1302, †1303, †1304, †1305, †1312, †1313, †1314, †1315
1				C-308, †1306
	1			C-308, †1316
1	1	1		C-401
1	1	1		C-402
1	1	1		C-403
1	1	1		C-404
1	1	1		C-405
1	1	1		C-406
11	11	11		C-407,408,409,410,411,412, 413,414,432,443,458

† *Used on TBS-8 only.*
Ω *American War Standard Type No.*

V1

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			CAPACITORS (CLASS 48) (Cont.)	
1	1	1		C-439
1	1	1		C-440
2	2	2		C-442,455
1	1	1		C-452
1	1	1		C-456
			JACKS, PLUGS, SOCKETS (CLASS 49)	
1	1	1	-49008	J-203
1	1	1	-49307	X-412
1	1	1	-49308	X-410
5	5	5	-49364	X-402,405,406,407,408
1	1	1	-49365	X-409
17	17	17		J-101
4	4	4		J-102,402,403
2	2	2		J-201,202
1	1	1		J-401
1	1	1		J-801
17	17	17		P-101
2	2	2		P-201,801
3	3	3		X-101,102,112
6	6	6		X-103,104,105,106,107,108

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			JACKS, PLUGS, SOCKETS (CLASS 49) (Cont.)	
2	2	2		X-109,110
2	2	2		X-111
1	1	1		X-114 (TBS only)
2	2	2		X-114,414
1		1		X-201 (TBS only)
1	1	1		X-201
1	1	1		X-401
2	2	2		X-403,404
1	1	1		X-411
			MICROPHONES (CLASS 51)	
1	1	1	-51018	Q-801
1	1	1	-51019	Q-201
1	1	1		Q-501
			INSULATORS (CLASS 61)	
22	22	22	-61166	E-106,204
			-61166	E-112
2	2	2	-61172	E-110
10	10	10	-61190	E-108
2	2	2	-61208	E-402

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			INSULATORS (CLASS 61) (Cont.)	
4	4	4	-61260	E-111
6	6	6	-61306	E-107
4	4	4		E-109
4	4	4		E-123
4	4	4		E-124
1	1	1		E-403
1	1	1		E-404
2	2	2		E-405
1	1	1		E-406
2	2	2		E-701,702
			WIRES & CONDUCTORS (CLASS 62)	
1	1	1		W-101
1	1	1		W-102
1	1	1		W-103
1	1	1		W-104
1	1	1		W-105
1	1	1		W-401
1	1	1		W-402
1	1	1		W-403
1	1	1		W-404

V1

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			WIRES & CONDUCTORS (CLASS 62) (Cont.)	
1	1	1		W-405
1	1	1		W-406
1	1	1		W-407
1	1	1		W-408
1	1	1		W-409
1	1	1		W-410
1	1	1		W-411
1	1	1		W-412
1	1	1		W-413
1	1	1		W-414
1	1	1		W-415
1	1	1		W-416
1	1	1		W-417
1	1	1		W-418
1	1	1		W-419
1	1	1		W-420
1	1	1		W-421
1	1	1		W-501
1	1	1		W-701

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			RESISTORS (CLASS 63)	
1	1	1	-63005	R-105
1	1	1	-63083F	R-107
1	1	1	-63288	R-118
1	1	1	-63288	R-101
1	1	1	-63360	R-139
2	2	2	-63360	R-437,457
7	7	7	-63360	R-404,407,410,413,417,427, 441
1	1	1	-63360	R-450
1	1	1	-63360	R-444
1	1	1	-63360	R-405
1	1	1	-63360	R-438
4	4	4	-63360	R-403,409,412,442
2	2	2	-63360	R-416,455
3	3	3	-63360	R-452,453,454
1	1	1	-63360	R-433
1	1	1	-63360	R-406
1	1	1	-63360	R-419
4	4	4	-63360	R-425,435,436,451
1	1	1	-63360	R-428
1	1	1	-63360	R-415

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			RESISTORS (CLASS 63) (Cont.)	
1	1	1	-63360	R-424
1	1	1	-63360	R-430,431,446
7	7	7	-63360	R-401,408,411,414,426,440, 443
2	2	2	-63360	R-420,445
2	2	2	-63360	R-423,429
1	1	1	-63360	R-432
2	2	2	-63426	R-113,140
1	1	1	-63426	R-121
1	1	1	-63426	R-122
1	1	1	-63426	R-123
2	2	2	-63426	R-111,112
1	1	1	-63474	R-104
1	1	1	-63474	R-126
2	2	2	-63474	R-203,204
1	1	1	-63474	R-131
1	1	1	-63474	R-133
1	1	1	-63474	R-135
1	1	1	-63474	R-116
1	1	1	-63474	R-130
1	1	1	-63474	R-114

V1

TABLE III (Continued)
PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED	QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED	QUANTITY 120V D.C.	QUANTITY 230V D.C.	QUANTITY 440/220 V D.C.	NAVY TYPE NUMBER	ALL SYMBOL DESIGNATIONS INVOLVED
			RESISTORS (CLASS 63) (Cont.)					RESISTORS (CLASS 63) (Cont.)					RESISTORS (CLASS 63) (Cont.)	
1	1	1	-63474	R-201	1	1	1		R-110	2	2	2		R-308,309
1	1	1	-63474	R-115	1	1	1		R-124	1	1			R-310
1	1	1	-63474	R-129	1	1	1		R-125		1			R-311, †1314
1	1	1	-63474	R-102	2	2	2		R-127,128	1				R-311, †1304
2	2	2	-63474	R-103,137	1	1	1		R-138	1	1	1		R-421
1	1	1	-63474	R-136	1				R-301, †1201	1	1	1		δR-421
1	11	1	-63474	R-119		1			R-301, †1211	1	1	1		R-422
1	1	1	-63474	R-120			1		R-301	1	1	1		δR-422
1	1	1	-63606-10	R-134	1	1	1		R-302, †1301, †1311					
1	1	1	-63678-5	R-456	1	1	1		R-302					
3	3	3	-63678-10	R-402,434,449		1			R-303, †1212					
2	2	2	-63678-10	R-447,448	1				R-303, †1202					
1	1	1	-631025	R-132	1				R-304, †1203					
1	1	1	-631045	R-108		1			R-304, †1213					
1	1	1	-631109	R-202	1				R-305, †1204					
1	1	1	-631136	R-439		1			R-305, †1214					
1	1	1	-631137	R-418	1				R-307					
1	1	1	-631937	R-117	1				R-307, †1303					
1	1	1	-632163	R-501		1			R-307, †1313					
1	1	1		R-106		1			R-307					
1	1	1		R-109	1	1	1		R-308, †1302, †1312					

δ Resistor board assemblies R-421 and R-422 to be supplied if resistors R-421 and R-422 are not available.
† Used on TBS-8 only.

V1

TABLE IV
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

TBS	NOs - 60613	TBS-3	NXs - 1736	TBS-6	NXsr-36725
TBS-1	NOs - 70095	TBS-4	NXss- 17599	TBS-7	NXsr-38310
TBS-2	NOs - 70095	TBS-5	NXss- 18747	TBS-8	NXsr-51552

											SPARE PART QUANTITIES													
											EQUIPMENT									STOCK			TENDER	
120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
				MISCELLANEOUS (CLASS 10)																				
x	x	x	A-601	Antenna assembly, destroyer type, 4 ground rods 48" long and 3 quarter-wave radiating rods of 33", 38-3/8" and 44" lengths, each used for particular frequencies, antenna body, 60" high, assembling hardware, 3-band frequency range 60 to 80 megacycles	-66015		1		P-720364-501											2	2			
x	x	x	A-101	Shock mount, 2-1/4" square plate, 1" thick, 15 lbs. load rating at 1/16" deflection			27	#200P-15	K-892997-1	1							1	1	1	4	4	2	1	2
x	x	x	A-102	Shock mount, 2-1/4" square plate, 1" thick, 20 lbs. load rating at 1/16" deflection			27	#200P-20	K-892997-2	1							1	1	1	4	4	2	1	2
x	x	x	A-103, 406	Case cover, brass, 0.064" thick, 1-5/16" x 1-5/16" overall dimensions, 2 holes, 0.173" dia.			1		K-843733-1											1	1			
x	x	x	A-104, 405	Case connector, aluminum alloy sand casting, threaded 3/4"-20 threads 1-1/4" x 1-9/16" overall dimensions, 1/2" dia. hole on top, 1" dia. hole in body			1		K-843703-1											1	1			
x	x	x	A-401	Shock mount, 1-3/4" square plate, 5/8" thick, 12 lbs. load rating at 1/16" deflection, 1-3/8" between mounting holes			27	#150P-12	K-883488-1											8	8	4	1	4
x	x	x	A-402	Door assembly, right hand, consisting of: aluminum door, 0.128" thick, 2-15/64" long, 1-55/64" wide, brass knob and pin bushing, brass latch 0.091" thick, spring washer, aluminum plate, rubber stop, hinges and assembling hardware			1		K-850908-501											1	1			
x	x	x	A-403	Door assembly, left hand, consisting of: aluminum door, 0.128" thick, 2-15/64" long, 1-55/64" wide, brass knob and pin bushing, brass latch 0.091" thick, spring washer and assembling hardware			1		K-850908-502											1	1			
x	x	x	A-404	Potentiometer bracket, brass, 0.064" thick, 1-1/2" long, 7/8" wide, 13/32" dia. hole			1		K-815838-1											1	1			

TBS	IB-38011	TBS-3	IB-38159	TBS-6	IB-38246
TBS-1	IB-38051	TBS-4	(G.E.)	TBS-7	(G.E.)
TBS-2	IB-38116	TBS-5	IB-38211	TBS-8	IB-38331

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	TBS-7	TBS-8	TENDER BOX	TBS-8
				MISCELLANEOUS (CLASS 10) (Continued)																				
x	x	x	A-701	Nitrogen flask, 1 qt. size, including dry nitrogen gas to 1800 lbs. max. pressure per sq. in. at 70°F. normal pressure fitted with valve suitable for discharging minute quantities of gas into transmission line, flask to withstand max. pressure of 3000 lbs./ sq. in.			165		K-884960-3											1	1	1	1	1
x	x	x	E-113	Tube cap connector assembly consisting of: flexible copper connector, 3-1/2" long and contact 0.128" dia.			1		K-854595-501	1							2	2	2	2	2			
x	x	x	E-114	Tube cap connector assembly consisting of: flexible copper connector 3-1/2" long, 3/8" wide, 0.0159" thick and contact 0.128" dia.			1		K-854595-502	1							1	1	1	1	1			
x	x	x	E-115	Tube cap connector assembly consisting of: flexible copper connector 4-3/4" long, 1/2" wide, 0.0159" thick, and tin plate contact 0.159" dia.			1		K-854598-501	1							1	1	1	1	1			
x	x	x	E-116	Tube cap connector assembly consisting of: two flexible copper connectors 3/4" and 4-3/16" long respectively, contact 0.128" dia., and one terminal			1		K-854602-501	1							1	1	1	1	1			
x	x	x	E-117	Tube cap connector assembly consisting of: two flexible copper connectors, 4-1/2" and 3-1/8" long respectively, contact 0.159" dia.			1		K-854613-501	1							1	1	1	1	1			
x	x	x	E-118	Tube cap connector assembly, (grid clip) 11/32" I.D., 3/8" wide, 27/32" overall length			483	Type #24	K-801165-1	1							1	1	1	1	1			
x	x	x	E-119	Tube cap connector assembly, (grid clip) 17/32" I.D., 1/2" wide, 27/32" overall length			483	Type #12	K-801165-2	1							1	1	1	1	1			
x	x	x	E-120	Terminal lug, shakeproof, bronze tinned 0.018" thick, bent at 30° angle, screw #6			599	Cat.#2103-6	K-30042-1	1							4	4	4	4	1	2	1	2
x	x	x	E-138, 407	Washer, paper insulating, 3/32" thick, 5/16" dia. with hole 0.144" dia.			1		K-59111-3											8	8	8	1	8

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
				MISCELLANEOUS (CLASS 10) (Continued)																				
		x	E-303	Fuse block, ferrule, single fuse type, ceramic base, 1-30 amps.			23	Cat.#3937	K-870643-1									1		3	3	1	1	1
x	x		E-303, 1203	Fuse block, 1-30 amps., ferrule, double fuse type			23	Cat.#1917	K-881388-1	1							1	1	1	2	2	1	1	1
x	x	x	E-304, 1304, 1314	Fuse block, special			18	8135378AA2	M-427877-41	2							1		1	2	1	1	2	1
x	x	x	E-305	Fuse clip			18	5831965AA	M-427877-77													1	2	1
x	x	x	E-401	Receiver fuse board assembly, laminated, phenolic, insulated fuse board, 1/8" thick, 2-1/8" long, 1-27/32" wide, with shield, 4 clips, 4 terminals and assembling hardware			1		K-850887-501											1	1			
x	x	x	E-408	Tube shield aluminum, 0.015" thick, 1.591" I.D., 1.657" O.D., 3-1/2" long			82	Cat.#B-704 or B-709	K-833405-4											7	7			
x	x	x	E-409	Shield cap, aluminum, 0.020" thick, 1-5/8" I.D., 1-1/4" high			82	Cat.#B-903	K-850869-7											7	7			
x	x	x	E-410	Shield base, aluminum, 0.025" thick, 1-7/32" I.D., 1-21/32" O.D., 1/2" high, 1.843" between mounting holes			82	Cat.#B-803	K-850869-1											6	6			
x	x	x	E-411	Grid clip, steel to snap on tight on glass tube, grid connection, 9/16" long, 3/8" wide			760	Cat.#154	K-79834-1											3	3			
x	x	x	E-413	Spacer, ceramic base, impregnated, 0.116" thick, 0.375" O.D., 0.1495" I.D.			22	RE 13A 317 Grade G	K-829954-2	1							6	6	6	24	24	6	1	6
x	x	x	E-415	Terminal board mounting, 4 terminal assemblies, 8 rivets, 115 v, 60 cycles output			1		K-850905-501											1	1			
x	x	x	E-416	Spade terminal, brass, 0.032" thick, 13/16" long			1		K-806765-1											4	4			
x	x	x	E-417	Terminal board assembly, bakelite board mounting, two brass terminals			11	Cat.#1520	K-81641-3											3	3			
x	x	x	E-418	Knob assembly consisting of: pointer and black phenolic knob, 1" dia., with tapped hole for #8-32 setscrew			1		K-815104-509											10	10			
x	x	x	E-419	Terminal lug, brass, 0.020" thick, bent at 90° angle			1		K-60106-6											27	27			

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
				MISCELLANEOUS (CLASS 10) (Continued)																				
x	x	x	E-420	Resistor board assembly for R-420,423,424,425, 427,428,429,430,431, and C-441, laminated insulation, 5-27/32" long, 1-5/8" wide, 1/16" thick, cloth base, mounting 9 resistors, 1 capacitor, 3 spacers, 2 brass eyelets, 18 half terminals and 2 bushings			1		P-720171-502											1	1			
x	x	x	E-421	Resistor board assembly for R-406,407,408,409, 410,411,412,413,414,443, laminated insulation, 5-27/32" long, 1-5/8" wide, 1/16" thick, cloth base, mounting 10 resistors, 6 brass eyelets, 20 full terminals, 2 bracket assemblies and spacer			1		P-720171-501											1	1			
x	x	x	E-422	Resistor board assembly for R-437,438,441,444, 445,446, and C-416,449, laminated insulation, 4-1/8" long, 1-5/8" wide, 1/16" thick, cloth base, mounting 9 resistors, 2 capacitors, 2 spacers, 2 bushings and 16 half terminals			1		P-720171-504											1	1			
x	x	x	E-423	Resistor board assembly for R-416,417,426 and C-436, laminated insulation, 2-1/16" long, 1-5/8" wide, 1/16" thick, cloth base, mounting 3 resistors, 1 capacitor, 9 full terminals, 4 brass eyelets, and 2 bracket assemblies			1		P-720171-503											1	1			
x	x	x	E-424	Terminal lug, brass, 0.020" thick, bent at 30° angle			1		K-60106-4											2	2			
x	x	x	E-425	Terminal board assembly, bakelite board mounting, one brass terminal			11	Cat.#1512	K-81641-1											1	1			
x	x	x	E-426	Terminal, lug type, brass, 0.180" dia. hole, 25/32" long, hot tin dipped finish			1		K-8431-1											4	4			
x	x	x	E-427	Grid clip, phosphor bronze for acorn tube, 0.010" thick, 0.669" long, 0.090" wide			552		K-99046-1											2	2			
x	x	x	E-428	Grid clip, steel, to fit tightly over metal tube or octal base, "G" tube, 11/16" long, 1/4" wide			11	Part #6005	K-79834-2											1	1			
x	x	x	E-432	Shield base, aluminum, 0.025" thick, 1-3/8" I.D., 1-21/32" O.D., 1/2" high, 1.843" between mounting holes			82	Cat. #B-803	K-850869-6											1	1			

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	TBS-7	TBS-8	TENDER BOX	TBS-8
				MISCELLANEOUS (CLASS 10) (Continued)																				
x	x	x	H-201, 402	Knurled nut, brass, straight knurl, 1/16" thick, threaded 15/32"-32 threads, 19/32" O.D.			1		K-60514-1											1	1			
x	x	x	H-401	Locknut, brass, 1/16" thick, tapped 15/32"-32 threads, 9/16" O.D., double chamfer			1		K-818921-1											1	1			
x	x	x	H-403	Handle, brass, 4-3/4" long, 1-3/16" high			46 307a 740		K-12124-1											2	2			
x	x	x	H-404	Case screw, brass, threaded #6-32 threads for 3/8", 1-5/8" overall length, knurled handle			1		K-854205-1											2	2			
x	x	x	H-405	Case nut, brass, threaded #6-32 threads, 5/16" O.D., 3/16" thick			1		K-854205-3											1	1			
x		x	I-101,201	Lamp miniature screw base, 6.3 v, 0.15 amp., 0.94 watts, bulb T-3-1/4 clear			18	Mazda 40	K-61114-2	1	3											12	1	12
x	x	x	I-101,201, 401	Lamp, miniature bayonet base, 6.3 v, 0.25 amp., 1.6 watts, bulb T-3-1/4 clear			18	Mazda 44	K-61114-15	1	1	4	4	4	4	4	8	8	8	24	24	16	1	16
x	x	x	O-101	Coupling, insulated, flexible, cross shaped, 1-9/32" sq., 1-1/16" long, 0.2525" I.D.			23		K-843141-1											4	4	2	1	2
x	x	x	O-102	Spring, phosphor bronze, 0.032" dia., 4 active turns, 5/8" free length			1		K-860235-1	1							1	1	1	5	5	2	1	2
x	x	x	O-103	Coupling, insulated, steatite, black, with brass extensions for 1/4" shaft, 9/16" smaller dia., 45/64" larger dia., 1-1/4" overall length, two #8-32 cup point setscrews			23	Cat.#252	K-880947-1											1	1	1	1	1
x	x	x	O-104	Spring, phosphor bronze, 0.0159" dia., 23 active turns, wound right hand, 1-7/8" free length			1		K-856136-1	1							1	1	1	5	5	2	1	2
x	x		O-105	Tube clamp, stainless steel, 1-5/32" dia.			126	926A-2	K-888964-501	1									1			1	1	1
x	x		O-106	Tube clamp, stainless steel, 1-3/8" dia.			126	926C-2	M-438114-5	1									3			3	1	3
x	x	x	O-202,403	Clamp, steel, cadmium plated, 0.037" thick, 1" I.D., 1-7/16" between mounting holes, 3/4" high			28 761	Cat.#105-1	K-844039-2											2	2			

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	TBS-7	TBS-8	TENDER BOX	TBS-8
				MISCELLANEOUS (CLASS 10) (Continued)																				
x	x		O-301	Grease cup			18	5852859AA2	M-427877-42											1	1	1	2	1
x	x		O-302	Grease cup and relief fitting			18	8124237AA2	M-427877-43											1	1	1	2	1
		x	O-303	Grease cup and relief fitting			18	8124237AA2	M-427877-44											2	2	2	2	2
x	x		O-304	Grease relief fitting			18	8104245AA1	M-427877-45											1	1	1	2	1
		x	O-305, 309	Gasket, cover, fiber packing		33-P-22	18	5895834AB1	M-427877-46	2							1	1		4	4			
x	x		O-305, 1305, 1315	Gasket, cover, fiber packing		33-P-22	18	5895834AB1	M-427877-47	2							2	2	2	8	8	4	2	4
x	x	x	O-306, 1306, 1316	Gasket, cork		32-C-5	18	8167060AA-P1	M-427877-48	2							2	2	2	8	8	4	2	4
x	x		O-307, 1307, 1317	Assembly of rotating parts for speed regulator including assembly of weights, springs and assembly of mounting hub and slip ring			18	8109968AC9	M-427877-50	2							1	1	1	1	1	1	2	1
x	x		O-308, 1308, 1318	Adjusted mechanical assembly for speed regulator including contact adjusting screw and contact clip, cover plate and adjusting knob			18	8124116AC2	M-427877-51	2							1	1	1	1	1	1	2	1
x	x	x	O-308	Adjusting mechanical assembly for speed regulator			18	8124116AA3	M-427877-85													1	2	1
x	x	x	O-401	Stop spring, phosphor bronze, extra hard, 0.064" thick, 3" long, 5/8" wide, 2 holes 0.128" dia., 2 holes 0.173" dia.			1		K-850922-1											2	2			
x	x	x	O-402	Clamp, steel, cadmium plated, 0.037" thick, 1-3/8" I.D., 1-27/32" between mounting holes, 3/4" high			28 761	Cat.#106-1	K-844039-1											3	3			
x	x	x	O-404	Clamp, stainless steel, 1-13/16" high, 1-11/32" wide, 0.025" thick			1		K-77973-3											7	7			
x	x	x	O-405	Cable clamp, steel, 0.050" thick, 5/16" wide, 0.140" hole, inner radius 3/32"			1		K-17301-19											2	2			
x	x	x	O-406	Cable clamp, steel, 0.050" thick, 5/16" wide, 0.170" hole, inner radius 3/32"			1		K-17301-21											2	2			

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
				MISCELLANEOUS (CLASS 10) (Continued)																				
x		x		Spare parts box #1			1		T-620059-504		1	1												
x				Spare parts box #1			1		M-441010-1		1	1	1	1		1								
		x		Spare parts box #1			1		M-441012-1		1	1	1	1		1								
		x		Spare parts box #2			18	V-5079999-AA	K-860256-27		1	1	1	1		1								
x		x		Spare parts box #1			1		T-620059-507				1	1	1									
	x			Spare parts box #2			18	V-5835417-AA	K-875577-23					1	1	1								
	x			Spare parts box #1			1		M-441011-1					1		1								
	x			Spare parts box #1			1		M-441011-2								1							
		x		Spare parts box #1			1		M-441012-2								1							
		x		Spare parts box #2			18	V-5079958-AB	M-427877-64									1	1					
x	x			Spare parts box #2			18	V-5872845-AB	M-427877-62									1	1	1				
x				Spare parts box #1			1		P-717811-3										1					
	x			Spare parts box #1			1		P-717911-4										1					
				Tender spare parts box #2			18	V-5872844-AB	M-427877-68														x	1
				R-F DEVICES (CLASS 14)																				
x	x	x	AF-401	Assembly in container consisting of: 3 variable capacitors C-401,402,403, a terminal board assembly T-402, R-F transformer assembly T-401, case assembly, cover assembly, acorn tube socket X-401, 12 ceramic spacers E-414, and two spacers E-413, 17 terminals, connection line, spring, washer and assembling hardware, together with connection list including capacitors C-417,418,419,420,465 and resistors R-401,402,403,404,434,456			1		P-720135-501	1										1	1			

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	TBS-7	TBS-8	TENDER BOX	TBS-8
				MOTOR GENERATORS (CLASS 21)																				
x			B-301, G-301	Motor generator, 120 v d.c., 1 h.p., 3600 r.p.m., starting current 125 amps., full load current 9.6 amps., shunt wound, ball bearing, 40° temp. rise, a-c take-off from motor 170 watts, 0.78 amp., 220 v, generator high voltage 306 watts, 0.350 amp., 875 v, low voltage 60 watts, 0.200 amp., 300 v, insulation test voltage 2750 (750 v after filter capacitors are connected) component spare parts as follows:	-21300 -21300A		18	5BC66AB865 5LY57AB6	K-860272-1	2	1	1	1	1	1	1								
		x	B-301, G-301	Motor generator, 210-220-230 v a.c., 3 phase, 60 cycles, 1 h.p., 3450 r.p.m., starting current 21 amps., full load current 2.7 amps., induction wound, ball bearing, 40°C. temp. rise, insulation test voltage 1750, generator high voltage 306 watts, 0.350 amps., 875 v, low voltage 60 watts, 0.200 amp., 300 v, shunt wound, insulation test voltage 2750 (750 v after filter capacitors are connected), 50°C. temp. rise	-21301		18	5K67BC603 5LY57AB5	K-860273-1		1			1		1								
		x	B-301 G-301	Motor generator, 440 v a.c., 3 phase, 60 cycles 1 h.p., 3450 r.p.m., starting current 10.5 amps., full load current 1.4 amps., induction wound, ball bearing, insulation test voltage 2250, 40°C. temp. rise, generator high voltage 306 watts 0.350 amp. 875 v, low voltage 60 watts, 0.200 amp., 300 v, shunt wound, insulation test voltage 2750 (750 v after filter capacitors are connected)	-21302		18	5K57BC580 5LY57AB2	K-860274-1	2	1	1	1	1		1								
	x		B-301, G-301	Motor generator, 230 v d.c., 1 h.p., 3600 r.p.m. starting current 65 amps., full load current 5.0 amps., shunt wound, ball bearing, insulation test voltage 1750, 40° temp. rise, a-c take-off from motor 170 watts, 0.78 amp., 220 v, generator high voltage 306 watts, 0.350 amp., 875 v, low voltage 60 watts, 0.200 amp., 300 v, insulation test voltage 2750 (750 v after filter capacitors are connected)	-21745		18	5BC66AB1333 5LY57AB10	K-875578-1	2				1	1	1								
x			B-301, 1301, G-301, 1301	Motor generator 120 v d.c., 1 h.p., 3600 r.p.m. starting current 125 amps., full load current 9.6 amps., shunt wound, ball bearing, 40°C. temp. rise, a-c take-off from motor 170 watts, 0.77 amp., 220 v, generator high voltage 306 watts, 0.350 amp., 875 v, low voltage 60 watts, 0.200 amp., 300 v, insulation test voltage 2750 v (750 v after filter capacitors are connected)	-211127		18	5BC66AB1525 5BC66AB1522	P-717756-2	2								1	1					

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
				MOTOR GENERATORS (CLASS 21) (Continued)																				
		x	B-301, G-301	Motor generator, 440 v a.c., 3 phase, 60 cycles, 1 h.p., 3450 r.p.m., starting current 10.5 amps., full load current 1.4 amps., induction wound, ball bearing, insulation test voltage 1880, 50°C. temp. rise, generator high voltage 306 watts, 0.350 amp., 875 v, low voltage 60 watts, 0.200 amp., 300 v, shunt wound, insulation test voltage 2750 (750 v after filter capacitors are connected)	-211129		18	5K67BC1293 5BC66AB1520	P-717755-1	2							1	1						
	x		B-301, 1311, G-301, 1311	Motor generator, 230 v d.c., 1 h.p., 3600 r.p.m. starting current 65 amps., full load current 5.0 amps., shunt wound, ball bearing, insulation test voltage 1460, 50° temp. rise, a-c take-off from motor 170 watts, 0.77 amp., 220 v, generator high voltage 306 watts, 0.350 amp., 875 v, low voltage 60 watts, 0.200 amp., 300 v, insulation test voltage 2750 (750 v after filter capacitors are connected)	-211130		18	5BC66AB1526 5BC66AB1523	P-717756-1	2							1	1	1					
x			B-301A G-301A	Armature, complete, for CG-21300,-21300A			18	5LY57AB6	K-860256-1	2	1	1	1	1	1	1								
x			B-301A G-301A	Armature, complete for CG-21300,-21300A			18	8160056AB1	M-427877-70	2												1	2	1
		x	B-301A G-301A	Armature, complete, for CG-21301,-21302			18	5LY57AB2	M-427877-87	2	1	1	1	1		1						1	2	1
	x		B-301A G-301A	Armature, complete, for CG-21745			18	5LY57AB10	K-875577-1	2				1	1	1								
	x		B-301A G-301A	Armature, complete, for CG-21745			18	8160056AC1	M-427877-71	2												1	2	1
x			B-301A G-301A B-1301A G-1301A	Armature, complete, for CG-211127			18	8167844AA1	M-427877-1	2								1	1		2			
		x	B-301A G-301A	Armature, complete, for CG-211129			18	8167844AC1	M-427877-2	2							1	1		2	2			
	x		B-301A G-301A B-1311A G-1311A	Armature, complete, for CG-211130			18	8167844AB1	M-427877-3	2							1	1	1	2	2			

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	TBS-7	TBS-8	TENDER BOX	TBS-8
				MOTOR GENERATORS (CLASS 21) (Continued)																				
x	x	x	B-301B, G-301B	Ball bearing, 2 per set for CG-21300,-21300A, -21301,-21302,-21745			18	V-5831955AA	K-860256-2	2	2	2	2	2	2	2								
x	x	x	B-301B, 1301B, 1311B, G-301B, 1301B, 1311B	Ball bearing, Hoover #7204 for CG-211127, -211129, -211130			18	5855279AC1	M-427877-12	2							2	2	1	6	6	2	2	2
x	x		B-301C	Brush, spring, pigtail and terminal assembly (Motor) for CG-21300,-21300A,-21745			18	M-5057458AA18	K-860256-4	2	20	20	20	20	20	20								
x	x		B-301C, 1301C, 1311C	Brush, spring, pigtail and terminal assembly (Motor) for CG-211127,-211130			18	8100097AB6	M-427877-14	2							20	20	10	60	100	20	2	20
x	x		B-301D	Brush, spring, pigtail and terminal assembly (Regulator) for CG-21300,-21300A,-21745			18	M-5033779AA11	K-860256-6	2	10	10	10	10	10	10								
x	x		B-301D, 1301D, 1311D	Brush, spring, pigtail and terminal assembly (Regulator) for CG-211127,-211130			18	5863334AG8	M-427877-15	2							10	10	5		50	10	2	10
x	x		B-301E	Brush holder and insulation (Motor) for CG-21300,-21300A,-21745			18	K-5049837AB2	K-860256-8	2	2	2	2	2	2	2								
x	x		B-301E, 1301E, 1311E	Brush holder and insulation (Motor) for CG-211127,-211130			18	8100089AD2	M-427877-18	2							4	4	2	12	12	8	2	8
x	x		B-301F	Brush holder and insulation (Regulator) for CG-21300,-21300A,-21745			18	K-5085034AA1	K-860256-10	2	2	2	2	2	2	2								
x	x		B-301F, 1301F, 1311F	Brush holder and insulation (Regulator) for CG-211127,-211130			18	5869394AD1	M-427877-19	2							2	2	1	6	6	4	2	4
x	x		B-301G	Springs (Motor) for CG-21300,-21300A,-21745			18	K-5855781	K-860256-12	2	3	3	3	3	3	3								
x	x		B-301H	Springs (Regulator) for CG-21300,-21300A,-21745			18	K-1744224	K-860256-14	2	3	3	3	3	3	3								
x			B-301J	Main field coil (Motor) for CG-21300,-21300A			18	5BC66AB865	K-860256-16	2	2	2	2	2	2	2								
	x		B-301J	Main field coil (Motor) for CG-21745			18	5BC66AB1333	K-875577-16	2				2	2	2								
x			B-301J, 1301J	Main field coil (Motor) for CG-211127			18	8167847AA1	M-427877-6	2								2	2		8	4	2	4
	x		B-301J, 1311J	Main field coil (Motor) for CG-211130			18	8167845AA1	M-427877-7	2							2	2	2	8	8	4	2	4

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
				MOTOR GENERATORS (CLASS 21) (Continued)																				
x	x	x	G-301E	Brush holder and insulation (Generator) for CG-21300,-21300A,-21301,-21302,-21745			18	K-5049935AL7	K-860256-7	2	2	2	2	2	2	2								
x	x	x	G-301E, 1301E, 1311E	Brush holder and insulation (Generator) for CG-211127,-211129,-211130			18	5869388AM1	M-427877-17	2							8	8	4	24	24	16	2	16
x	x		G-301F	Brush holder and insulation (Collector) for CG-21300,-21300A,-21745			18	K-5049935AR1	K-860256-9	2	2	2	2	2	2	2								
x	x		G-301F, 1301F, 1311F	Brush holder and insulation (Collector) for CG-211127,-211130			18	5869388AN1	M-427877-20	2							4	4	2	12	12	8	2	8
x	x	x	G-301G	Springs (Generator) for CG-21300,-21300A,-21301, -21302,-21745			18	K-5624865	K-860256-11	2	3	3	3	3	3	3								
x	x		G-301H	Springs (Collector) for CG-21300,-21300A,-21745			18	K-3533302	K-860256-13	2	3	3	3	3	3	3								
x			G-301J	Main field coil (Generator) for CG-21300,-21300A			18	5LY57AB6	K-860256-15	2	2	2	2	2	2	2								
		x	G-301J	Main field coil (Generator) for CG-21301,-21302			18	5LY57AB2	K-860256-23	2	2	2	2	2		2								
		x	G-301J	Main field coil (Generator) for CG-21301,-21302			18	8160055AA1	M-427877-72													4	2	4
	x		G-301J	Main field coil (Generator) for CG-21745			18	5LY57AB10	K-875577-15	2				2	2	2								
x	x		G-301J	Main field coil (Generator) for CG-21300,-21300A, -21745			18	8169733AA1	M-427877-73													4	2	4

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES — EQUIPMENT: TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK: TBS-6	TBS-7	TBS-8	TENDER: BOX	TBS-8
				MOTOR GENERATORS (CLASS 21) (Continued)																				
x			B-301K	Commutating field coil (Motor) for CG-21300, -21300A			18	5BC66AB865	K-860256-21	2	2	2	2	2	2	2								
x			B-301K	Commutating field coil (Motor) for CG-21300, -21300A			18	8169738AA1	M-427877-76													2	2	2
	x		B-301K	Commutating field coil (Motor) for CG-21745			18	5BC66AB1333	K-875577-21	2				2	2	2								
	x		B-301K	Commutating field coil (Motor) for CG-21745			18	8169740AA1	M-427877-86													2	2	2
x			B-301K, 1301K	Commutating field coil (Motor) for CG-211127			18	8169393AA1	M-427877-10	2								1	2		4	4	2	4
	x		B-301K, 1311K	Commutating field coil (Motor) for CG-211130			18	8169392AA1	M-427877-11	2							2	1	2	8	4	4	2	4
x	x		B-301L, 1301L, 1311L	Brush holder cap (Motor) for CG-211127,-211130			18	5895854AA2	M-427877-23	2							4	4	2	12	12	8	2	8
x	x		B-301M, 1301M, 1311M	Brush holder cap (Regulator) for CG-211127, -211130			18	5863338AB1	M-427877-24	2							2	2	1	6	6	4	2	4
x	x		B-301N, 1301N, 1311N	Washer, prenite (Motor) for CG-211127,-211130			18	5895849AA1	M-427877-27	2							4	4	2	12	12	8	2	8
x	x		B-301P, 1301P, 1311P	Washer, prenite (Regulator) for CG-211127,-211130			18	5861433AA1	M-427877-28	2							2	2	1	6	6	4	2	4
x	x	x	G-301C	Brush, spring, pigtail and terminal assembly (Generator) for CG-21300,-21300A,-21301, -21302,-21745			18	M-5052405AC12	K-860256-3	2	40	40	40	40	40	40								
x	x	x	G-301C, 1301C, 1311C	Brush, spring, pigtail and terminal assembly (Generator) for CG-211127,-211129,-211130			18	5869390AH3	M-427877-13	2							40	40	20	120	120	40	2	40
x	x		G-301D	Brush, spring, pigtail and terminal assembly (Collector) for CG-21300,-21300A,-21745			18	M-5052405AA19	K-860256-5	2	20	20	20	20	20	20								
x	x		G-301D, 1301D, 1311D	Brush, spring, pigtail and terminal assembly (Collector) for CG-211127,-211130			18	5869390AH4	M-427877-16	2							20	20	10	100	100	20	2	20

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	EQUIPMENT TBS-1	EQUIPMENT TBS-2	EQUIPMENT TBS-3	EQUIPMENT TBS-4	EQUIPMENT TBS-5	EQUIPMENT TBS-6	EQUIPMENT TBS-7	EQUIPMENT TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
				MOTOR GENERATORS (CLASS 21) (Continued)																				
x	x		G-301J, 1301J, 1311J	Main field coil (Generator) for CG-211127,-211130			18	8167846AB1	M-427877-4	2							2	2	2	8	8	4	2	4
		x	G-301J	Main field coil (Generator) for CG-211129			18	8167880AA1	M-427877-5	2							2	2		8	8		2	4
x			G-301K	Commutating field coil (Generator) for CG-21300,-21300A			18	5LY57AB6	K-860256-20	2	2	2	2	2	2	2								
		x	G-301K	Commutating field coil (Generator) for CG-21301,-21302			18	5LY57AB2	K-860256-24	2	2	2	2	2		2								
	x		G-301K	Commutating field coil (Generator) for CG-21745			18	5BC66AB1333	K-875577-20	2				2	2	2								
x	x	x	G-301K	Commutating field coil (Generator) for CG-21300,-21300A,-21301,-21302,-21745			18	8169734AA1	M-427877-74													2	2	2
x	x		G-301K, 1301K, 1311K	Commutating field coil (Generator) for CG-211127,-211130			18	8169391AA1	M-427877-8	2							2	2	2	8	8	4	2	4
		x	G-301K	Commutating field coil (Generator) for CG-211129			18	8169394AA1	M-427877-9	2							2	2		8	8			
x	x	x	G-301M, 1301M, 1311M	Brush holder cap (Generator and Collector) for CG-211127,-211129,-211130			18	5898031AA2	M-427877-22	2							12	12	6	36	36	24	2	24
x	x	x	G-301P, 1301P, 1311P	Washer, prenite (Generator and Collector) for CG-211127,-211129,-211130			18	5855002AA1	M-427877-26	2							12	12	6	36	36	24	2	24

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
MAGNETIC CONTROLLERS (CLASS 21)																								
x			K-301, 1201	Motor starting contactor, four step d.c., 1-1/2 h.p., 120 v d.c., 4 points of acceleration, 3 wire control less low voltage and overload protection, 55 v coil to operate in series with resistor from 120 v.d.c. component spare parts as follows:	-21319		35	Cat.#EQ-1024-G1 Class 7107 Type B1	K-881401-1															
				Set of seven arcing contacts (Formerly K-301A Dwg.#K-860257-1) as follows:																				
x			K-301A, 1201A	(4) Contact finger			35	Part 751-G12	K-880962-1	1	4	4	4	4	4	4		4	4		8	8	1	8
x			K-301B, 1201B	(1) Contact finger			35	Part 1445-G2	K-880962-2	1	1	1	1	1	1	1		1	1		2	2	1	2
x			K-301C, 1201C	(1) Contact terminal			35	Part 1445-G9	K-880962-3	1	1	1	1	1	1	1		1	1		2	2	1	2
x			K-301D, 1201D	(1) Contact terminal			35	Part 1445-G14	K-880962-4	1	1	1	1	1	1	1		1	1		2	2	1	2
				Set of two sliding brushes (Formerly K-301B Dwg.#K-860257-2) as follows:																				
x			K-301E, 1201E	(1) Sliding brush contact, carbon			35	Part 751-X48	K-880962-5	1	1	1	1	1	1	1		1	1		2	2	1	2
x			K-301F, 1201F	(1) Sliding brush contact, copper			35	Part 751-X47	K-880962-6	1	1	1	1	1	1	1		1	1		2	2	1	2
				Set of six springs (Formerly K-301C Dwg.#K-860257-3)																				
x			K-301G, 1201G	(3) Finger springs			35	Part 751-G10	K-880962-7	1	3	3	3	3	3	3		3	3		3	3	1	3
x			K-301H, 1201H	(1) Finger spring			35	Part 751-G9	K-880962-8	1	1	1	1	1	1	1		1	1		1	1	1	1
x			K-301I, 1201I	(1) Finger spring			35	Part 1445-X9	K-880962-9	1	1	1	1	1	1	1		1	1		1	1	1	1
x			K-301J, 1201J	(1) Return spring			35	Part 750-X22	K-880962-10	1	1	1	1	1	1	1		1	1		1	1	1	1
x			K-301K, 1201K	Coil (Formerly K-301D Dwg.#K-860257-4)			35	Part 751-S1-W26	K-880962-20	1	1	1	1	1	1	1		1	1		3	2	1	2
		x	K-301	Motor starting contactor, 3 pole, 440 v with 220 v, coil for 3 wire control to operate in series with a resistor from 220 v a.c. component spare parts as follows:	-21320		35	Cat.#EQ-1018-G1 Dwg.#2073-C7 Class 8502	K-881402-1															
				Set of 12 arcing contacts (Formerly K-301A Dwg.#K-860270-1) as follows:																				
		x	K-301L	(3) Contact finger			35	Part 2073-G2	K-880963-1	1	3	3	3	3		3	3	3		6	6	6	1	6
		x	K-301M	(6) Contact			35	Part 2073-G1	K-880963-2	1	6	6	6	6		6	6	6		12	12	12	1	12

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	TBS-7	TBS-8	TENDER BOX	TBS-8
				MAGNETIC CONTROLLERS (CLASS 21) (Continued)																				
		x	K-301N	(1) Contact			35	Part 1487-G8	K-880963-3	1	1	1	1	1		1	1	1		2	2	2	1	2
		x	K-301O	(1) Contact			35	Part 1487-G15	K-880963-4	1	1	1	1	1		1	1	1		2	2	2	1	2
		x	K-301P	(1) Contact and spring assembly			35	Part 1487-G9	K-880963-5	1	1	1	1	1		1	1	1		2	2	2	1	2
				Set of four springs (Formerly K-301B Dwg.#K-860270-2) as follows:																				
		x	K-301Q	(3) Spring			35	Part 1487-X39	K-880963-6	1	3	3	3	3		3	3	3		3	3	3	1	3
		x	K-301R	(1) Spring (Used on Models TBS-3,4,5,6,7, and 8)			35	Part 2073-X3	K-880963-7	1				1		1	1	1		1	1	1	1	1
		x	K-301S	Coil (Formerly K-301D Dwg.#K-860270-3)			35	Part 1487-S1-S29B	K-880963-9	1	1	1	1	1		1	1	1		1	1	1	1	1
		x	K-301W	(1) Spring (Used on Models TBS,TBS-1,2)			35	Part 1487-D39-X1	K-880963-14	1	1	1	1									1	1	1
	x		K-301, 1211	Motor starting contactor, four step, d.c., 1-1/2 h.p., 230 v d.c., 4 points of acceleration, 3 wire control less low voltage and overload protection, 115 v coil to operate in series with resistor from 230 v d.c. component spare parts as follows:	-21804		35	Cat.#EQ-1024-G2 Class 7107 Type B1	K-881400-1															
				Set of seven arcing contacts (Formerly K-301A Dwg.#K-860257-1) as follows:																				
	x		K-301A, 1211A	(4) Contact finger			35	Part 751-G12	K-880962-1	1				4	4	4	4	4	4	8	8	8	1	8
	x		K-301B, 1211B	(1) Contact finger			35	Part 1445-G2	K-880962-2	1				1	1	1	1	1	1	2	2	2	1	2
	x		K-301C, 1211C	(1) Contact terminal			35	Part 1445-G9	K-880962-3	1				1	1	1	1	1	1	2	2	2	1	2
	x		K-301D, 1211D	(1) Contact terminal			35	Part 1445-G14	K-880962-4	1				1	1	1	1	1	1	2	2	2	1	2
				Set of two sliding brushes (Formerly K-301B Dwg.#K-860257-2) as follows:																				
	x		K-301E, 1211E	(1) Sliding brush contact, carbon			35	Part 751-X48	K-880962-5	1				1	1	1	1	1	1	2	2	2	1	2
	x		K-301F, 1211F	(1) Sliding brush contact, copper			35	Part 751-X47	K-880962-6	1				1	1	1	1	1	1	2	2	2	1	2
				Set of six springs (Formerly K-301C Dwg.#K-860257-3) as follows:																				
	x		K-301G, 1211G	(3) Finger spring			35	Part 751-G10	K-880962-7	1				3	3	3	3	3	3	3	3	3	1	3
	x		K-301H, 1211H	(1) Finger spring			35	Part 751-G9	K-880962-8	1				1	1	1	1	1	1	1	1	1	1	1
	x		K-301I, 1211I	(1) Finger spring			35	Part 1445-X9	K-880962-9	1				1	1	1	1	1	1	1	1	1	1	1
	x		K-301J, 1211J	(1) Return spring			35	Part 750-X22	K-880962-10	1				1	1	1	1	1	1	1	1	1	1	1
	x		K-301T, 1211T	Coil (Formerly K-301D Dwg.#K-860257-14)			35	Part 751-S1-W29	K-880962-21	1				1	1	1	1	1	1	3	3	2	1	2

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	TBS-7	TBS-8	TENDER BOX	TBS-8
				ELECTRICAL MEASURING INSTRUMENTS (CLASS 22)																				
x	x	x	M-102	Ammeter, r-f, 2-1/2", round type, flanged bakelite case with anti-glare glass, low loss back plate for operation at 60-80 mc, full scale 0-4 amp., factory calibration for non-magnetic panel	-22024	17-I-12	18	Type DW-44	M-427681-2	1	1	1	1	1	1	1	1			1	1			
x	x	x	M-101	Milliameter, d-c, 2-1/2", round type, flanged bakelite case with anti-glare glass, factory calibration for non-magnetic panel, full scale 0-200 ma.	-22064	17-I-12	18	Type DW-41	M-427681-1	1	1	1	1	1	1	1	1			1	1			
x	x	x	M-103	Voltmeter, modulation, 2-1/2", round type, flanged bakelite case with anti-glare glass, rectifier type, 0-25 v movement full scale 0-100%, in equal divisions, factory calibration for non-magnetic panel			18	Type DW-46	M-427681-3	1	1	1	1	1	1	1	1			1	1			
x	x	x	M-401	D-C milliammeter, full scale 3 milliamperes, 1-120 db, 2-1/2" flush type, calibrated in db, plus at zero position, minus at full scale, current to correct within ±5% of full scale deflection			18	Type DW-4X	K-850862-1	1	1	1	1	1	1	1	1			1	1			
x	x	x	M-402	A-C voltmeter, rectifier type, 2-1/2" flush type, full scale 0-48.80 v, 500 ohms resistance per volt, scale -16 to +3 db with minus sign at zero position and plus sign at full scale, a-c resistance 24.400 ohms ±5% at 25°C. measured at 1000 cycles anti-glare glass, voltage to be correct within ±5% of full scale deflection			18	Type DW-4X	K-850855-1	1	1	1	1	1	1	1	1			1	1			
				SWITCHES (CLASS 24)																				
x	x	x	S-106, 202	Switch, toggle, S.P.S.T., rated 1 amp. at 250 v d.c. and 3 amps. at 125 v d.c., threaded 15/32"-32 threads for 15/32" silver plated contacts	-24000	RE 24AA 118A	7	#20994-ET	M-420278-1	1							2	2	2	2	2	2	1	2
x	x	x	S-401	Switch, toggle, D.P.S.T., insulated, threaded 15/32"-32 for 15/32", contact silver plated rated 1 amp. at 250 v d.c. and 3 amps., at 125 v d.c.	-24001		7		M-413702-7	1							1	1	1	1	1	1	1	1
x	x	x	S-105	Switch, interlock, push-button, nickel finish, threaded 15/32"-32 threads for 9/16", momentary contact, normally open, contacts rated 3 amps. at 230 v	-24014		7	Cat. #3592	K-823087-1	1							1	1	1	1	1	1	1	1

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	TBS-7	TBS-8	TENDER BOX	TBS-8
				SWITCHES (CLASS 24) (Continued)																				
x	x	x	S-101	Switch, push-button, single pole make contact, non-locking, complete with red bakelite knob, nut and washer	-24047		28	Cat.#2001	K-821506-3	1							1	1	1	1	1	1	1	1
x	x	x	S-102	Switch, push-button control, momentary contact, two buttons, one black marked "START", one red marked "STOP", both contacts normally open			35	Type B20	K-843617-2	1							1	1	1	1	1	1	1	1
x	x	x	S-103	Switch, emergency stop, tumbler, shallow porcelain cup, S.P.S.T., rated 10 amps. at 125 v, 5 amps. at 250 v			8	Cat.#5501	K-854949-2	1							1	1	1	1	1	1	1	1
x	x	x	S-104	Switch, meter selector, isolantite, wafer, 2 gang, 5 position, 3/8" bushing, positioning lug and flat on shaft			28	SPO-Y-21751	M-415758-3	1							1	1	1	1	1	1	1	1
x	x	x	S-201	Switch, push-button control, similar to S-102 except buttons in different position			35	Type B20	K-843617-1	1							1	1	1	1	1	1	1	1
x	x	x	S-402	Switch, rotary, wafer type, S.P. section 4 position, shaft 23/32" long x 0.250" dia. 3/8"-32 thread for 5/16", all terminals and contacts silver plated			31	Type H	M-420265-1	1							1	1	1	1	1	1	1	1
x	x	x	S-403	Switch, rotary, wafer type, D.P., 1 section 3 position, shaft 23/32" long x 0.250" dia. 3/8"-32 thread for 5/16", all terminals and contacts silver plated			31	Type H	M-420266-1	1							1	1	1	1	1	1	1	1
x	x	x	S-404	Switch, push-button, S.P., make contact, locking type switch with nickel plated brass frame, complete with washer and nut			28	Cat.#2001-L	K-850856-1	1							1	1	1	1	1	1	1	1
x	x	x	S-405	Switch, S.P.S.T., part of R-439			40		K-850864-1	1							1							

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
				PROTECTIVE DEVICES (CLASS 28)																				
x	x		F-301, 302, 304, 305, 1201, 1202, 1203, 1204, 1211, 1212, 1213, 1214	Fuse, cartridge, ferrule type, renewable, 25 amps., 250 v			8	Cat.#7060	K-99108-6	1							8	8	8	40	40	16	1	16
x	x		F-301A, 302A, 304A, 305A, 1201A, 1202A, 1203A, 1204A, 1211A, 1212A, 1213A, 1214A	Fuse, link, renewable, 25 amps., 250 v, ferrule type			8	Cat.#7160	K-99108-36	1	16	16	16	16	16	16	40	40	40	200	200	80	1	80
		x	F-301,302, 303	Fuse, cartridge, ferrule type, renewable 25 amps., 600 v			8	Cat.#7260	K-99109-6	1							6	6		30	30	12	1	12
		x	F-301A, 302A, 303A	Fuse, link, renewable, 25 amps., 600 v			8	Cat.#7360	K-99109-36	1	12	12	12	12		12	30	30		150	150	60	1	60
x	x	x	F-306, 307, 1301, 1302, 1311, 1312	Fuse, 1/2 amp., 1000 v			18	V-5831963AA	M-427877-40	2	8	8	8	8	8	8	40	40	40	200	200	80	2	80
x	x	x	F-401,402	Fuse, glass cartridge type, 3 amps., 250 v 1-1/4" long, 1/4" ferrule dia.			26	Type 3AG	K-55544-4	1	8	8	8	8	8	8	20	20	20	100	100	80	1	80

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES EQUIPMENT TBS												
											EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
				RELAYS (CLASS 29)																				
x	x	x	K-101	Relay, horizontal type, right arm, 3 break contacts, consisting of coil, K-101A, and contacts, K-101B			79	D-282282	P-713837-530											2	2			
x	x	x	K-101A K-102A	Relay, coil, bakelite, impregnated, 21,300 turns AWG #39 SSC wire, single, one winding, d-c resistance 3000 ohms			79	D-282282	M-415604-17	1	1	1	1	1	1	1	1	1	1	5	5	3	1	3
x	x	x	K-101B	Relay contacts, horizontal type, 3 sets of palladium contacts, 2-1/2" long, 27/32" high, 23/32" wide, overall dimensions			1		K-880966-1	1	4	4	4	4	4	4	4	1	1	3	3	2	1	2
x	x	x	K-102	Relay, horizontal type, right arm, 1 break contact and 1 make contact, consisting of coil, K-102A, and contacts K-102B			79	K-282282	P-713837-528											2	2			
x	x	x	K-102B	Relay contacts, horizontal type, 4 contacts, 2-1/2" long, 23/32" wide, 13/16" high, overall dimensions			79		K-880965-1	1	4	4	4	4	4	4	4	1	1	3	3	2	1	2
x	x	x	K-103	Relay, transmit and receive, 5 contacts, 3 break-make, consisting of coil, K-103A, and contacts K-103B, together with 2 brackets, cover, coil bracket and guide assembly, plunger, support, spring, strap, coil plug, 4 bushing insulators, 2 contact assemblies, 2 spacers, contact arm, terminal board, 4 insulators, bushing, stud contact, 4 copper connectors, 5 terminals, plate and assembling hardware			25		P-721538-501											2	2			
x	x	x	K-103A	Relay coil d-c resistance 1100 ohms, 12,200 turns, #37 enamel wire			25	Cat.#257	K-883493-1	1				1	1	1	1	1	1	3	3	2	1	2
x	x	x	K-103A	Relay coil, d-c resistance 1140 ohms, 10,300 turns, #38 AWG wire (TBS, TBS-1, & 2 only)			1		K-900555-501	1	1	1	1											
x	x	x	K-103B	Relay contact assembly consisting of two contacts, contact arm, stud contact and contact assembly			1		K-860239-502	1	20	20	20	20	20	4	4	1	1	3	3	2	1	2
x	x	x	K-104, 201	Relay, control, 1 make contact, bakelite base, consisting of coil, K-104A, and contacts K-104B			24	Type #2230538	K-843567-2											6	6			

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES — EQUIPMENT TBS	EQUIPMENT TBS-1	EQUIPMENT TBS-2	EQUIPMENT TBS-3	EQUIPMENT TBS-4	EQUIPMENT TBS-5	EQUIPMENT TBS-6	EQUIPMENT TBS-7	EQUIPMENT TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
				RELAYS (CLASS 29) (Continued)																				
x	x	x	K-104A, 201A	Relay coil, operates on 5 ma, at 10 v d.c., d-c resistance of coil approximately 1950 ohms			24		K-843567-3	1	1	1	1	1	1	1	2	2	2	8	8	5	1	5
x	x	x	K-104B, 201B	Two relay contacts, one round and one flat			24		K-880967-501	1	8	8	8	8	8	4	4	2	2	8	8	5	1	5
x	x	x	K-105	Trip relay, 3" long, 2" wide, 2" deep, overall dimensions			25	Type 1040R	K-860214-1											2	2			
x	x	x	K-105A	Coil resistance 43 ohms ±5%, nominal tripping current 140 ma d.c.			25		K-860214-2	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	K-105B	Contact arm and 1 contact			25		K-880964-501	1	8	8	8	8	8	4	4	1	1	3	3	2	1	2
				TRANSFORMERS & REACTORS (CLASS 30)																				
		x	T-301	Transformer, 440/220 v, 0.250 kva rating, test voltage 2500; pri. 440 v, 0.6 amp., 60 cycles, 15.5 ohms d.c. test voltage 2500; sec. 220 v, 1.14 amps., 4.7 ohms d.c., 2500 v test	-30445		68	Type CF #25354	K-860271-501											1	1	1	1	1
x	x	x	L-111	Reactor, interstage, oil hermetically sealed, hi-pot test 2000 v, total impedance 125,000 ohms min. measured at 3 v, 60 cycles a.c. and 0 amp.d.c., See Winding Data, Section VII	-30471		1		K-900548-501	1							1	1	1	3	3	1	1	1
x	x	x	T-501	Transformer, output, potted in case, consisting of: three pri. and two sec., ratio 19.7 to 1 from full pri. to full sec., hi-pot test 1500 v pri. impedance 5800 ohms min., measured at 3 v, 60 cycles a.c. and 0 amp. d.c.; See Winding Data, Section VII	-301309		1		K-901060-501	1							1	1	1	3	3	2	1	2
x	x	x	T-101	Transformer compound and oil filled, hermetically sealed, ratio 1 to 3 ±5% from full primary to full secondary; See Winding Data, Section VII			1		K-900544-501	1							1	1	1	3	3	2	1	2
x	x	x	T-102	Compound and oil filled, hermetically sealed, ratio 3 to 1 ±5% from full primary to full secondary; See Winding Data, Section VII			1		K-900549-501	1							1	1	1	3	3	2	1	2
x	x	x	T-103	Transformer potted in case, ratio 1.7 to 1 ±5% from full pri. to full sec., midtap to be within 1% of neutral, hi-pot test 4000 v, pri. impedance 5200 ohms min. at 30 v, 60 cycles a.c. and 0.068 amp. d.c., additive polarity with finish of pri. connected to start of sec., induced voltage 1200 v, 500 cycles on sec. pri. 2850 turns AWG #29 E wire tapped at 1425 turns			1		K-900543-501	1							1	1	1	3	3	2	1	2

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	EQUIPMENT TBS-1	EQUIPMENT TBS-2	EQUIPMENT TBS-3	EQUIPMENT TBS-4	EQUIPMENT TBS-5	EQUIPMENT TBS-6	EQUIPMENT TBS-7	EQUIPMENT TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
				TRANSFORMERS & REACTORS (CLASS 30) (Continued)																				
	•		T-103 (Cont.)	wound 119 turns per layer over 0.050" thick kraft spool 29/32" x 1-9/16" x 1-15/16" long, wire traverse 1.562", insulation between layers 1 turn 0.003" kraft paper, over coil 3 turns 0.010" argelac, d-c resistance 140 ohms ±10%, at 25°C., coil build 0.468", sec.: 1675 turns AWG #29 E wire, wound 119 turns per layer over pri., wire traverse 1.562", insulation between layers 1 turn 0.003" kraft paper, over coil 3 turns 0.010" argelac, d-c resistance 101 ohms ±10%, at 25°C., coil build 0.272", iron core stacked 1-1/2" with 0.003" air gap, See Winding Data, Section VII																				
x	x	x	T-104	Transformer, potted in case, consisting of: one pri. and five filaments, rated as follows: pri. no load voltage 230/220/210, hi-pot voltage 2500; fil. #1, no load voltage 7.88 ±3%, full load voltage 7.5/3.75 rated current 4.0 amps., hi-pot voltage 1500; fil. #2, no load voltage 7.88 ±3%, full load voltage 7.5/3.75, rated current 4.0 amps., hi-pot voltage 1500; fil. #3 no load voltage 2.625 ±3%, full load voltage 2.5/1.25, rated current 5.0 amps., hi-pot voltage 1500; fil. #4; no load voltage 6.56 ±3% full load voltage 6.3, rated current 4.0 amps. hi-pot voltage 1500; fil. #5, no load voltage 7.88 ±3%, full load voltage 7.5/3.75, rated current 8.0 amps., hi-pot 1500 max. core loss 12 watts; max. exciting current 0.4 amp. at 230 v, 60 cycles, See Winding Data, Section VII			1		K-900545-501	1							1	1	1	3	3	2	1	2
x	x	x	T-105	Transformer, oil and compound hermetically sealed ratio 6.25 to 1 ±5% from pri. to sec. #1, 7.84 to 1 ±5% from pri. to sec. #2, hi-pot test 1500 v, adjusted for 1000 cycles output, with molded, fixed capacitor, 3900 mmfd ±5%, 400 v d.c. working, across start and finish of pri. winding; See Winding Data, Section VII			1		K-900546-501	1							1	1	1	3	3	2	1	2
x	x	x	T-201	Transformer potted and sealed in case, ratio 1 to 6 ±5% from pri. to sec., sec. impedance 600 ohms min. at 3 v, 60 cycles, a.c. and 0.0085 amp. d.c., hi-pot test 1000 v, additive polarity with pri. finish connected to sec. start; See Winding Data, Section VII			1		K-900547-501	1							2	2	2	6	6	4	1	4

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	TBS-7	TBS-8	TENDER BOX	TBS-8
				TRANSFORMERS & REACTORS (CLASS 30) (Continued)																				
x	x	x	T-401	R-F transformer assembly consisting of: 2 coils mounted in same horizontal and vertical planes, vertical plane being 5/8" from base to center line of coils; pri.: 6 turns of 10 strands AWG #40 DS litz wire, parallel lay, wound over mineral wax impregnated, unglazed steatite ceramic form 5/8" dia., start and finish of coils to extend 1-1/2", coil and form to be wax impregnated; sec.: 5 turns AWG #14 bare wire wound 11 turns per inch with 5/8" inside coil dia., start and finish to be spaced 29/64" and to extend 5/8" from coil, coil to be silver plated 0.0002" thick, See Winding Data, Section VII			1		M-420271-501	1							1	1	1	3	3	1	1	1
x	x	x	T-402	Special r-f transformer assembly consisting of: a base, 2 hex. spacers, 7 terminals, and 2 coils mounted in same horizontal and vertical planes, the vertical plane being 5/8" from the base to center line of coils, unglazed steatite form; coil #1: same as sec. coil of T-401; coil #2: same as coil #1 except 3 turns, See Winding Data, Section VII			1		K-850579-501	1							1	1	1	3	3	1	1	1
x	x	x	T-403	Transformer assembly consisting of: terminal board, 2 core and stud assemblies, 2 coils spaced 0.281" apart, each coil 39 turns AWG #33 E wire wound 64 threads per inch on 1/2" dia. form with start and finish extending 3", mounted in can with C-407,408,424,425 and R-452, See Winding Data, Section VII			1		P-720166-501	1							1	1	1	3	3	2	1	2
x	x	x	T-404	Transformer assembly consisting of: terminal board, 2 core and stud assemblies, 2 coils same as T-403, mounted in can with C-409,410, 427,428 and R-453, See Winding Data, Section VII			1		P-720166-505	1							1	1	1	3	3	2	1	2
x	x	x	T-405	Transformer assembly consisting of: terminal board and two terminals, 2 core and stud assemblies, 2 coils spaced 0.250" apart, each coil 40 turns AWG #33 E wire wound 64 threads per inch on 1/2" dia. form with start and finish extending 3", mounted in can with C-411,412, 430,432 and R-415,454, See Winding Data, Section VII			1		P-720166-502	1							1	1	1	3	3	2	1	2

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
TRANSFORMERS & REACTORS (CLASS 30) (Continued)																								
x	x	x	T-406	Transformer assembly consisting of: terminal board, 2 core and stud assemblies, 2 coils spaced 0.312" apart, coil #1, 39-1/2 turns, coil #2, 40 turns AWG #33 E wire wound 64 threads per inch on 1/2" dia. form with start and finish extending 3", mounted in can with C-413,414,434,435 and R-419, See Winding Data, Section VII			1		P-720166-503	1							1	1	1	3	3	2	1	2
x	x	x	T-407	Transformer assembly consisting of: terminal board, 2 core and stud assemblies, 2 coils spaced 0.500" apart, coil #1, 61 turns, coil #2 75 turns AWG #35 E wire close wound on 1/2" dia. form with start and finish extending 3", mounted in can with C-451, R-440,451, See Winding Data, Section VII			1		P-720166-504	1							1	1	1	3	3	2	1	2
x	x	x	T-408	Transformer potted in case, ratio 1.93 to 1 ±5%, hi-pot test 1500 v pri. and 1000 v sec., pri. impedance at 3 v, 60 cycles a.c. and 0.058 amp. d.c., 2400 ohms min.; See Winding Data, Section VII			1		K-900590-501	1							1	1	1	3	3	2	1	2
x	x	x	T-409	Transformer potted in case, 4 windings, no load voltage, pri. 115 v, plate 517 v ±3%, heater 6.76 v ±3%, rectifier 5.31 v ±3%; full load voltage, plate 490/245, heater 6.30 v, rectifier 5 v; rated current, plate 0.130 amp., heater 4.1 amps., rectifier 3 amps.; hi-pot test 2500 v all windings; max. core loss 10 watts; max. exciting current 0.35 amp. at 115 v, 60 cycles a.c.; induced voltage 460 v, 400 cycles, midtap to be within ±3% of neutral; See Winding Data, Section VII			1		K-900539-501	1							1	1	1	3	3	2	1	2
* VACUUM TUBES (CLASS 38)																								
x	x	x	V-107, 108	Power amplifier triode, glass, medium 4 pin base, filament current 2.5 amps. at 2.5 v a.c. or d.c.	-2A3	RE 13A 600A	1a	-2A3							2	2	4	4	4					
x	x	x	V-412	Full-wave high vacuum rectifier, medium 4 pin phenolic base, filament current 3.0 amps. at 5.0 v a.c. or d.c.	-5Z3	RE 13A 600A	1a	-5Z3							1	1	2	2	2					

* To be packed separately.

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	EQUIPMENT TBS-1	EQUIPMENT TBS-2	EQUIPMENT TBS-3	EQUIPMENT TBS-4	EQUIPMENT TBS-5	EQUIPMENT TBS-6	EQUIPMENT TBS-7	EQUIPMENT TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
				*VACUUM TUBES (CLASS 38) (Continued)																				
x	x	x	V-111	Twin amplifier, medium 7 pin phenolic base, heater current 0.8 amp. at 6.3 v a.c. or d.c.	-6A6	RE 13A 600A	1a	-6A6							1	1	2	2	2					
x	x	x	V-402,410	Triple grid detector amplifier, small 6 pin phenolic base, small metal cap, heater current 0.3 amp. at 6.3 v a.c. or d.c.	-6C6	RE 13A 600A	1a	-6C6							2	2	4	4	4					
x	x	x	V-109,110 405,406, 407	Triple grid, super control amplifier, small 6 pin phenolic base, small metal cap, heater current 0.3 amp. at 6.3 v a.c. or d.c.	-6D6	RE 13A 600A	1a	-6D6							5	5	10	10	10					
x	x	x	V-409	Triode pentode, small 7 pin phenolic base, small metal cap, heater current 0.3 amp. at 6.3 v a.c. or d.c.	-6F7	RE 13A 600A	1a	-6F7							1	1	2	2	2					
x	x	x	V-403	Twin triode amplifier, small shell, octal 8 pin phenolic base, skirted miniature cap, heater current 0.6 amp. at 6.3 v a.c. or d.c.	-6F8-G	RE 13A 600A	1a	-6F8-G			2	2	2	2	1	1	2	2	2					
x	x	x	V-404	Detector amplifier triode, small shell, octal 6 pin phenolic base, heater current 0.3 amp. at 6.3 v a.c. or d.c.	-6J5-G -6J5-GT -6J5	RE 13A 600A	1a	-6J5-G -6J5-GT -6J5			2	2	2	2	1	1	2	2	2					
x	x	x	V-411	Beam power amplifier, medium shell, octal 7 pin phenolic base, heater current 1.25 amps.,at 6.3 v a.c. or d.c.	-6Y6-G	RE 13A 600A	1a	-6Y6-G			2	2	2	2	1	1	2	2	2					
x	x	x	V-408	Duplex diode high-mu triode, small 6 pin phenolic base, small metal cap, heater current 0.3 amp. at 6.3 v a.c. or d.c.	-75	RE 13A 600A	1a	-75							1	1	2	2	2					
x	x	x	V-112	Full-wave, high vacuum rectifier, small 5 pin phenolic base, heater current 0.5 amp. at 6.3 v a.c. or d.c.	-84	RE 13A 600A	1a	-84							1	1	2	2	2					
x	x	x	V-101,102	Transmitting beam power amplifier, medium 5 pin base, micanol, small metal cap, heater current 0.9 amp. at 6.3 v a.c. or d.c., plate dissipation 25 watts	-807	RE 13A 600A	1a	-807							2	2	4	4	4					
x	x	x	V-103,104, 105,106	R-F power amplifier, oscillator, class B modulator, medium 4 pin phenolic bayonet base, medium metal top cap, small metal side cap, filament current 4.0 amps. at 7.5 v a.c. or d.c., plate dissipation 50 watts	-808	RE 13A 600A	1a	-808			8	8	8	8	4	4	8	8	8					
x	x	x	V-401	Super-control r-f amplifier pentode, acorn type, heater current 0.15 amp. at 6.3 v a.c. or d.c., 7 terminals	-956	RE 13A 600A	1a	-956			2	2	2	2	1	1	2	2	2					

* *To be packed separately.*

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
				CRYSTAL HOLDERS & CRYSTALS (CLASS 40)																				
x	x	x	Y-101	Cut crystal in ceramic holder	-62000		1	Model AVA-10T	MI-5750-6	1	2	2	1	12	4	4								
x	x	x	Y-401	Cut crystal in ceramic holder	-62000		1	Model AVA-10R	MI-5750-5	1	2	2	1	12	4	4								
x	x	x	X-113	Crystal holder socket, octagon shape, 3 contacts, mycalex insulation			247		K-834496-1								1	1	1	2	2	1	1	1
x	x	x	X-413	Crystal holder base assembly consisting of: 2 jacks, J-402 and J-403 mounted in a mycalex base 1/8" thick, and 1 bracket			1		K-856795-501								1	1	1	1	1	1	1	1
				INDUCTANCES (CLASS 47)																				
x	x	x	L-106,107, 112,113, 114	R-F choke, isolantite mounting, continuous universal winding, 4 sections, pigtail connections, impregnated, capacity 1 mmfd, d-c resistance 50 ohms, current rating 125 ma, inductance 2-1/2 millihenries, See Winding Data, Section VII	-47122		483	Type #100	K-834206-2	1	3	3	3	3	3	3	3	1	1	5	5	5	1	5
x	x	x	L-101	Self-supporting inductor, r-f, coil of 8 turns AWG #8 tinned copper wire, left-hand wound, both ends swaged, 1" I.D., approx. 1-25/32" overall length, See Winding Data, Section VII			1		K-877212-1											1	1			
x	x	x	L-102	Self-supporting inductor, r-f, coil of 4 turns AWG #8 tinned copper wire, left-hand wound, both ends swaged, 7/8" I.D., approx. 2-11/32" overall length, See Winding Data, Section VII			1		K-843688-1											1	1			
x	x	x	L-103	Inductor, r-f, coil of 4 turns AWG #8 tinned copper wire, right-hand wound, 1/4" pitch, 1" I.D., approx. 18" developed length, 3 terminals and 2 soft copper strip connectors, 0.0201" thick, See Winding Data, Section VII			1		K-843677-501											1	1			
x	x	x	L-104	Self-supporting inductor, r-f, coil of 2-1/2 turns AWG #20 x 3/16" O.D. wall thick copper tubing, right-hand wound, 7/16" pitch, 13/16" I.D., approx. 1-5/8" overall length, See Winding Data, Section VII			1		K-843689-1											1	1			

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES													
											EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
INDUCTANCES (CLASS 47) (Continued)																								
x	x	x	L-108,109	Self-supporting choke coil, impregnated coil of 30 turns AWG #18 tinned copper wire, wound right-hand, 3/8" I.D., 42" developed length See Winding Data, Section VII			1		K-843674-1	1	1	1	1	1	1	1	1		1	2	2	2	1	2
x	x	x	L-110	Potted in case, hi-pot test 1500 v, impedance 1600 ohms min. measured at 3 v, 60 cycles a.c. and 0.050 amp. d.c., d-c resistance 80 ohms ±10% at 25°C., See Winding Data, Section VII			1	RT-514	M-68994-502	1							1	1	1	3	3	1	1	1
x	x	x	L-301A&B 1201A&B 1211A&B	Reactor pack consisting of 2 identical reactors potted in case, inductance 0.8 henry, a-c impedance 272 ohms min. at 3 v, 60 cycles a.c. and 0.40 amp. d.c., hi-pot test 2000 v, d-c resistance 18.0 ohms at 25°C.; See Winding Data, Section VII			1		K-900556-501	1							1	1	1	3	3	1	1	1
x	x	x	L-302, 1301 1311	Choke, ohmite, 5.4 mh, current rating (d.c.) 1000 ma, d-c resistance 0.85 ohms, See Winding Data, Section VII			18	5835321AA	M-427877-38	2	1	1	1	1	1	1	1	1	1	1	1	1	2	1
x	x		L-303,304, 1302,1303, 1312,1313	Choke, 10 turns of 0.064" dia. E wire on 9/16" dia. tube, close wound, See Winding Data, Section VII			18	8167068AA-P1	M-427877-39	2										1	1			
x	x	x	L-401	Transformer, crystal oscillator assembly consisting of: 1 coil 18 turns #23 E copper wire, wound 20 threads per inch on 1/2" dia. form with start and finish extending 3", mounted in can with C-443,444, R-435 and R-447, core and stud assembly and terminal board, See Winding Data, Section VII			1		P-720172-501	1							1	1	1	3	3	2	1	2
x	x	x	L-402	Transformer, assembly consisting of: 1 coil, 6 turns AWG #23 E copper wire, wound 20 threads per inch on 1/2" dia. form with start and finish extending 3", mounted in can with C-445, 458 and R-436, core and stud assembly and terminal board, See Winding Data, Section VII			1		P-720172-502	1							1	1	1	3	3	2	1	2
x	x	x	L-403	Transformer, assembly consisting of: 1 coil, 4-3/4 turns AWG #14 bare soft copper wire, wound 8 threads per inch on 1/2" dia. form grooved with 6-1/2" threads with start and finish extending 3", mounted in can with C-446, core and stud assembly and terminal board, See Winding Data, Section VII			1		P-720172-503	1							1	1	1	3	3	2	1	2
x	x	x	L-404,405	Coil approx. 69 turns AWG #18 E copper wire, single layer close wound right-hand on 1" dia. laminated insulated coil form, 4" long See Winding Data, Section VII		17-P-5 Type PBG	1		M-407170-501	1	1	1	1	1	1	1	2	2	2	2	2	1	1	1

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
				INDUCTANCES (CLASS 47) (Continued)																				
x	x	x	L-406A&B	Transformer consisting of: 2 iron core reactors potted in case, reactor #1: hi-pot test, 1000 v a.c., min. impedance 900 ohms measured at 3 v, 60 cycles a.c. and 0.110 amp. d.c.; d-c resistance 115 ohms ±7-1/2% at 25°C., reactor #2: hi-pot test 1000 v a.c., impedance 4000 ohms min. measured at 3 v, 60 cycles a.c. and 0.050 amp. d.c., d-c resistance 350 ohms ±7-1/2%, at 25°C; See See Winding Data, Section VII			1		K-900589-501	1							1	1	1	3	3	2	1	2
x	x	x	L-407,408	Coil, d-c resistance 0.019 ohm at 25°C., inductance of 15.7 mh ±10% at 1.0 v, 1000 cycles, (Spare part Dwg. No. is K-900676-504); See Winding Data, Section VII			1		K-900676-501	1	1	1	1	1	1	1	2	2	2	2	2	1	1	1
x	x	x	L-409	Same as L-407 except symbols and length of stud (Spare part Dwg.No. is K-900676-505)			1		K-900676-502	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
x			L-1202	Coil, wound on 5/8" dia. spool, 2-1/8" long (Formerly K-301K, R-306,1205,1206) See Winding Data, Section VII			35	Part 751-S72-W14	K-880962-11	1	1	1	1	1	1	1	1	1	1	3	3	3	1	3
	x		L-1212	Coil, wound on 5/8" dia. spool, 2-1/8" long (Formerly K-301K,R-306,1215,1216) See Winding Data, Section VII			35	Part 751-S72-W14	K-880962-11	1				1	1	1	1	1	1	3	3	3	1	3

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
				CAPACITORS (CLASS 48)																				
x	x	x	C-108	Capacitor, fixed, molded, mica, 0.0001 mfd ±20%, 5000 v d.c. working	-48001	RE 48A 112Q RE 48A 154F	1	Faradon Model AF	K-35485-4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
x	x	x	C-122	Capacitor, fixed, molded, mica, 50 mmfd ±20%, 5000 v d.c. working	-48038-20	RE 48A 112Q RE 48A 154F	1	Faradon Model AF	K-35485-3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
x	x	x	C-115, 126, 128, 140	Capacitor, fixed, molded, mica, 0.0005 mfd ±20%, 5000 v d.c. working	-48401-20	RE 48A 112Q RE 48A 154F	1	Faradon Model AF	K-35485-8	1	2	2	2	2	2	2	2	1	1	4	4	3	1	3
x	x	x	C-107, 109, 114, 116, 123, 130, 131, 132	Capacitor, fixed, molded, mica, 0.005 mfd ±20%, 2500 v d.c. working	-48409-20	RE 48A 112Q RE 48A 154F	1	Faradon Model AF	K-35485-16	1	4	4	4	4	4	4	4	2	2	8	8	5	1	5
x	x	x	C-137	Capacitor, fixed, paper, oil filled, single section, 0.1 mfd ±10%, 500 v d.c. working	-48552-10	RE 13A 488	1		P-721074-51	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	C-138,139	Capacitor, fixed, paper, oil filled, single section, 1.0 mfd ±10%, 250 v d.c. working	-48553-10	RE 13A 488	1		P-721074-52	1	1	1	1	1	1	1	1	1	1	5	5	3	1	3
x	x	x	C-134A&B	Capacitor, fixed, paper, oil filled, two sections each section 0.5 mfd ±10% 250 v d.c. working, each section grounded to case	-48554-10	RE 13A 488	1		P-721074-53	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	C-120	Capacitor, midget, variable, 3.0 mmfd to 15 mmfd, 9 plates 0.070" air gap, with mounting brackets and stub shaft with screwdriver slot	-48626		9	ZT-15-AS	K-883482-1	1							1	1	1	2	2	1	1	1
	x	x	C-303, 1301, 1311	Capacitor, molded, fixed, mica, 0.01 mfd ±20%, 1200 v d.c. working	-48643		18	8167086AA-P1 Type H-25	M-427877-30	2							1	1	1	1	1	1	2	1
x	x	x	C-435	Capacitor, fixed, molded, mica, 100 mmfd ±10%, 500 v d.c. working	-48674 δCM20B101K	RE 48A 148C RE 48A 154F δC75.3-1942	1		P-722001-573	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
x	x	x	C-143	Capacitor, fixed, molded, mica, 100 mmfd ±10%, 400 v d.c. working, toothpick	-48761		1		M-86012-547	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
x	x	x	C-421A&B, 437A&B, 438 A&B, 447A&B, 448A&B	Capacitor, fixed, paper, oil filled, 2 sections, 0.125 mfd +10% -3%, 500 v d.c. working, each section grounded to case	-48795	RE 13A 488	1		P-72039-505	1	3	3	3	3	3	3	3	1	1	13	13	10	1	10

δ American War Standard Type Number.
δ American War Standard Specification.

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TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
				CAPACITORS (CLASS 48) (Continued)																				
x	x	x	C-417,420, 444,445, 446,465	Capacitor, fixed, molded, mica, 2000 mfd ±10%, 500 v d.c. working, low loss type	-48856-B10	RE 48A 143F RE 48A 154F	13	1W-L	K-837955-3	1	3	3	3	3	3	3	3	2	2	6	6	4	1	4
x	x	x	C-418,419	Capacitor, fixed, molded, mica, 2000 mmfd ±10%, 500 v d.c. working	-48856-B10	RE 48A 143F RE 48A 154F	13	1W	K-837955-2	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2
x	x	x	C-451	Capacitor, fixed, molded, mica, 1000 mmfd ±10%, 500 v d.c. working	-48983-B20 δCM30B102K	δC75.3-1942	1		P-722017-559	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
x	x	x	C-422	Capacitor, fixed, molded, mica, 5000 mfd ±10%, 500 v d.c. working	-481037-B10	RE 48A 143F RE 48A 154F	13	1W-5D5LL 1W-L	K-837955-5	1	1	1	1	1	1	1		1						
x	x	x	C-453A&B, 454A&B	Capacitor, fixed, paper, oil filled, 2 sections 0.5/0.5 mfd ±15%, 400 v d.c. working, each section grounded to case	-481161		1		P-72024-509	1	1	1	1	1	1	1	1	1	1	3	3	3	1	3
x	x	x	C-141,142	Capacitor, fixed, paper, oil filled, single section, 1.75 mfd ±20%, 50 v d.c. working	-481716	RE 48A 110P	1		P-72044-501	1	1	1	1	1	1	1	1	1	1	5	5	3	1	3
x	x	x	C-301,1201 1211	Capacitor, fixed, pyranol, 3.0 mfd, 1000 v d.c. working	-481733		18	Cat.#23-F-12	M-418141-12	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	C-129	Capacitor, fixed, paper, oil filled, single section 8.0 mfd ±20%, 500 v d.c. working	-482238		1		P-72028-511	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	C-113	Capacitor, variable, ceramic base, air trimmer, 50 mmfd max., 4 mmfd min., 19 plates, double spaced, shaft 0.250" dia. x 1/2" long	-482241		19	Less Stop Pin	K-838609-5	1							1	1	1	2	2	1	1	1
x	x	x	C-457,460, 461	Capacitor, fixed, molded, mica, 680 mfd ±10%, 500 v d.c. working, max. operating temp. 85°C.	δCM25B681K	δC75.3-1942	1		P-722008-593	1	2	2	2	2	2	2	2	1	1	3	3	2	1	2
x	x	x	C-423,426, 429,433, 450,462	Capacitor, fixed, molded, mica, 3900 mmfd ±10% 500 v d.c. working	δCM35B392K	δC75.3-1942	1		P-722026-553	1	3	3	3	3	Ψ	3	3	Ψ	2	6	Ψ	4	1	4
x	x	x	C-415,416, 422,424, 425,427, 428,430, 431,434, 449,459, 464	Capacitor, fixed, molded, mica, 5600 mmfd ±10%. 500 v d.c. working,	δCM35B562K	δC75.3-1942	1		P-722026-557	1	6	6	6	6	6	6	6	3	4	13	13	9	1	9

δ American War Standard Specification.
δ American War Standard Type Number
Ψ Spares for C-133,423,426,429,433,450 and 462 included in quantity shown for C-101,102,103,104,110,111,112, 118,119,124 and 125 group of spares on Models TBS-4 and TBS-7.

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
				CAPACITORS (CLASS 48) (Continued)																				
x	x	x	C-436, 441, 463	Capacitor, fixed, molded, mica, 10,000 mmfd ±10%, 300 v d.c. working	δCM40P103K	δC75.3-1942	1		P-722035-563	1	2	2	2	2	2	2	2	1	1	3	3	2	1	2
x	x	x	C-101, 102, 103, 104, 110, 111, 112, 118, 119, 124, 125	Capacitor, fixed, molded, mica, 3900 mmfd ± 20%, 400 v d.c. working, toothpick			1		M-86013-516	1	6	6	6	6	10	6	6	6	3	11	18	7	1	7
x	x	x	C-106	Capacitor, variable, ceramic base, 75 mmfd max., 11 plates, single spaced, shaft 0.250" dia. x 1/2" long			19		K-838607-2	1							1	1	1	2	2	1	1	1
x	x	x	C-117	Capacitor, variable, ceramic base, air trimmer, 2 sections, 31 mmfd max. per section, 11 plates double spaced, shaft 0.250" dia. x 1/2" long			19		K-843673-3	1							1	1	1	2	2	1	1	1
x	x	x	C-121	Capacitor, variable, air, 2.1 mmfd to 10 mmfd			19	N-10	K-854504-1	1							1	1	1	2	2	1	1	1
x	x	x	C-127	Capacitor, variable, ceramic base, air trimmer, 31 mmfd max., 11 plates, double spaced, less stop pin			19		K-838609-4	1							1	1	1	2	2	1	1	1
x	x	x	C-133	Capacitor, fixed, molded, mica, 3900 mmfd ±10%, 400 v d.c. working, toothpick			1		M-86013-546	1	†	†	†	†	Ψ	†	1	Ψ	1	1	Ψ	1	1	1
x	x	x	C-136	Capacitor, fixed, paper, oil filled, single section, 14 mfd ±20%, 50 v d.c. working			1		P-72028-514	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	C-201	Capacitor, dry electrolytic, 25 mfd +100% -10%, 25 v d.c. working			1		M-86021-2	1	1	1	1	1	1	1	2	2	2	6	6	6	1	6
x	x	x	C-302, 1202, 1212	Capacitor, fixed, pyranol, 5.0 mfd, 220 v d.c. working			18	Cat.#26-F-110	K-881403-1	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	C-303	Capacitor, molded, fixed, faradon, 0.01 mfd ±20%, 1200 v d.c. working			18	Model F V-5835319AA	M-427877-78	2	1	1	1	1	1	1						1	2	1

Ψ Spares for C-133,423,426,429,433,450 and 462 included in quantity shown for C-101,102,103,104,110,111,112,118 119,124 and 125 group of spares on Models TBS-4 and TBS-7.
† Spares for C-133 included in quantity shown for C-423,426,429,433,450 and 462 group of spares on Models TBS, TBS-1, TBS-2, TBS-3 and TBS-5.

δ American War Standard Specification.
δ American War Standard Type Number.

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	EQUIPMENT TBS-1	EQUIPMENT TBS-2	EQUIPMENT TBS-3	EQUIPMENT TBS-4	EQUIPMENT TBS-5	EQUIPMENT TBS-6	EQUIPMENT TBS-7	EQUIPMENT TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
				CAPACITOR (CLASS 48) (Continued)																				
x	x	x	♀C-304, 305, 306, 307	Capacitor, molded, fixed, mica, 3900 mmfd ±20%, 400 v d.c. working, toothpick			18	V-5835320AA	M-427877-79	2	1	1	1	1		1						2	2	2
x	x		C-304, 305	Capacitor, molded, fixed, mica, 3900 mmfd ±10%, 500 v d.c. working			34		K-4158374-1	2					1									
x	x		C-304, 305, 306, 307, 1302, 1303, 1304, 1305, 1312, 1313, 1314, 1315	Capacitor, molded, fixed, mica, 0.003 mfd ±10%, 800 v d.c. working			18	8106460AA-P4	M-427877-32	2							1	1	1	4	4	3	2	3
		x	C-304, 305, 306, 307, 1302, 1303, 1304, 1305, 1312, 1313, 1314, 1315	Capacitor, molded, fixed, mica, 0.003 mfd ±10%, 800 v d.c. working			18	8106460AA-P4	M-427877-31	2							1	1		2	2			
x			C-308, 1306	Capacitor, molded, fixed, pyranol, 10 mfd (Cat.#26F412) 120 v		RE 13A 488C	18	8128988AA-P1	M-427877-33	2								1	1		3	2	2	2
	x		C-308, 1316	Capacitor, molded, fixed, pyranol, 3 mfd, 230 v		RE 13A 488C	18	8167010AB-P1	M-427877-34	2							1	1	1	3	3	2	2	2
x	x	x	C-401	Capacitor, variable, air trimmer, 2.5-14 mmfd ±10%, 2 rotor plates, 2 stator plates, low loss, wax dip ceramic base, silver plated rotor contact spring, shaft 0.250" dia. x 5/8" long			19	APC	K-850873-1											2	2	1	1	1

♀ *Capacitors having a tolerance as specified or less may be used.*

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	TBS-7	TBS-8	TENDER BOX	TBS-8
				CAPACITORS (CLASS 48) (Continued)																				
x	x	x	C-402	Capacitor, variable, air trimmer, 2.5-14 mmfd ±10%, 2 rotor plates, 2 stator plates, low loss, wax dip ceramic base, silver plated rotor contact spring, shaft 0.250" dia. x 5/8" long			19	APC	K-850873-5											2	2	1	1	1
x	x	x	C-403	Capacitor, variable, air trimmer, 3-26 mmfd ±10%, 4 rotor plates, 3 stator plates, low loss, wax dip ceramic base, silver plated rotor contact spring, shaft 0.250" dia. x 5/8" long			19	APC	K-850873-3											2	2	1	1	1
x	x	x	C-404	Capacitor, variable, air trimmer, 3-41 mmfd ±10%, 6 rotor plates, 5 stator plates, low loss, wax dip ceramic base, silver plated rotor contact spring, shaft 0.250" dia. x 5/8" long			19	APC	K-850873-4											2	2	1	1	1
x	x	x	C-405	Capacitor, variable, air trimmer, 3-37 mmfd ±10%, 5 stator plates, 5 rotor plates, low loss, wax dip ceramic base, silver plated rotor contact spring, shaft 0.250" dia. x 5/8" long			19	APC	K-850873-6											2	2	1	1	1
x	x	x	C-406	Capacitor, variable, air trimmer, 3-30 mmfd ±10%, 4 rotor plates, 4 stator plates, low loss, wax dip ceramic base, silver plated rotor contact spring, shaft 0.250" dia. x 5/8" long			19	APC	K-850873-2											2	2	1	1	1
x	x	x	C-407, 408, 409, 410, 411, 412, 413, 414, 432, 443, 458	Capacitor, fixed, ceramic, wax impregnated, 50 mmfd ±2-1/2%, 500 v d.c. working			10		K-85522-3	1	6	6	6	6	6	6	6	3	3	12	12	8	1	8
x	x	x	C-439	Capacitor, dry electrolytic, 10 mfd +100% -10%, 100 v d.c. working			1		M-86021-3	1	1	1	1	1	1	1	1	1	1	3	3	3	1	3
x	x	x	C-440	Capacitor, paper foil, metal case, 0.1 mfd ±20%, 200 v d.c. working			1		M-80376-506	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES — EQUIPMENT: TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK: TBS-6	TBS-7	TBS-8	TENDER: BOX	TBS-8
				CAPACITORS (CLASS 48) (Continued)																				
x	x	x	C-442, 455	Capacitor, dry electrolytic, 10 mfd +75% -10%, 350 v d.c. working			1		M-86021-8	1	1	1	1	1	1	1	1	1	1	6	6	6	1	6
x	x	x	C-452	Capacitor, dry electrolytic, 50 mfd +100% -10%, 15 v d.c. working			1		M-86021-6	1	1	1	1	1	1	1	1	1	1	3	3	3	1	3
x	x	x	C-456	Capacitor, dry electrolytic, 20 mfd +75% -10%, 300 v d.c. working			1		M-86021-7	1	1	1	1	1	1	1	1	1	1	3	3	3	1	3
				JACKS, PLUGS, SOCKETS & CONNECTORS (CLASS 49)																				
x	x	x	J-203	Jack, single closed circuit, complete with hex nut and washer	-49008		702	#2-A	K-7862660-2	1							1	1	1	4	4	2	1	2
x	x	x	X-412	Tube socket, 4 prong, wafer type, laminated phenolic base, 1-3/8" hole centers, 4 brass tubular rivets	-49307	17-P-5 Type FBG	1		M-401806-501	1							1	1	1	1	1	1	1	1
x	x	x	X-410	Tube socket, 6 prong, wafer type, phenolic base, 1-3/8" hole centers, 6 tubular brass rivets	-49308	RE 49AA 304A	1		M-401806-503	1							1	1	1	1	1	1	1	1
x	x	x	X-402, 405, 406, 407, 408	Tube socket, 6 prong, silver plated contacts, wafer type, ceramic base, 1-27/32" hole centers	-49364	RE 13A 524	23		K-856997-3	1							3	3	3	5	5	3	1	3
x	x	x	X-409	Tube socket, 7 prong, silver plated contacts, wafer type, ceramic base, 1-27/32" hole centers	-49365	RE 13A 524	23		K-856997-4	1							1	1	1	1	1	1	1	1
x	x	x	J-101	Jack, complete with terminal and nut threaded 1/4"-28 threads, body length 17/32", plated			23	Cat.#74	K-99015-3	1							4	4	4	10	10	6	1	6
x	x	x	J-201, 202	Connector, chassis, 4 contacts, female, not grounded, knurled nut threaded 13/16"-28 threads, polarized			6	Type PC4-F	M-420410-1	1							2	2	2	8	8	4	1	4
x	x	x	J-401	Jack, nickel plated brass frame, complete with nut (Cat.#255) and washer (Cat.#226) 3/4" long			28	Cat.#701	K-833759-3	1							1	1	1	2	2	1	1	1
x	x	x	J-801	Chestset jack, two-way extension, 3-11/32" overall length			28	Cat.#100-A	K-854220-1	1							1	1	1	2	2	1	1	1

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES													
											EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
				JACKS, PLUGS, SOCKETS & CONNECTORS (CLASS 49) (Continued)																				
x	x	x	P-101	Plug connector, banana type, including contact springs, 3/32" thick nut, threaded #6-32 threads			23	Cat.#75-A	K-99025-4	1							4	4	4	10	10	6	1	6
x	x	x	P-201, 801	Connector (handset and chestset), 4 prong, male, polarized, for 0.385" O.D. cable			6	MC4-M	M-420410-2	1							2	2	1	6	6	3	1	3
x	x	x	X-101, 102,112	Tube socket, wafer type 5 contact, alsimag base, 1-27/32" hole centers		RE 49AA 311A	23	"J" Code #225	K-843314-2	1							2	2	2	3	3	2	1	2
x	x	x	X-103, 104,105, 106,107, 108	Tube socket, wafer type, 4 contact, alsimag base, 1-27/32" hole centers		RE 49AA 311A	23	"J" Code #224	K-843314-1	1							3	3	3	6	6	3	1	3
x	x	x	X-109,110	Tube socket, wafer type, 6 contact, alsimag base, 1-27/32" hole centers		RE 49AA 311A	23	"J" Code #226	K-843314-3	1							1	1	2	2	2	1	1	1
x	x	x	X-111	Tube socket, wafer type, 7 contact, alsimag base, 1-27/32" hole centers		RE 49AA 311A	23	"J" Code #227	K-843314-5	1							1	1	1	1	1	1	1	1
x	x	x	X-114	Pilot light socket, miniature screw base, red jewel			28	B-310R	K-99013-5	1	1													
x	x	x	X-114,414	Pilot light socket, miniature bayonet base, nickel plated brass bracket and red jewel			28	B-310R	K-815228-3	1	1	2	2	2	2	2	2	2	2	2	2	2	1	2
x		x	X-201	Socket and bracket, screw type socket, terminal insulated from bracket			15		K-854542-1	1	2													
x	x	x	X-201	Socket and bracket, bayonet type socket, terminal insulated from bracket			15		K-854542-2	1		2	2	2	2	2	2	1	1	2	2	1	1	1
x	x	x	X-401	Tube socket, acorn type, 5 contact, steatite ceramic base, 1-3/8" hole centers			19	S-900X	K-845142-2	1							1	1	1	1	1	1	1	1
x	x	x	X-403, 404	Tube socket, 8 prong, silver plated contacts, wafer type, ceramic base, 1-27/32" hole centers (metal tube)			19		K-856996-6	1							1	1	1	2	2	1	1	1
x	x	x	X-411	Tube socket, wafer type, octal shape, 8 contacts, bakelite cloth base, 1/16" thick, 1-27/32" hole centers			690		K-841826-1	1							1	1	1	1	1	1	1	1
				MICROPHONES (CLASS 51)																				
x	x	x	Q-201	Microphone and receiver handset assembly consisting of: mouthpiece, earpiece, 40 ohm carbon button microphone, receiver unit rated 600 ohms at 1000 v, press-to-talk microphone switch all housed in molded composition shell, 4 conductor cable, 4' long and terminal in a polarized connector	-51019		21		P-720305-501	1	1	1	1	1	1	1								

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
				INSULATORS (CLASS 61)																				
x	x	x	E-106, 204	Insulator, stand-off ceramic, 1/2" long, 1/2" O.D., both ends tapped #6-32 threads for 3/16"	-61166	RE 13A 317	22		K-823568-1	1							11	11	11	44	44	22	1	22
x	x	x	E-112	Insulator, stand-off, ceramic, cylindrical post, 1/2" long, 1/2" O.D., tapped both ends #6-32 threads for 3/16"	-61166		22	397-L1/2	K-802900-20	1							1	1	1	2	2	1	1	1
x	x	x	E-110	Insulator, stand-off, ceramic 11/16" long, 1/2" O.D., both ends tapped #6-32 threads for 1/4"	-61172	RE 13A 317	22		K-823568-7	1							1	1	1	4	4	2	1	2
x	x	x	E-108	Insulator, bushing, ceramic, 3/16" long, 5/8" O.D., 15/32" body O.D., 0.154" I.D.	-61190	RE 13A 317	22		K-818952-7	1							5	5	5	20	20	10	1	10
x	x	x	E-402	Insulator, bushing type, isolantite, 1/4" high, 3/4" O.D. 9/16" body O.D., 0.154" I.D.	-61208	RE 13A 317	22		K-818952-2											4	4	4	1	4
x	x	x	E-111	Insulator, bushing, ceramic, 0.425" long, 1/2" O.D., 3/8" body O.D., 0.173" I.D.	-61260	RE 13A 317	22		K-818952-3	1							2	2	2	8	8	4	1	4
x	x	x	E-107	Insulator, stand-off, steatite, square post, 1-1/4" long, tapped at both ends #10-32 threads for 3/8"	-61306		22,63, 293	334,1080, R-571	K-802906-1	1							3	3	3	12	12	6	1	6
x	x	x	E-123	Insulator, bushing, male portion, glazed white porcelain, 1/4" head, 5/8" O.D., 11/32" neck, 9/32" O.D., 0.149" hole for feed-through conductor			98	Cat.#458	K-871587-1	1							2	2	2	8	8	4	1	4
x	x	x	E-124	Insulator, bushing, female portion, glazed white porcelain, body 5/8" long, tapered 5/8" to 7/16" dia. with 5/16" recess 11/32" dia., 0.149" hole for feed-through conductor			98	Cat.#458	K-871587-3	1							2	2	2	8	8	4	1	4
x	x	x	E-403	Insulation, laminated, cloth base, 1/8" thick, 1-3/4" long, 1" wide, 25/64" dia. center hole, 1-3/8" between mounting holes			1		K-850879-1											1	1	1	1	1
x	x	x	E-405	Insulation, phenolic, insulating material, 15/16" dia. hole, 1/32" thick, 1-9/16" long x 1-9/16" wide		17-P-5 Type PBG	1		K-59839-1											4	4	4	1	4
x	x	x	E-406	Insulator, octal shape, bakelite paper base, 15/16" dia. hole, 1/32" thick, 2-1/4" long, 1-1/2" wide			690		K-841826-2											2	2	2	1	2

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
				INSULATORS (CLASS 61) (Continued)																				
x	x	x	↓E-433	Insulation, laminated, cloth base, 1/64" thick, 4-5/16" long, 1" wide			1		K-850902-1											3	3	3	1	3
x	x	x	↓E-434	Insulation, laminated, phenolic, natural, 6" x 12" x 1/8" thick			649a	Type 17-P-5 PBE Form S	K-885326-1													2	1	2
x	x	x	↓E-435	Insulator, laminated, phenolic, natural, 1" dia. x 12" long			656	Type 17-P-5 PBE Form R	K-885325-1													1	1	1
x	x	x	↓E-436	Insulator, laminated, phenolic, natural 1/2" dia. x 12" long			656	Type 17-P-5 PBE Form R	K-885325-2													1	1	1
x	x	x	↓E-437	Insulator, polystyrene rod, 1" dia. x 6" long			90a	XMS-10,023	K-885325-3													1	1	1
x	x	x	E-701, 702	Insulator, for transmission line, ceramic, 3/32" I.D., 1/2" O.D., 2-1/2" long			165	Type 341	K-854548-12	1	2	2	2	2	2	2	2	1	1	4	4	2	1	2
				WIRES & CONDUCTORS (CLASS 62)																				
x	x	x	W-101	Cable, coaxial, assembly consisting of: conduit assembly, two brass collars, 27 ceramic beads, 4 ceramic spacers, flexible copper conductor, 168 strands 0.085" O.D., 8-1/2" long with terminal at each end			1		M-418237-501	1							1	1	1	2	2	1	1	1
x	x	x	W-102	Cable, coaxial, assembly consisting of: conduit assembly, two brass collars, 120 ceramic beads, 13 ceramic spacers, conductor copper tinned wire, 0.102" dia., 28" long with a terminal at each end			1		M-418237-502	1							1	1	1	2	2	1	1	1
x	x	x	W-103	Copper braid, tinned copper shielded, 1/8" O.D. 7/32" I.D., 2" long, make from K-844810-1			416	Cat.#1208	K-883924-145								1	1	1	1	1	1	1	1
x	x	x	W-104	Wire, tinned, soft copper conductor, braid covered varnished cloth, insulated wire, 16 strands, AWG #30, green color, 36" long			1		K-883924-143	1							1	1	1	1	1			
x	x	x	W-105	Wire, asbestos covered, insulated, 26 strands AWG #30, black color, 8" long			1		K-883924-144	1							1	1	1	1	1			

↓ *Not on equipment, furnished as spare part material only.*

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	EQUIPMENT TBS-1	EQUIPMENT TBS-2	EQUIPMENT TBS-3	EQUIPMENT TBS-4	EQUIPMENT TBS-5	EQUIPMENT TBS-6	EQUIPMENT TBS-7	EQUIPMENT TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
				WIRES & CONDUCTORS (CLASS 62) (Continued)																				
x	x	x	W-401	Cable, consisting of: wire, white covered, with green tracer, 10 strands AWG #30 lenz push-back, hook-up wire with a tinned copper braided shielding and black-glazed cotton braid outer covering, 25" overall length			1		M-420311-501											1	1	1	1	1
x	x	x	W-402	Cable, consisting of: two wires, white covered with red tracer, 10 strands AWG #30 long push-back, hook-up wire, 19" long; and wire white covered with green tracer, 10 strands AWG #30 lenz push-back, hook-up wire, 21" long, tinned copper braided shielding, and black-glazed cotton braid outer covering			1		M-420311-502											1	1	1	1	1
x	x	x	W-403	Cable, consisting of: wire, red covered, 10 strands AWG #30 tinned copper wire, rubber insulated, 1/64" radius, 22" long, black covered, 10 strands AWG #30 tinned copper wire, rubber insulated, 1/64" radius 21" long, tinned copper, braided shielding, black-glazed cotton braid outer covering			1		M-420311-503											1	1	1	1	1
x	x	x	W-404	Cable, consisting of: wire, white covered with yellow tracer, 10 strands AWG #30 lenz push-back, hook-up wire close braided shielding, black-glazed cotton braid outer covering, 8-3/8" long			1		K-871944-1											1	1	1	1	1
x	x	x	W-405	Cable, consisting of: wire, white covered with yellow tracer, 10 strands AWG #30 lenz push-back, hook-up wire, close braided shielding, black-glazed, cotton braid outer covering, 12" long			1		K-871944-2											1	1	1	1	1
x	x	x	W-406	Wire, green, 10 strands, AWG #30 tinned copper wire, rubber insulated, 3" long			1		K-880730-141											1	1			
x	x	x	W-407	Wire, green, 26 strands, AWG #38 tinned copper wire, rubber insulated, 5" long			1		K-880730-142											1	1			
x	x	x	W-408	Wire, white with yellow tracer, solid AWG #20 lenz, low loss, push-back, hook-up wire, 78" long			416		K-880730-143											1	1			
x	x	x	W-409	Wire, white, solid AWG #20 lenz, low loss, push-back, hook-up wire, 63" long			416		K-880730-123											1	1			

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
				WIRES & CONDUCTORS (CLASS 62) (Continued)																				
x	x	x	W-410	Wire, white with green tracer, solid AWG #20 lenz, low loss, push-back, hook-up wire, 140" long			416		K-880730-124											1	1			
x	x	x	W-411	Wire, white with brown tracer, solid AWG #20 lenz, low loss, push-back, hook-up wire, 289" long			416		K-880730-125											1	1			
x	x	x	W-412	Wire white with red tracer, solid AWG #20 lenz, low loss, push-back, hook-up wire, 190" long			416		K-880730-126											1	1			
x	x	x	W-413	Wire, white with blue tracer, solid, AWG #20 lenz, low loss, push-back, hook-up wire, 146" long			416		K-880730-127											1	1			
x	x	x	W-414	Wire, white with black tracer, solid, AWG #20 lenz, low loss, push-back, hook-up wire, 133" long			416		K-880730-128											1	1			
x	x	x	W-415	Wire, white with orange tracer, solid AWG #20 lenz, low loss, push-back, hook-up wire, 43" long			416		K-880730-129											1	1			
x	x	x	W-416	Wire, white with green tracer, 10 strands, AWG #30 lenz, low loss, push-back, hook-up wire, 22" long			416		K-880730-130											1	1			
x	x	x	W-417	Wire, white with black tracer, 10 strands, AWG #30 lenz, low loss, push-back, hook-up wire, 6" long			416		K-880730-131											1	1			
x	x	x	W-418	Bus wire, AWG #16, tinned, soft copper wire, 29" long			1		K-880730-133											1	1			
x	x	x	W-419	Bus wire, AWG #20, tinned, soft copper wire, 56" long			1		K-880730-132											1	1			
x	x	x	W-420	Varnished tubing, black,0.042" dia. x 4-1/2" long			1 C7a		K-880730-139											1	1			
x	x	x	W-421	Insulating tubing, 106" I.D. x 11" long			107a		K-880730-140											1	1			
x	x	x	W-701	Transmission line fittings consisting of: two end seals with bleeder valve and 0-30 lb. pressure gauge, nitrogen flask (A-701), inner and outer conductor couplings, hose adaptor and shut-off valve, flask fitting, outlet hose with fittings and clamps, flask handle, bleeder valve key, varnished tubing, and insulating washer			165		K-884960-501											1	1	1	1	1

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT									STOCK			TENDER	
											TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	TBS-6	TBS-7	TBS-8	BOX	TBS-8
RESISTORS (CLASS 63)																								
x	x	x	R-105	Resistor, fixed, wire wound, ferrule type, 500 ohms ±10%, 10 watts	-63005		21		K-99026-28	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-107	Resistor, fixed, wire wound, ferrule type, 4000 ohms ±10%, 18 watts	-63083F	RE 13A 372	1		T-620340-554	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-118	Resistor, fixed, composition, insulated pigtail terminals, 56,000 ohms ±10%, 1 watt	-63288	RE 13A 372G	4		K-78728-83	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-101	Resistor, fixed, composition, pigtail, 100,000 ohms ±10%, 1 watt, insulated	-63288	RE 13A 372G	4		K-78728-86	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-139	Resistor, fixed, composition, insulated pigtail terminals, 5600 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	4		K-78727-71	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-437, 457	Resistor, fixed, composition, wax impregnated, insulated, pigtail terminals, 270 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-55	1	1	1	1	1	1	1	2	2	2	10	10	2	1	2
x	x	x	R-404, 407, 410, 413, 417, 427, 441	Resistor, fixed, composition, insulated pigtail terminals, 1200 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-63	1	4	4	4	4	4	4	7	7	7	35	35	11	1	11
x	x	x	R-450	Resistor, fixed, composition, wax impregnated, insulated, pigtail terminals, 1500 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-64	1	1	1	1	1	1	1	1	1	1	5	5	2	1	2
x	x	x	R-444	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 3300 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-68	1	1	1	1	1	1	1	1	1	1	5	5	2	1	2
x	x	x	R-405	Resistor, fixed, composition, insulated pigtail terminals, 4700 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-70	1	1	1	1	1	1	1	1	1	1	5	5	2	1	2
x	x	x	R-438	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 6800 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-72	1	1	1	1	1	1	1	1	1	2	5	5	2	1	2
x	x	x	R-403, 409, 412, 442	Resistor, fixed, composition, insulated pigtail terminals, 10,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-74	1	2	2	2	2	2	2	4	4	4	20	20	6	1	6

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	TBS-7	TBS-8	TENDER BOX	TBS-8
				RESISTORS (CLASS 63) (Continued)																				
x	x	x	R-416, 455	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 22,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-78	1	1	1	1	1	1	1	2	2	2	10	10	3	1	3
x	x	x	R-452, 453, 454	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 33,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-80	1	2	2	2	2	1	2	3	3	3	15	15	5	1	5
x	x	x	R-433	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 56,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-83	1	1	1	1	1	1	1	1	1	1	5	5	2	1	2
x	x	x	R-406	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 68,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-84	1	1	1	1	1	1	1	1	1	1	5	5	2	1	2
x	x	x	R-419	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 82,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-85	1	1	1	1	1	1	1	1	1	1	5	5	2	1	2
x	x	x	R-425, 435, 436, 451	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 100,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-86	1	2	2	2	2	2	2	4	4	4	20	20	6	1	6
x	x	x	R-428	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 120,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-87	1	1	1	1	1	1	1	1	1	1	5	5	2	1	2
x	x	x	R-415	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 330,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-92	1	1	1	1	1	1	1	1	1	1	5	5	2	1	2
x	x	x	R-424	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 470,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-94	1	1	1	1	1	1	1	1	1	1	5	5	2	1	2
x	x	x	R-430, 431, 446	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 560,000 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-95	1	2	2	2	2	2	2	3	3	3	15	15	5	1	5
x	x	x	R-401, 408, 411, 414, 426, 440, 443	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 1.0 megohm, ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-98	1	4	4	4	4	4	4	7	7	7	35	35	9	1	9

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	TBS-7	TBS-8	TENDER BOX	TBS-8
				RESISTORS (CLASS 63) (Continued)																				
x	x	x	R-420, 445	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 1.2 megohm ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-99	1	1	1	1	1	1	1	2	2	2	10	10	3	1	3
x	x	x	R-423, 429	Resistor, fixed, composition, wax impregnated, insulated pigtail terminals, 2.2 megohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BT-1/2	K-850981-102	1	1	1	1	1	1	1	2	2	2	10	10	3	1	3
x	x	x	R-432	Resistor, low power, fixed molded, wire wound, insulated pigtail terminals, 100 ohms ±10%, 1/2 watt	-63360	RE 13A 372G	21	BW-1/2	K-857034-11	1	1	1	1	1	1	1	1	1	1	5	5	3	1	3
x	x	x	R-113, 140	Resistor, fixed, composition, radial leads, pigtail terminals, 330 ohms ±5%, 2 watts	-63426	RE 13A 372G	4		K-78724-147	1	1	1	1	1	1	1	1	1	1	5	5	3	1	3
x	x	x	R-121	Resistor, fixed, composition, radial leads, pigtail terminals, 5600 ohms ±5%, 2 watts	-63426	RE 13A 372G	4		K-78724-177	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-122	Resistor, fixed composition, radial leads, 8200 ohms ±5%, 2 watts	-63426	RE 13A 372G	4		K-78724-181	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-123	Resistor, fixed, composition, radial leads, pigtail terminals, 27,000 ohms ±5%, 2 watts	-63426	RE 13A 372G	4		K-78724-193	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-111, 112	Resistor, fixed, composition, radial leads, pigtail terminals, 39,000 ohms ±5%, 2 watts	-63426	RE 13A 372G	4		K-78724-197	1	1	1	1	1	1	1	1	1	1	5	5	3	1	3
x	x	x	R-104	Resistor, fixed, composition, radial leads, pigtail terminals, 22 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-42	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-126	Resistor, fixed, composition, radial leads, 390 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-57	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-203, 204	Resistor, fixed, composition, radial leads, pigtail terminals, 560 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-59	1	2	2	2	2	2	2	2	2	2	10	10	6	1	6
x	x	x	R-131	Resistor, fixed, composition, radial leads, pigtail terminals, 680 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-60	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-133	Resistor, fixed, composition, radial leads, 1500 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-64	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-135	Resistor, fixed, composition, radial leads, pigtail terminals, 2700 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-67	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	TBS-7	TBS-8	TENDER BOX	TBS-8
				RESISTORS (CLASS 63) (Continued)																				
x	x	x	R-116	Resistor, fixed, composition, radial leads, pigtail terminals, 3900 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-69	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-130	Resistor, fixed, composition, radial leads, pigtail terminals, 5600 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-71	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-114	Resistor, fixed, composition, radial leads, pigtail terminals, 6800 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-72	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-201	Resistor, fixed, composition, radial leads, pigtail terminals, 10,000 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-74	1	1	1	1	1	1	1	1	1	1	5	5	3	1	3
x	x	x	R-115	Resistor, fixed, composition, radial leads, pigtail terminals, 12,000 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-75	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-129	Resistor, fixed, composition, radial leads, pigtail terminals, 33,000 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-80	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-102	Resistor, fixed, composition, radial leads, pigtail terminals, 56,000 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-83	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-103, 137	Resistor, fixed, composition, radial leads, pigtail terminals, 100,000 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-86	1	1	1	1	1	1	1	1	1	1	5	5	3	1	3
x	x	x	R-136	Resistor, fixed, composition, radial leads, pigtail terminals, 150,000 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-88	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-119	Resistor, fixed, composition, radial leads, pigtail terminals, 470,000 ohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-94	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-120	Resistor, fixed, composition, radial leads, pigtail terminals, 1.8 megohms ±10%, 2 watts	-63474	RE 13A 372G	4		K-78724-101	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-134	Resistor, wire wound, lug and wire terminals, 25,000 ohms ±10%, 10 watts	-63606-10	RE 63A 101A Style 1-3/4-RPT	32	Ohmite Brown Devil	K-844908-5	1	1	1	1	1	1	1	1	1	1	5	5	3	1	3
x	x	x	R-456	Resistor, low power, fixed, molded, wire wound, wax impregnated, insulated pigtail terminals, 62 ohms ±5%, 1/2 watt	-63678-5	RE 13A 372G	21	BW-1/2	K-857034-9	1	1	1	1	1	1	1	1	1	1	5	5	2	1	2
x	x	x	R-402, 434, 449	Resistor, low power, fixed, molded phenolic, wire wound, insulated pigtail terminals, 10 ohms ±10%, 1/2 watt	-63678-10	RE 13A 372G	21	BW-1/2	K-857034-5	1	2	2	2	2	2	2	3	3	3	15	15	5	1	5

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	220 V D.C.	230/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES EQUIPMENT TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
				RESISTORS (CLASS 63) (Continued)																				
x	x	x	R-447, 448	Resistor, low power, fixed, molded, wire wound, insulated pigtail terminals, 56 ohms ±10%, 1/2 watt	-63678-10	RE 13A 372G	21	BW-1/2	K-82283-47	1	1	1	1	1	1	1	2	2	2	10	10	3	1	3
x	x	x	R-132	Resistor, fixed, wire wound, ferrule type, 4000 ohms ±10%, 10 watts	-631025	RE 13A 372	1		T-620340-704	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-108	Potentiometer, variable, wire wound, 20,000 ohms, 4 watts, linear, round shaft 25/32" long, 0.248" O.D., insulated contact arm, threaded 3/8"-32 threads for 3/8"	-631045	RE 13A 492C	28	Cat.#M20MP	M-418173-3	1							1	1	1	5	5	3	1	3
x	x	x	R-202	Potentiometer, 1000 ohms, 4 watts, threaded 3/8"-32 threads for 3/8"	-631109		28	Cat.#M1MP	M-418173-1	1							2	2	2	5	5	3	1	3
x	x	x	R-439	Potentiometer, wire wound, 3500 ohms ±10%, 750 ohms first 50% from switch operating end, 2-1/2 watt capacity, 0.250" dia. round shaft 25/32" long (includes S-405)	-631136	RE 13A 492C	40		K-850864-1	1							1	1	1	5	5	3	1	3
x	x	x	R-418	Potentiometer, 250,000 ohms ±20% threaded 3/8"-32 threads for 5/16" 0.250" dia. round shaft, 23/32" long, "C" taper	-631137		21	Type CS	K-850909-1	1							1	1	1	5	5	3	1	3
x	x	x	R-117	Potentiometer, variable, wire wound, 10,000 ohms, 4 watts, linear, round shaft, insulated contact arm, threaded 3/8"-32 threads for 3/8" ("M" type)	-631937	RE 13A 492C	28	Cat.#M10MP	M-418173-4	1							1	1	1	5	5	3	1	3
x	x	x	R-501	Resistor, variable, L pad, attenuator, dual section, R1 of 14.7 ohms, R2 of 75.0 ohms; provides a 15 ohm input with a 15 ohm load, 40 db attenuation logarithmetically with rotation, complete with hardware and knob impedance 14.7 ohms rated 4 watts, linear taper	-632163		28	L-15	K-183290-1	1							1	1	1	5	5	3	1	3
x	x	x	R-106	Resistor, fixed, wire wound, ferrule type, 25,000 ohms ±10%, 18 watts			21		K-99028-45	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-109	Resistor, fixed, wire wound, ferrule type, 6300 ohms ±10%, 10 watts			21		K-99026-39	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-110	Resistor, fixed, wire wound, ferrule type, 1600 ohms ±10%, 10 watts			21		K-99026-33	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-124	Resistor, fixed, wire wound, ferrule type, 100,000 ohms ±5%, 38 watts			21		K-883481-1	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES: EQUIPMENT TBS	EQUIPMENT TBS-1	EQUIPMENT TBS-2	EQUIPMENT TBS-3	EQUIPMENT TBS-4	EQUIPMENT TBS-5	EQUIPMENT TBS-6	EQUIPMENT TBS-7	EQUIPMENT TBS-8	STOCK TBS-6	STOCK TBS-7	STOCK TBS-8	TENDER BOX	TENDER TBS-8
				RESISTORS (CLASS 63) (Continued)																				
x	x	x	R-125	Resistor, fixed, wire wound, ferrule type, 5000 ohms ±10%, 18 watts			21		K-99028-38	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x	x	x	R-127, 128	Resistor, wire wound, pigtail terminals, 50 ohms ±10%, 10 watts			32	Ohmite Brown Devil	K-844908-4	1	1	1	1	1	1	1	1	1	1	10	10	6	1	6
x	x	x	R-138	Resistor, fixed, wire wound, ferrule type, 1000 ohms ±10%, 18 watts			21		K-99028-31	1	1	1	1	1	1	1	1	1	1	3	3	2	1	2
x			R-301, 1201	Resistor, 200 ohms (Formerly K-301L Dwg.#K-860257-5)			35	PX1-200	K-880962-12	1	1	1	1	1	1	1		1	1		3	2	1	2
	x		R-301, 1211	Resistor, 800 ohms (Formerly K-301P Dwg.#K-860257-10)			35	PX1-800	K-880962-16	1				1	1	1	1	1	1	3	3	2	1	2
		x	R-301	Resistor, ohmite, 150 ohms (Formerly K-301K Dwg.#K-860270-4)			35	Part PM92-12-1	K-880963-8	1	1	1	1	1		1	1	1		3	3	3	1	3
x	x	x	R-302, 1301, 1311	Resistor, 1000 ohms, 50 watts			18	5895465AB-P21	M-427877-52	2						1	1	1	1	5	5	3	2	3
x	x	x	R-302	Rheostat, 160 ohms, 25 watts			18	5835315AA	M-427877-84													3	2	3
	x		R-303, 1212	Resistor, 12.5 ohms (Formerly K-301Q Dwg.#K-860257-11)			35	PX1-12.5	K-880962-17	1				1	1	1	1	1	1	3	3	2	1	2
x			R-303, 1202	Resistor, 3.2 ohms (Formerly K-301M Dwg.#K-860257-6)			35	PX1-3.2	K-880962-13	1	1	1	1	1	1	1		1	1		3	2	1	2
x			R-304, 1203	Resistor, 1.25 ohms (Formerly K-301N Dwg.#K-860257-7)			35	PX1-1.25	K-880962-14	1	1	1	1	1	1	1		1	1		3	2	1	2
x			R-305, 1204	Resistor, 0.8 ohms (Formerly K-301O Dwg.#K-860257-8)			35	PX1-0.8	K-880962-15	1	1	1	1	1	1	1		1	1		3	2	1	2
	x		R-304, 1213	Resistor, 6.4 ohms (Formerly K-301R Dwg.#K-860257-12)			35	PX1-6.4	K-880962-18	1				1	1	1	1	1	1	3	3	2	1	2
	x		R-305, 1214	Resistor, 2.0 ohms (Formerly K-301S Dwg.#K-860257-13)			35	PX1-2.0	K-880962-19	1				1	1	1	1	1	1	3	3	2	1	2
x			R-307	Resistor, 300 ohms, 57 watts			18	8100568AB3	M-427877-81													2	2	2
x			R-307, 1303	Resistor, 400 ohms, 50 watts			18	5895465AB1	M-427877-53	2								1	1		5	3	2	3

TABLE IV (Continued)
SPARE PARTS LIST BY NAVY TYPE NUMBERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

120 V D.C.	230 V D.C.	220/440 V A.C.	SYMBOL DESIGNATION	NAME OF PART AND DESCRIPTION	NAVY TYPE NUMBER	NAVY DRAWING OR SPECIFICATION	MFR.	MFR. DESIGNATION	RCA DRAWING AND PART NUMBER	BOX	SPARE PART QUANTITIES — EQUIPMENT — TBS	TBS-1	TBS-2	TBS-3	TBS-4	TBS-5	TBS-6	TBS-7	TBS-8	STOCK — TBS-6	TBS-7	TBS-8	TENDER — BOX	TBS-8
				RESISTORS (CLASS 63) (Continued)																				
	x		R-307, 1313	Resistor, 1500 ohms, 50 watts			18	5895465AE2	M-427877-54	2						1	1	1	1	5	5	3	2	3
	x		R-307	Resistor, 1200 ohms, 57 watts			18	8100568AB4	M-427877-82													2	2	2
x	x	x	R-308, 1302, 1312	Resistor, globar, 550 ohms			18	8127261AA4	M-427877-35	2						1	1	1	1	3	3	2	2	2
x	x	x	R-308, 309	Resistor, globar, 275 ohms, 80 watts			18	5895116AG-P5	M-427877-83													2	2	2
x	x		R-310	Resistor, wire wound, bracket type, 350 ohms, 22 watts			18	8100568AB2	M-427877-80	2	1	1	1	1	1	1						2	2	2
	x		R-311, 1314	Resistor, 100 ohms ±10%, 25 watts			18	8160446AA3	M-427877-37	2						1	1	1	1	3	3	2	2	2
x			R-311, 1304	Resistor, 25 ohms ±10%, 25 watts			18	8160446AA2	M-427877-36	2								1	1		3	2	2	2
x	x	x	R-421	Resistor, fixed, molded, wire wound, insulated, 600 ohms ±10%, 4 watts			21	MW-3	K-850979-1	1	1	1	1	1	1	1	1	1	1	5	5	3	1	3
x	x	x	†R-421	Resistor board assembly consisting of: laminated insulation board, six terminals and three resistors in parallel, 1800 ohms ±10%, 2 watts			1		M-440521-501	1	1					1	1	1	1	5	5	3	1	3
x	x	x	R-422	Resistor, fixed, molded, wire wound, insulated, tapped, 6 resistances; R-422A, 1700 ohms ±10%, 1 watt; R-422B, 7100 ohms ±10%, 1 watt; R-422C, 2300 ohms ±10%, 1 watt; R-422D, 1000 ohms ±10%, 0.5 watt; R-422E, 23 ohms ±20%, 0.5 watt; R-422F, 55 ohms ±10%, 1.2 watts			21	MW-5	K-850858-1	1	1	1	1	1	1	1	1	1	1	5	5	3	1	3
x	x	x	†R-422	Resistor board assembly consisting of: laminated insulation board, 16 terminals and 8 resistors in series; 2 resistors, 27 ohms ±10%, 1 watt; resistor, 22 ohms ±10%, 1 watt; resistor, 1000 ohms ±10%, 1 watt; resistor, 2200 ohms ±5%, 1 watt; resistor, 3300 ohms ±10%, 1 watt; resistor, 3900 ohms ±10%, 1 watt; resistor, 1800 ohms ±5%, 1 watt			1		M-440521-502	1	1					1	1	1	1	5	5	3	1	3

† Resistor board assemblies R-421 and R-422 to be supplied if resistors R-421 and R-422 are not available.

TABLE V - APPLICABLE COLOR CODES

RESISTOR AND CAPACITOR CODES

MICA CAPACITOR CODING

Values of capacitance and tolerance are coded identically on both R.M.A. 6 dot and A.W.S. coded capacitors. Only the coding of the sixth (lower left) dot differs between the two.

R.M.A. CODE

R.M.A. coded capacitors have 3 or 6 dots located as shown below.

6 DOT COLOR CODE

On capacitors bearing 6 dots, the upper 3 dots become the first 3 figures. When the number of zeros determined by the "Zero Add" (lower right) dot is added, the capacitance in micromicrofarads (mmfd) is obtained. The other two dots show the percentage tolerance and the voltage rating.

EXAMPLE:

Brown, Red, Green
Green, Silver, Brown

125 + 0 = 1250 mmfd capacitance
10% tolerance
500 v d-c working voltage

3 DOT COLOR CODE

On capacitors bearing 3 dots, the first 2 dots become the first two figures. When the number of zeros determined by the "Zero Add" (third) dot is added, the capacitance in micromicrofarads (mmfd) is obtained. All 3 dot capacitors are rated at 500 v d-c working voltage.

EXAMPLE:

Red, Green, Brown

25 + 0 - 250 mmfd capacitance
(inferred tolerance) 500 v d-c working voltage

A.W.S. CODE

A.W.S. coded capacitors may have a coded "Type Designation" or 6 colored dots as shown below.

TYPE DESIGNATION

CM 20 A 050 M

Component Case Characteristic Capacitance Tolerance

COMPONENT: All mica capacitors are identified by "CM".
*CASE: Identifies external shape and dimensions.
*CHARACTERISTIC: Identifies temperature coefficient and "Q".

CAPACITANCE:
The first 2 digits are the first 2 figures of the capacitance, in mmfd. The third determines the number of zeros to add. If more than 3 digits are used, all except the last are figures of capacitance. The last determines the number of zeros to add.

TOLERANCE:

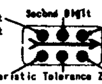
Designation	Tolerance
G	±2%
J	±5%
K	±10%
M	±20%

EXAMPLE: The above type designation identifies the capacitance as 5 mmfd and the tolerance as 20 per cent.

*For specific information see publication C75.3 - 1942 of the American Standards Association.

6 DOT COLOR CODE

EXAMPLE:
Black Orange Orange
Black Silver Red
033 + 00 = 3300 mmfd capacitance
10% tolerance
"A" characteristic

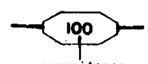


R.C.A. CODE

for mica capacitors of the shape shown below

The capacitance in micromicrofarads (mmfd) is stamped on the case. The color of the numbers shows the tolerance, as follows:

Green . . . 2.5% Blue 10%
Black . . . . 5% Yellow . . . 20%
Red . . . 30%



capacitance in micromicrofarads

† When the "ZERO ADD" color is GOLD, multiply the preceding digits by 0.1 for capacitance in mmfd; when the "ZERO ADD" color is SILVER, multiply by 0.01

COLOR IDENTIFICATION FOR MICA CAPACITORS

COLOR	DIGITS and ZERO ADD	TOLERANCE R.M.A.	TOLERANCE A.W.S.	TOLERANCE R.C.A. mica	D-C VOLTAGE (R.M.A.)	CHARACTERISTIC (A.W.S.)
BLACK	0			5%		A
BROWN	1	1%			100	B
RED	2	2%	2% (G)		200	C
ORANGE	3	3%			300	D
YELLOW	4	4%		20%	400	E
GREEN	5	5%		2½%	500	F
BLUE	6	6%		10%	600	G
VIOLET	7	7%			700	
GRAY	8	8%			800	
WHITE	9	9%			900	
GOLD	†	5%	5% (J)		1000	
SILVER	†	10%	10% (K)		2000	
NO COLOR		20%	20% (M)		500	

†When the "ZERO ADD" color is GOLD, multiply the number obtained from "A" and "B" by 0.1 to get capacitance in mmfd; when it is SILVER; multiply the number by 0.01.

RESISTOR CODING

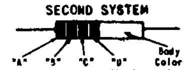
(Composition and Low Power Wire Wound Resistors)

THE R.M.A. CODING AND A.W.S. CODING FOR THESE RESISTORS ARE IDENTICAL

FIRST SYSTEM

Tolerance may not be given; in which case there will be no "D" band.

SECOND SYSTEM



The body color indicates the type of resistor, and is coded as follows:

BODY COLOR	TYPE
Black	Composition, non-insulated
Any Color but Black	Composition, insulated
Chocolate Brown	Wire wound, insulated

TO FIND RESISTANCE IN OHMS FROM COLOR CODING:
Obtain the digits identified by the colors of "A", "B", and "C" from the following table:

COLOR	Digit or Zero Add	COLOR	Digit or Zero Add	Tolerance
Black	0	Violet	7	
Brown	1	Gray	8	
Red	2	White	9	
Orange	3	Gold	†	5%
Yellow	4	Silver	†	10%
Green	5	No Color		20%
Blue	6			

† When the "ZERO ADD" color is GOLD, multiply the number obtained from "A" and "B" by 0.1 to get resistance in ohms; when it is SILVER; multiply the number by 0.01.

EXAMPLE

A B x C = 25 x 0.1 = 2.5
Resistance is 2.5 ohms
Tolerance: 10 per cent

EXAMPLE

The first two digits "A" and "B" become the first two numbers of the resistance. The ZERO ADD digit, "C", gives the number of zeros to add after the first two numbers. (If the ZERO ADD color is GOLD or SILVER, it becomes a multiplier. See note †)

A B + C zeros =
25 + 3 zeros = 25,000
Resistance is 25,000 ohms
Tolerance: 10 per cent

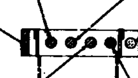
RCA CERAMIC CAPACITOR CODING

COLOR IDENTIFICATION

COLOR	DIGIT	ZERO ADD	TOLERANCE Note 1	TOLERANCE Note 2	TEMP. COEFFICIENT [MMFD/MMFD/°C.]
BLACK	0	0			0
BROWN	1	1	5%	0.5 mmfd	-0.30×10^{-4}
RED	2	2			-0.80×10^{-4}
ORANGE	3	3	2½%		-1.5×10^{-4}
YELLOW	4	4			-2.2×10^{-4}
GREEN	5	5	5%	0.5 mmfd	-3.3×10^{-4}
BLUE	6	6			-4.7×10^{-4}
VIOLET	7	7			-7.5×10^{-4}
GRAY	8		2½%	0.25 mmfd	
WHITE	9		10%	1.0 mmfd	

Note 1 - This column applies to capacitances GREATER than 10 mmfd.
Note 2 - This column applies to capacitances LESS than 10 mmfd.

COLOR CODING



The d-c working voltage of this type is 500 volts.

EXAMPLE:

4 Brown Dots
Red End Color

11 + 0 = 110 mmfd capacitance
±5% tolerance
-0.80×10^{-4} mmfd/mmfd/°C. temperature coefficient
inferred: 500 volt rating

TABLE VI
LIST OF MANUFACTURERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

TBS	NOs - 60613	TBS-3	NXs - 1736	TBS-6	NXsr - 36725		
TBS-1	NOs - 70095	TBS-4	NXss - 17599	TBS-7	NXsr - 38310		
TBS-2	NOs - 70095	TBS-5	NXss - 18747	TBS-8	NXsr - 51552		

CODE NUMBER	MFR. PREFIX	NAME	ADDRESS
1	CRV	Radio Corporation of America	Camden, N.J.
1a	CRC	Radio Corporation of America	Harrison, N.J.
4	CBZ	Allen Bradley Co.	1326 S. 2nd Street Milwaukee, Wis.
6	CPH	American Phenolic Corp.	1830 S. 54th Street Cicero, Ill.
7	CHH	Arrow-Hart & Hegeman Electric Co.	102 Hawthorne Street Hartford, Conn.
8		Bryant Electric Co.	Bridgeport, Conn.
9	CBK	Allen D. Cardwell Mfg. Co.	81 Prospect Street Brooklyn, N.Y.
10	CBN	Central Radio Lab. (Centralab)	900 E. Keefe Avenue Milwaukee, Wis.
11	CMG	Cinch Mfg. Co.	2339 W. Van Buren Street Chicago, Ill.
13	CD	Cornell-Dubilier Electric Corp.	1000 Hamilton Blvd. S. Plainfield, N.J.
15		Drake Mfg. Co.	1713 Hubbard Street Chicago, Ill.
18	CG	General Electric Co.	Schenectady, N.Y.
19	CHC	Hammarlund Mfg. Co.	460 W. 34th Street New York, N.Y.
20	CHD	Hardwick Hindle Inc.	40 Herman Street Newark, N.J.
21	CIR	International Resistance Corp.	401 N. Broad Street Philadelphia, Pa.
22	CBU	Isolantite, Inc.	343 Courtland Street Belleville, N.J.
23	CEJ	E. F. Johnson Co.	Waseca, Minn.
24	CKU	Kurman Electric Co., Inc.	241 Lafayette Street New York, N.Y.
25	CLR	Leach Relay Co.	5912 Avalon Blvd. Los Angeles, Calif.
26	CLF	Littelfuse Lab.	4757 N. Ravenswood Avenue Chicago, Ill.
27		Lord Mfg. Co.	Erie, Pa.
28	CMA	P.R. Mallory & Co., Inc. (Yaxley Division)	3029 E. Washington Street Indianapolis, Ind.
31	COC	Oak Mfg. Co.	1200 N. Clybourne Avenue Chicago, Ill.
32	COM	Ohmite Mfg. Co.	4837 W. Flournoy Street Chicago, Ill.
34		Solar Mfg. Co.	588 Avenue A Bayonne, N.J.
35	CSZ	Square D Co.	6060 Rivard Street Detroit, Mich.
40	CWC	Wirt Co.	5221 Greene Street Philadelphia, Pa.
46		Airadio, Inc.	Stamford, Conn.
63	CAS	American Lava Corp.	Cherokee Blvd. & Mfr's Road Chattanooga, Tenn.
68	CAT	American Transformer Co.	172 Emmet Street Newark, N.J.
75a		Arrow Automatic Products Corp.	27 Vestry Street New York, N.Y.
79	CAU	Automatic Electric Co.	Mankato, Minn.
82		Aluminum Goods Mfg. Co.	Manitowoc, Wis.
90a		Bakelite Corp.	River Road Boundbrook, N.J.
98	CYB	Birnbach Radio Co., Inc.	145 Hudson Street New York, N.Y.
107a		Wm. Brand Co.	276 4th Avenue New York, N.Y.

TBS	IB-38011	TBS-3	IB-38159	TBS-6	IB-38246
TBS-1	IB-38051	TBS-4	(G.E.)	TBS-7	(G.E.)
TBS-2	IB-38116	TBS-5	IB-38211	TBS-8	IB-38331

TABLE VI (Continued)
LIST OF MANUFACTURERS
FOR MODEL TBS SERIES TRANSMITTING AND RECEIVING EQUIPMENT

CODE NUMBER	MFR. PREFIX	NAME	ADDRESS
126		Birtcher Corp.	Los Angeles, Calif.
165	CPD	Communication Products Co.	245 Custer Avenue Jersey City, N.J.
220		Dayton-Rodgers Co.	Minneapolis, Minn.
247	CEZ	Electronic Mechanics, Inc.	70 Clifton Blvd. Clifton, N.J.
293	CDP	General Ceramics Co.	Keasbey, N.J.
304	CAB	General Radio Co.	30 State Street Cambridge, Mass.
307a		H.S. Getty Co., Inc.	3348 N. 10th Street Philadelphia, Pa.
402		Kurz-Kasch Co., Inc.	Dayton, Ohio
407		F. Kelly Co.	Derby, Conn.
416	CLE	Lenz Electric Mfg. Co.	1751 N. Western Avenue Chicago, Ill.
483		National Co., Inc.	61 Sherman Street Malden, Mass.
496		Northern Chemical Supply Co.	11 S. Elkins Street South Boston, Mass.
521		Patton-MacGuyer Co.	Edgewood Station Providence, R.I.
552		Phila. Metal Stamping Co. of Penna.	400 E. Rittenhouse Street Philadelphia, Pa.
579		C.B. Rodgers	Danbury, Conn.
599		Shakeproof Lockwasher Co.	2501 N. Keeler Avenue Chicago, Ill.
649a		Synthane Co.	Oaks, Pa.
656		Spaulding Fibre Co.	Tonawanda, N.Y.
690	CUF	Ucinite Co., Division of United Can Fastener Co.	1 Nevada Street Newtonville, Mass.
702	CRA	Utah Radio Products Co.	812 Orleans Street Chicago, Ill.
740	CWP	Winship Co.	Utica, N.Y.
760		F.R. Zierich Mfg. Co.	New York, N.Y.
761		Worcester Pressed Aluminum Co.	13 Hope Avenue Worcester, Mass.