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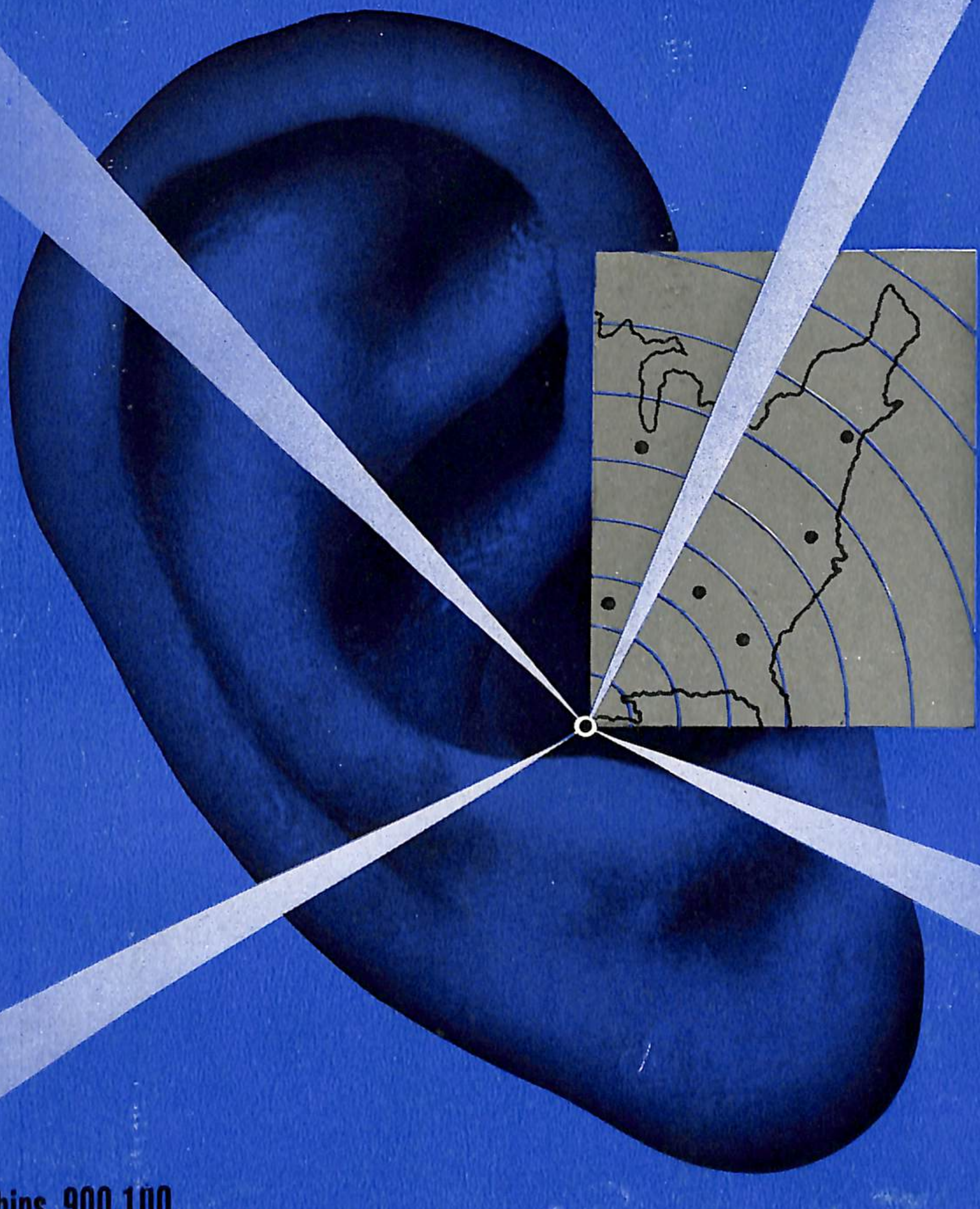
MARCH 1947

BUSHIPS Electron



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BUSHIPS Electron

A MONTHLY MAGAZINE FOR RADIO TECHNICIANS

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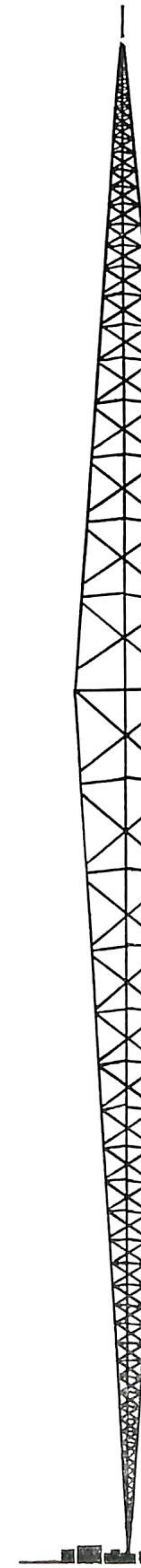


RADIO WASHINGTON

To all Navy communication personnel the call signs NAA and NSS are synonymous with Radio Washington. Time signals, weather broadcasts, "fox" schedules, press schedules, storm warnings and ice warnings are only a few of the many special services rendered by this activity located in the Navy Department on Constitution Avenue in the Nation's Capitol. During any 24-hour period there are few naval ships or stations throughout the world which are not served, either directly or indirectly, by this key station of the Naval Communication System. From the time a potential radio striker starts learning the code until he completes his Naval service, NAA/NSS will be a part of his vocabulary.

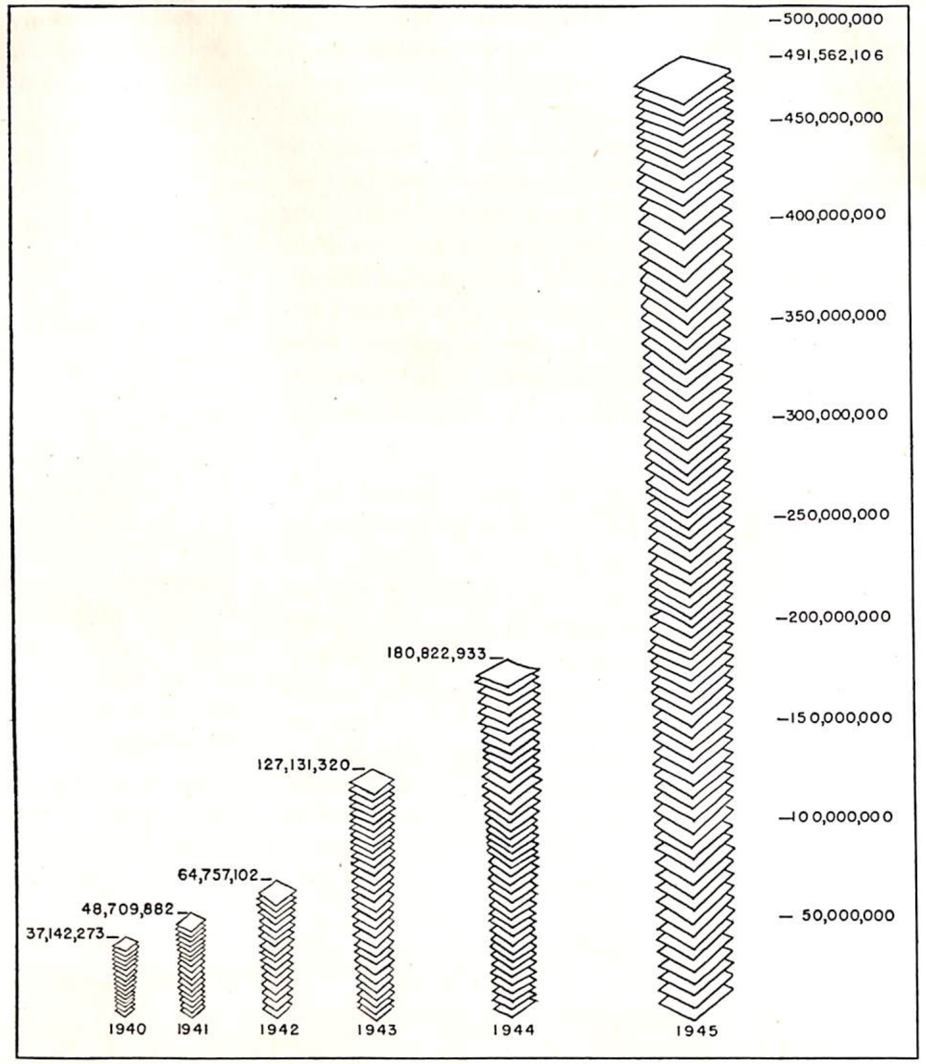
Radio Washington is the key station of the entire Naval Communication System, which is organized to provide adequate communications for command and administration between the Navy Department and all naval activities and naval operating forces ashore and afloat. Radio Washington actually includes the following five activities: a central communication office located in the Navy Department, Washington, D. C., a high-power radio transmitter station at Annapolis, Md., a radio receiving and monitoring station at Cheltenham, Md., a radio link transmitter and receiver station at Arlington, Va., and an electronics office. The electronics office is at the Naval Gun Factory, Washington, D. C. (formerly called the Navy Yard), and is charged with the maintenance and upkeep of all equipment located at the four stations comprising Radio Washington.

Radio Washington has grown from the arc-and-spark days of World War I, when the peak load in November, 1918, was 1,198,000 groups, to an efficient, high-speed organization handling approximately 41,000,000 groups per month in the latter days of World War II and on into 1946. Approximately twenty percent of the traffic handled during these peak periods was in some type of code which required processing by specially trained personnel assigned to that task. A total of about 515 officers, enlisted, and civil-service personnel were on duty at Radio Washington during the peak periods of World War I, while 1,004 were attached during the latter days of World War II. It can be seen from these figures that, although the work load was approximately thirty-four times greater in World War II, the personnel required to handle the increase was only doubled. The answer to this seeming riddle lies in the maze of modern, efficient equipment now installed at the various sections which comprise Radio Washington.

An important point which further demonstrates the versatility of this station is that much of the equipment which has been accepted for universal naval usage was tested experimentally right in Radio Washington. This

View of the message distribution desks and a portion of the filing bins located in the Message Center at Radio Central, Washington, D. C.

Chart depicting the amount of traffic handled (in millions of words) at Radio Washington over the years 1940-1945. This chart was taken from an official history of Radio Washington prepared by personnel attached thereto.



is particularly interesting when one considers that the efficiency and traffic handling ability of the station was not impaired despite the confusion of continually installing and testing the new equipment.

A second point of immediate and lasting importance was the thought and care given to proper training of personnel who were assigned to the communications activities in that area. All the advantages of this modern, expensive equipment would have been nullified without proper operation and maintenance by experienced personnel. Thus it can again be said that, regardless of how modern or efficient the design of equipment may be, its value is lost unless it is correctly operated and serviced.

Previous issues of the ELECTRON have carried technical and descriptive articles on such subjects as the teletypewriter, frequency-shift keying, single-sideband, and other types of modern high-speed communication equipment. It will now be shown how these various systems are integrated into a close-knit, efficient communication organization.

COMMUNICATION OFFICE

The Navy Department Communication Officer is charged with the operation of the communication system in the Washington area, which includes Annapolis, Cheltenham, and Arlington. He maintains jurisdictional liaison with the various bureaus, offices, and agencies of the Navy Department as well as other government departments. He is also responsible for maintaining electrical control of all the activities comprising Radio Washington.

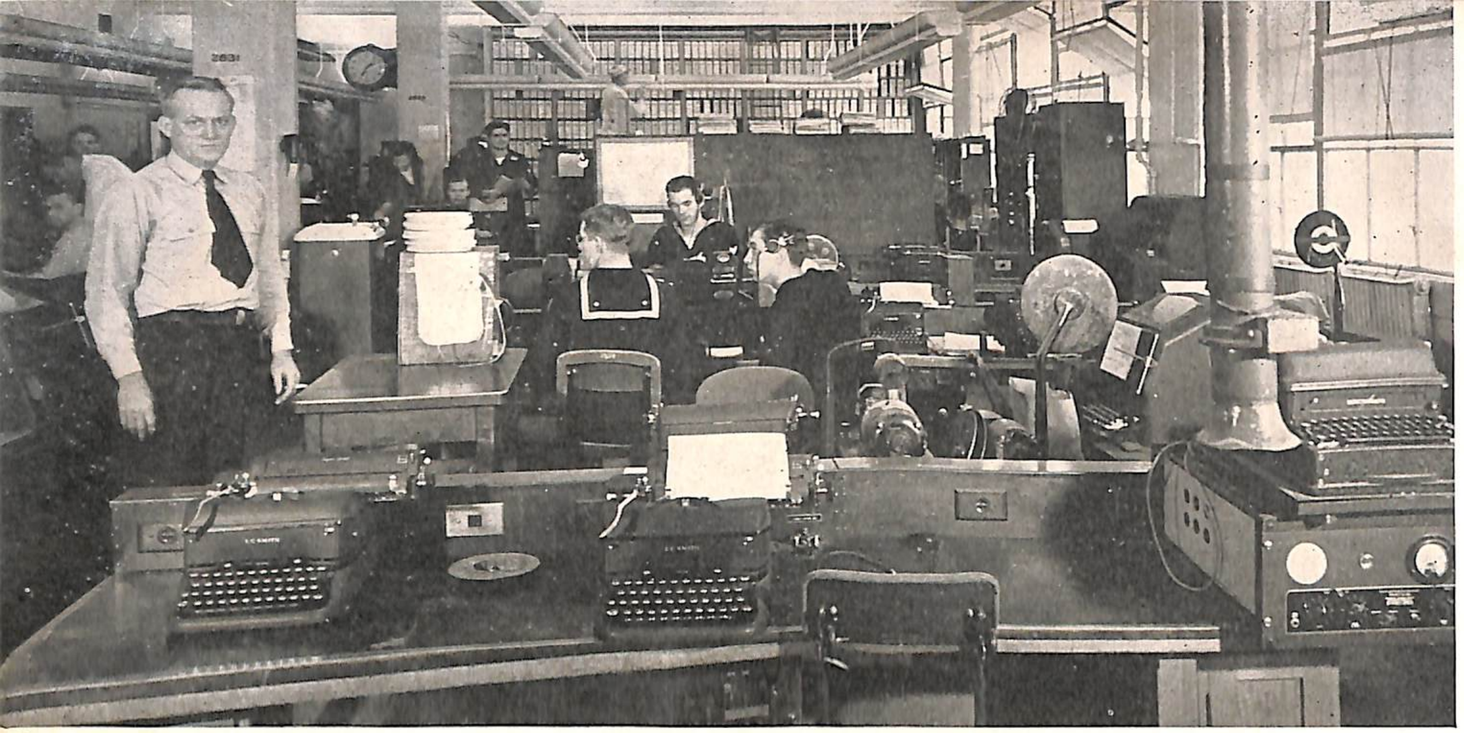
The communication organization in the Navy Department proper is broken up into three branches, Radio Central, Wire-Relay-Center and Crypto Center. Located in Radio Central are a message center (which is the communication office proper), a radio room, mailgram and call-sign room, and a repair shop. The Wire-Relay Center includes semi-automatic relay equipment and teletype equipment for the handling of NTX *Naval Teletype System* and commercial communications. The Crypto Center includes a classified message center, code rooms, and an issue room.

Practically all of the communication and control equipment is located in the message room, the radio room, and the wire-relay center. Since the message center is the largest of the three spaces, a greater percentage of equipment is installed there. In addition to all the necessary items such as typewriters, filing systems, and many others which are common to any communication organization, there are 28 each of Model 19, Model 15, and Model 14 Teletypewriter equipments (see page 1, ELECTRON for September 1945) mounted on tables in this space. These 84 equipments can be used in many different combinations such as *duplex, multiplex,* and *diplex,* which will be defined presently. Also installed in this room are two Model UP Single-Sideband Terminal Equipments (two more being currently installed) and two Model UN Carrier-Control Link Equipments (see page 12, ELECTRON for April 1946). Six each of the Models 19, 15, and 14 equipments are used with each single-sideband terminal equipment, which provides six *duplex* circuits (2-way) on one equipment.

Duplexing is the process of having two parallel circuits set up between two stations, such as the one between Washington and San Francisco. On one of the circuits Washington transmits to San Francisco, while on the other San Francisco transmits to Washington, both circuits being in use simultaneously. For repeats and passing information other than the traffic on hand, either station can break its transmission and send the desired information, then resume transmitting traffic.

Special auxiliary equipment, known as the *multiplex* system, is also used. With this system, a station can have four 60-wpm teletypewriter channels going out on a single radio transmitter circuit. By employing another set of equipment on another frequency (*duplex operation*), this station can also be receiving four 60-wpm circuits from the same station. Four-channel multiplex operation is obtained by feeding four tape transmitters into a single transmitting distributor which scans the transmitting pulses and combines them into a single circuit. This is accomplished by a so-called time-division system, whereby the duration of the pulse of each element in the TTY signal is reduced to one-fourth. Four characters, one from each machine, are thereby sent sequentially in the time ordinarily required for one. When this composite signal is received at the receiving station the procedure is reversed, the incoming signals there being separated by a receiving distributor and channelled to four corresponding teletype printers. Synchronization between the transmitting distributor and the receiving distributor is obtained by means of synchronous motors driven by temperature-controlled tuning

Teletype equipment located in the message center of Radio Washington, and used with single-sideband or multiplex equipment.



View of the Message Center of Radio Central, showing additional teletype equipment and Boehme automatic equipment. In the background are the hourly and daily traffic files.

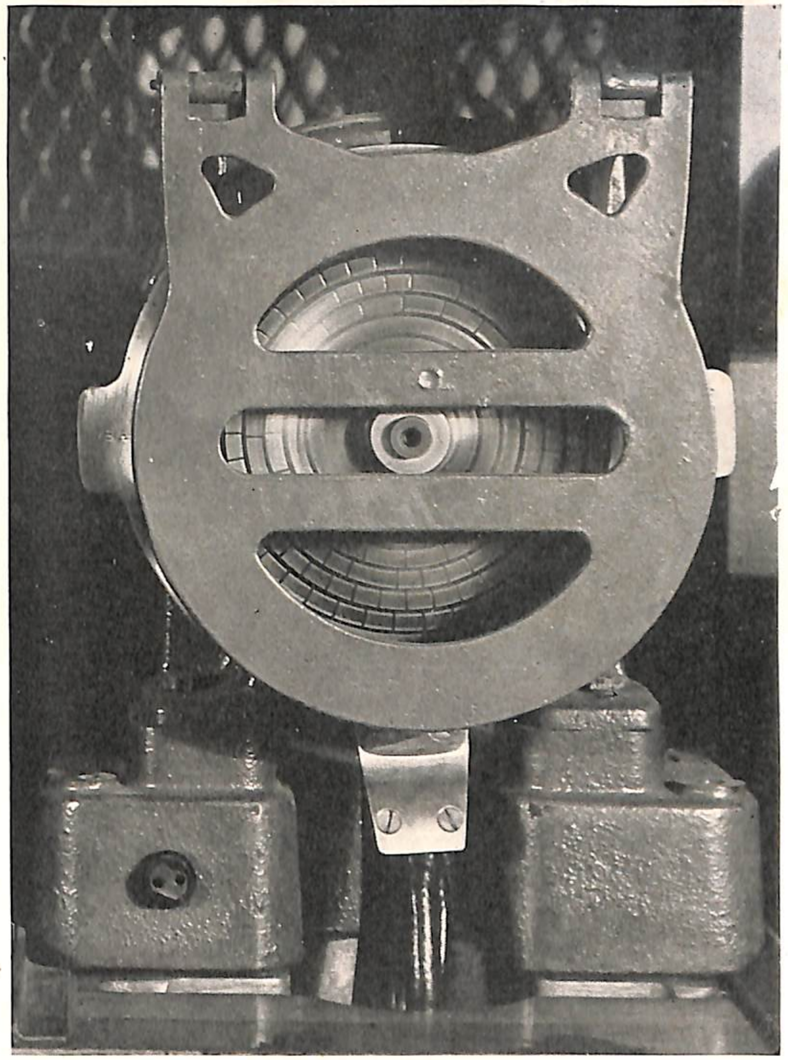
forks, which in turn are supervised by a correction system at the receiving terminal. Standard Model 15 and 19 sets are used, and patching facilities permit the use of these positions for multiplex, single-sideband, or other services. Multiplex transmission is effected by removing the Model 14 transmitter distributor from the Model 19 set and placing the multiplex transmitter assembly in the sub-base. The transmitter distributors are connected to the multiplex distributor through a patch board to permit connecting any position to any multiplex channel. Relays formerly mounted on the receiving tables have been replaced with a bank of special relays to permit extending any receiving channel to a remote point. Transmission from a remote point over a multiplex channel must be accomplished by a tape relay. If traffic conditions warrant, Radio Washington can utilize 4 complete multiplex systems for a total of 16 transmitting circuits and 16 receiving circuits simultaneously.

A second special method of arranging teletype equipment is the diplex system. This is also a time-division system, but for only two channels and requiring only relatively simple equipment. Each diplex channel, as employed at Washington, employs a Model 19, two Model 15, one or two Model 14 Teletypewriters, and a diplex transmitter distributor which replaces the standard Model 14 transmitting distributor and mounts in the same sub-base assembly. Each transmitting teletype utilizes a tape perforator and a tape transmitter, just as in the multiplex system, and the outputs of the two tape transmitters are combined on a time-division basis in the transmitting distributor. Diplex distributors are very simple, and require no tuning fork for maintaining synchronism.

The Model UN Carrier-Control Link Equipment is referred to as a "system" inasmuch as it cannot be readily broken down into specific equipments. It is a multichannel, on-off (tone on for *mark* and no-tone for *space* conditions) voice-frequency carrier system normally used via VHF radio link, but useable over a landline loop of suitable quality. It provides narrow-band teletypewriter channels, medium-band channels for multiplex, wide-band channels for Boehme high-speed, and voice channels. Single-sideband control channels are provided by utilizing a complete VHF radio link for each UP terminal. The VHF transmitters and receivers are located nearby in Arlington, Virginia, and are connected to the terminal equipment by cable.

The Model UP Single-Sideband Multi-teletypewriter-channel Terminal Equipment consists of basic channel equipment the same as the UN. Six teletypewriter narrow-band channels are derived from 24 narrow-band channels provided by the UN equipment. Each teletypewriter keys four narrow-band channels, a *mark* keying two channels, and a *space* keying two channels, to provide polar frequency-diversity transmission. At the receiving end the terminal equipment converts the 24 tones into teletypewriter narrow-band channels utilizing the full advantages of the polar frequency-diversity transmission. The two UP terminals now in operation are used to work San Francisco and Honolulu, while the two being installed are contemplated for use with San Juan and Balboa.

Close-up of a distributor used with the multiplex system. The unit is in operation, preventing observation of the rotating arm and distributor brushes.



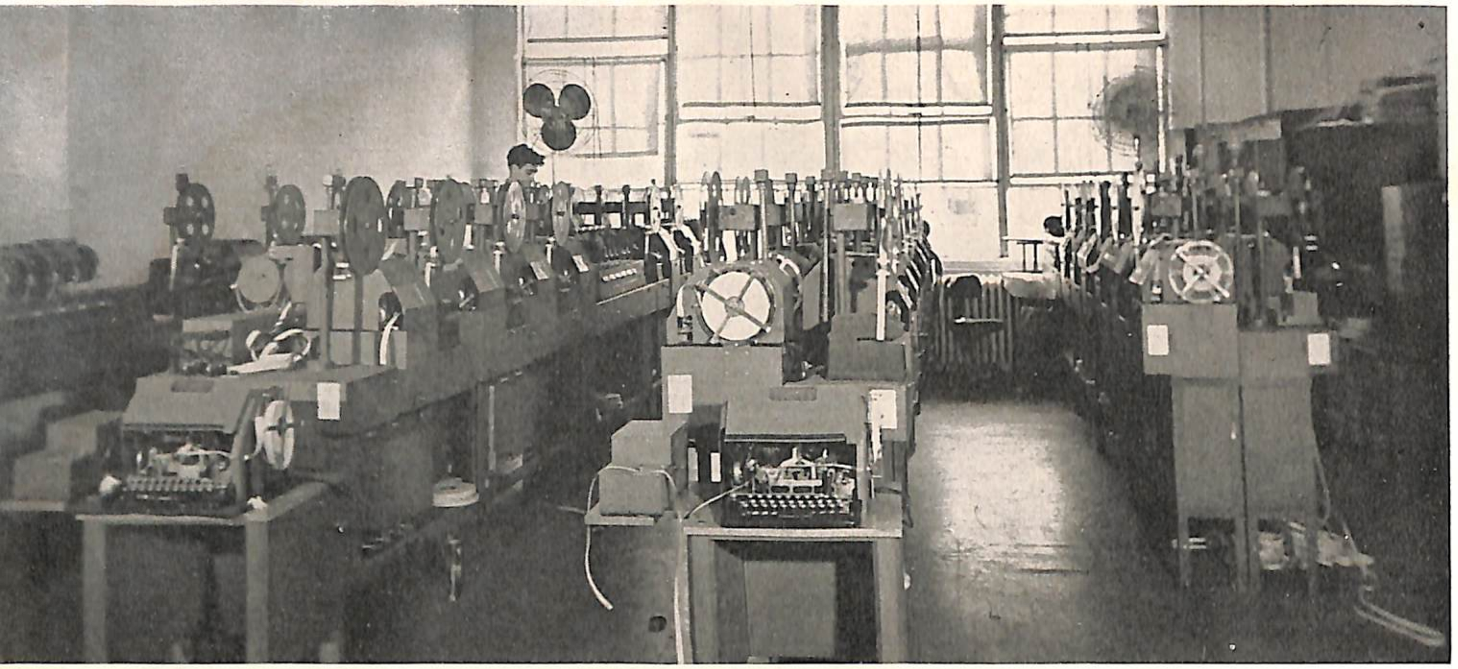
The UO Single-Sideband Speech-Control and Speech-Privacy Terminal Equipment contains special circuits required to provide an optimum voice channel via a radio circuit, ringing and control circuits, plus speech-scrambling equipment to provide a limited degree of privacy. These terminals will be used as required on the four single-sideband circuits.

For emergency measures, such as failure of terminal equipment for the single-sideband circuits, the message center still has available three high-speed 1-channel Boehme tape-keying circuits. Most of the old timers are familiar with the Boehme system, as it used to be the only high-speed system in use. Regular Morse-code characters are punched in a tape which may be pulled through a keying head at any rate up to several hundred words per minute. Receiving these signals at high speeds is accomplished by a syphon recorder. The tape must then be transcribed manually at a lower speed. One of these circuits is still in constant use to Balboa because the single-sideband installation is not yet completed at that station. The other two are kept on standby, one for working San Francisco and the other for working Honolulu. In addition to these three traffic circuits, eight other automatic circuits utilizing Boehme keying are used to transmit weather, hydrographic reports, primary "fox" schedules, etc., at low speeds. Radio Washington also has single-channel radio-teletype circuits set up with Bermuda, Point Lyautey (French Morocco), Rio De Janeiro, and Londonderry (Ireland).

Located in the wire room are 11 Model 19, 3 Model 14, and 6 Model 15 Teletype equipments which are used for local communication service.

RELAY ROOM (NTX CENTER)

The relay room employs a semi-automatic tape-perforation method of transferring message tapes from the incoming receivers to the outgoing transmitters. Installed in this room are ten receiving consoles each containing eight Model 14 typing reperforators, ten transmitting tables each containing twelve transmitter-dis-



Banks of automatic numbering machines installed in the Relay Room of Radio Washington.

Four of the ten transmitting tables installed in the Relay Room. Tapes can be seen running into slots in the front of the different machines.

tributors, forty-eight automatic numbering and monitoring equipments, and a control switchboard where special connections can be made.

One receiving console and one transmitting table are used as a "tape factory" for cutting additional tapes when required for multiple-address messages. One to eight typing reperforators may be operated from a single transmitter-distributor to produce the additional tapes required.

Incoming circuits are terminated in typing reperforators and the tapes are torn off to message length by the operators on duty. The torn tapes are then placed in the appropriate sending position by inserting them in the correct order of priority into the tape grid bearing the NTX call to which the message is addressed. If the message carries more than one addressee it is taken to the tape factory where one tape is made for each additional addressee. These additional tapes are then inserted in the correct sending positions for the addressees in question. Messages are transmitted by inserting the tape in the transmitter-distributor. Heavily loaded circuits are equipped for tandem operation whereby transmitter-distributors are used in pairs and so that one may be threaded while the other is transmitting. They are wired in such a manner that the change-over to the other transmitter occurs automatically at the end of each message.

The automatic numbering machines are an important adjunct in speeding up traffic and relieving the operator of keeping the outgoing station serial numbers straight. As each message transmitted from a shore station to another shore station or to a ship at sea must have an identifying serial number, manual numbering on heavily loaded circuits would result in much lost circuit time as it involves inserting a small piece of perforated tape ahead of each message. This method of "tab-numbering" is used only on multi-point circuits. The automatic numbering machines carry a reel of tape which has been punched with the call sign of the receiving and transmitting stations and the proper consecutive message numbers. At the start of each message the tape transmitter automatically shifts over to this machine which transmits the proper station calls followed by the message serial number, then transfers the keying circuit back to the tape transmitter which then transmits the message.

The monitoring equipment maintains copies of all traffic on each circuit. A monitoring Model 14 typing reperforator is associated with each circuit, and records each word and character handled. As the monitoring unit operates, the time and date is automatically stamped on the tape at frequent intervals, thus keeping not only a log of what is sent or received, but the time as well. The tape is wound up on a tape reel for retention and is used to check outgoing messages and for making re-runs.

At the present time there is a total of fifty-seven operating circuits. Twenty-three of these circuits go to the various naval district headquarters and other distant points, while thirty-four are local circuits to the numerous naval activities in the vicinity of Washington, D. C. Of the fifty-seven circuits, forty-nine use leased landlines and eight use radio. The radio channels include two to San Francisco, three to Honolulu, and one each to San Juan, Balboa, and Argentia.

The above paragraphs have been devoted primarily to a discussion of the personnel and equipment set-up at radio central in Washington, D. C. It must be remembered that all the actual transmitting is accomplished at either Annapolis or Arlington, while the receiving is done at Cheltenham.

TRANSMITTING STATIONS

Radio Arlington was originally the Number 1 transmitting station for Radio Washington and, as the old timers will recall, was assigned the call of NAA. With the requirement for increased facilities and the demand for additional space required for the installation, Arlington was relegated to the status of a standby transmitting station and a site near Annapolis was chosen as the main transmitting station.

Radio Annapolis is a high-powered transmitting station containing approximately 60 transmitters ranging in power output from a half to 500 kilowatts. For use in conjunction with these transmitters is a large number of antenna arrays. Some are directional, depending upon the desired employment. This station is self-supporting and self-sustaining. The operational control of the station is of course exercised from Radio Central through the medium of the Model UN system through Arlington and by leased lines.

RECEIVING STATIONS

For incoming traffic, the receiving station at Cheltenham is the first link in the Washington loop. This receiving station site was chosen because of its comparatively isolated location which results in a decrease of interference from man-made static and interference. Cheltenham, like Annapolis, is a veritable forest of antenna arrays—directional, diversity, and many others. All traffic is received at this station and passed to radio central by the UN System and leased lines. Many operators are required at this station to maintain incoming signals at the proper levels, monitor correctly, service and maintain equipment, etc. In addition to the above mentioned UN link with Washington, there are wire lines connecting all the links in the Washington loop, which can be used in case of emergency. Telephone communication via the radio links between all stations is utilized for passing orders or information to other stations.

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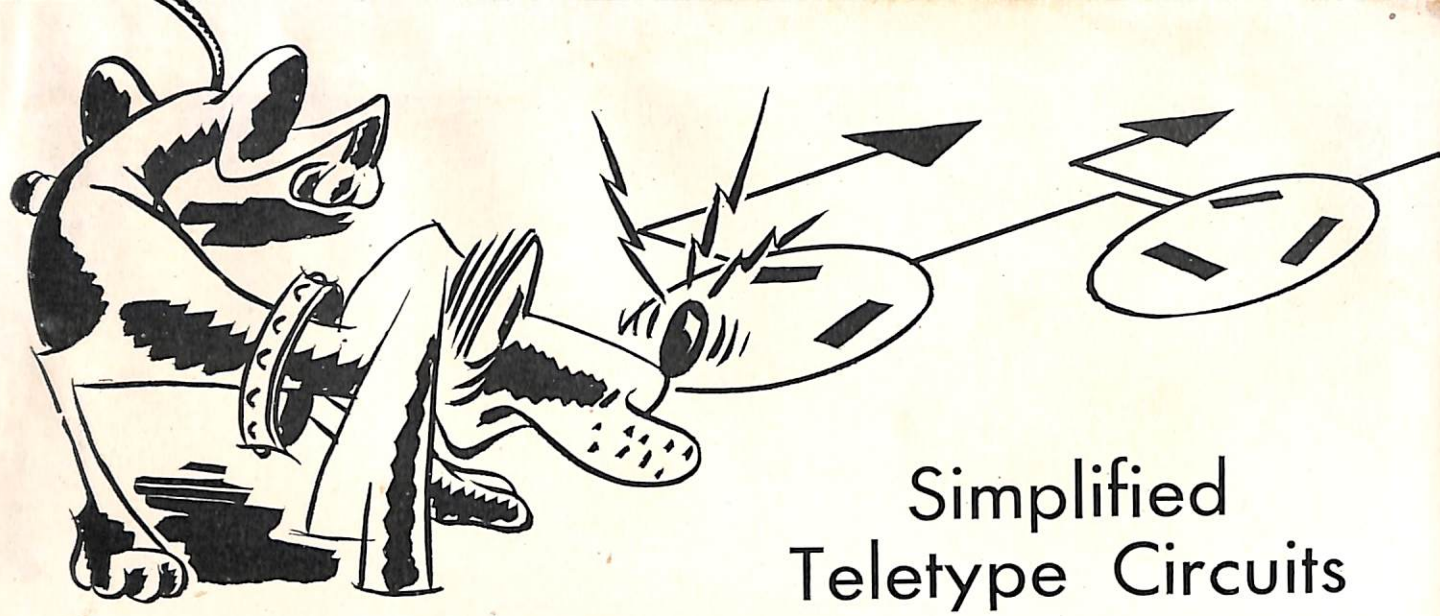
Remember, the job is not finished until replacement parts are ordered and a failure report card filled out and mailed.



Simplified Teletype Circuits

■ Teletype equipment can be reduced to a series of mechanical sequences and electrical circuits. Although the mechanical operation is shown and described quite thoroughly in the teletype instruction books, details of the numerous electrical circuits incorporated in a Model 19 teletypewriter, for example, are noticeably absent. The following simplified point-to-point diagrams should therefore be found helpful in tracing circuits, especially when trouble shooting.

Figures 1 and 2 show circuits through the switching key. The key (see figure 3) is a three-position selector switch by means of which the teletypewriter is operated in conjunction with either of two lines as shown. In all these diagrams the letter after a point designation indicates the terminal block on which that point is located. For example, line 1 is connected to terminals 1 and 2 on the E block. Similarly, line 2 is connected to terminals 3 and 4 on the E block.

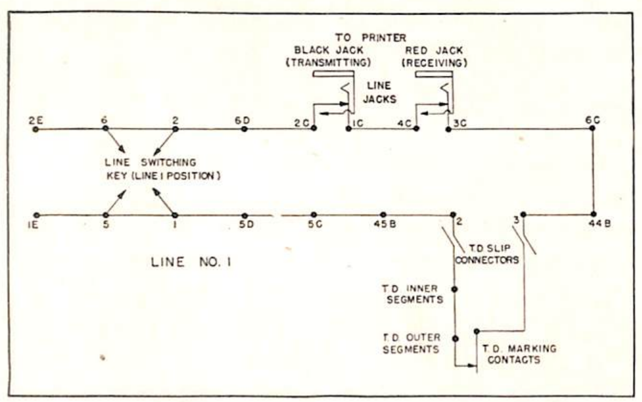
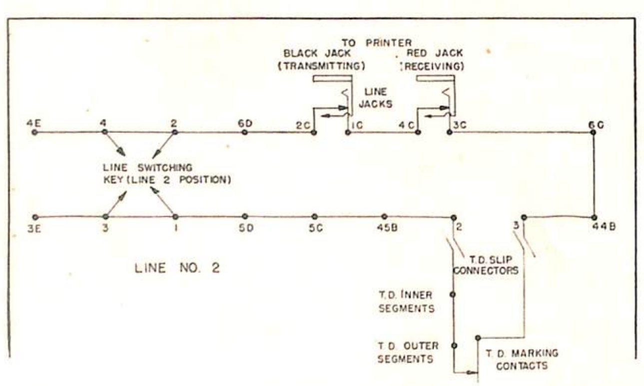


FIGURE 1—*Connections through the line switching keys, showing the switch in position for using line 1 (above) and line 2 (lower circuit).*



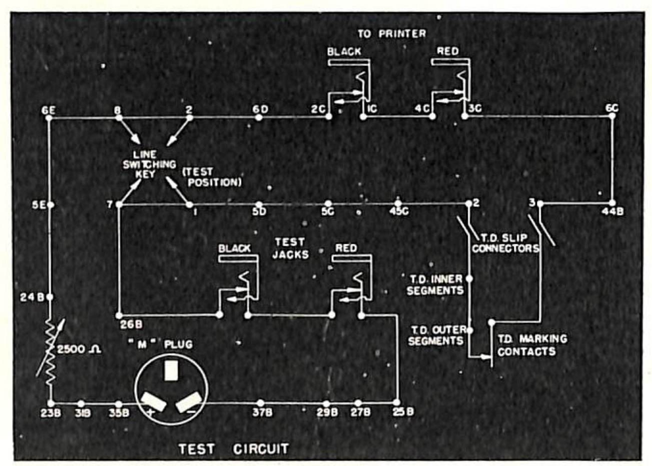


FIGURE 2—*Test circuit when line switching key is in the* TEST *position.*

Figure 2 shows provisions for a test circuit, utilizing the local printer and transmitter-distributor, or a test transmitter-distributor, or a printer by means of the test jacks. Local d-c line current is supplied through the M plug. The switching key should be in the center position and there must be a jumper across terminals 5 and 6 of the E block to provide continuity unless there is another printer or other equipment connected to these terminals.

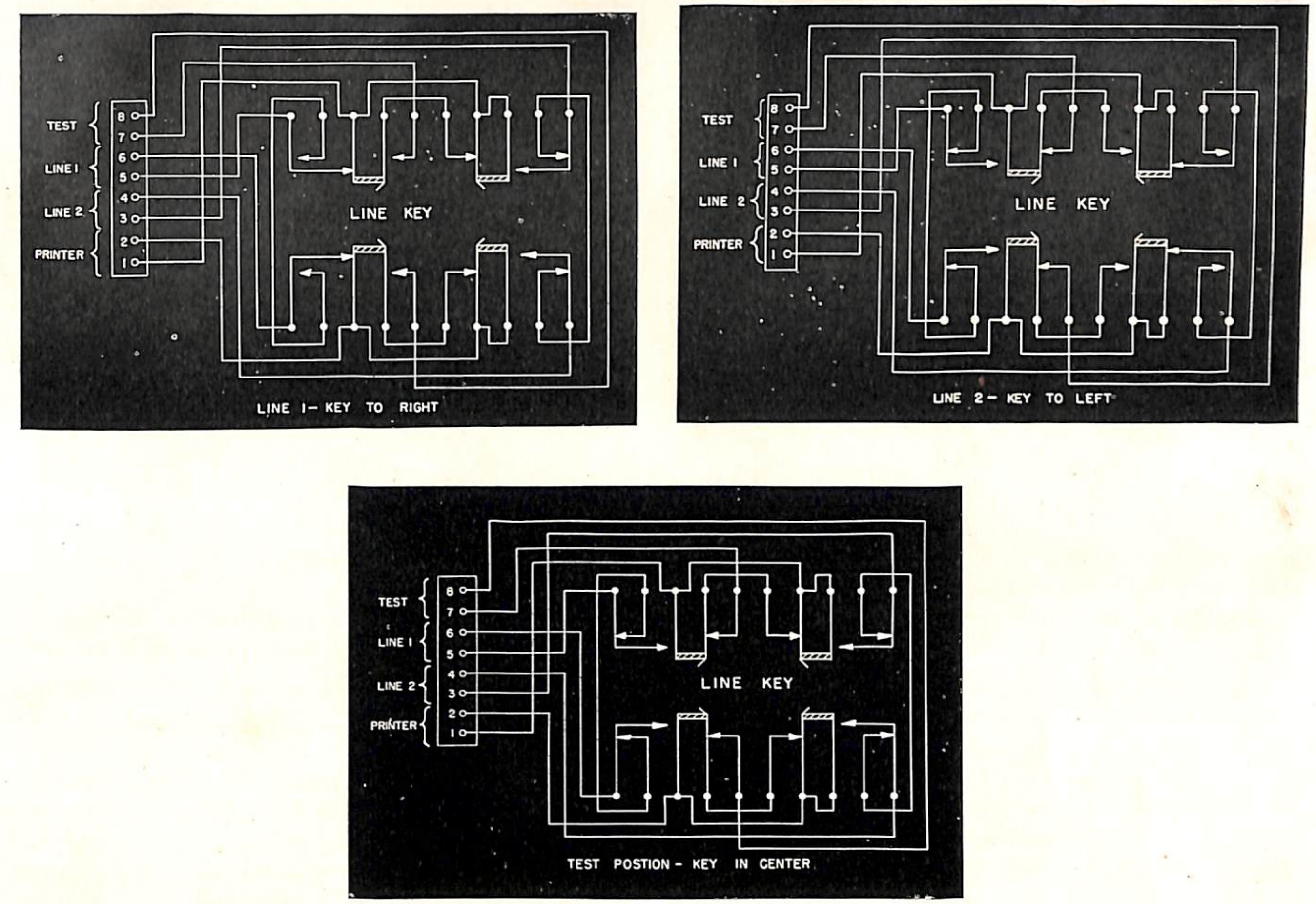


FIGURE 3—*Wiring diagrams for the three positions of the line switching key.*

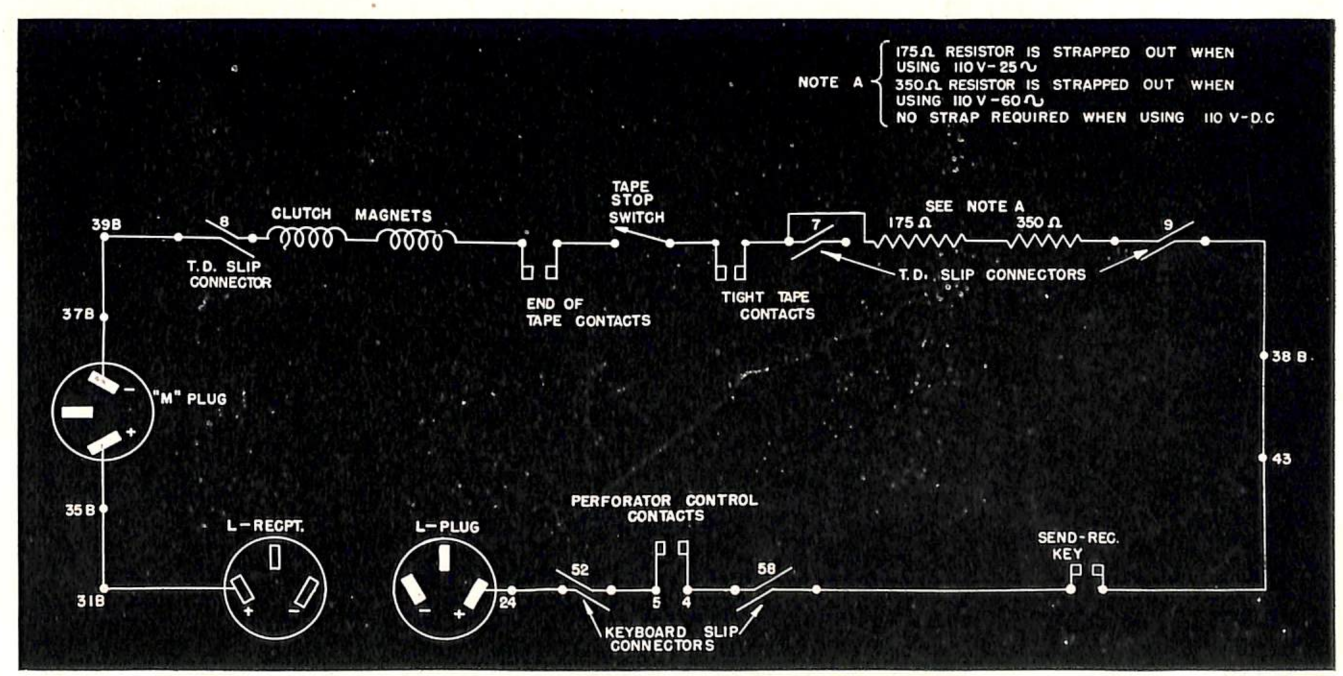


FIGURE 4—*Simplified schematic of the various contacts and slip connectors in the transmitter-distributor clutch-magnet circuit.*

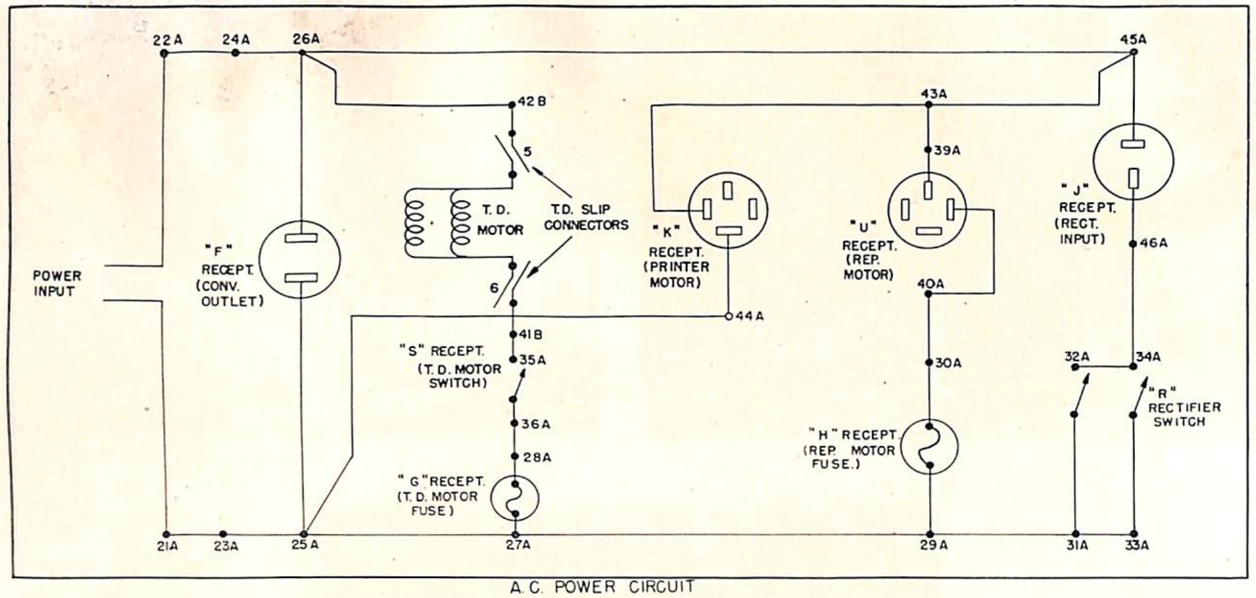


FIGURE 5—*A-c power circuit, showing the receptacles and terminals required to provide a-c power to the motors and rectifiers of the Model 19 teletypewriter. This diagram should be of great value in tracing through the various motor and fuse circuits.*

As noted on the Model 19 composite wiring diagrams found in the instruction books, connections between the table and the M-15 perforator transmitter are made by means of cables and plugs. The signal line connects to the 30 and 40 blocks and the a-c and d-c power connections are tied to the 20 block. D-c current to provide power to the perforator contacts is obtained through keyboard slip contacts 52 and 53.

There are three positions to the keyboard control operating lever. First is the KEYBOARD position, which provides for direct keyboard transmission to the line with a printed record produced on the typing unit. While in this position the perforator control contacts are open, thereby deenergizing the various perforator control circuits. Second is the middle or KEYBOARD-AND-TAPE position which provides for simultaneous direct keyboard transmission to the line and perforation of tape with a printed record being produced on the typing unit.

Figure 6 shows the basic perforator circuit originating at terminals 52 and 53 of the keyboard slip contacts. In the KEYBOARD-AND-TAPE position, only perforator control contacts number 4 and 5 are closed. The cam-pulsing contacts are actuated as a result of their operating spring riding into the indent on two of the transmitting cams. In the third, or TAPE position, only perforation of tape is accomplished, with the associated printer either receiving messages from a distant station or monitoring the perforated tape as it is being transmitted to the line. All perforator control contacts are closed in this position.

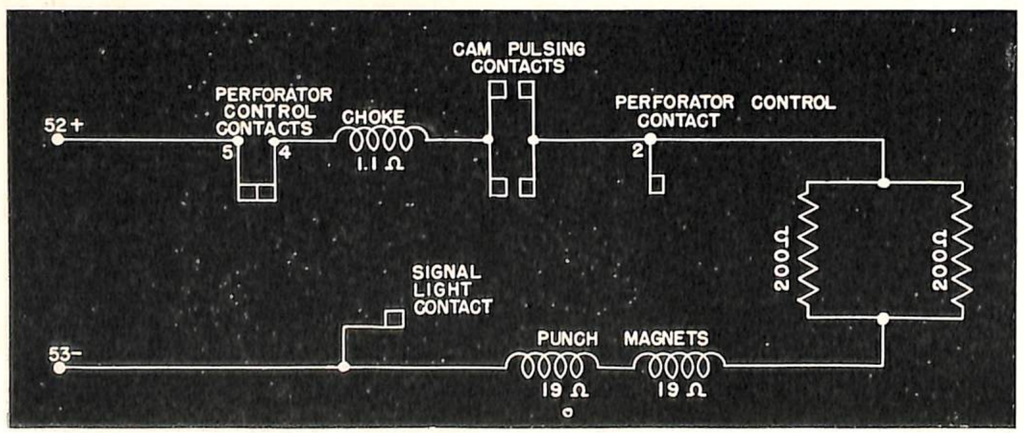
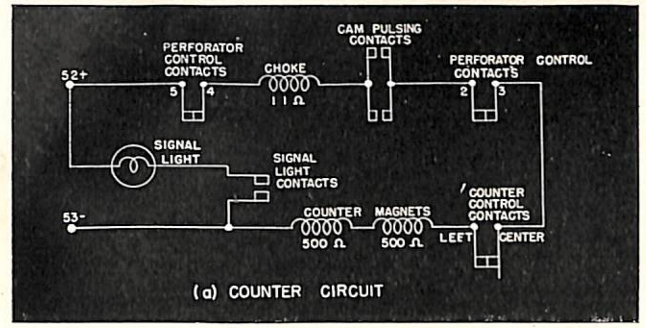
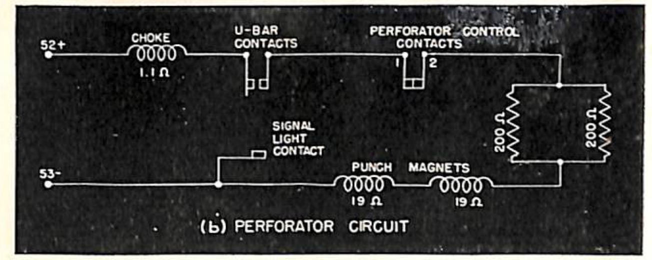


FIGURE 6—*Basic perforator circuit for* KEYBOARD-AND-TAPE *operation.*





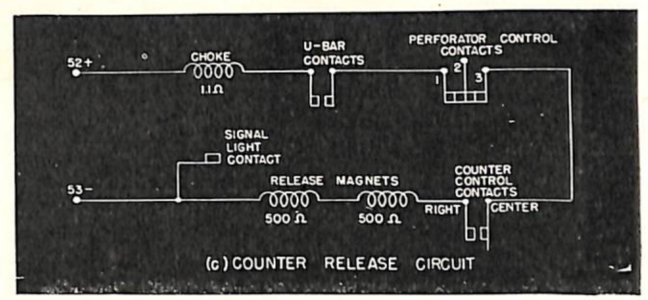


FIGURE 7—*These three separate circuits are established when this keyboard-control operating lever is in the* TAPE *position.*

There are three separate series circuits, each connected to the keyboard slip contacts 52 and 53, when the keyboard control operating lever is in TAPE position. These basic circuits are shown in figure 7. The counter magnets shown in figure 7(a) are energized when the center and left counter-control contacts are closed.

The punch magnets shown in figure 7(b) are energized upon closing of the U-bar contacts. The operation of any key lever, in addition to setting up combinations on the selector fingers, moves the universal selector bar downward. This causes the Y-lever connecting link and the Y-lever connecting link extension to move the upper end of the universal-selector-bar contact operating lever to the left, against the tension of its retractible spring, which will permit the universal-selector-bar contacts to close.

The third series circuit of the keyboard-control operating lever when in the TAPE position is for the counter-ratchet release magnets shown in figure 7(c). When the carriage-return key lever is depressed, the movement of the counter-control mechanism causes the contact operating lever to break the left pair of counter-control contacts and close the right pair. This connects the release-magnet circuits in series with the universal-selector-bar contacts so that the magnets will operate when these contacts close. The operation of the release-magnet armature causes the release lever, which is attached to it, to disengage both the feed and latch pawls from the counter ratchet. The ratchet spring then returns the ratchet to its starting position.

The preceding paragraphs and diagrams have dealt primarily with the perforator circuits of the Model-15 perforator transmitter. There are still five circuits of the machine to be considered when using the line relay. These are the line, common 115-volt d-c power distribution, magnet, bias and shunt circuits. The line circuit is divided in two parts, send and receive, which are actually connected in series at the C block, terminals 1 and 4, in the table, as shown in figure 1. In the standard Model 15, a jumper is placed between terminals 34 and 41 on the printer unit.

The sending line circuit begins and terminates at the 30 (or *send*) block mounted on the right side of the base. This is shown in figure 8. Continuity is obtained when not transmitting by means of the 6th cam, which operates the start-stop contacts.

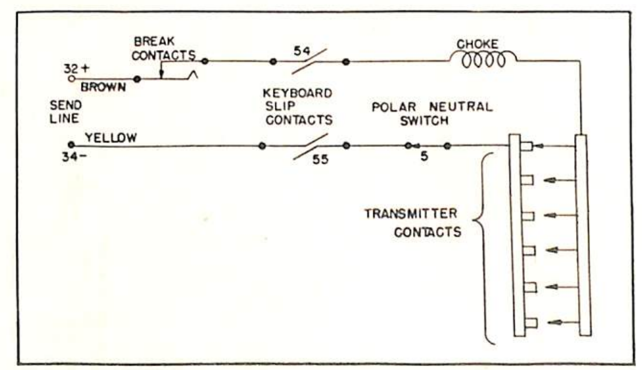


FIGURE 8—*Simplified schematic of sending circuit.*

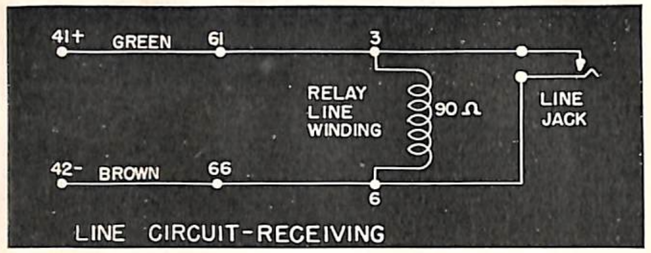


FIGURE 9—*Simplified receiving-line circuit.*

The receiving line circuit, as shown in figure 9, energizes the 3-6 winding of the line relay which, in turn, actuates the marking contacts of the relay. Note the line jack to provide continuity of the circuit when the relay is removed.

The 20 (or *power*) block is the block from which all a-c and d-c power is distributed within the printer. D-c power is distributed from terminals 24 and 25 of this block as shown in figure 10. Note the keyboard slip connectors 52 and 53 to which all perforator circuits are connected.

In addition to the receiving-line circuit shown in figure 9, there are three more circuits through the relay, each beginning and ending at terminals 62 and 63 of the 60 block; they are the *selector magnet, bias,* and *shunt* circuits shown in figure 11.

The first of these, the selector-magnet circuit, is energized by the opening and closing of the relay marking contacts mentioned above. The line jack is provided to close the circuit when the typing unit is removed from the base, thus preventing the interruption of service on the line. The jack is held open when the typing unit is mounted in place. The .25 μf capacitor, 2000-ohm, and 400-ohm series resistors reduce the arcing of the relay contacts.

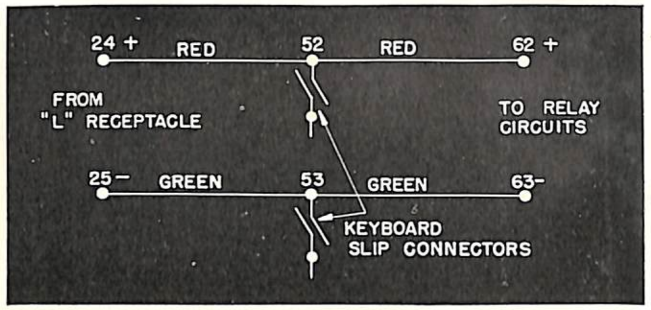


FIGURE 10—*D-c power distribution circuits.*

The purpose of the bias circuit is to ensure that, when no current flows through the line winding, the relay armature will be pulled to the space position, thus removing current from the selector magnets and closing the shunt circuit. A continuous current of 27 ma flows through the bias winding. Note that this circuit operates only when the polar neutral key is in the NEUTRAL position.

The shunt circuit is not considered absolutely essential but greatly increases efficiency of operation. This circuit functions as a voltage regulator in that, during the course of normal operation when current is not flowing through the magnet circuit, the same amount of current flows through the shunt circuit.

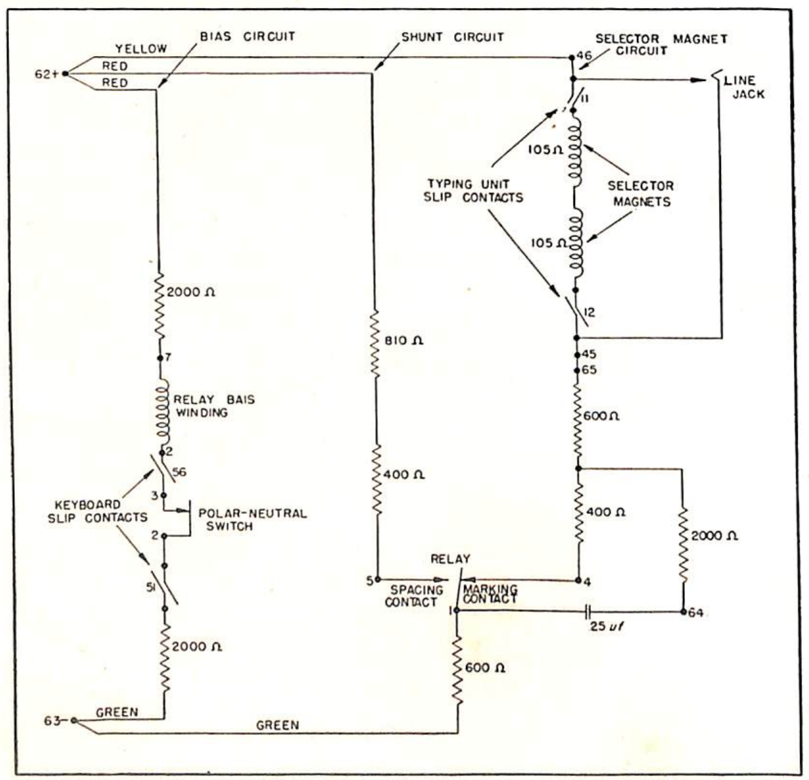
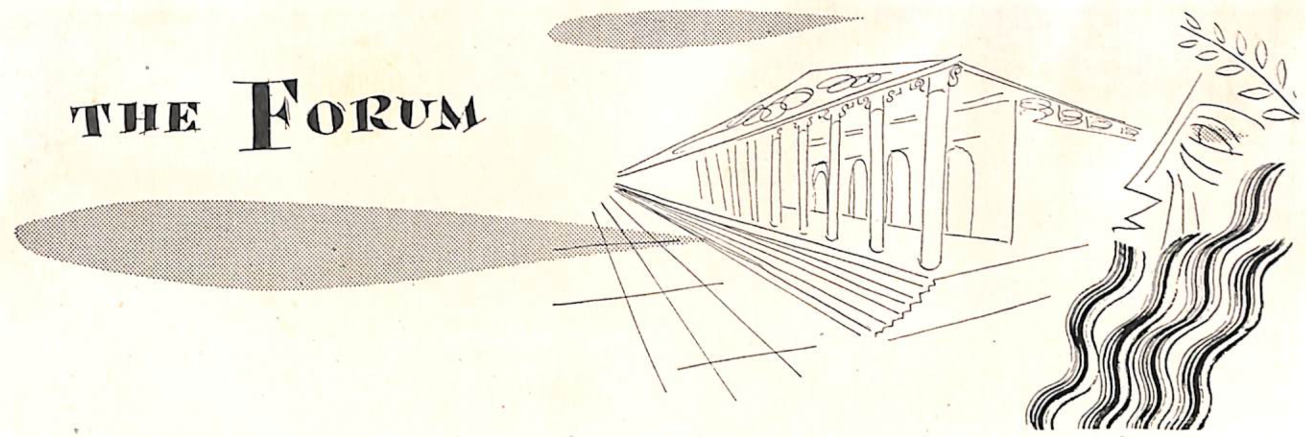


FIGURE 11—*Three separate circuits associated with the relay are connected to terminals 62 and 63.*

THE FORUM



HOME-MADE D/F SYSTEM

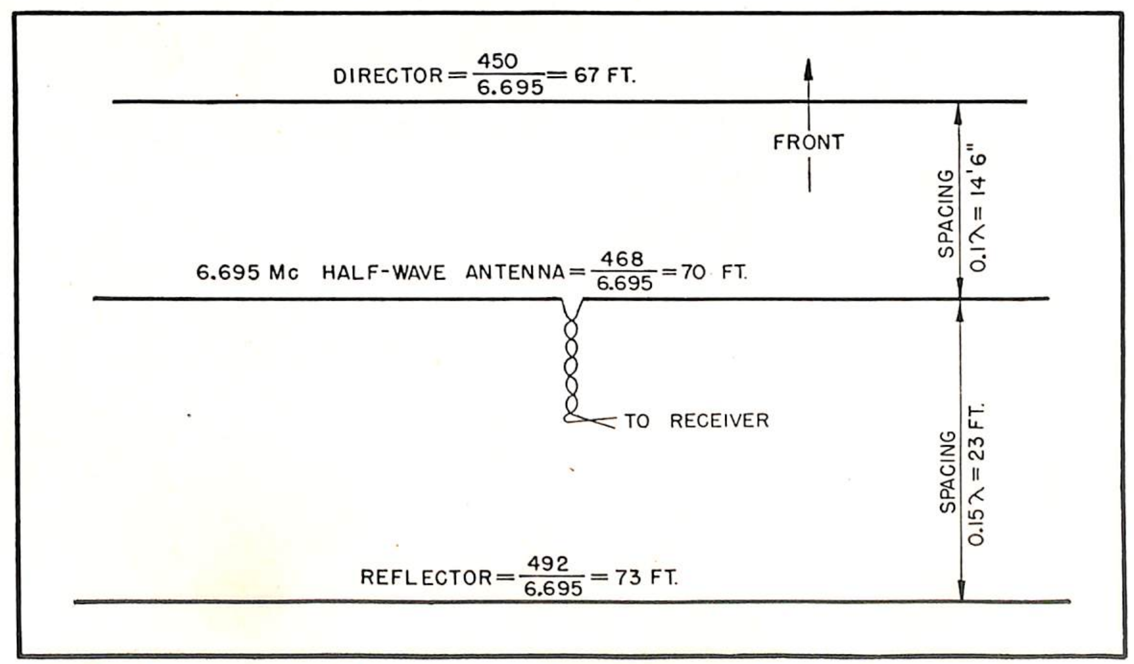
Condensed from a report by

JAMES M. BRUNING, Lt. Comdr., USNR, USS *Tennessee*

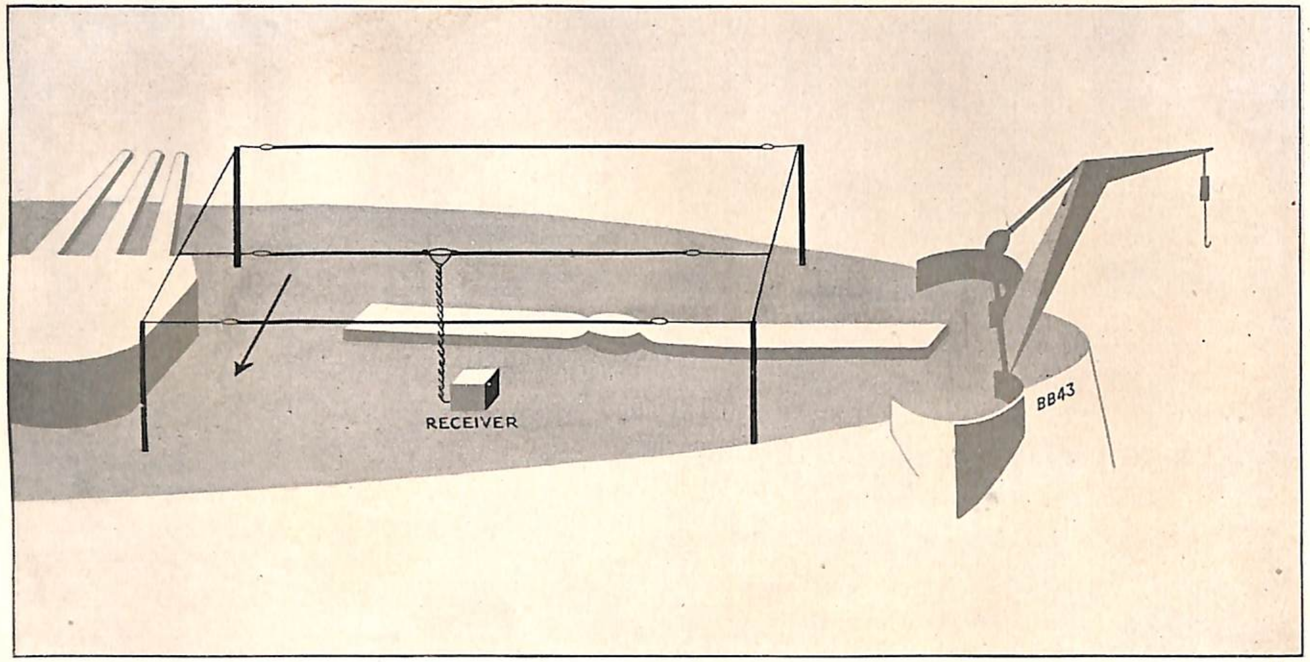
On 6 June 1945 two OS2U planes were catapulted from the *Tennessee* and sent on an extended scouting mission. When the planes attempted to return, they were unable to make visual or radar contact with the task force group and, because of their dwindling gasoline supply, were finally forced to land on the water. Radio contact was established on 6695 kc and the ship informed that they could transmit only on this frequency and would be on the air at intervals until their gasoline was used up.

Since the planes had no D/F equipment, and since there was none aboard ship capable of tuning in their high-frequency transmissions, the only solution appeared to be to improvise a suitable D/F system. There were already a dozen conventional receivers that could hear the signal. The problem was to build a directional antenna system and couple it to one of the existing receivers.

A simple loop antenna could be made and used but without previous calibration and compensation the results would be useless. What was needed was a reception device having dimensions somewhat comparable to that of the topside hamper—at least fifty to sixty feet. That dimension was close to the length of a half-wave doublet antenna for 6695 kc, which is 70 feet. Allowing for supports, insulators, halyards, etc., a clear space about 75 feet long was needed. The radiation pattern from such a half-wave system would be essentially a



Plan view (drawn to scale) of home-made D/F antenna system showing the antenna, director and reflector.



Pictorial view of home-made D/F antenna system installed on the Tennessee, showing location of the array.

figure 8 with maximum reception at right angles to the wire. The addition of a single-wire, parasitically-excited reflector would increase the forward gain and eliminate most of the reception from the back direction. The system would establish the "sense" of the received signal, but the bearing determination would be too broad for accurate work. The addition of a director in front of the receiving antenna would greatly increase the forward gain of the system, and still further reduce pickup from the sides and back of the array.

The total dimensions of such a 3-element array were determined to be 75 by 40 feet, and it would have a forward gain of 6 db over that of a simple half-wave doublet. It would have a front-to-back ratio of over 15 db. There would be only one major lobe to the system, located at right angles to the wires in a plane parallel to them, and the total horizontal beam width at the half-power points should be less than 40 degrees. The broad quarterdeck of the *Tennessee* could accommodate the array. Once installed, it would be too large to be rotated independently, but this could be accomplished by swinging the ship.

By sunrise the next morning a large number of men from the C&R department were already at work rigging up the directional array. The dimensions and general arrangement are shown in the illustration. Twisted lamp cord about a quarter-wavelength long was used to connect the center antenna doublet to an RBC receiver. The twisted-pair characteristic impedance of around 70 ohms formed a not-too-bad geometric mean between the 8-10 ohms impedance of the center-fed array and the receiver input impedance of several hundred ohms.

The pilots were told to call the ship at exactly 1500 and to keep on talking for at least five minutes. When the time arrived and the signals began coming in over the RBC speaker the helmsman begin to swing ship. As each heading was called out, the bearing was jotted down along with the reading of the signal intensity meter on the receiver. A beautiful maximum was swept through and then the signal intensity started to fall off again. Readings were quickly plotted. When the ship's head was 045 true, maximum receiver input was indicated. Since the antenna array was installed facing 90 degrees to the left of the ship's heading, it was evident that the indicated direction to the planes was 315 degrees true.

When the planes were eventually located, a 315-degree line of bearing drawn out from the ship's 1500 position passed right through the spot where the planes were found, 132 miles away from the ship. Sufficient information is not available to determine whether the rescue was effected only as a result of the D/F bearing or through a combination of circumstances. In any event, the fact remains that the bearing turned out to be very accurate.

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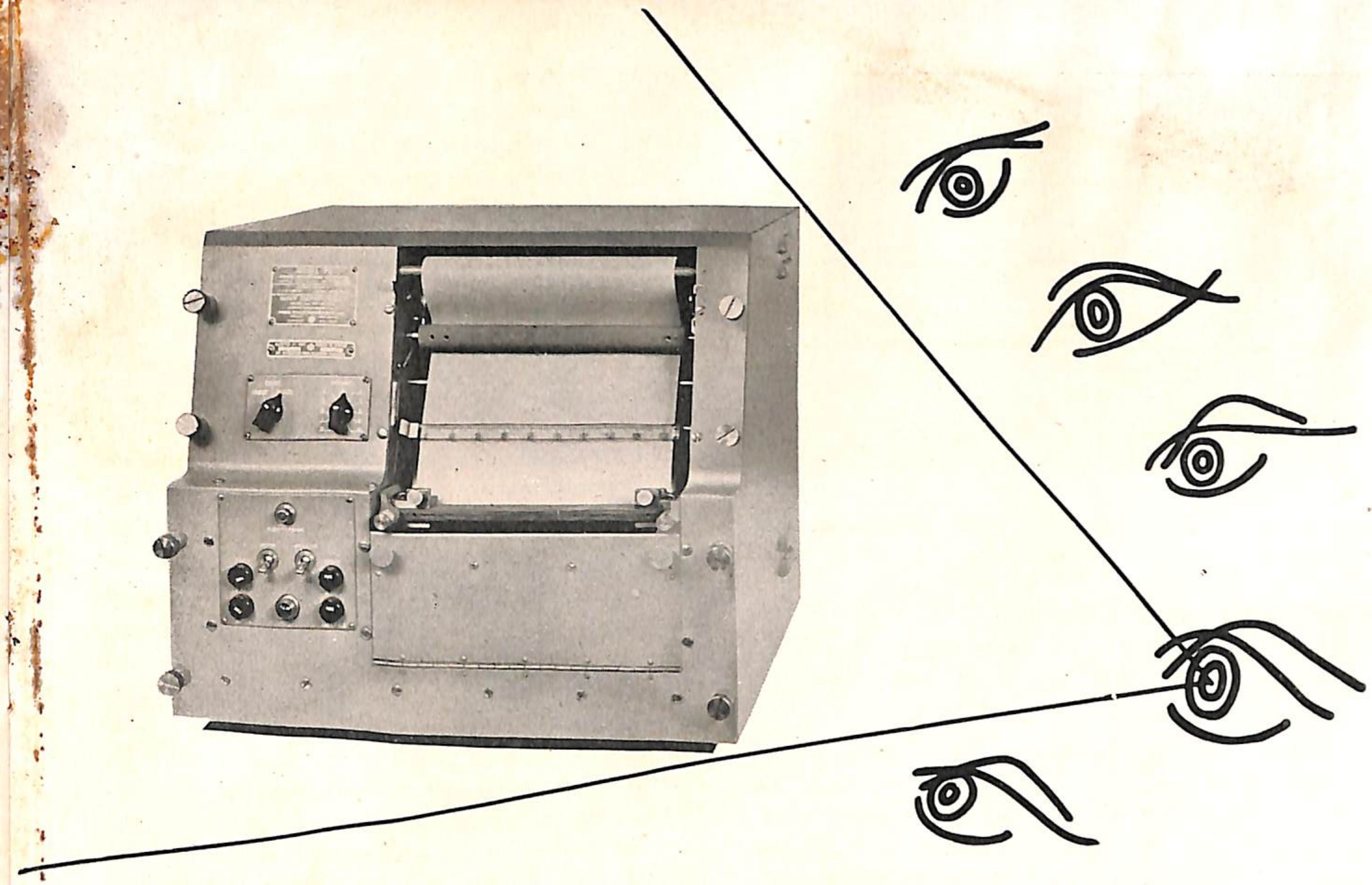
CREDIT

Material for the story "Splicing RG-84/U and RG-85/U Cables" in the October ELECTRON was taken from a report by the Naval Gun Factory, Washington, D. C. Through an oversight no mention was made of the fact that some of the original material for this subject was contributed by Mr. R. J. Violette of the Search Radar Section, Naval Research Laboratory.



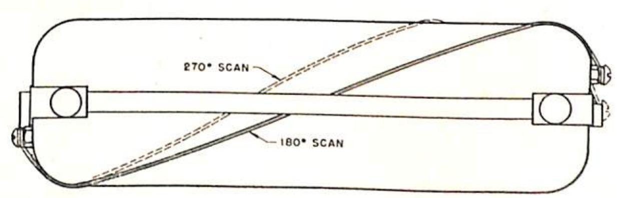
PQ Visual Recorder

■ For the purpose of providing a permanent visual record of the output of models RDC, RDG, and RDH panoramic search receivers, a unit known as the PQ Visual Recorder has been designed and is now appearing in the service. There will be one recorder for each of these receivers, and connection to the associated receiver will be made with a non-critical length of RG-8/U cable.

In the panoramic search receivers the tuning capacitors rotate at a rate of 900 revolutions per minute, thereby tuning the circuit through its entire band 15 times each second. Consequently, any frequency received appears in the output as a pulse which repeats itself 15 times a second. These pulses are fed through the RG-8/U cable to the Visual Recorder where they are first amplified and then recorded. The receiver output of the order of 100 to 150 volts is stepped up by the recorder amplifier which delivers from 300 to 450 volts to the recording mechanism.

The recording mechanism, consisting of a printer blade separated from a spiral point of contact by means of "pyro" paper, is similar to a lawnmower in operation. As shown in figure 1, the contact consists of a wire wound spirally on a rotating drum. As the drum rotates, the point of contact between the printer bar and this spiral moves horizontally with reference to the frame of the recorder.

The pulse from the amplifier is fed to the printer bar, grounds through the pyro paper at the point of contact causing a mark. The density of this mark is proportional to the pulse voltage. If the drum is made to rotate in synchronism with the receiver tuning capacitor it is apparent that the point of contact of the spiral with the printer bar will occur at the same relative horizontal position each time the pulse is delivered.



The printing drum of the PQ looks like a lawn-mower.

The result with the paper stationary would be a series of dots, each one occurring in the same spot. However, the paper is made to move vertically between the bar and drum and the series of dots become a series of

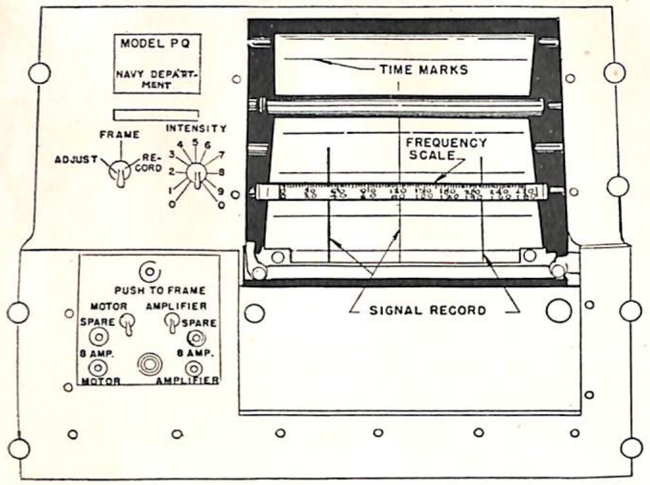


Diagram of the PQ, showing chart with signals and time marks.

closely spaced marks. These marks make a vertical line on the recording paper, the horizontal position being a measure of the signal frequency with the length determining the duration (see figure 2).

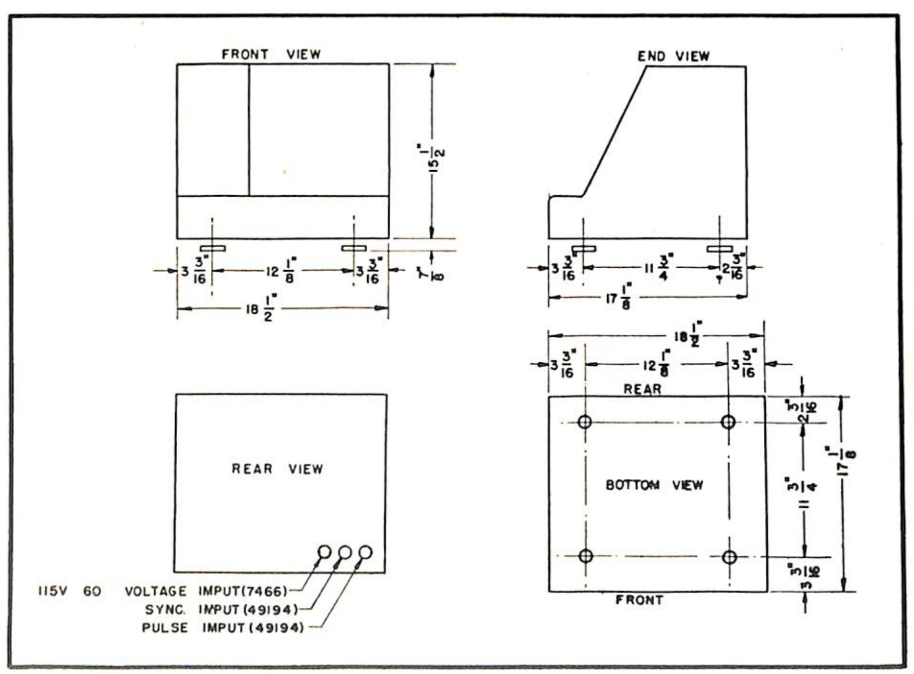
A calibration scale for reading the frequency is provided on the recorder. It is calibrated in two parts, one for 270-degree scanning and one for 180-degree scanning by the receiver. The scale readings may be converted to actual frequency by means of calibration curves which are provided for the various r-f coils in the receiver.

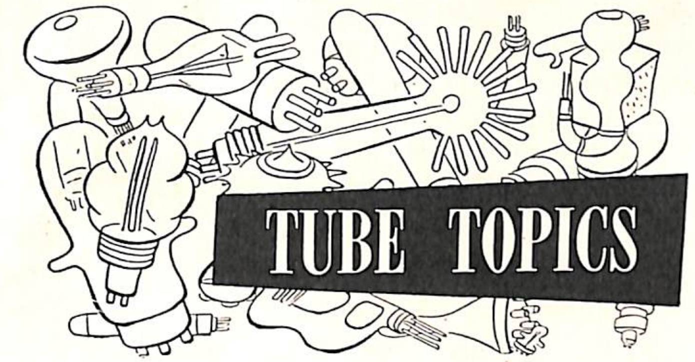
The printer blade is so placed that recordings are visible within a fraction of a second after their occurrence, and the design of the window permits continuous viewing of signals recorded during a period of approximately one minute. Previous recordings may be examined by pulling the paper out from the take-up roller. This roller is driven through a friction drive and geared so that it rotates approximately thirteen times faster than the feed roll. After the recordings have been examined it is only necessary to release the paper and the fast-acting roller will quickly take up the slack. In order that time may be measured, a cam controlled by the line power is provided. This cam makes a horizontal line on the paper every thirty seconds. Since the paper travels at a rate of six inches per minute these lines are three inches apart. By marking any one of these lines with the actual clock time, and using it as a reference, it is possible to determine the time at any part of the record by counting the number of horizontal lines, remembering that they represent thirty-second intervals.

Synchronism between the tuning capacitor in the receiver and the drum assembly in the recorder is achieved by driving each with 1800-rpm synchronous motors. However, these motors are so designed that they will lock-in at eight possible angular positions, and as it is necessary that the scanning period in the receiver coincide with the marking period in the recorder, some indication of their relative position must be available. This is accomplished by sending a synchronizing signal from the receiver at the start of each scan to make a framing mark on the recorder. When this framing mark is at the left-hand edge of the paper the two are synchronized; if not, the recorder motor must be momentarily thrown out of synchronism until the mark moves over to the left edge.

The foregoing description was not intended as an explanation of the technical details of this new equipment, but was given to introduce and illustrate some of its operational features.

Outline and mounting dimensions of the PQ Visual Recorder.



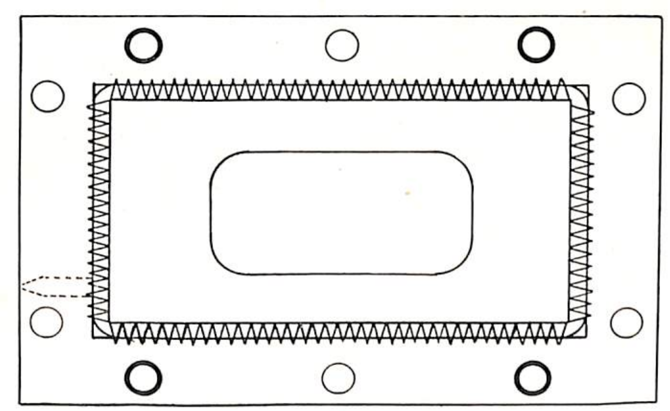


TUBE TOPICS

THE 1B54 PRE-TR TUBE

It should be noted that two different shells have been used in the manufacture of 1B54 pre-TR tubes supplied to the fleet in SG-3, XSG-4, CXHR and SX radar equipments. The original 1B54 tubes had shells made of brass. This design was later changed to steel after it was discovered that the brass-shelled tubes were failing due to temperature cycling. Accordingly, it is recommended that any brass-shelled 1B54 tubes now on hand be removed from active stock and reserved for emergency use only. The two types can be identified through the use of a magnet, since only the steel shells will be attracted to the magnet.

It has also been found that the life of the 1B54 tube can be increased by changing its mounting slightly. This is accomplished by using only 4 of the original 10 mounting holes. The proper holes to use are shown in the illustration.



Details of the 1B54 tube. Only the four mounting holes indicated by heavy lines should be used when installing the tube.

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4C33 TUBES IN THE SR-2

When replacing 4C33 tubes in SR-2 transmitters, the final step of the process is accomplished by rotating the tubes 30 degrees to the left in order to lock them in place. The tubes must fit snugly against the grid-ring fingers and considerable force must be applied in order to lift the detent roller over the locking cam. This force must be applied in such a way as to avoid placing undue torsional strain on the bakelite air ducts. Several failures of these air ducts that have been reported were caused by carelessness when replacing the tubes. To prevent future failures of this type, the tubes should be carefully pushed upward against the grid ring by hand, whereupon they will slide smoothly into the locked position.

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INCREASING THE LIFE OF 2050 TUBES

The AFC circuits of XSG-3 and XSG-4 radar equipments, and of SG-3 radars bearing serial numbers 1 through 9, utilized limiting choke L-229 in the plate circuit of V-220, a type 2050 tube. This choke has proven inadequate for the application. Accordingly, beginning with the SG-3 serial number 10, a 1000-ohm ±10%, ½-watt resistor was substituted for L-229. If you wish to increase the life of V-220, and your equipment still has limiting choke L-229 in the plate circuit of V-220, make this change and record it in the appropriate log.

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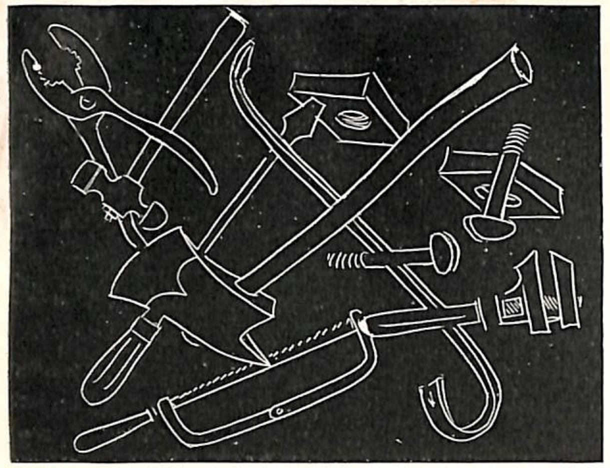
NMC-1/-2 RECEIVER REMOVAL

The NMC-1 and NMC-2 fathometer equipment front panels must swing through an arc somewhat greater than 90° in order to permit the removal of the receiver-amplifier chassis for servicing. This is due to the fact that the manufacturer used a long-type phone jack for J-301 in the equipment. This jack extends into the area that must be occupied by the receiver-amplifier when it is moved forward for removal or servicing.

Since this equipment is usually bulkhead-mounted in an already crowded space, some piece of equipment on the immediate right-hand side generally prevents the front panel from swinging far enough to permit the removal of the receiver-amplifier chassis. Therefore, if the foregoing condition is encountered, the substitution of a short-type phone jack, Navy type 49283 or equivalent, for the one now in the equipment is recommended. Care must be taken in installation, however, to make the correct connections and also to insulate the frame of the jack from the front panel. If the frame of the jack is grounded, only half the output will be heard in either the loudspeaker or headphones. It is suggested that the old insulating grommets be saved and used on the new installation.



TDYA/-1A RECEIVING ANTENNAS

■ Originally, the TDY/-1 consisted of only a transmitting-jamming system. At a later date, modification kits were developed which, after installation, changed the TDY/-1 to TDYa/-1a, and one of the major changes accomplished by this kit was the addition of a receiving antenna. At the present time, however, the high-frequency Model DBM-1 radar direction-finding equipment and antenna, and present modern receivers can perform "receiving" functions for the RADCM system more efficiently than the receiving antenna of the TDYa/-1a.

Since the TDYa/-1a receiving antenna is no longer necessary to the functioning of the RADCM system aboard ship, and consistent with the Bureau of Ships policy of encouraging the reduction of topside weight whenever practicable, it is proposed and intended that the receiving antenna furnished with the Model TDYa/-1a modification kit be deleted from the RADCM allowance of all combatant ships on which the Model DBM-1 radar direction-finding equipment is installed, and the Model TDYa/-1a receiving antenna itself be removed from the mast. It is to be noted, however, that this article does not constitute authority for the issuance of a work order. Removal of this antenna together with its attendant servicing platform and cables from its present location will be authorized in appropriate ShipAlts issued by the Bureau of Ships.

On Model TDYa/-1a pre-production equipments bearing serial numbers 1 through 25, the receiving antenna bears the Navy type number CRP-66AKG. On these equipments the cam and microswitch assembly which permits switching from one transmitting antenna to the other (through operation of the waveguide switch) are located on one of the transmitting antenna assemblies, and consequently do not have to be disturbed when removing the receiving antenna.

On TDYa/-1a production equipments bearing serial numbers 26 through 33, the receiving antenna bears the Navy type number CRP-66ALK. On these equipments, the cam and microswitch assembly is located on the CRP-66ALK receiving antenna and must be transferred to one of the CRP-66AKG transmitting antennas when the receiving antenna is removed if automatic operation of the waveguide switch is to be retained. Actually, this entails interchanging the reflector drive assembly from the receiving antenna with the reflector drive assembly from either of the two transmitting antennas. To accomplish this, it is necessary to completely disassemble the two antennas. The detailed procedure follows:

1—Dismount or uncrate receiving antenna CRP-66 ALK and one transmitting antenna CRP-66AKG and place them on the deck.

2—Remove the turret assembly from the receiving antenna by removing all of the cap screws around the base of the antenna. Tilt the turret assembly and remove the nut holding the reflector in place. Remove the reflector.

3—Remove the top access cover plate. Disconnect the synchro cabling at the terminal strip. Remove the 5/16-inch bolts that anchor the reflector drive assembly to the upper wheel casting. At the terminal strip, cut the microswitch cable at terminals 164, 165 and 166, and then carefully lift the reflector drive assembly out of the turret assembly.

4—On the CRP-66AKG transmitting antenna, open the external cabling access door and disconnect the monitor leads 59 and 60 from terminal strip E-302. Remove terminal strips E-301 and E-302 from their mounting brackets by loosening the captive screws. Remove all of the cap screws around the base of the antenna and carefully separate the turret assembly from the pedestal.

5—Tilt the turret and, while working inside the turret, remove the reflector by taking off the nut on the side of the shaft.

6—Remove the access plate at the top and disconnect the synchro cables from the upper terminal strip. Remove the 5/16-inch bolts that anchor the reflector drive assembly to the upper wheel casting and carefully lift the reflector drive assembly out of the turret assembly.

7—Install the reflector drive assembly removed in Step 6 in the CRP-66ALK receiving antenna. Replace the 5/16-inch bolts and secure. Reconnect the synchro cables to the terminal strip.

8—Tilt the turret and re-install the reflector. Replace the turret assembly on the pedestal and secure it with the captive screws.

9—Repack the CRP-66ALK receiving antenna and add it to stock spares or dispose of it as directed.

10—Scratch the number 65 on marker strip E-302 on the CRP-66AKG transmitting antenna over the terminal adjacent to terminal 64. Scratch the number 66 over the remaining blank terminal on the strip. Make up a three-wire, color-coded, 9-foot 4-inch cable and connect it to terminals 64, 65 and 66 on strip E-302. Run the new cable along the main antenna cable and secure it by lacing the two cables together. Several feet of wire must be left at the top of the antenna for connection to the microswitches.

11—Install the remaining reflector drive assembly (the one having the cam and microswitch bracket) in the transmitting antenna. Secure and reconnect the synchro cabling. Remove the remnants of the old cable from the microswitches. Run a single jumper between one terminal of each microswitch and, using the new three-wire cable, connect this lead to terminal 64 of E-302, connect the free terminal of S-501 to terminal 65 of E-302, and connect the free end of S-502 to terminal 66 of E-302. Dress the three-wire cable and clamp as necessary.

12—Replace the reflector and secure. Replace the turret assembly on the pedestal and install the cap screws. Fasten the terminal strips in place and reconnect monitor leads 59 and 60.

13—Reinstall the CRP-66AKG transmitting antenna and reconnect the external cabling. Pick up two spares in the external cable and connect them to the newly-created terminals 65 and 66.

14—At the CRP-23AHE antenna control unit disconnect the external cabling (if any exists) to terminals 265 and 266 on terminal strip E-202. At the antenna control unit pick up the two spare leads used in Step 13 and connect them as follows: Terminal 65 on E-302 to terminal 265 on E-202, and terminal 66 on E-302 to terminal 266 on E-202.

15—Realign the synchro system and the microswitch cams as outlined in the modification instruction book that accompanies the TDYa/-1a conversion kit.

It has been proposed that a kit composed of a microswitch cable, several Adel clamps and a new marker strip be assembled and distributed. If such a kit is issued in the future, the temporary modification as described above should be altered to include the new parts. To accomplish this it should not be necessary to again dismount the transmitting antenna, as the only new work required will be replacement of the marker strip and cable, and the installation of several Adel clamps. This can be done by working through the top and bottom access doors, making it unnecessary to remove the turret assembly.

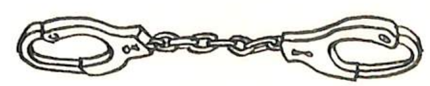
BI-DIRECTIONAL COUPLERS

■ A kit containing two bi-directional couplers has been designed for use with the SP radar equipment. The main advantages derived from the use of such couplers are that they provide the means for making an accurate day-by-day comparison of the transmitter's output power, and provide a more reliable method of matching the antenna to the transmitter.

These couplers are designed to mount on the TR wave-guide section of the SP radar. Due to the great accuracy with which the insertion slots for these couplers must be laid out and cut, and the ease with which the TR section can be injured, it has been decided to issue a new modified TR waveguide section which is slotted and prepared for attachment of the couplers.

All SP radars bearing serial numbers 101 or higher were shipped from the factory with a modified TR waveguide section and bi-directional couplers installed, and a modified TR section in the equipment spares. All SP radars bearing lower serial numbers were shipped with the original TR section and no couplers, and it is desired that bi-directional couplers be installed on these equipments as soon as practicable. A field-change kit has therefore been distributed to the Electronics Officers at the major Naval shipyards. The kit contains all the parts and materials necessary for making this modification, except the modified TR waveguide section (G.E. part No. W-7,351,952-G2) which is government furnished and must be requested in addition to the kit. Accordingly, all ships having a Model SP radar with serial number 1 to 100 inclusive should request both "Field Change No. 59-SP" and a modified TR waveguide section (G.E. part No. W-7,351,952-G2) at their first availability, from the Electronics Officer at any major Naval shipyard.

Since there are not sufficient modified TR waveguide sections available to permit the distribution of one with each field-change kit it is necessary to obtain additional sections from those ships which now have them in their equipment spares. In view of the fact that the Bureau does not consider these sections as expendable items, ships should not hesitate to relinquish them. Therefore it is requested that all ships having an SP radar bearing serial 101 or higher remove the modified TR waveguide section from their equipment spares and ship it to the Electronics Supply Branch, Naval Supply Depot, Oakland, California. The TR section should be well packed to protect it from damage, and clearly marked "TR waveguide section to be held for issue with Field Change No. 59-SP."



ARCING IN SR-2 RADARS

■ Failure reports from vessels equipped with Model SR-2 radar equipments indicate that r-f arcing in the transmitter unit is causing considerable trouble. This arcing is of two types, power arcing and grid-ring arcing.

Power arcing is encountered when the equipment is operated with excessive plate voltage on the 4C33 tubes. It usually occurs in the oscillator circuit, and results in a breakdown between the antenna coupling loop and the plate of the righthand 4C33 tube (as viewed when facing the transmitter). Serious damage to the equipment may result if this type of arcing is allowed to occur frequently. Holes may be burned through the glass of the 4C33 tubes at or near the plate seal, thus destroying the usefulness of the tubes, or damage may be done to the modulator circuits.

Power arcing can be detected in several ways. Loud pops and singing noises can be heard, or flashes can be seen through the tube access door. Bright railings and hash appear on the monitor scope in the transmitter and on the *A* scope in the indicator console.

Experience has indicated that approximately 6.5 kv is the maximum plate voltage that can be applied to the 4C33 tubes without danger of arcing. In order to eliminate arcing due to excessive plate voltage, it is suggested that plate transformer taps be disconnected from the stepping relay in such a manner as to limit the maximum voltage to approximately 6.5 kv.

This can be accomplished by removing the leads from taps G-38, G-39, G-40, and G-41 on transformer T-2302. Next, tape these leads together, being careful to insulate them from possible contact with the transformer case, and tuck them away under the main cable to prevent whipping or motion under conditions of shock and vibration. Now remove the leads from taps G-38, G-39, G-40 and G-41 on relay K-2302. Tape the ends and tuck them away neatly. Finally, connect a length of tinned bare copper wire between terminals G-38, G-39, G-40, G-41 and G-42 on relay K-2302 so that all these terminals are shorted together and connected to G-42.

Now, operation of the RAISE push button on either the transmitter or the indicator console will allow voltages up to approximately 6.5 kv, in four steps, while further depression of the button will cause no additional increase in modulator voltage.

Power arcing can also be eliminated or lessened by carrying out several other corrective measures. One of these is to carefully tune the cathode and load stubs to the position of best operation. Another is to check to ensure that the dehydrator and the compressor which pressurize the coaxial cable and the antenna system are operating properly. Should moisture seep into the system at any point, proper loading of the transmitter may become impossible.

In the case of installations where antennas are located near large masses of metal (such as the ship's mast or other obstruction) so that at one or more points energy from the antenna is directed squarely into the mass of the metal, reflected energy may upset the antenna loading sufficiently to cause power arcing within the transmitter. Ship personnel are cautioned against operating the equipment with the antenna stationary in those positions that cause trouble. This danger can be eliminated by reducing the modulator voltage and accepting the resulting slight sacrifice of range.

Several methods of eliminating grid-ring arcing are currently being investigated by the Bureau of Ships. One of these, a new type grid-ring contact, is undergoing laboratory tests. Progress along these lines will be reported in future articles.

RADIO SONDE INTERFERENCE

■ During recent months, several cases of interference in RAU-series Radio Sonde equipments have been reported to the Bureau. Several ideas were suggested and these along with some practical pointers are passed on for further use. It must be remembered, however, that each case of interference should be checked very carefully before taking any of the recommended steps, as few of the cases are similar.

The AN/ARC-4 transmitter employes several frequency-multiplication stages, and signals of approximately 72 Mc find their way from these stages into the ARC-4 antenna and are radiated, causing interference. This interference may be reduced or eliminated by the insertion of a wave trap in the transmitter, the trap being tuned to about 72 Mc. The type of circuit used must be determined by the selected location. In general, series-resonant traps having the highest possible L-to-C ratio should be used across high impedances (as across a tank circuit) and parallel-resonant traps used in series with low-impedance loads (as in series with a coaxial line to an antenna). It must be remembered that the radio sonde receiver is of the super-regenerative type and, in common with other receivers of this type, tunes broadly and will accept strong signals over a considerable frequency variation from the nominal 72.2 megacycles. Consequently the interfering signals will not necessarily be exactly on this nominal frequency.

In the case of the TBY, MBF, and TBS equipments which operate on 72 megacycles, there is nothing much to do except to secure them when the Radio Sonde is in use.

The TBL operating frequency of 9320 kc has an eighth harmonic (74.56 Mc) that may cause interference if the balloon transmitter frequency is off its nominal value in the direction of the higher frequencies and the harmonic is strong enough to enter the broad super-regenerative receiver.

Other bad sources of interference in radio sonde equipments are electrical devices such as motors, generators and, especially, portable tools. The noise from the portable tools may be reduced by inserting a pair of capacitors in series across the power line and connecting the common wire to the frame of the tool. For the permanently installed devices, pi-section filters are recommended. Maintenance work on the units may reduce the interference, but for complete suppression it will be necessary to install the filters. For a description of these filters and details for their installation consult the "INT" section of the Communication Equipment Maintenance Bulletin.

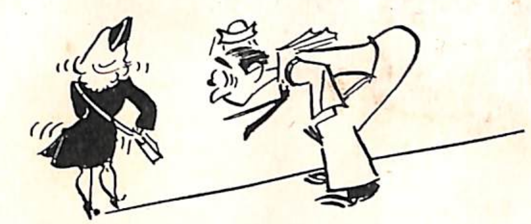
Ignition noises from gasoline engines may also cause trouble, but interference of this type may be suppressed by the use of shielding harnesses.

Interference produced by the low-frequency radars (SA, SC, and SK) can be eliminated by the use of a type 53153 filter which is described on page "INT:4" of the C.E.M.B.

Fortunately, the higher-frequency radars, such as the SG, do not generally interfere with the radio sonde equipment.

By making use of the above suggestions it is usually possible to reduce the radiated noise field to less than 5 microvolts per meter at a distance of 3 feet from the noise source, and to reduce the noise fed into a power line to 5 microvolts. These figures should be obtained over a frequency range of 150 kc to 225 Mc.

It is recommended that radio sonde equipped stations and vessels report all cases of interference on the NBS-383 failure report card or by special letter. If the foregoing suggestions do not remedy the situation a statement should be included in the report to that effect. Electronics Officers should install the type 53153 filter on all Radio Sonde receivers within their jurisdiction.



SX ROTATING WAVEGUIDE

■ The preliminary instruction book for the SX radar equipment (Ships-379) does not contain a procedure for aligning the scanner nozzle of the rotating waveguide section of the equipment. The following procedure, however, will be in the final instruction book for the SX radar:

Place the SX in operation, but remove power from the amplidyne so that the scanner motor cannot run. Place a 0-100 volt d-c voltmeter across terminals E-3407-1 and E-3407-4 (ground) in the antenna control unit to measure the sweep voltage, and an 0-150 volt d-c voltmeter across terminals E-3407-2 and E-3407-4 to measure the blanking voltage.

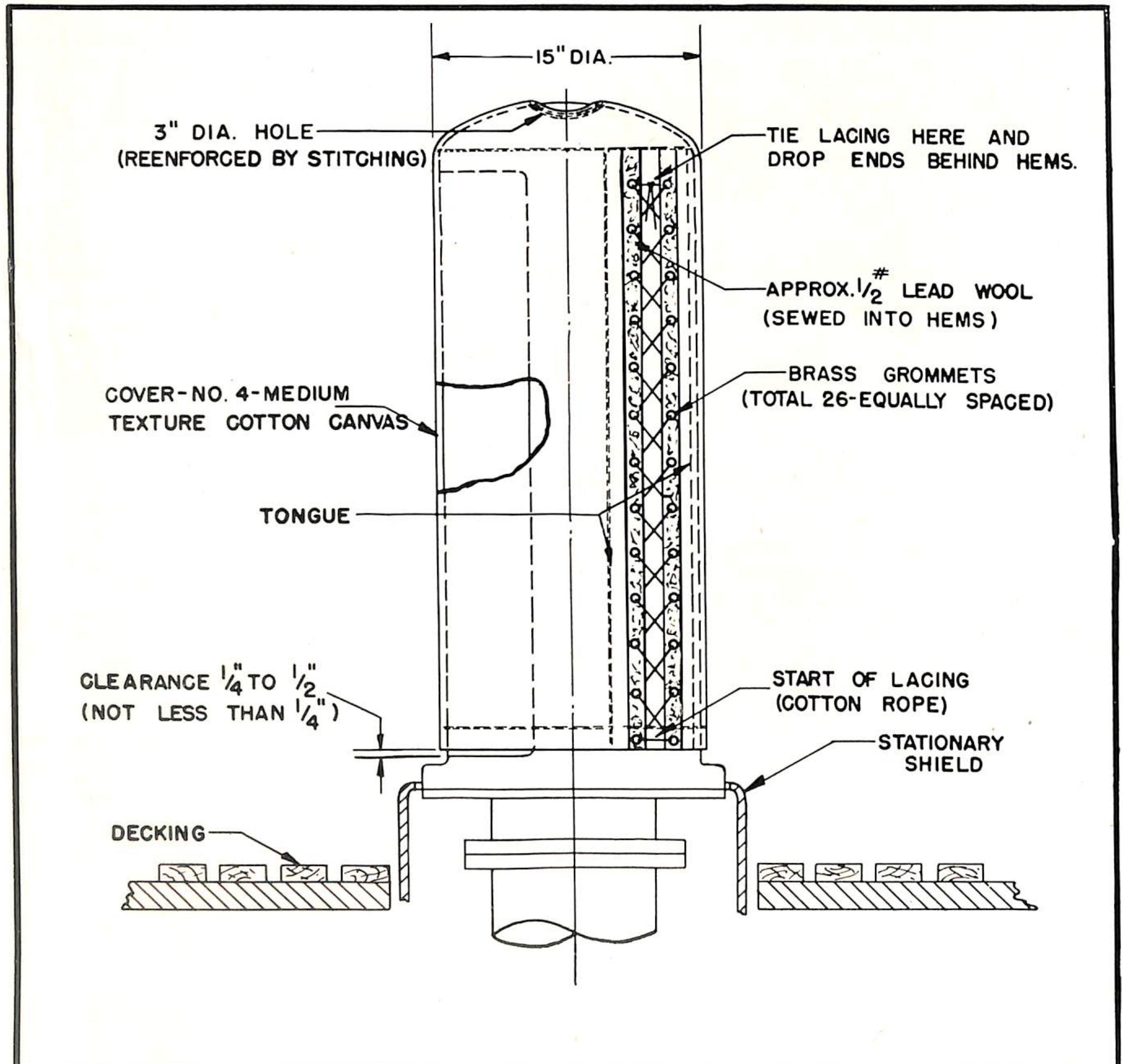
As the elevation handwheel is turned in a clockwise direction, the sweep voltage should rise slowly to a maximum, and then drop rapidly to a minimum. The maximum sweep voltage should be adjusted to 55-65 volts by varying C-3407, and the minimum to 0-5 volts by adjusting R-3411.

The gears under the front panel of the antenna control unit should be meshed, and the commutator in the rear of the unit adjusted so that the sweep voltage is maximum at 11 degrees on the dial and minimum at 0 degrees. The blanking voltage should jump to 100 volts at 11 degrees, drop to 0 volts at 0 degrees, and remain at this value from 0 degrees to 11 degrees. Now C-3407 and R-3411 should be readjusted to give a sweep voltage of 44 volts at 8 degrees, and 0 volts at 2 small divisions before 0 degrees in the red portion of the dial.

With power now applied to the amplidyne, the 5HG synchro in the Robinson horn should be adjusted by setting the elevation dial in the antenna control unit at 0 degrees, and turning the synchro so that the rotating waveguide is on the edge of the crossover region in the horn. This region can be identified by the "squealing" noise made by the r-f power going into the resistance material. It should be noted that the waveguide should not be left in this position any longer than necessary. Turning the elevation dial to $\frac{1}{2}$ degree should eliminate this squealing. If the squealing is still heard, the 5HG has been aligned on the wrong side of the crossover region. Therefore, repeat this part of the alignment procedure, but turn the rotating waveguide to the other edge of the crossover region.

CANVAS TRANSDUCER COVERS

■ WFA and WFA-1 submarine sonar equipments use the type CBM-78246 rubber deck transducer. To protect the present natural gum rubber of the topside transducer from the harmful effects of sunlight, canvas covers have been designed and authorized, and will be used until a suitable protective paint or a new rubber-type covering can be developed. These covers must be short enough to prevent them from jamming the transducer rotating mechanism, and long enough to leave no more than 1/4 inch of the sound-transparent rubber window exposed. When conditions permit, however, it is preferable to cover the entire window. When making the covers, all seam material should be folded over so as to lie on the outside of the cover, away from the surface of the transducer, so that the folds cannot press against the rubber covering of the transducer.



Details of canvas cover designed to protect the natural gum rubber covering of the WFA/WFA-1 topside transducer from the harmful effects of the sun.

TBY STORAGE BATTERIES

■ The type 19018 battery power pack used with TBY radio equipment is rapidly becoming a very scarce item. Present supplies are being depleted and no further procurement is contemplated at this time. The bureau has a replacement available but it is suggested that all activities make use of the method outlined in the Communication Equipment Maintenance Bulletin, page TBY:1, and extend the life of the batteries now on hand. It has been reported that this method sometimes doubles the battery life.

The replacement equipment consists of a type CLG-19029 portable non-spill storage battery, a CLG-20144 vibrator power unit and a CLG-20145 battery charger. The vibrator power unit and battery are interchangeable both mechanically and electrically with the type 19018 dry-battery pack. These replacement units are obtainable as shown in the following list. This list contains the latest available information and is published only as a guide.

Activity	QUANTITIES		
	Type 19029 Battery	Type 20144 Vibrator	Type 20145 Charger
NSD Mechanicsburg	..	163	82
NSD Bayonne	1	1	68
NSY Boston	0	132	5
NSY New York	7	11	2
NRB Nola	25	32	0
IndMan 9th ND	14	7	4
Balboa	65	43	6
Radoak	206	91	9
NSD San Diego	..	82	30
NSD San Pedro	261	46	..
NSY Mare Island	257	62	30
NSY Puget Sound	201	167	40
NSD Clearfield	45	..	202
NSY Pearl Harbor	221	0	27
NSY Carleston	135	..	..

The battery is shipped in a dry, partially-charged condition, and electrolyte must be added before it is used. When first filled it may show near full charge by specific gravity test or by voltage test with a high resistance voltmeter. However, it is not capable of delivering its rated current until it has been cycled by charging and discharging several times. It may be tested by using it in place of a properly operating battery.

Low output or intermittent operation of the vibrators often indicates low battery voltage and a need for recharging. It is essential that the battery never remain in a completely discharged condition for more than 24 hours before recharging if satisfactory life is to be obtained. Lack of proper attention greatly reduces the life of any storage battery.

Batteries should be checked at least once every thirty days during storage, or other inactive periods, for state of charge and electrolyte level. Booster charges should be given to return the battery to a fully charged condition every thirty days, or more often if the specific gravity falls below 1.180.

The instruction book advises leaving the battery attached to the vibrator for emergency charging from another storage battery but this practice is not desirable as a routine procedure. The fumes which escape from any battery while charging would in this case eventually cause corrosion of the vibrator pack parts. If the battery is disconnected from the vibrator power unit in order to be charged from a 6-volt storage battery, or from the CLG-20145 charger, proper polarity must be observed.

On shipboard installations the use of type CLG-20206 110-volt a-c or d-c vibrator power packs is recommended. These units are available and should be used whenever possible.

All failures and derangements to these units should be reported immediately to the bureau on NBS-383 failure report cards. These reports will enable the bureau to prepare trouble shooting notes, correct design defects, and provide necessary spare parts.

DBM-1 ANTENNA LOCATION

Repeated requests from the field for information invite attention to the fact that the high- and low-frequency antennas of the RADCM Model DBM-1 radar direction-finding equipment have been more or less haphazardly installed aboard ships. The location of these antenna assemblies is very important, as the efficiency of the Model DBM-1 depends upon the efficiency of its antenna system. Consequently, the following suggestions are offered for information and guidance in planning installations for these antennas.

When selecting the antenna location, it should be understood that the antennas should be mounted as high as possible, and as far as possible from obstructions which would distort the antenna pattern. This means that the ideal location is atop the highest mast on the ship.

Any metal object in the same plane (at the same height as the antenna or close to it) will distort the antenna pattern. The amount of distortion caused by surrounding metal objects or obstructions will depend primarily upon two things, the size of the object and the nearness of the object to the antenna. The size of the object, whether it is a mast or some other obstruction, will decrease the intensity of the signals received through it; i.e., signals from the direction of the obstruction will be attenuated. The obstruction also will cause distortion of the antenna pattern by reflecting the signals from some other direction into the antenna, giving false or distorted indications of bearing.

In view of these facts, the low- and high-frequency antenna spinners should be mounted on a bracket that extends as far as possible from the mast. The antennas should be mounted much higher than the level of the stacks. If this is impractical, the antennas should be mounted as far aft as possible in order to reduce the effects of the stack, bridge and mast, together with the multiplicity of wires or stays around them.

When mounted on a single bracket on the mainmast, the low-frequency antenna should be spaced about seven feet from the mast, and the high-frequency antenna should be mounted about four feet from the mast. These distances are correct for a 10-inch mast; for a larger mast the distances should be increased. If the antennas are mounted on separate brackets, the low-frequency antenna spinner must be given the better of the two locations.

It is not necessary to mount the spinners together. Distortion from obstructions, however, is more pronounced in the case of the lower frequencies. If there are two different proposed antenna sights, the low-frequency antenna must therefore be mounted in the better location if the two proposed antenna sites are not equally favorable. The service rail on the mounting bracket should not project beyond the level of the bottom of the radome. Also, the antennas must not be mounted in the draft of the ship's stack, as overheating of the drive unit may result with consequent failure.

In all cases where these antennas are installed, it is requested that the low-frequency antenna be located at least two feet above the high-frequency antenna, thus obtaining for the low-frequency antenna a clear train of arc of 360°.

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SU/SU-1 GYRO CONTROL BOX

Ships-313-1 is Supplement No. 1 to Ships-313 (instruction book for Model SU radar equipment) and has been prepared to assist naval repair activities in making routine tests, repairs, and balancing adjustments on the gyro control box of the antenna stabilizer. This supplement is now available and may be obtained upon request to the nearest Electronics Officer.

The requirements for servicing the gyro control box are that a workshop be maintained free from moisture and dust, that a device be supplied for simulating the roll and pitch of a vessel, and that the services of a skilled precision instrument mechanic be available.

Because of these requirements the original Model SU/SU-1 contracts provided for the shipment of defective control boxes from naval repair activities to the manufacturers. However, since these contracts and their guarantee have expired, it will be necessary for the Electronics Officer of each shipyard to make the necessary provisions for servicing and adjusting these gyro control boxes in accordance with the methods outlined in Ships-313-1. These special facilities are available in the gyro compass repair shops at all naval shipyards.

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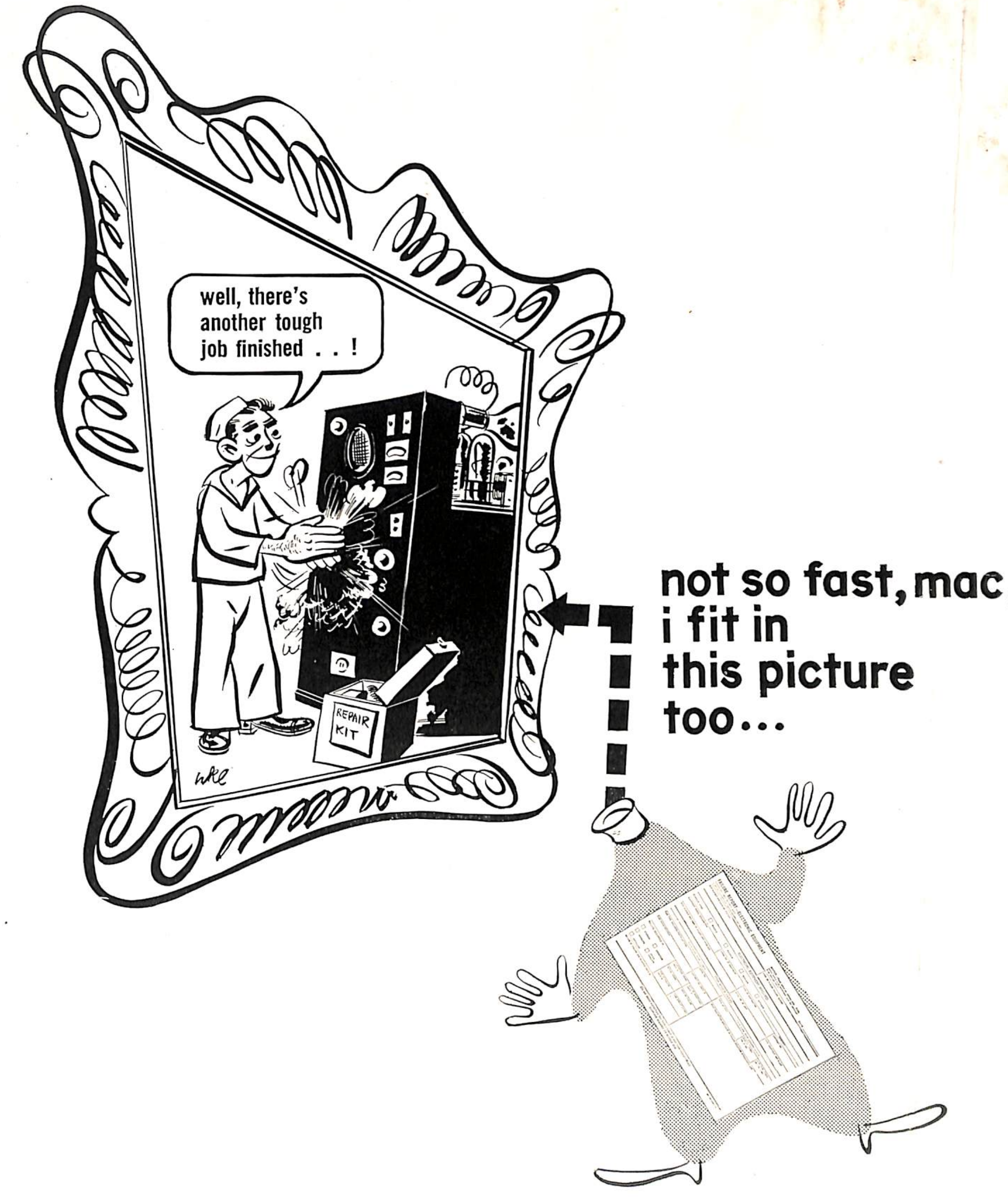
SONAR TRANSDUCER REPAIR SERVICES

It has been called to the attention of the Bureau of Ships that some Naval activities are still shipping sonar transducers to the Western Electric Company's Hawthorne Plant, Chicago, Illinois for precision repairs. This practice should be discontinued, since the repair contracts with this plant have expired. In the future, when sonar transducers require the manufacturer's services for precision work, the matter should be referred to the Bureau of Ships.



MAYBE WE CAN GIVE YOU A HAND

Write up your troubles and send them to ELECTRON magazine. If you have no troubles, write us anyway, giving us the details on how you solved a particularly difficult problem on your ship. Through the pages of ELECTRON we will pass the information on for the benefit of all.