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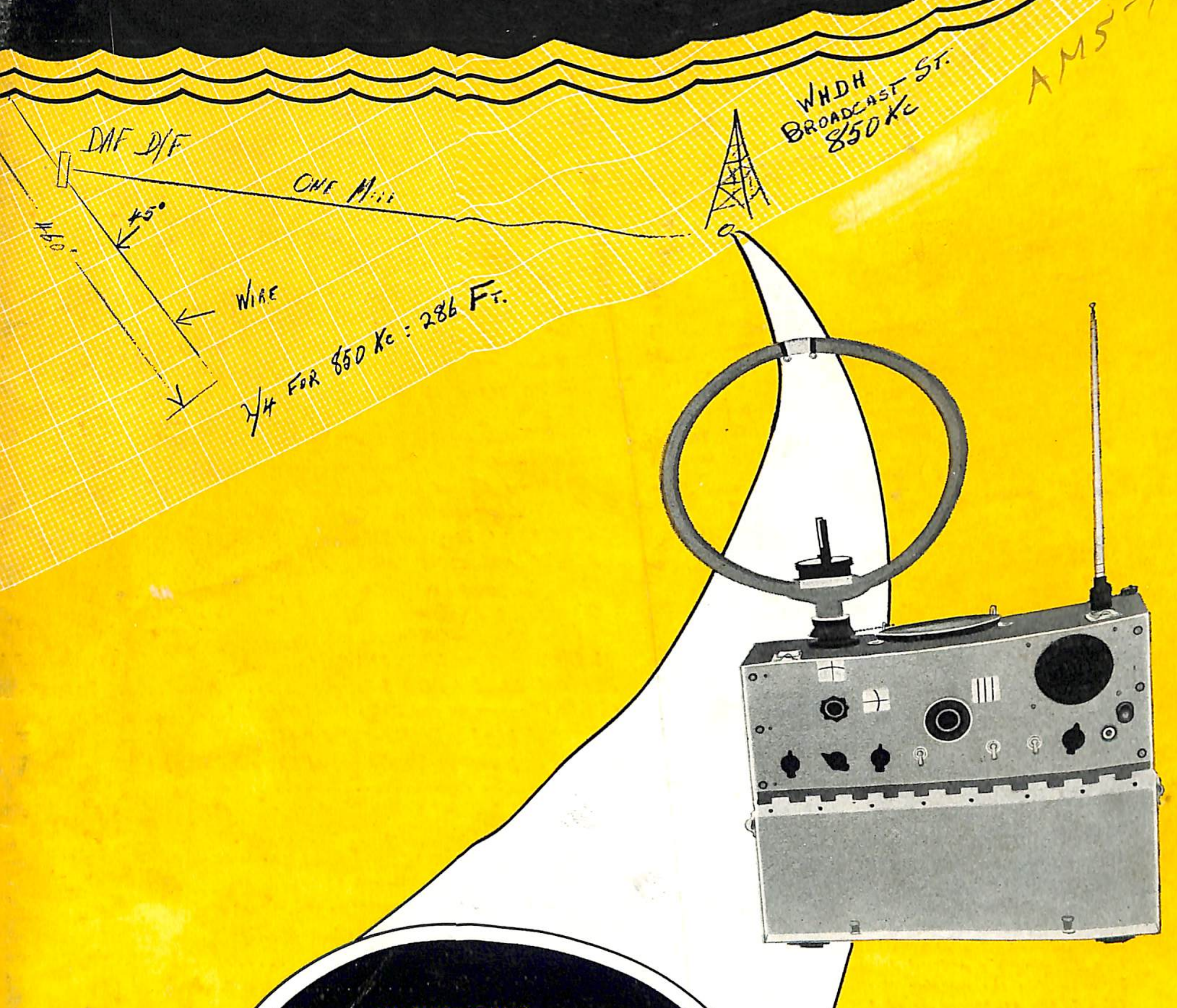

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IN THIS ISSUE...

ANALYSIS OF RESONANT METALIC STRUCTURES UNDERGROUND

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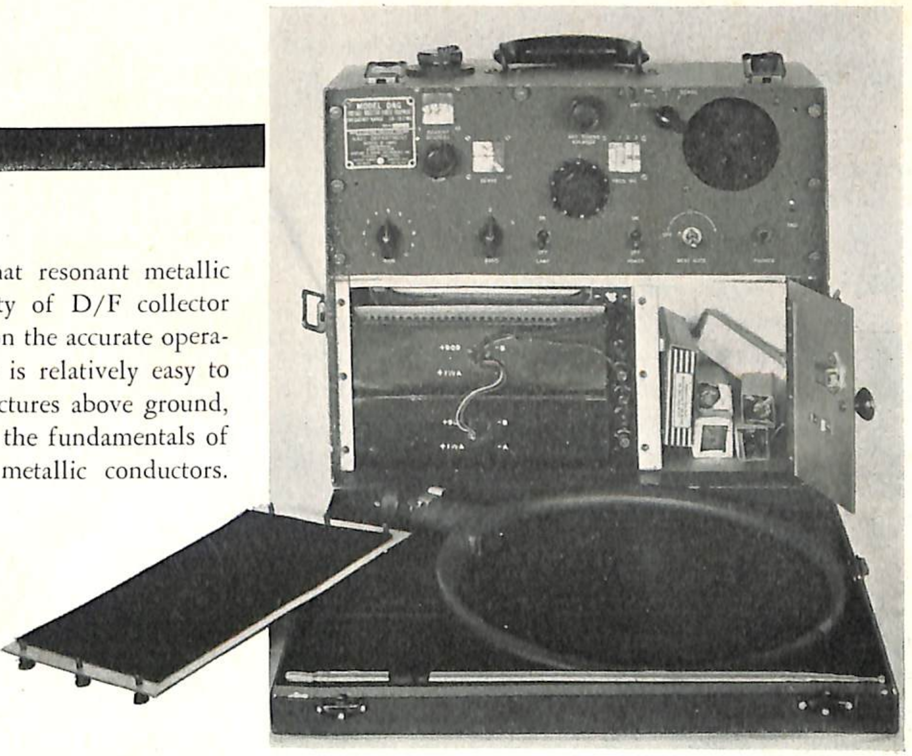
analysis of resonant metalic structures underground

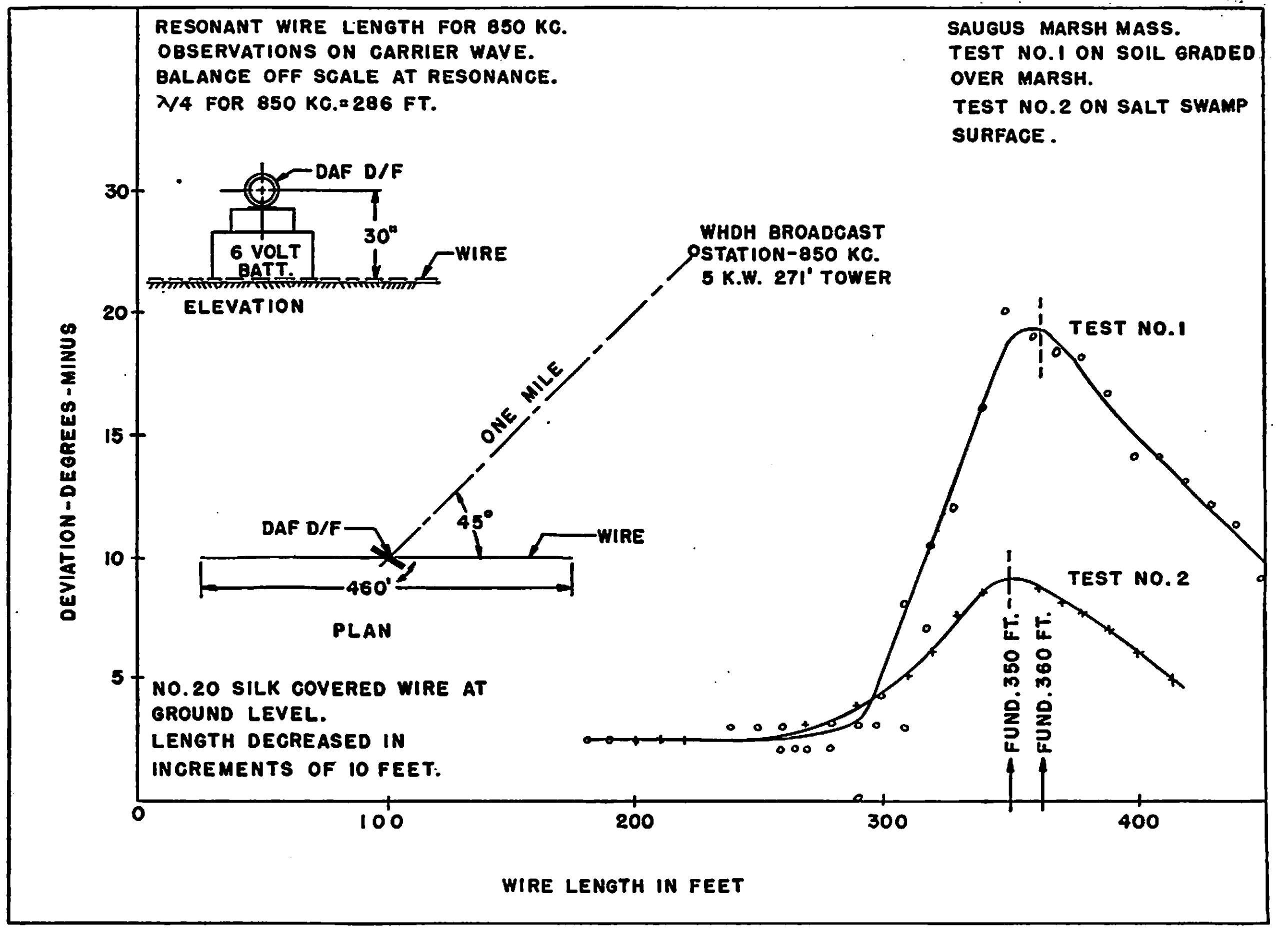
by
E. J. Pilkington
Electronics Office, Boston Naval Shipyard



MODEL DAG
D/F EQUIPMENT

Introduction

It has been known for years that resonant metallic structures in the immediate vicinity of D/F collector systems have a deleterious effect upon the accurate operation of D/F equipment. While it is relatively easy to determine the fundamentals of structures above ground, it has been a problem to determine the fundamentals of below-ground or water-immersed metallic conductors.



Graph No. 1 shows the results of tests to determine the fundamental frequency of an insulated wire at ground level on a salt marsh. (Saugus Marsh, Lynn, Mass.)

The high r-f attentuation of buried or submerged wires and cables has made it impossible heretofore, to make even an approximate measurement. By using a portable battery-operated loop D/F receiver in conjunction with a target r-f oscillator, a sensitive method has been devised to accomplish this work simply and expeditiously.

Facts Bearing on the Problem

That a wire magnetically linking vertically to a D/F loop had a quadrantal deviation characteristic, has been known for some time and the principle has been used at old Navy navigational D/F stations to cancel deviation due to geological irregularities. This quadrantal principle is also used to obtain variable coupling between wire and loop for measurement purposes.

Narrative of Original Work

This writer is not cognizant of any of the outlined measurements having been made in a similar manner by any one else. The first attempt to measure the fundamental period of an underground communication cable by channging the length of it in increments and noting the resultant change in observed bearings on fixed transmitting stations was made, approximately, in 1936 to 1938 and reported to the Bureau of Ships. Another attempt was made in 1939 at the Naval Shipyard, Boston, to measure the fundamental of the hull of a destroyer, using the same methods described in this report. Due to lack of sufficient range of the ship's Model DP D/F, the frequency at which the vessel's hull resonated could not be reached. Another attempt, in 1943, at measuring the fundamental period of a submarine at the South Boston Naval Shipyard Annex was made with some success. Both these tests were never reported to the Bureau of Ships.

Methods of Measurement

The method used in obtaining data for this report when measuring surface or underground conductors is as outlined below:

1—With a horizontal metallic path surfaced or buried, set up portable D/F and oscillator as shown on Graph No. 4.

2—Locate, in a fixed position, a target oscillator along an axis of maximum deviation about 200′ to 300′ distance. The 0°–180° on D/F scale is lined up with axis of wire.

3—Vary target oscillator in frequency increments, taking an observed bearing on the D/F each time.

4—Compute the deviation-difference between each observed bearing and the relative bearing of the fixed oscillator. Whether the deviation will be positive or negative will depend along which one of the four axis of maximum deviation the test is being conducted. This deviational sign is an indication that correct coupling between wire and loop is taking place and that the set-up is functioning properly.

5—Coupling between wire and loop may be varied by increasing or decreasing the vertical distance between loop and wire or replacing the target oscillator to the right or left ten or twenty degrees (D/F scale reading) of the axis of maximum deviation. Also, with the D/F loop located at the center, maximum current coupling is obtained at its resonant period. Moving the loop receiver toward either extremely reduces this coupling.

—Vertical antenna radiators should be used with the target signal oscillators—such as those used on the Model OAN (L. F.) and the CFT52300 (H. F.).

7—An untuned or aperiodic loop D/F circuit is desirable for these tests, similar to that of the Model DAG–1 D/F.

Data Obtained

All data of a pertinent nature is depicted in the Graphs accompanying this article. Other data such as logged observed bearings, etc., have been omitted.

Discussion of Probable Errors

The frequency settings of the two oscillators used in these measurements were determined by the calibrated tuning dials of the respective equipments and are within plus or minus 50 kc.

Due to minima, at times ten to thirty degrees wide, it was necessary to average the limits of their nulls. Deviational data is within plus or minus 3 degrees.

Balance settings were obtained during the tests depicted on Graphs Nos. 1 and 2 on each side of the resonant peak shown. Due to limited time during all reference tests, little attention was given to the balancer.

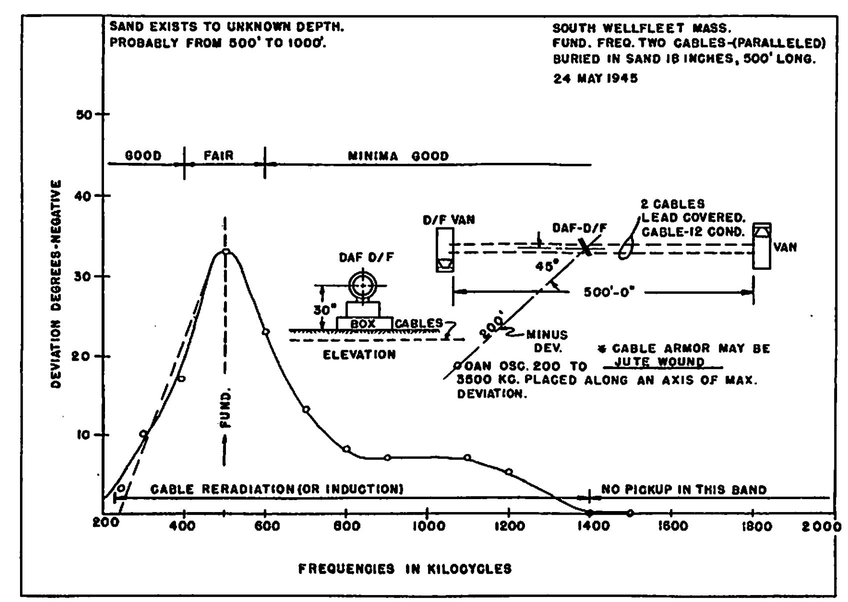
For precise qualitative measurements for standardization purposes in regard to this type of work, sites which are level and of homogenous soil surroundings should be selected.

Discussion of Results of Measurements

Graph No. 1 describes the determination of a resonant insulated wire length at ground level located over a salt marsh for a frequency of 850 kc. The target used was the WHDH broadcast tower—distance one mile. This test was conducted in 1945. One curve was made with an insulated prone (horizontal) wire stretched over filled land on the marsh surface and the other was made with the same kind of wire laid directly on the surface of the wet marsh. In both these tests, the r-f target was fixed and the wire decreased in length for increments of 10 feet, obtaining a bearing each time. The plot has been made between wire length and deviation. The resonant lengths found were 350 feet and 360 feet long.

Graph No. 2 shows a method where wire length is fixed and the oscillator frequency is varied in steps for determination of the resonant period of two underground armored cables, (probably covered with jute).

Graph No. 2 shows the results of tests to determine the fundamental frequency of armored cables buried in sandy soil. (South Wellfleet, Mass., Navy CIC Sta.)



These cables were buried 12" to 18" in sand at South Wellfleet, Mass., and connected between two portable vans. The fundamental period was found to be 500 kcs.

Graph No. 3 illustrates the method of measuring the fundamental frequency of an 85-foot length of bare copper wire at ground level. This length resonated at a frequency of 3040 kc., which is approximately one quarter of a wavelength long. If measurements had been extended on up to 20,000 kc., the limit of the DAG D/F, several harmonics would have probably appeared with lower peaks. These peaks would have appeared at the odd harmonics with the D/F located at the center of the prone wire being measured.

Graph No. 4 depicts a measurement made with the same 85-foot length of bare copper wire immersed 4 inches below the water table in the Corea Swamp at Corea, Maine. While it was impossible to complete the frequency run in steps below 1500 kc., due to the lower band limit of the receiver, enough data was obtained to show that the resonant period of the immersed wire was approximately 1400 kc. This test showed the resonant length to be one-half as long again as when used on the surface as tested above in the preceding paragraph. In other words, the immersed wire resonated at approximately one-eighth of a wavelength long.

Graph No. 5 depicts the deviational quadrantal law of a horizontal metallic path located directly under the D/F loop. Using a portable battery-operated D/F loop receiver, vertical linkage takes place magnetically between the top and bottom turns of the loop from the wire. Due to the difference in the time element between top and bottom sections of the loop, a resultant flow of current takes place around its turns. This resultant energy appears as deviation when taking a bearing on the oscillator target. Its value changes with frequency changes, increasing to maximum at resonance and increasing to a lesser degree at the odd harmonics with the D/F loop centrally located over the prone ground wire. In order to cancel this circulating current when obtaining a minimum or zero signal, it is necessary to turn the D/F loop when facing the target to the right if operating in the two negative sectors; and to the left if operating in the two positive quadrants. In any test conducted, of course, only one sector of maximum axis of deviation is involved.

Conclusions

It is believed that a sensitive method has been developed for measuring the fundamental periods of underground and underwater metallic paths, whether bare or insulated. Due to the great attenuation of such metallic paths, it is doubtful that there exists any other method or methods sensitive enough to accomplish a similar measurement.

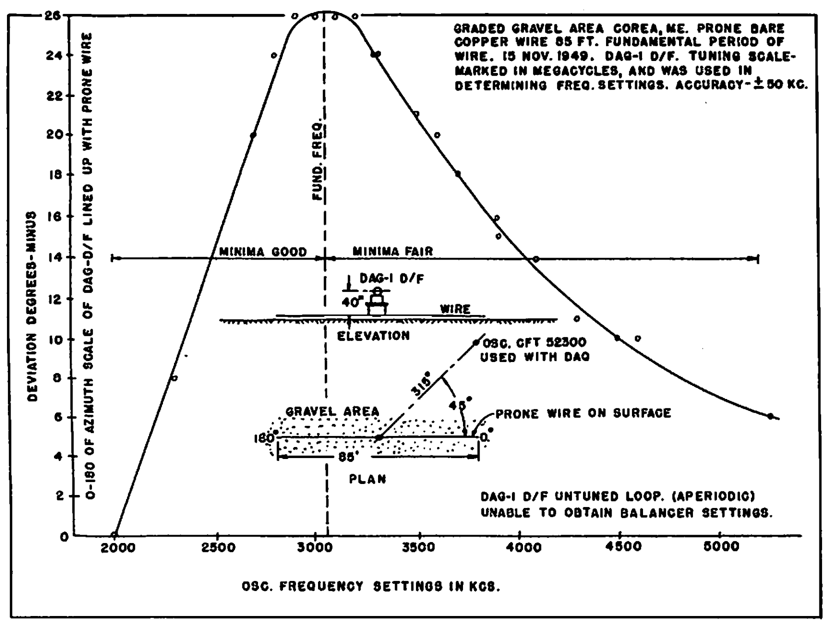
Time, personnel, and money have not been available to accomplish locally as much as was desired along these lines, but enough data has been obtained to show that the methods are workable.

From the data contained in this article, the following approximations in regard to resonant wire lengths in different media such as air, ground, or water can be made:

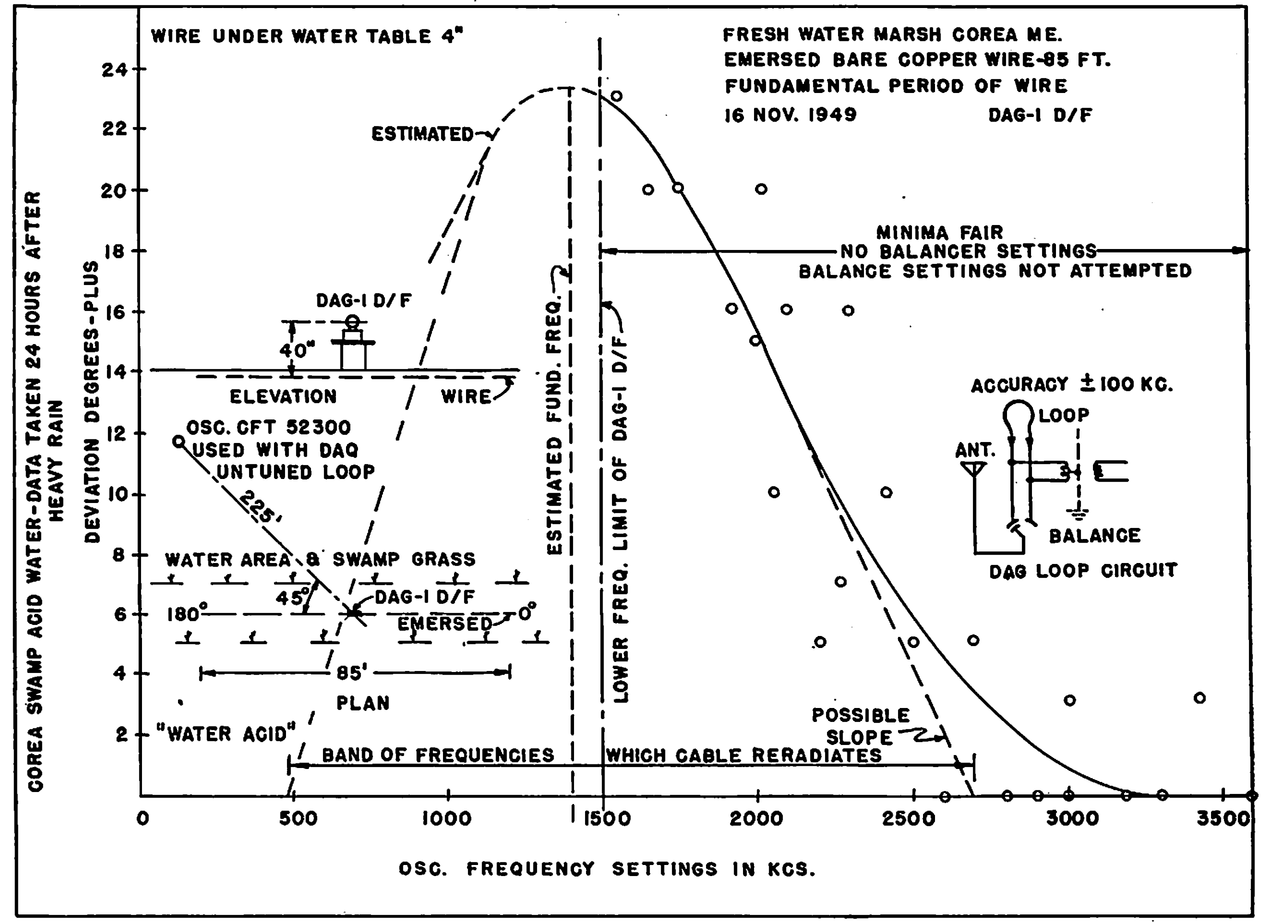
1—Bare copper wire in fresh water—Resonant wire length is $\lambda/8$

2—Bare copper wire in sandy soil—Resonant wire length is $\lambda/4$

3—Bare copper wire on soil surface—Resonant wire length is $\lambda/4$



Graph No. 3 depicts the results of tests to determine the fundamental frequency of bare copper wire at ground surface level. (Corea Swamp, Corea, Maine.)



Graph No. 4 shows the results of tests to determine the fundamental frequency of bare copper wire immersed below the water table of Corea, Maine, Swamp.

4—Bare copper wire in sea water (estimated)—Resonant wire length is $\lambda/16$

5—Insulated copper wire on surface of salt marsh—Resonant wire length is $\lambda/3$

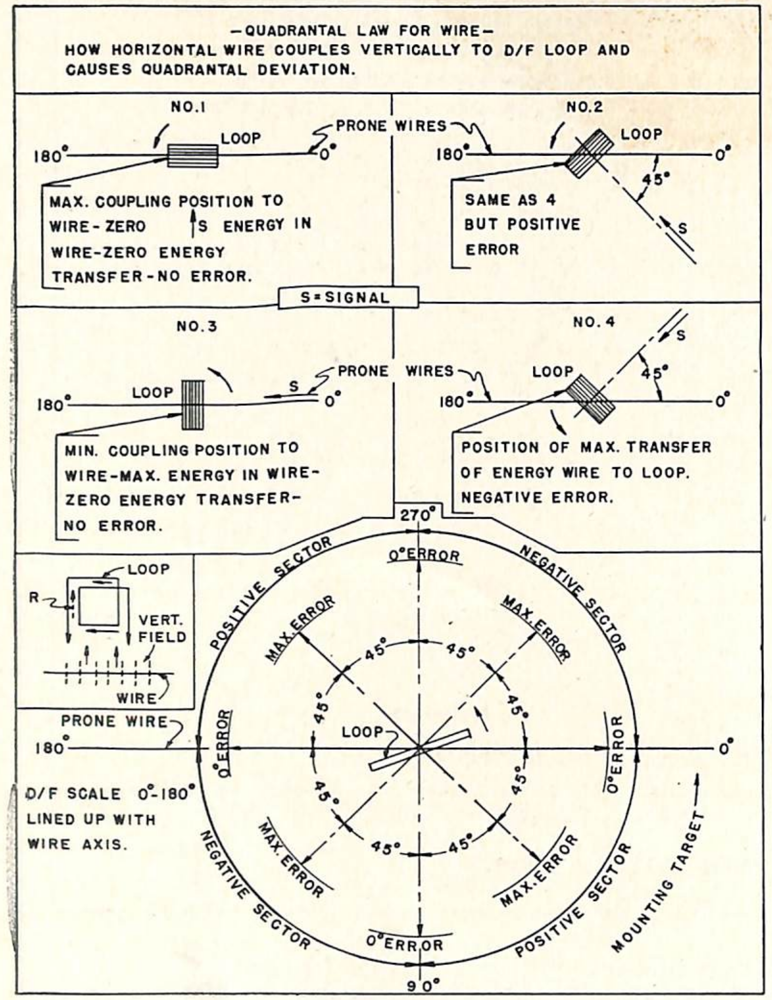
Determination of D/F site suitability may be made by burying resonant lengths of wire at the sites proposed for the collector systems and measuring their fundamentals. These resonant lengths should be cut for frequencies falling within the band of each array. If these test wires are immersed in water at sufficient depth (cable depth), it may be impossible to obtain coupling between them and the portable D/F loop, thus indicating no penetration of the propagated wave for that particular band. If a resonant curve is obtainable, then based on this data, cut all cables longer than the resonant length found at the proposed site of the array, exercising care that the longer lengths do not possess some strong harmonic falling within the arrays working frequency band.

While it has been the purpose of this report to deal only with the resonant periods of single prone metallic paths, it might be well to mention that the portable D/F, as a measuring instrument, may also be used for measuring the fundamental periods of vessels, vertical metallic structures, and also, multi-radial ground systems used for vertical quarter or half wave radiators.

It has been suggested that the methods used herein to obtain the fundamental periods of under-surface conductors might be used for soil conductivity measurements.

From the tests conducted in the First Naval District, it is indicative that if underground or underwater insulated conductors were cut to a resonant length for some particular frequency, they would make fairly good antennas which might be used for military purposes. The best results undoubtedly would be obtained on the lower frequencies where greater under-surface penetration would be obtained.

By a properly arranged group of propagation tests using the portable loop D/F with buried conductors at



Graph No. 5 shows how loop D/F couples to ground wires or cables, depicts the deviational quadrantal law in relation to the D/F and metallic path.

various depths, it should be possible at critical frequencies for a given medium to determine the point where reflection stops and penetration begins.

Due to the lack of proper D/F and oscillator equipment prior to World War II, it has not been practicable, heretofore, to undertake tests as described. But with the Navy equipment now available, it should be possible, with a series of tests lasting from thirty to sixty days, to obtain additional valuable fundamental information. Only the surface has been scratched through the efforts of the experiments reported in this article.

There is a promising possiblity of simulating shipboard structures in the field through the use of properly arranged wires or cables, using the loop D/F as a measuring instrument for study and to analyze the deviational data obtained.

Already, due to the local use of the deviational quadrantal characteristic of underground cables approaching D/F houses at early Navy "compass stations" deviation due to cables or geological conditions has been both controlled and cancelled. Seasonal changes have been minimized; and night-effect, as amplified by unsymmetrical underground cable arrangements, reduced in its magnitude during observations on night time bearings (375 kc).

Recommendations

It is recommended that the problem of recent paths or structures placed underground or underwater be thoroughly investigated by the Bureau of Ships for the purpose of aiding in the proper location, construction and operation of future radio direction finder stations.

It is also suggested that the problems of underground and underwater rubber insulated antenna systems be investigated, using resonant lengths for each collector system. There are also some basic balancer problems which should be investigated at the same time.

MODELS SS AND SV RADAR TROUBLES

6AG7 Troubles

Most maintenance personnel have found that certain resistors in the Model SS and SV–1 consoles become hot, and blowers are not practical due to space limitations. When a burned resistor is located, with no apparent cause of failure, it is advisable to replace same with one of the next higher wattage rating. Some resistor failures, however, are the result of defective 6AG7 tubes and the technician of the *U.S.S. Catfish* has reported that much trouble can be avoided by testing all 6AG7 tubes before placing them in equipments. These tubes should be especially checked for shorts since old tube stocks have had much handling and many tubes are defective.

Magnetron Data

The Model SS Radar Equipment uses a Type 2J50 magnetron which has the following characteristics:

Frequency .... 8825 Mc (± 75 Mc)
Gauss 5650
Power output .... 56 kw.

This magnetron is also used in the Model ST radar, Fire Control Radars Mark 8 Mods 3 and 4, Mark 13 Mods 0-3 and Mark 34 Mods 0-4.

The Models SV and SV–1 radars use magnetron Types 4J36 through 4J41 having the following characteristics:

Frequency	4J36	3675 Mc	(± 25 Mc)
"	4J37	3625 Mc	(")
"	4J38	3575 Mc	(")
"	4J39	3525 Mc	(")
"	4J40	3475 Mc	(")
"	4J41	3425 Mc	(")

Power output is 750 kw for all the above-listed magnetrons.

Gauss is 2500 for all the above listed magnetrons.

4J36 through 4J38 are used in the SV, SV–1 and SG–3 radars.

4J39 is used in the SV–1 and SX radars.

4J40 and 4J41 are used in the SV and SV–1 radars.

The information given above may come in handy some day, and especially if you should happen to need a magnetron in an emergency. The other equipments listed may be available in the area if such an emergency should arise.

Erratic Crystal Current

If you are troubled with erratic crystal current, remove the entire signal crystal assembly (it unscrews). You will then notice a small ring which is removable and normally fits snugly up around the crystal as one contact. The crystal does not always seat properly when plugged in; thus when you have this assembly apart, fit the small ring into the crystal. Next, screw the assembly back into place making certain it is tight. Your signal crystal current will probably be steady if this is correctly accomplished. The moral is to avoid removing the crystal unless absolutely necessary, as it may not always seat properly when plugged back in. The technician on the *U.S.S. Diodon* discovered this the hard way so don't let it happen to you.

High Voltage Rectifier Tubes

Type 221A tubes may sometimes be received when 371B's are ordered as they are interchangeable. The 221A is, however larger physically. Due to the additional height of the 221A it is difficult to insert in the high-voltage rectifier sockets of the Models SV and SV–1. Some ships have cut down the metal socket far enough to allow for easy insertion of the 221A. This can be done quite easily on a lathe without harming the socket, and then either type of tube can be used.

A-B Sweep Position

If the A-scope refuses to center properly or stays over to one side of the scope try d-c voltage checks on V1 and V2 in the "A" Deflection and Bearing sweep amplifier circuit. A common trouble here is that C5A or C5B shorts. R23 and R24 will therefore carry an excessive current and quite possibly burn out. R17 in this circuit also gives much trouble.

Waveguide Switch Humming

A considerable number of waveguide switches in Model SS radar installations have been examined to determine the possible causes of an annoying "hum" when operated. It has been observed that the switches are physically mounted in different ways. Some are right side up, some up-side down (with reference to the engraving) and some are on their sides. This difference in mounting seems to be one factor in the "humming" situation. If the switch is mounted right side up, the plunger is drawn down into the coil and normally does not "hum." If the switch is mounted upside down the plunger is drawn up and very often hums. Those mounted on their sides seem to cause more trouble than switches right side up. It is not particularly practical or desirable to change the mounting as various problems exist in different installations but this item will at least serve to explain possible reasons for the "hum."

Lubrication (preferably graphite powder) of the moving parts of the switch mechanism will often help. Spring tension is also important and a new spring will sometimes remedy this situation.

—SubFlot One Electronics Newsletter

indicator alignment

models DAS-1/-3/-4

The following loran alignment procedure is considered superior to the method given in the instruction books for the Models DAS-1, DAS-3, and DAS-4 equipments and should be used when complete alignment of these equipments is required.

This alignment procedure is the result of many months of laboratory instruction at the U.S. Naval School, Electronics, Treasure Island, California, and incorporates short cuts in alignment procedure and the most effective technique developed during this time.

Pre-Alignment Adjustments

Turn the indicator "ON" and allow a brief warm-up period before proceeding. (In the field, the indicator should be turned on at least fifteen minutes before alignment is checked.) Turn INTENSITY down as necessary so that the scope screen will not be damaged. The procedure outlined is for Models DAS-1, DAS-3 and the DAS-4. Differences will be indicated where necessary.

Control	*Function*	*Adjustment*
Receiver gain control	Receiver gain	Turn all the way CCW
R	Coarse delay multi-vibrator	Turn all the way CW
M	Fixed trace separation	Set to center of mechanical range.
Q	Square wave generator	Turn all the way CW

Control	*Function*	*Adjustment*
P	Voltage regulator	DAS-1, DAS-3 Turn all the way CCW. DAS-4 Turn all the way CW.
N	Astigmatism control	Turn all the way CCW.
ADJ 0—DAS-1/DAS-3 ADJ LO—DAS-4	Coarse delay control	Set to center of mechanical range.
ADJ 10,000—DAS-1/DAS-3 ADJ HI—DAS-4	Coarse delay control	Set to center of mechanical range.
ADJ 200—DAS-1/DAS-3 ADJ LO—DAS-4	Fine delay control	Set to center of mechanical range.
ADJ 700-DAS-1/DAS-3 ADJ HI—DAS-4	Fine delay control	Set to center of mechanical range.
A	First divider	Set to approximate center of the mechanical range.
B	Second divider	Set to approximate center of the mechanical range.
C	Third divider	Set to approximate center of the mechanical range.
D	Fourth divider	Set to approximate center of the mechanical range.
S	Fourth divider	Set to approximate center of the mechanical range.
L	180° Phase shifter	Set to center of mechanical range.
PRR Switch	Pulse repetition rate	L postion.

Alignment

The indicator is a delicate piece of electronic equipment and requires precise adjustment for satisfactory results. It has a number of circuits with a limited range of stable adjustment. Screwdriver adjustments should *always* be set in the center of the range which provides the proper pattern. (See Figure 1.) Other controls re-

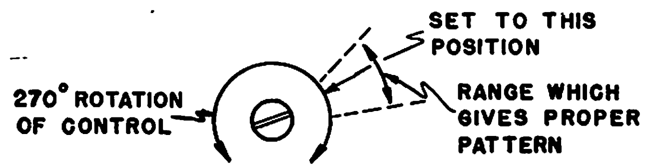


FIGURE 1

quire only inspection of the oscilloscope pattern to insure that the adjustment is correct, and where such inspection indicates proper operation, no further adjustment is necessary.

The RECEIVER switch on the DAS-4 indicator is different from that of the DAS-1 and DAS-3. When referring to this switch, and alignment is being made to a DAS-4, follow instructions given. If alignment is being made to a DAS-1 or DAS-3, "RECEIVER ON-1" will denote the upper setting of the switch.

To denote the setting of the SWEEP SPEED and FAST SWEEP switches, the following system will be used (examples):

SWEEPS S-3 Set SWEEP SPEED to SLOW; Set FAST SWEEP to position 3.

SWEEPS F-1 Set SWEEP SPEED to FAST; Set FAST SWEEP to position 1.

Turn RECEIVER GAIN control full CCW.

Adjust INTENSITY, FOCUS, HORIZONTAL and VERTICAL centering controls for clear picture of desired intensity.

Control

"J" Slow sweep trace length.
RECEIVER ON-1
SWEEPS S-3
Adjust so that the trace or traces are approximately 4 inches long.

"Q" Square wave generator.
RECEIVER ON-1
SWEEPS S-3
Adjust for two separate horizontal traces of equal length.

"K" Fast sweep trace length.
RECEIVER ON-1
SWEEPS F-1
Adjust so that both trace lengths are approximately 4 inches long.

"P" Voltage regulator.
RECEIVER OFF
SWEEPS F-1
Adjust to mid scale of the range where the traces have the greatest stability.
If at this time no adjustment of the control improves the stability, set the control to the center of its mechanical range and readjust it for best trace stability as directed under step "A."

"N" Astigmatism.
RECEIVER OFF
SWEEPS F-1
Vary "N" and the "FOCUS" control until the point is found that gives the sharpest definition on the screen.

"A" First divider.
RECEIVER OFF
SWEEPS F-1
Adjust so that there are four 10 µs markers and five even spaces between the 50 µs markers. If the bottom trace jitters horizontally while the upper trace is steady, readjust the voltage regulator control "P" slightly until both traces are steady. If the "A" adjustment cannot give the proper spacing, reset control "A" adjustment to approximate center of range and adjust capacitor C11 (DAS-1) or C111 (DAS-3, DAS-4) to give the proper marker spacing. (Figure 2.)

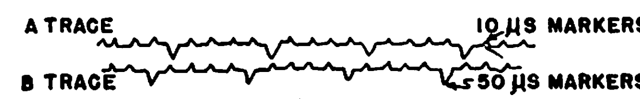


FIGURE 2

"L" Phase shifting network.
RECEIVER OFF
SWEEPS F-1
Adjust so that the 50 µs markers are as short as possible, with five spaces between each pair of 50 µs markers.

"M" Fixed trace separation.
RECEIVER OFF
SWEEPS F-1
Adjust so that the 50 µs markers on the "A" trace just touch the tips of the 10 µs markers on the "B" trace as the FINE DELAY control is varied. (Figure 3.)

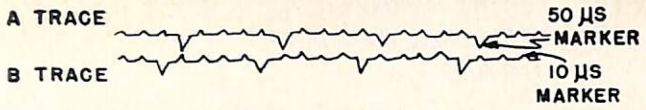


FIGURE 3

"B" Second divider.

RECEIVER OFF
SWEEPS F-2

Adjust so that there are ten 50 µs markers between two 500 µs markers, on the "B" trace. The tenth 50 µs marker will appear just a little to the left of the 500 µs marker. It may be necessary to vary the FINE DELAY control to make the 500 µs marker appear. (Figure 4.)

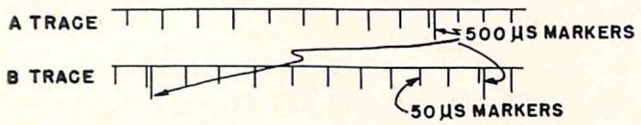


FIGURE 4

"C" Third divider.

RECEIVER ON–1
SWEEPS S–3

Adjust so that every fifth 500 µs marker is as short as posible. (Figure 5.)

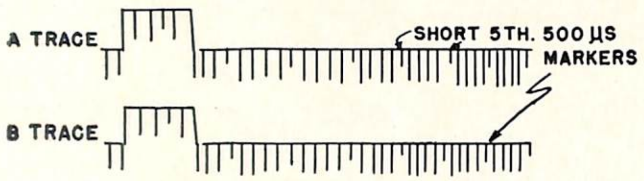


FIGURE 5

"J" Readjust, if necessary, to obtain 4-inch trace lengths.

"D" Fourth divider.

RECEIVER ON–1
SWEEPS S–3

Adjust so that there are eight groups of five 500 µs markers with the PRR switch in the "L" position. (Figure 6.)

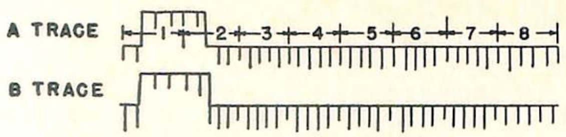


FIGURE 6

"J" Readjust, if necessary, to obtain 4-inch trace lengths.

"S" Fourth divider.

RECEIVER ON–1
SWEEPS S–3

Adjust so that there are six groups of five 500 µs markers with the PRR switch in the "H" position. (Figure 7.)

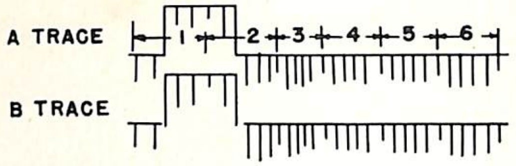


FIGURE 7

"R" Coarse delay multivibrator.

RECEIVER ON–1
SWEEPS S–3
STATION SELECTOR switch at 0

Adjust so that there are two 500 µs markers before the "A" pedestal, in all positions of the STATION SELECTOR and PRR switches. (Figure 8.)

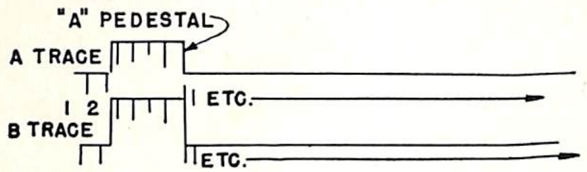


FIGURE 8

"B1" Coarse delay.

RECEIVER ON–1
SWEEPS S–3
COARSE DELAY control at minimum
FINE DELAY control at minimum

Adjust "O" on DAS–1/DAS–3, or "LO" on DAS–4 so that there are two 500 µs markers before the "B" pedestal. (Figure 9.)

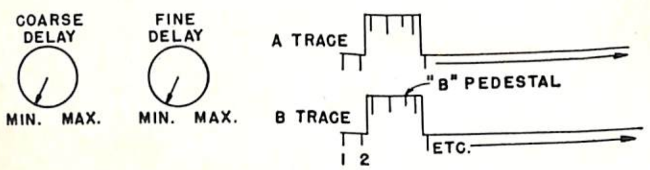


FIGURE 9

"B1" (*Cont.*)

RECEIVER ON–1
SWEEPS S–3
COARSE DELAY control at maximum.
FINE DELAY control at minimum.

Adjust "10,000" on DAS–1/DAS–3, or "HI" on DAS–4 so that there are twenty-two 500 µs markers before the "B" pedestal. (Figure 10.)

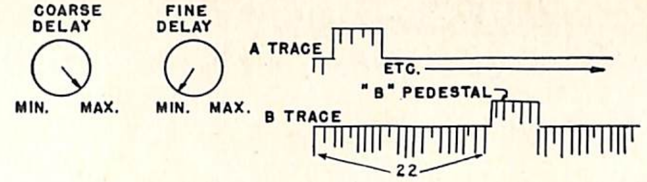


FIGURE 10

NOTE: Interaction of coarse delay adjustments will usually be encountered. It may be necessary to juggle the adjustments until the patterns shown are obtained. This also applies to next adjustment "B".

"B2" Fine delay.

RECEIVER OFF
SWEEPS F-2
COARSE DELAY control at mid-range
FINE DELAY control at minimum

Adjust "200" on DAS–1/DAS–3, or "LO" on DAS–4 so that four 50 µs markers appear be-

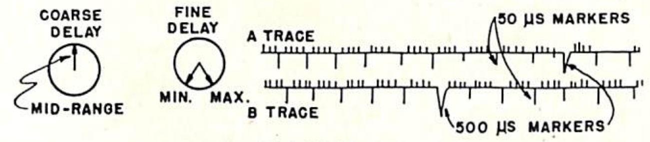


FIGURE 11

tween a 500 µs marker on the "B" trace and the first 500 µs marker to the right on the "A" trace. Turn the FINE DELAY to maximum and adjust "700" on DAS–1/DAS–3, or "HI" on DAS–4 for the same as above. (Figure 11.)

Station Selector Adjustments—Preliminary

Set Controls	*DAS–1/DAS–3*	*DAS–4*
RECEIVER	ON–1	ON–1
SWEEPS	S–3	S–3
COARSE DELAY	Advance past mid-point	Advance past mid-point
TEST-OPERATE	Connect test load from COUNTER TEST jack to test point #2	TEST

Station Selector Adjustments—Final

Rate 0

Set Controls	*DAS–1/DAS–3*	*DAS–4*
STATION SELECTOR	1	0
PHASE SHIFT	Left	

Adjust TRACE SEPARATION control to provide a space between the two block patterns of dots. Each block should have a height of 10 dots, except for the first (left) column which should have eight dots. If the bottom row of dots is not completely filled (ignoring these dots displaced upward due to the pedestal), adjust the second divided control "B" slightly until the row is filled. After this adjustment there should still be eight dots in the first column and 10 in all the others. (Figure 12.)

Rate 1

Set Controls	*DAS–1/DAS–3*	*DAS–4*
STATION SELECTOR	1	1
PHASE SHIFT	Center	

Adjust screw "1" for seven dots in the first column with the PRR switch in positions "L" and "H". These dots should align horizontally with the lower seven dots in the second column. (Use the bottom block pattern ONLY for these adjustments.)

Rate 2 through 7

Adjustments should be made in manner similar to that used for Rate 1, in accordance with the following table:

At the conclusion of above adjustments, return the TEST-OPERATE switch to OPERATE on the DAS–4. On the DAS–1/DAS–3 remove the test lead from the COUNTER TEST jack and from test point number 2.

"FRAMING" switch (DAS–1/DAS–3)
"LEFT-RIGHT" switch (DAS–4)

RECEIVER ON–1
SWEEPS S–3
PRR switch and STATION SELECTOR to a known station pair.

Advance receiver gain control until signals appear. Signals from this station pair should stop: If not, refer to NOTE below. Moxe LEFT-RIGHT switch to LEFT and to RIGHT to see that the pulses move in the corresponding directions, and approximately at the same speed in each direction. If not, with switch in LEFT position, adjust "A" so that the signals drift left, then place switch in RIGHT position and readjust "A", if necessary.

NOTE: If unable to stop signals with PRR and STATION SELECTOR switches in correct positions, proceed as follows: Check adjustments A, B, C, D, and S to make sure they are correct as previously outlined. If

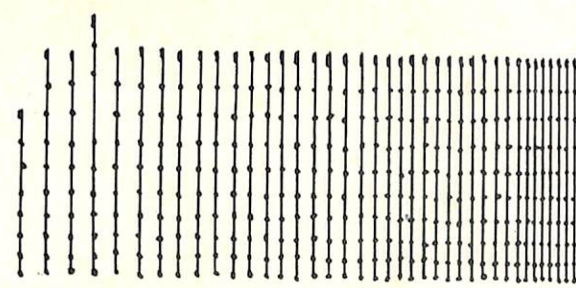


FIGURE 12

these are correct, then check the STATION SELECTOR pattern. If all adjustments are correct, and signals still do not stop, adjust "A" slightly with RECEIVER ON–1, SWEEPS S–3. Signals should settle down and stop. Then recheck framing procedure.

THE INDICATOR IS NOW ALIGNED AND READY TO OBTAIN ACCURATE LORAN TIME DIFFERENCE READING.

	Station Selector		*Phase Shift*		
Rate	*DAS-1/DAS-3*	*DAS-4*	*DAS-1/DAS-3 (only)*	*Adj. Control*	*Dots First Row on L&H*
2	2	2	Center	2	6
3	3	3	Center	3	5
4	4	4	Center	4	4
5	5	5	Center	5	3
6	6	6	Center	6	2
7	6	7	Right	7	1

by

WILLIAM T. JENKINS

Philadelphia Naval Shipyard

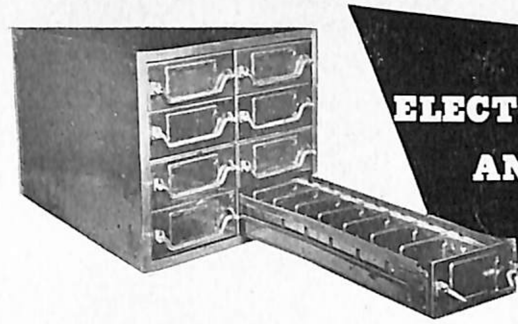
Most people give so-called "High Voltage" circuits a wide berth and use extreme caution when working with it. But too many people use little or no caution when handling low voltage circuits and equipment. There are more fatalities caused by voltages in the 110-440 range than by voltages in the 1200-60,000 range. The approximate internal resistance of the body is 500 ohms, and dry skin has a surface resistance of 100,000 to 600,000 ohms. Resistance between hand and foot is 400 to 600 ohms, and from ear to ear, 600 ohms.

A current of 100 to 200 milliamperes passing through the body is usually fatal. Currents of 80 milliamperes and below usually are not fatal, but are painful and cause muscular contraction and make breathing difficult. Currents of 50 to 100 milliamperes cause a severe spasmodic heart beat.

Using the above values of resistance, and some calculations based on Ohm's law, it is not hard to see why even commercial voltages are really hazardous. As an example, assume your skin is moist from perspiration and you are working on a 120-volt appliance, or on terminals that carry 120 volts. If something goes wrong and you make contact with the 120 volts, the conditions can be something like this—skin resistance 1000 ohms, body resistance 500 ohms, total 1500 ohms.

$I = E/R$ or $120/1500 = 80$ milliamperes. This is close to a lethal amount and in some cases would be fatal.

Never take an electric circuit for granted—always consider it as being HOT. Use precautions accordingly and you won't be knocked COLD.



ELECTRON TUBE ALLOWANCES AND BIN STOWAGE

Most (service force) ships should have received their new electron tube allowance lists by this time. Listed below are some pointers on setting up the bin stowage for the tubes.

1—Check your list carefully to make sure that you are allowed spares for each type tube installed. If not, check your Electronic Equipment Inventory NavShips 4110 and find which equipments you failed to report on the inventory as the tube allowance is generated from your Electronic Equipment Inventory. Correct both allowance and inventory and send a copy of each to the Bureau of Ships for correction.

2—Sort your tubes by type and then set aside the allowed quantity of each type. Excess tubes should be turned in to the nearest shipyard Electronics Officer or to the nearest Service Force Command. Requisition any tubes needed to make up the full allowance of each type.

3—Tube lockers with adequate shelves or bins in the store room are recommended; however, arrangements should depend upon the conditions existing on the individual ship. Remember that with the new allowance you will have fewer tubes than before under the old "one spare for each socket" system.

4—*Do not overstock on tubes.* Hold as closely as possible to the allowance in order that space may be saved and deficiencies (if any) of the system will become apparent.

5—The new allowance is based on a three-month supply. If a ship is scheduled for extensive cruises, it is permissible to over-stock on critical types as operating needs dictate.—*SerLant Monthly Bulletin.*

ELECTRONIC COUNTERMEASURES FIELD CHANGES AND DRAWINGS

The following field changes to the Model RDO receiver are now available and should be accomplished at the earliest opportunity by maintenance personnel of the vessels to which the affected equipment is assigned.

1—Field Change No. 2—RDO—Preamplifier Installation.

2—Field Change No. 3—RDO—Insertion of Pulse Stretcher.

The status of other field changes for countermeasures equipment is as follows:

1—Field Change No. 1—RAO-9—Oscillator Voltage Output Jack. Available June 1950.

2—Field Change No. 2—RDP—Improvement of Visual Presentation. Available latter part of 1950.

3—Field Change No. 2—AN/SPR-2—Modification of Plate Rod Cap. Available latter part of 1950.

To adequately describe the construction and electrical circuit of the Mixer Assembly CV-13/APR-5 used as part of the Model AN/SPR-2 receiver and to furnish instructions on changing the 1N21B crystal, Bureau of Ships drawing RE 100F 2006 is available. The details of this drawing were published in Supplement 30 of the C.E.M.B., Page AN/SPR: 2, for ready-reference purposes.

The following new and revised restricted countermeasures installation and interconnection drawings have been issued to installing activities:

1—Countermeasures Intercept and D/F System AN/BLR-1 for Submarines, AN/SSQ-12 for Small Combatant Vessels—RE 100F 2000D.

2—Countermeasures AN/SSQ-12 Intercept and D/F System for Large Combatant Vessels—RE 100F 2011B.

3—Typical Arrangement Comm. Countermeasures Equipment (Special)—RE 100J 2007B.

4—Typical Arrangement Radar Countermeasures Equipment (Special)—RE 100J 2009B.

5—AN/SLT-1 Countermeasures Cabling Diagram External—RE 100Z 2010C.

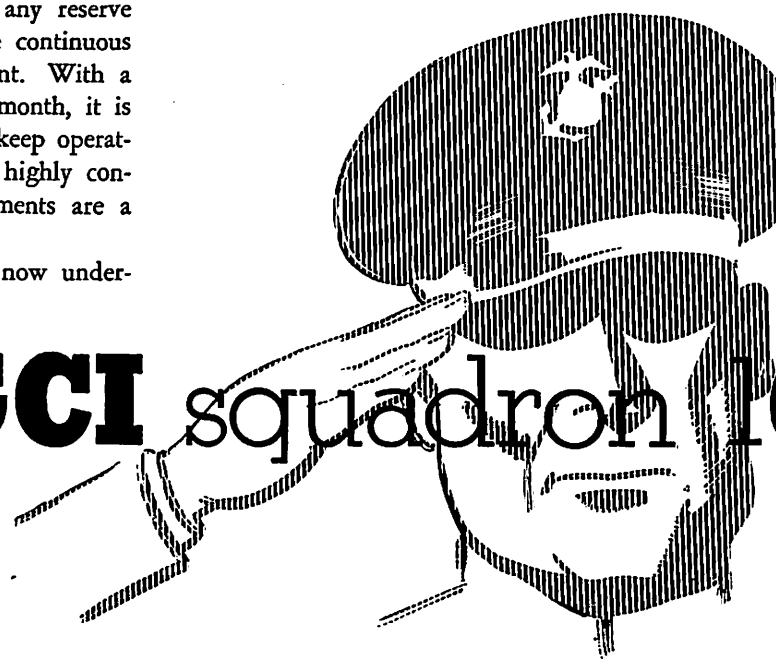
6—Fundamental Data Requirements for Installation of AN/SLT-1 Equipment—RE 100F 2005D.

7—AN/SLT-1 Countermeasures Dimensions Outline and Mounting—RE 100J 2008A.

Additional copies of these drawings can be obtained from the Bureau of Ships, Code 983.

CLEAN ELECTRONIC EQUIPMENT USUALLY NEEDS LESS MAINTENANCE

marine GCI squadron 16 reports



Of great importance in the success of any reserve Ground Control Intercept Squadron is the continuous operation of its radio and radar equipment. With a unit training for a few hours twice each month, it is mandatory that all equipment operate and keep operating. To prevent any interruption of this highly concentrated training period, duplicate equipments are a virtual "must."

At the new combat information center now undergoing construction at NAS, Minneapolis, Minnesota, v-h-f communication equipment (SCR–573 and SCR–574) has been set up in the remotely operated vans as is the normal practice and additionally in the Combat Information Center itself. Each of these locations has duplicate transmitters and receivers, totaling four components in each location. With this arrangement, two different frequencies can be utilized, and a spare is still available for each frequency.

Much of the operation of Marine Ground Control Intercept Squadron 16 is during severe cold weather. This produces an added strain on communication equipment located in areas heated for short periods only. Equipment failure and frequency creepage are common occurences. Having learned from experience that the breakdown of any single piece of equipment can seriously harm the entire day's program, this duplicate arrangement has been put to very good use since its recent inception.

Following out this double installation procedure, one of the AN/TPS-1b equipments allocated to this organization has been installed in a mobile truck van. This radar set has been used as a substitute for the stationary companion set operating in the Combat Information Center itself. However, normal employment of this equipment is at a remote vantage point where its coverage can supplement the information available from the home based AN/TPS-1b.

Whenever and wherever possible, duplicate operating systems for all ground control intercept equipments should be made available if full utilization is to be made of the training time.

Among the many valuable things learned at the annual maneuvres this year was the art of distribution of manpower for efficient, full time operation. It was necessary to have crews on duty at the gear from 0730 to 2200 in many cases, with other day operations from 0700 to 1900. These crews were made up of raw recruits and men of lower pay grades who were using their vacation to attend the maneuvers. Because of this, it was necessary to see that the men had sufficient liberty time to keep them eager for their return at the gear.

A survey was taken of the men available, and it was found that by using three separate groups, or shifts, with a top flight NCO in charge, that the gear could be operated with several experienced men on each group, and new, inexperienced men on a small portion of the jobs. These jobs were assigned to the men according to their importance, and the NCO and officers took on the task of teaching the recruits the new job. With the three crews operating a minimum of 2 hours to a shift, and in some cases for 3 or 4 hours, it was soon apparent that the efficiency would remain high.

With a group of high spirited men, a few hours of inactivity is worse than a few hours of hard work. So the short shift gave the men new interest on their next, and perhaps, more eventful shift. Among the things that officers learned was that when the chips are down, the Marine will do the job and do it well. Working with a group of men who are really civilians in uniform, it is necessary not only to plan their work hours, but to plan their liberty time so that when a work shift is scheduled, a maximum effort will be made, and top grade efficiency will be maintained.

One of the more valuable techniques learned by Marine Ground Control Intercept Squadron 16 was the efficient employment possible of a new piece of direction finding equipment, the MRD–8. This equipment was made available to this organization at the annual maneuvers (FY–50). A simulated problem had been established by the high echelon called "Condition Volcano." When this condition was in effect, it was assumed that a guide missile was in the area, and was homing on some piece of electronic equipment.

With "Condition Volcano" in the status board, all signal generating equipment was immediately shut down after informing all "barrier" and "combat" air patrols under our control as to this condition. Aircraft flight leaders had been briefed to key their transmitters, without modulating, once every 30 seconds during this period. The combat air patrol would further orbit its position at that time, and the barrier patrol would continue its assigned courses.

With the position of these aircraft indicated on the plotting board at the time of calling this condition, continued plotting was readily available from this direction finding (DF) information. If any enemy aircraft or missiles were sighted by the airborne patrols, a short transmission from them gave this information and also their proposed course of action. The continuous flow of DF information then permitted the control squadron to keep a fairly accurate track of the friendly aircraft regardless of their position changes. By logging the DF plot times carefully, and assuming a constant speed of the aircraft, the distance from base could be determined by computing the circumferential distance between two subsequent DF bearings. For example let us assume that the MRD–8 equipment information is as follows:

Time	*Bearing*	*Assumption*
1431.5	268	Course—360
1432.0	270	Speed—180 knots
1432.5	272	" " "

The elapsed time above shows one minute, and the change in bearing indicates four degrees. At the assumed speed, the distance traveled was about three nauboard parallel to the course angle, and moving it radially until the three-mile scale subtends the bearings 268 and 272 we find that the distance out is approximately 43 miles. With a little practice, most of these mental gymnastics can be eliminated, and a controller can estimate the distance to the aircraft with amazing accuracy.

While this data was of no major importance during the "Condition Volcano" it was very valuable to the controller once the condition was released. The opportunity to deploy his forces at once without having to seek further information is of inestimable value when the tactical situation may require immediate action.

During this problem, all aircraft keyed their transmitters the same. In the future a better system would be to "code" each flight leaders transmission to better identify the flight. If standing operating procedures are to be established using these techniques, it will be imperative that Marine Ground Control Intercept Squadrons be furnished MRD-8 equipments in lieu of the present SCR–575 (DF) equipment now in use.

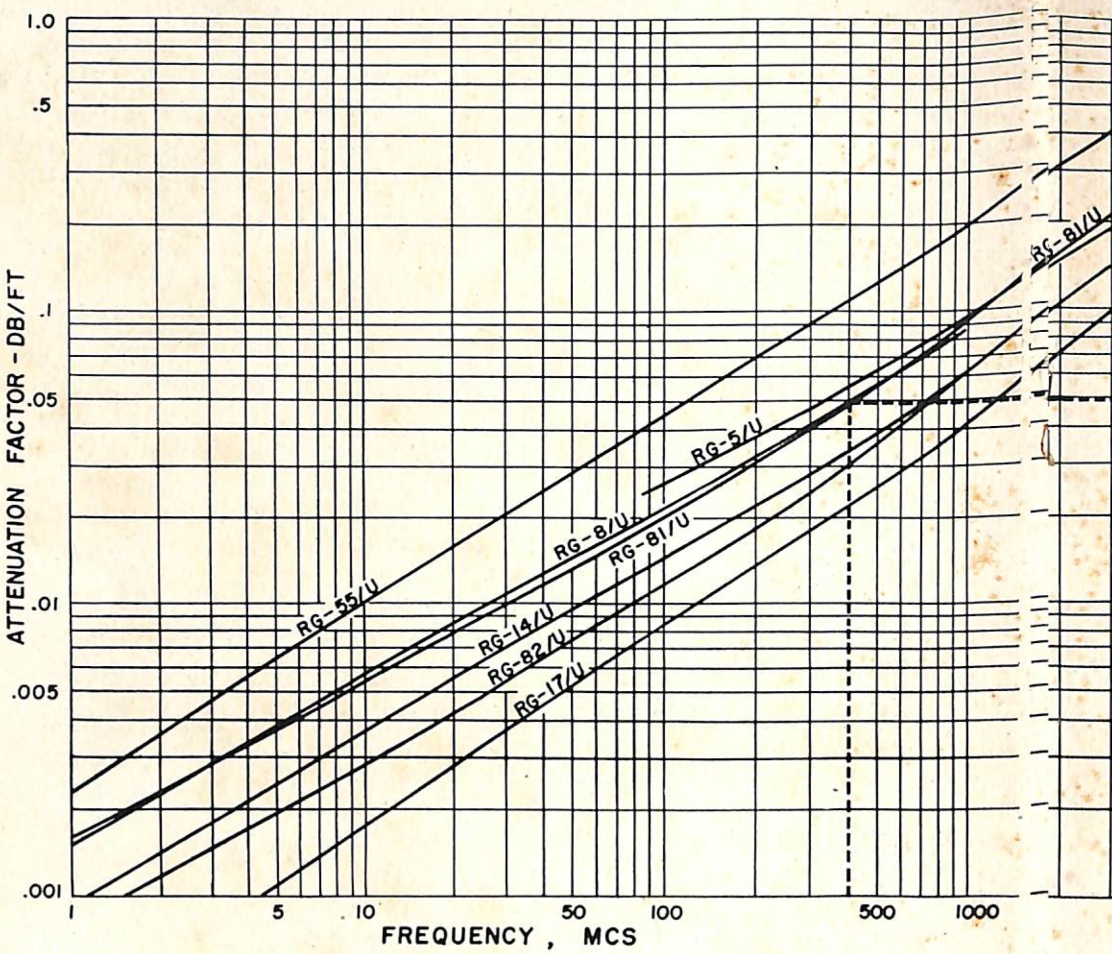
A P2V AIRCRAFT TEMPTS FATE

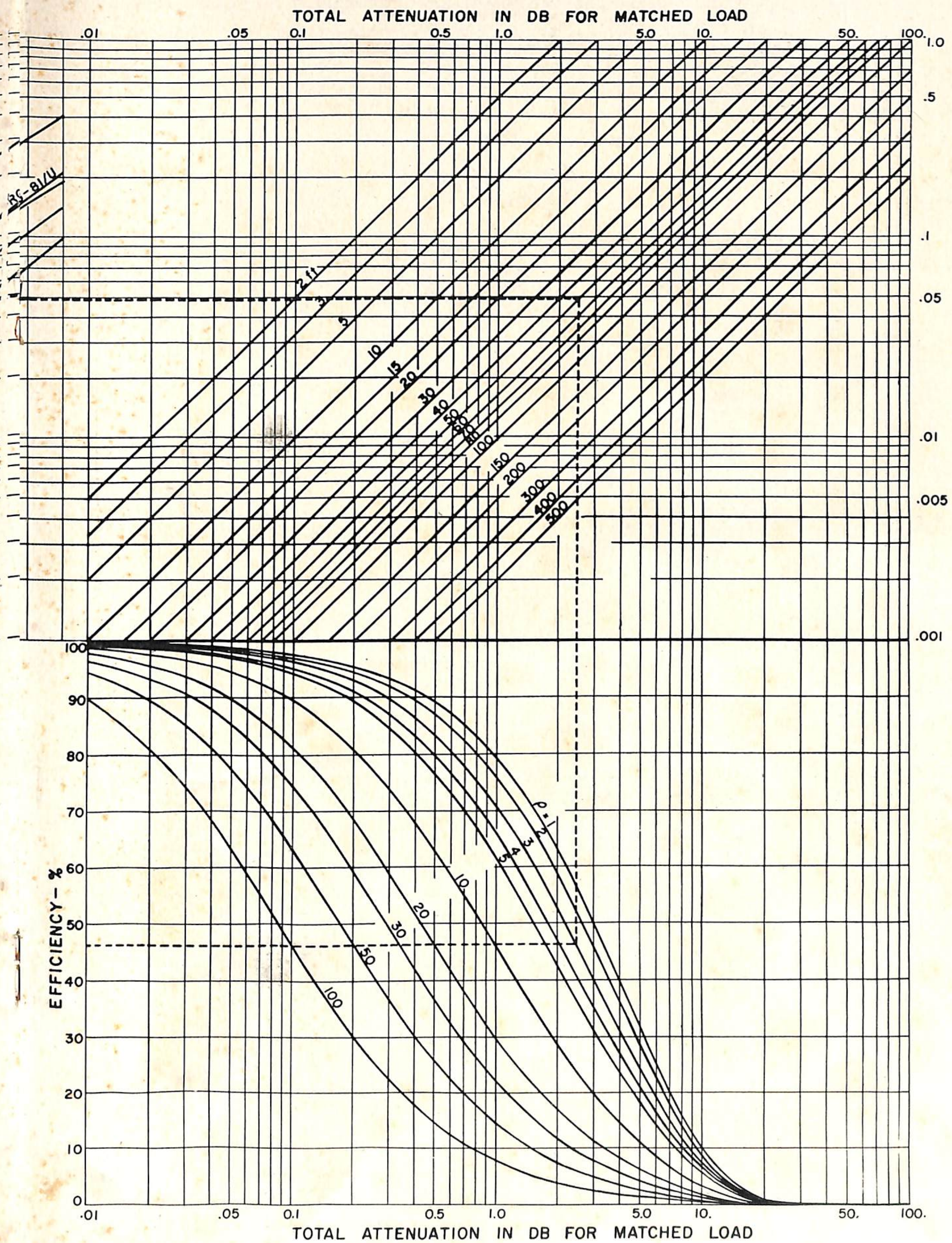
The following is a report of a GCA landing at the Naval Air Station, Quonset Point, Rhode Island.

"On 20 June 1950 at 2202 a P2V Bureau No. 124358 attached to VP–3 was turned over to GCA by the Naval Air Station, Quonset Tower for a routine approach. At the same time another plane was attempting a landing at nearby Providence Airport. Weather conditions being what they were, this latter aircraft missed on its initial approach and was ordered up to attempt a second approach. In order to clear the air above the Providence Airport, the Providence Approach Control ordered the P2V, on the base leg of an approach at Quonset, "Waved-off." Immediately after the "wave-off" the pilot of the P2V reported his starboard engine cutting out. Providence Approach Control was contacted and permission was granted for an immediate approach. In the meantime the pilot had secured and feathered the starboard engine. On the final approach the port engine started to "backfire." It was impossible for the plane to take another "wave-off." At 2216 the pilot made a successful single engine landing on runway #23 which is 4000 feet long and 500 feet wide. Ceiling at the time was 100 feet overcast with visibility 5 miles in fog."

USN USL notes

Instead of the usual column, The Laboratory offers the accompanying chart. It has been found useful at the Laboratory for determining the efficiency of transmission lines of various lengths terminated by various load impedances. It also provides a ready means for comparing the performance, with respect to efficiency, of different types of cables in a given installation.





UNDERWATER SOUND LABORATORY

CHART FOR DETERMINING EFFICIENCY OF COMMONLY USED TRANSMISSION LINES

(Variable Lengths, Variable Loads)

Method of Use

1. Enter at frequency scale and proceed upward until operating frequency intersects type of cable used.
2. Proceed to the right from point of intersection until applicable cable length is intersected.
3. Proceed in a downward direction until applicable VSWR, (ρ), is intersected.
4. Read resulting efficiency of cable on scale directly to the left.

Example

To find the efficiency of a 50-foot length of RG-8/U cable terminated by an impedance resulting in a VSWR of 3 at 400 MCS:
Enter at 400 MCS. Proceed upward to the RG-8/U cable curve, thence to the right until the 50-foot curve is reached, and then in a downward direction until $\rho = 3$ line is reached. The resultant cable efficiency is found to be approximately 47 %.

Notes

1. This chart is based on the following formula:

$$\frac{1}{\mu} \times 100 = \cosh 2a\ell + \left(\rho + \frac{1}{\rho}\right)\frac{\sinh 2a\ell}{2}$$

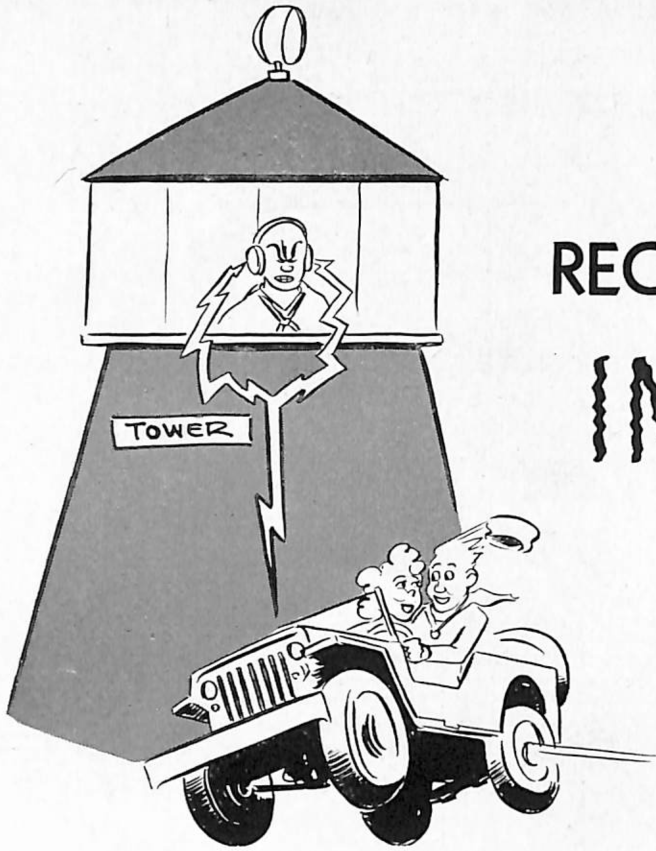
$$\text{where } \rho + \frac{1}{\rho} = \frac{X_L^2}{R_o R_L} + \frac{R_o}{R_L} + \frac{R_L}{R_o} \; ; \qquad \rho = \text{VSWR}$$

R_o = characteristic resistance of cable, ohms
R_L = load resistance, ohms
X_L = load reactance, ohms
a = attenuation factor of cable, nepers per meter
ℓ = length of cable, meters
μ = efficiency of cable, per cent

2. This chart is not applicable to cables terminated by highly mismatched load impedances ($\rho > 100$). In such cases the above formula must be modified by addition of another term which arises from consideration of reactive component of characteristic impedance of the cable.

K. K. Miller

RESTRICTED



RECEIVER NOISE AND INTERFERENCE

by
LT. W. E. JONES, USN
Staff, ComServLant

Properly speaking, anything that reduces the ability of the operator to understand the desired signal is interference. However, it is convenient to list the causes of interference under two headings. In this system, interference is the result of definite radio transmissions, intentional or unintentional. Noise is the result of incidental radio transmission or the result of a circuit defect or characteristic.

Receiver noise may be due to:

1—Atmospheric disturbances, usually called "static."
2—Electronic phenomena.
3—Defective circuits or parts.
4—Man-made "static" from electrical devices.

Receiver interference may be caused by:

1—Transmissions on working frequency.
2—Interstation interference.
3—Key clicks or thumps.

Disturbances in the atmosphere, or static, may originate from the action of the charged particles of dust, water or snow in the air. Such particles can cause charges to build up on masts, superstructures, or whole aircraft by motion or impact. No practical method of eliminating static has been discovered as yet.

There are two electronic phenomena that cause receiver noises. One is the noise caused by the random flow of electrons in a vacuum tube, which is called the "shot effect." The other is caused by the random movement of electrons in the conductors of the receiver input, including the coils of the first stage grid circuit. This movement is said to be due to "thermal agitation," since it is heat that causes the effect. These electronic noise sources are especially important in receiver input circuits because they limit the receiver sensitivity. If great amplification is used, these inherent noises will be amplified so much that weak signals cannot be raised above the noise level. Once a receiver is built, there is little that can be done about such noises.

Noise may originate in any receiver circuit or part that is defective. A partial list of most probable causes is given below:

1—Defective tube.
2—Shorting or grounding leads.
3—Loose or poorly made connections.
4—Defective resistor.
5—Defective power supply.
6—Defective speaker.
7—Insulation break down.
8—Dirty or peeling gang-capacitor plates.
9—Poor connection to antenna or ground.
10—Bad fuse connection or switches.

Methods of locating and correcting many such faults will be found elsewhere. A few additional items will be given here.

Tubes, or tube connections at the sockets, are frequent offenders. Each tube should be lightly tapped with the finger while the receiver is operating. If the tube contains loose lements or there are loose socket contacts, a loud noise will be heard.

A quick visual inspection before and while jarring the set may reveal a loose connection.

If the trouble has not been located, remove the first r-f tube. If the noise stops, check that stage. It it does not stop, remove the second r-f tube or mixer and check. Continue until the offending stage is located. When the noise is still heard after all but the last audio tube has been removed, the possibility that the trouble is in the power supply should not be overlooked.

A detector plate bypass capacitor will often become noisy, breaking down intermittently under plate voltage or signal surges. An ohmmeter continuity test will not necessarily show such a defect, since high voltage is necessary for breakdown. The capacitor should be disconnected to check this source of noise.

Because the plate voltage may be high, the primary of an audio transformer is apt to break down, although either the primary or secondary may do so. An insulation test can be made to check the conditions between the case and the windings.

In addition to the very common defect of open capacitors, there are several items that might be mentioned in connection with the power supply. Often a voltage dividing resistor will "creep" or "spark" across one or more sections. This sparking is due to leakage paths along the insulation or to imperfections such as metallic particles in the cement or enamel covering. The high voltage winding of the power transformer may break down intermittently. Line switches or fuse mountings may get noisy as the contacts wear or become corroded. Such action is especially likely when the set is subject to vibration.

When there is dust or flaky, peeling electroplating between the plates of a variable tuning capacitor, the alternate shorting and clearing will cause noise. The condenser plates should be kept clean and the dust blown out.

MAN-MADE INTERFERENCE may enter a receiver:

1—Through the antenna system.
2—Through the power supply line.
3—Through the receiver circuits themselves.
4—Through a combination of the above.

The first step in combating this type of noise is to find the path through which it is entering the receiver. Once the general path by which the noise enters the receiver is determined, then the search for the cause can begin. In searching for an interference source, it is helpful to have some idea as to the type of device that creates each type of noise. For that reason it saves time to check the nature of the noise and try to classify it by its characteristic sound.

Some noises are tunable, that is, they can be tuned in and out like any regular signal. Those that are tunable are usually the result of radiation. Those that are not are generally due to direct conduction. Tune the receiver to a frequency point where no signal is heard and increase the volume or gain control to a maximum. Remove the antenna lead from the receiver antenna terminal, and see that it is several feet from the terminal. If there is a decrease in noise, there is interference outside of the receiver and a part of it at least is being picked up by the antenna. If there is no decrease in noise, short the antenna terminal to the ground connection with a short piece of wire and listen again. If the noise drops off to an insignificant amount the antenna circuit is picking it up.

Many of these common sources of trouble can be eliminated by regular preventive maintenance checks, saving many hours of trouble shooting and poor operation of equipment.

—*SerLant Monthly Bulletin*

GENERAL DATA ON IFF USE IN SUBMARINES

The BN and BK units on board your submarine should be in operating condition! Some technicians have not turned on these equipments for months and are not even aware of how the equipments are supposed to work. This situation should be brought to a definite halt. The equipments are admittedly old and sometimes thought obsolete, but chances are you will have them on board for some time. Frequent operational test should be made with other vessels or planes.

Tenders have facilities for testing and adjusting BN and BK units. The BN can usually be tuned up and adjusted satisfactorily on board the submarine by use of the instruction book but the BK units should be checked out on the tender at least once each year as they have special equipment for this purpose.

When the BN is operating normally, its transmitter pulse and receiver grass can be observed on the radar indicators. The BN pulse can also be heard in the APR–1 receiver phones at approximately 160-180 Mc. The BK is harder to check and is nearly impossible without the cooperation of another vessel or by means of special tender test equipment.

—*SubFlot One Electronics Newsletter*

SR-3, SR-6 AND AN/SPS-6 SERIES MAINTENANCE NOTES

Removal of Standing Wave Ratio Tuners

The tuning iris assemblies, better known as the Standing Wave Ratio Tuners, installed in the waveguide runs of Models SR-3, SR-6, and AN/SPS-6 series radar equipments were provided to reduce high standing waves over portions of the operating frequency band.

Results of fleet tests indicate that the VSWR in well planned waveguide runs exceeds the permissible limits over only a small proportion of the operating frequency band. In addition the tuner assembly must be adjusted whenever the operating frequency is changed in order to obtain minimum standing waves in the waveguide. For the above reasons authorization is granted for removal or omission of subject tuners from installations where tests show a VSWR of 1.5:1 or better over 80 percent of the operating frequency band. It is requested that a note or graph of the test results be attached to the transmitter frame near the calibration charts. The note or graph should clearly indicate the frequency ranges that should be avoided. It is requested that a complete copy of the test results or resulting graph be forwarded by the personnel conducting the tests to the Bureau of Ships, Code 983, for review and recording.

In cases where the above conditions of VSWR cannot be met, it is recommended that the waveguide run be redesigned with the guidance of Bureau of Ships restricted letter S67–(16)–.5) (981–982–504) Serial R–981–3668 of 11 May 1948.

Should it be necessary to retain the Standing Wave Ratio Tuner as part of the waveguide system it must be installed as shown on Bureau of Ships Drawing RE 10F 627C.

Adjustment of STC Controls

Recent fleet tests on the subject equipment indicates that the tracking of small close-in targets can be greatly enhanced by an optimum setting of the STC circuit.

The following adjustment settings appear to give the best results:

Duration......Maximum setting

Flat..........¼ of full swing of the potentiometers

Depression....¼ of full swing of the potentiometers

Personnel responsible for this adjustment should be careful not to use too great a setting of the depression and flat controls as this will result in small targets such as buoys being suppressed. When making the adjustments long range and close-in small targets should be observed and settings made accordingly to give optimum detection of both. In all cases, duration should be set at maximum.

It is directed that ships and yard activities carefully adjust the STC controls as outlined above and that yard activities include these adjustments as a part of the final operations test when checking out the subject equipments.

AN/SPS–6 Series Flexible Waveguide Clamps

Reports have been received that the flexible waveguide sections on Models AN/SPS–6, AN/SPS–6A, and AN/SPS–6B antennas are failing due to fatigue caused by vibration flexure.

Clamps are provided on the upper surface of the feed horn support at the spot where the flexible waveguide passes through this feed horn support. These clamps are incorrectly shown in Figs. 3-5, 3-6, and 3-7 of Instruction Book NavShips 91081. They are shown in Figs. 3-5, 3-6, and 3-7 mounted along the short dimensions of the opening in the feed horn support. The waveguide clamps are actually located with their mounting holes along the edge of the long dimension of the opening in the feed horn support. This error will be corrected by Change 1 to instruction book NavShips 91081.

These clamps are designed to be attached rigidly to the feed horn support with the flexible waveguide clamped between them. A large bearing surface is provided on each clamp, and two through studs with elastic stop nuts on either end pass through holes at the ends of the clamp bearing surfaces.

With the flexible waveguides located between the clamps (the studs forming the short sides and the clamps forming the long sides of a rectangle surrounding the waveguide), the waveguide can be securely clamped between them by holding the studs with pliers while the nuts at each end are tightened. This, of course, shortens two sides of the rectangle and compresses the waveguide between the clamps which are the other sides. The clamps should be tightened as tight as possible without buckling the flexible waveguide.

Next, the clamps should be rigidly attached to the feed horn support using the four bolts provided. After the flexible waveguide clamps are installed properly, a check of the wedging of the waveguide in the clamps and of the tightness of the clamp attachment to the feed horn support should be made at least once a month. The clamping action can be increased by holding the stud with pliers and tightening the nuts at either end.

When the waveguide is properly clamped, it should not be possible to cause relative motion between the waveguide and the clamps by tugging at the waveguide.

In addition, the hardware connecting the flexible waveguide to the upper tube and to the feed horn and elbow, and the mounting bolts of the upper tube clamp should be tightened. The location of this hardware is shown correctly in Figs. 3-5, 3-6, and 3-7 of the instruction books. See points (A) and (B) and step (6).

AN/SPS–6 Series Fuse Rating

The AN/SPS–6 series radar instruction book NAVSHIPS 91,081 requires eight-ampere Fusetrons in positions F1103 and F1104 while the panel on the C–491A/SPS–6 antenna control requires ten-ampere Fusetrons in the same positions.

The ten-ampere Fusetron is the correct rating for fuse positions F1103 and F1104. This rating is correctly shown in Change Number 1 to the AN/SPS–6 instruction book NAVSHIPS 91,081.

AN/SPS–6 Antenna Mounting Lubrication

All antenna mountings, AB–146/SPS–6, have red cardboard tags attached to remind installation personnel to lubricate the equipment properly prior to commencing operations. Some of these tags have been shipped with incorrect information on them.

By error the tags call for Navy Type –2190T oil. They should specify U.S.A. 2–105 GR 90 oil. All persons concerned with installation of this equipment please note.

Replacing B–1303

The following is the approved procedure for replacing the drive motor, B–1303, in the antenna mounting AB–146/SPS–6 used with the following radars: AN/SPS–6 series, SR–3 with Field Change No. 6 and SR–6 with Field Change No. 5.

1—Unscrew the antenna mounting switch box cover and turn electrical stow switch to "off." Mechanically stow the antenna. Drain the oil from the main and gearmotor housings. While the oil is draining, open the antenna mounting terminal box and disconnect leads 168 and 170 on terminal board E–1301 and 60 and 71 on E–1302.

2—Loosen the conduit tube at the motor and at the terminal box, and remove it, slipping the four motor leads out. Remove drive motor B–130 from the main mounting housing by removing the eight hex bolts which retain it. Jacking screws are provided for loosening this motor in its seat. Note that a laminated shim, symbol No. 0–1351 is installed between the motor mounting flange and its seat in the main housing. Do not destroy this shim. It provides the necessary backlash adjustment between the gear motor output pinion and the main drive gear 0–1350.

3—Remove the shim 0–1351 from the motor which has just been taken out of the mounting and place it in position on the replacement motor. With this shim in place install the new motor. Do not re-install the conduit tube nor re-connect the motor leads yet. Wait until after the backlash has been properly adjusted.

4—Measure the backlash between the main drive gear 0–1351 and the output pinion of the drive motor as follows:

a—Lift the mechanical stowing lock, freeing the antenna for rotation.

b—Insert lead wire about 1/32″ in diameter into the mesh of the gears. Turn the antenna by hand, drawing the lead wire into one side of the gear mesh and forcing it out the other. The lead wire will be flattened in spots.

c—Measure the thickness of the wire at two adjacent flattened places with a micrometer. The sum of these two thicknesses is the gacklash of the gears. This backlash should not be more than 0.003″ nor less than 0.001″. If the sum of the thickness of two adjacent flat points of the lead wire does not lie within these limits, the backlash must be adjusted.

5—If the backlash is greater than 0.003″, the thickness of shim 0-1351 must be decreased. Remove the motor from the mounting and examine shim 0-1351. It appears to be made of solid sheet, but it is actually made up of 0.002″ thick laminations which can be peeled off after one spot is loosened with a jack knife. Removal of one such lamination (0.002″ tk) will decrease the backlash by about 0.0018″. Remove the number of laminations required to bring the backlash within the specified limits of 0.001″ to 0.003″. Re-install the motor and again check the backlash. Repeat this process until a suitable reading of backlash is obtained.

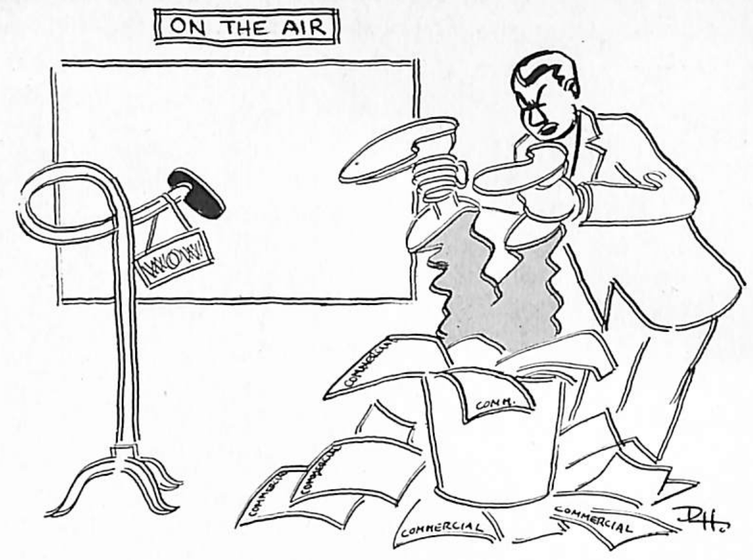
6—If the difference is less than 0.001″, the thickness of shim 0-1351 must be increased. To do this laminations peeled from a shim taken from spare parts must be added to shim 0-1351 until the proper backlash is obtained. The same procedure for measuring backlash as that outlined in paragraph "E" should be followed.

7—When the proper backlash adjustment has been obtained, re-install the motor conduit tube. Connect motor lead A2 to terminal 168, F2 to 170, A1 to 69 and F1 to 71. Close the terminal box cover, turn the electrical stow switch to "on," and screw the switch box cover on. The mounting is now ready for operation, except that it has not been re-filled with oil. *This is of the utmost importance.* Fill *both* the oil reservoirs, the main housing reservoir and the gearmotor reservoir, immediately. Operation of the mount, even for a few minutes, without lubrication will cause failure.

RCA TUBE HANDBOOK

The Bureau of Ships has been receiving requests for the RCA Tube Handbook. This is a commercial publication which the Bureau does not purchase for issue. Ships desiring the RCA Tube Handbook will have to request it direct from the publisher and finance the purchase from ship's funds.

HANDLING AND STOWING RADIOACTIVE SAMPLES . . . . . used for checking radiac equipment



Radium is continually active, sending off radiations at all times. As a result, certain precautions must constantly be observed to protect personnel, and materials such as unprocessed photographic films and papers and radiographic films which would be affected by the radiations.

Radium is shipped in woodcases of sufficient size to prevent personnel from approaching near enough to be harmed by these radiations, unless such contact is for an extended time. This type case has a screwed down cover, which is lifted off to remove the radium safe. For convenience, the radium safe is not replaced in the wooden case, except when it is to be reshipped.

The radium safe is usually a hard wood box with a hinged cover, although this hinged cover may be omitted in some designs. Inside this wood box is a continuous lead safe of sufficient thickness to protect the operator while the radium is being carried from place to place. The lead safe is provided with a lead plug which may be attached to the hinged cover, or may be otherwise securely held in place until it is necessary to use the radium. When the radium is not in use, it should always be kept in this safe, which should be locked in an iron or steel safe having walls three inches thick, or should be stored underground. A simple means of storage is provided by a hole in the floor, preferably in some place where personnel will not be working. This should be lined with concrete or brick and should be covered with a continuous lead slab about two inches thick.

The radium itself, in the form of radium sulphate is sealed in a silver capsule, usually cylindrical in shape. This capsule is contained in an aluminum or stainless steel holder, either cylindrical or pear-shaped, which is provided with strings for manipulation. THE RADIUM CAPSULE MUST NEVER BE REMOVED FROM THE HOLDER BY THE OPERATOR.

When using the radium, a location must be selected where personnel will not be working within twenty feet, or passing within six feet. The location should be roped off for a distance of six feet and preferably ten feet and suitable danger signs provided.

When calibrating radiac equipment, it is desirable to have in readiness a wooden block of the correct height, the top of which has been bored out slightly to form a shallow depression of sufficent size to accommodate the particular radium holder. A glass funnel in a ring stand also provides a convenient support, which can be located in the correct position before the radium is removed from the lead safe.

When everything is in readiness, the radium safe is opened and the radium holder removed and placed in position for use. The operator must not touch the radium holder, even though he may be wearing gloves. Ordinary gloves and clothing are not protection against these radiations. Lead aprons or gloves are but little better and may offer a false sense of security.

In order to manipulate the radium and still keep all parts of the body at a safe distance, the operator should be provided with a wood stick about ¾″ x ¾″ in cross-section and four feet long, and which should be notched at one end. To remove and carry the radium the string attached to the holder is placed in the notch, which is held just above the holder in the case. The stick is held by the opposite end, the string being held by the other hand. In this way the radium can be lifted from the safe, carried to the desired spot (which should not be more than a few feet from the safe) and placed in the correct position in a minimum time, and at no instant being closer than four feet from any part of the operator's body. As soon as the operation is finished the radium should be returned to the lead safe which should be closed immediately.

When handling radium, the operator should have a healthy respect but need have no fear of harmful physiological effects, provided all necessary precautions are taken in its use. Numerous Naval Inspectors performed radiographic examination almost continuously during World War II, in many cases using radium units as high as 500 milligrams, yet suffered no ill effects. Time and distance are the most important factors to keep in mind. The operator should not approach exposed radium holder nearer than necessary nor for a longer time than absolutely necessary to conduct the required operations of placing, checking equipment, and replacing in the lead safe. When not in actual use, the radium holder must be kept in the lead safe. This safe is designed to give sufficient protection to the operator while he is carrying it about, or even when working close to it except for prolonged periods. As a final protection, film badges should be worn by all personnel handling radium as required by Nav Med P–1283, Manual of Radiological Safety dated March 1948.

ARMORED CABLE, CLAMPS AND CONNECTORS

It has been brought to the attention of the Bureau of Ships that Armor Clamp MX–564/U is not being used when armored r-f coaxial cable is attached to Type RN and improved Type N connectors. This results in the armor not being adequately grounded and usually leads to interference difficulties.

Plan RE 49F 406 shows the simple assembly instructions for the use of this armor clamp. The cables and connectors which use this clamp are as follows:

Armored Cables	*Connectors*
RG–10/U	UG–21A/U, UG–21B/U
RG–12/U	UG–22A/U, UG–22B/U
RG–79/U	UG–23A/U, UG–23B/U
RG–116/U	UG–59/U, UG–59A/U
	UG–60/U, UG–60A/U
	UG–61/U, UG–61A/U

Where armored cables shown above are used, the obsolete UG–21/U, UG–22/U and UG–23/U connectors, which cannot accommodate the armor clamp, should not be used.

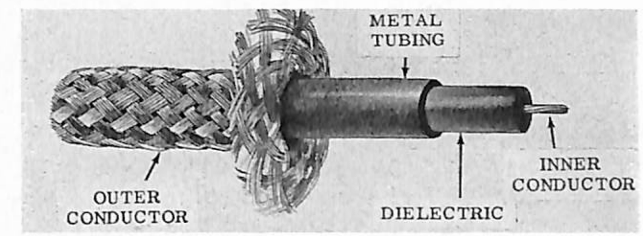
Installations not agreeing with the above should be modified at the earliest possible date.

PRESSURE GLAND FOR COAXIAL CABLE

by
U. S. Navy Electronics Laboratory
San Diego, California

Cables, conduits and piping are usually passed through a ship's bulkhead by means of a gland which, when adjusted for maximum watertight security, exerts considerable pressure on the pipe or cable. When such glands are used for coaxial cable transmission lines, however, the pressure alters the spacing between the outer and inner conductors of the cable, thus materially affecting the electrical characteristics of the line.

To overcome this difficulty, a simple but highly effective device has been developed. At the point where the cable passes through the bulkhead, a short length of metal tubing is inserted between the polyethylene dielectric and the outer conductor of the cable (see Figure 1).

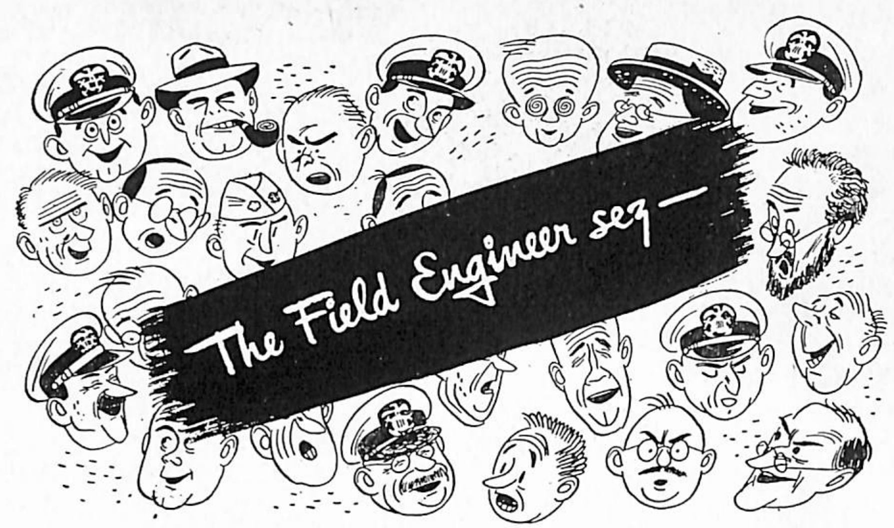


By providing a firm base against which the pressure gland can be compressed, the tubing makes it possible to tighten the gland to form a watertight seal. At the same time, the outer conductor of the cable, protected from compression by the tubing, is left without deformation so that the electrical characteristics of the line are unchanged.

QHB TRANSFORMER AND CAPACITOR REPLACEMENT

Analysis of recent failure reports covering Models QHB, QHBa, and QHB–1 equipments indicates excessive failures of certain of the oil-filled transformers and oil-filled capacitors in the receiver-transmitter unit, Type CAN–43073. Before a redesign of these transformers and capacitors can be applied it will be necessary that the contractor examine these failures to ascertain the exact cause of the failure.

It is therefore requested that Electronics Officers and Type Commanders, in cases of replacements, initiate steps to have these defective transformers and capacitors shipped to the Sangamo Electric Comany, Attention of Mr. C. H. Lanphier for examination. Replacements should be requested either locally or through the Electronic Supply Office, Great Lakes, Ill. Copy of the shipping memo should be forwarded to the Bureau of Ships, Code 983d.



MARK 34/6

Considerable trouble had been experienced by the ships company personnel due to improper operation of the equipment. Duty cycle control at maximum produced barely 6 volts on meter. Sweeps would double up on indicator. Detailed check of transmitter was made but no trouble was found. Current to 5D21 was measured and found to be only 90 mils maximum.

Resistance checks of the modulation generator were made and all were close to tolerance values. Voltage tests were then made on V1 and V2 resulting in a low reading at pin 1 of V2. All closed circuits were removed and resistance checks again made. These disclosed that C615, a 100-uufd capacitor, was partly shorted, reading 20,000 ohms. Replacement of this capacitor restored normal operation to the equipment.

As the range notch was increased from 0 yards, it moved above 3,000 yards, jumped erratically, then disappeared from the A-scope. Observation of TP–11, the exponential rise, actually looked like a square wave. Further tests showed that C–538, a 200-uufd capacitor, was intermittently shorting. This capacitor was replaced and operation of the range unit returned to normal.
—C. A. PICKELL, *11th Naval District*

MODEL QFA–1b

NRTC UNIT, Pittsburgh

A canvas dust cover has been made for the optical projector unit and should aid in the reduction of dust and dirt which normally accumulates in and on the unit. A sketch has been prepared for the fabrication of metal covers to fit over the optical mechanisms. These covers would discourage tampering by non-qualified personnel and could be left in place during normal operation of the equipment. The optical adjustments have been repeatedly found out of adjustment, indicating a need for "barrier" covers.

This report also mentions the presence of a cable exposed in a passageway. The installation of a "kick-plate" or raised duct is recommended. The use of such "kick-plates" or raised ducts wherever cable is exposed in passageways or compartments will minimize the possibility of damage to the cable and the resultant impairment or inefficient operation of equipment.—PHILCO *Field Engineer.*

MODEL SS

Resistor Matching—Bearing Sweep Generator

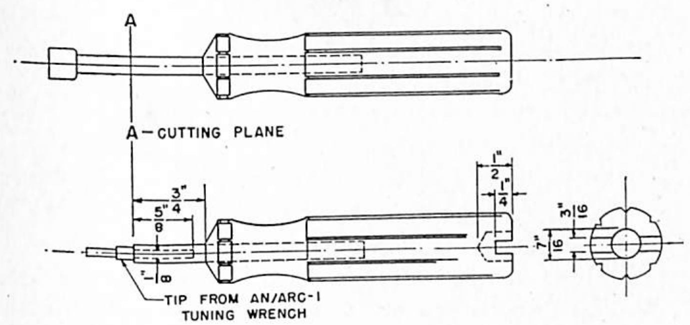
An odd trouble has recently been encountered at the Bell Telephone Laboratories by Mr. N. W. Bryant. During factory tests on a pre-video amplifier and bearing sweep generator trouble developed with centering on the A-B scope and during B presentation.

When voltage is measured between J10A and ground it should be equal to but of opposite polarity to the voltage measured from J10B to ground provided the modulating capacitor C1 is so adjusted that the capacities of the two sections are equal. In the case in question the voltages were not equal and the trouble was traced to resistors R40 and R41. These resistors have 10% tolerance which is satisfactory as far as the circuit is concerned since the actual resistor value is not critical. However, in order to maintain proper balance in the circuit, it is necessary that these resistors be selected in pairs so that the difference in their resistance does not exceed 2%. The same holds true for the pair of resistors R38 and R39.—*Western Electric Newsletter.*

MODEL AN/ARC–1 AUTOTUNE ADJUSTMENT

A damaged Excelite nut-driver or screwdriver with slight alteration can be put to good use in maintaining the autotone units of the Model AN/ARC–1 radio equipments. Figure 1 illustrates how such a damaged article can be utilized with the autotone adjusting wrench which is provided with the Model AN/ARC–1 equipment to make a useful tool.

After sawing off the shank at A-A, a 1/8-inch hole is drilled in the end of the shank to a depth of 3/8 inch. The tip of the AN/ARC–1 tuning wrench (with the knob removed) is then pressed into the shaft for a press fit. Finally, a 7/16-inch hole was drilled in the handle to a depth of 1/2 inch and a slot cut across the end 3/16 inch wide and 1/4 inch deep.



UNAUTHORIZED MODIFICATION OF QHB HAND KEYS

Reports are reaching the Bureau of Ships that the hand key on the Model QHB series sonar equipment console has been removed and replaced with an external hand key. In addition, a few activities have submitted suggestions for installation of external hand keys. Such alternations are unauthorized and the Bureau has disapproved all suggestions of an external hand key.

An improperly installed hand key is apt to be closed by some object being placed on it and cause the driver to key constantly, resulting in burned out transformers, tubes or other components.

Furthermore, it is considered unnecessary for communication purposes with Models AN/UCC–1 and AN/BQC–1 underwater telephone equipment being installed on surface ships and submarines.

All equipments with an external hand key are to be restored to their original condition immediately.

The Bureau has not received any requirements from the Fleet specifying the tactical need for an external hand key. If such a need exists and it is presented to the Bureau through channels, the Bureau will take action to design a hand key that will be safe and meet the tactical requirements.

CHANGE OF RESISTOR SYMBOLS IN F.C. NO. 10 AND 18–B—QGB

The July 1950 BUSHIPS ELECTRON carried an article pointing out that these two field changes assigned the same symbol numbers to certain resistors with different values.

Specifically, Field Change No. 10—QGB assigns
R–510–1 as 100,000 ohms
R–511–1 as 470,000 ohms

Field Change No. 18—B—QGB assigns
R–510–1 as 2.2 megohms
R–511–1 as 3300 ohms

In order to avoid serious errors in ordering replacement resistors and to facilitate accurate stock records, the contractor recommends that all Field Change No. 18—B—QGB Bulletins be changed to denote, R–510–1 as R–510–2, and R–511–1 as R–511–2. This will differentiate the resistance values of the two field changes.

REPLACING MODEL TEB IPA BAND CHANGE SWITCH

The original IPA band change switches in the Model TEB equipment have proved unsatisfactory in operation. The Bureau has procured on Contract NOBsr–49055 newly designed switches which have been delivered where the subject transmitters are installed. Current inventory data was used to determine the number of switches to be shipped to the activities using the subject transmitter. If additional switches are required, they will be supplied by the various stocking points of the Electronic Supply System.

REVISED MODEL RDO SCHEMATIC

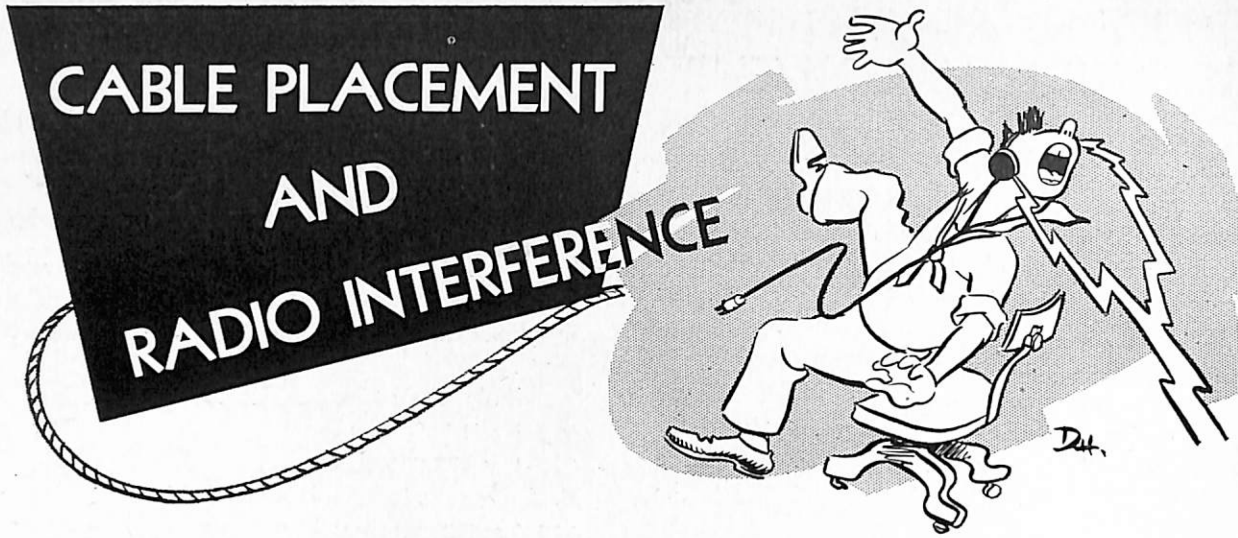
Copies of revised schematics for Field Changes Nos. 2 and 3 to the Model RDO receiver are available at the nearest District Publications and Printing Office as follows:

Figure 8A only of Field Change Bulletin for Field Change No. 2—RDO, NavShips 98140.

Figure 9A only of Field Change Bulletin for Field Change No. 3—RDO, NavShips 98134.

Figure 11A only of Field Change Bulletin for Field Change No. 3—RDO, NavShips 98134.

When ordering, itemize as shown above.



CABLE PLACEMENT AND RADIO INTERFERENCE

Radio interference studies of electronic installations aboard Naval vessels indicate that, frequently, insufficient thought is given to interference problems that may occur as the result of having high level and low level electronic cables installed close together. In the past, when examples of radio interference coupling caused by the improper placement of high and low level cables have been pointed out, the question usually asked is: "What about the cable armor; doesn't it act as a shield for the cables?" The answer is: "Yes, partly." Cable armor is designed for one purpose: cable protection. The fact that cable armor can also be used as radio-frequency shielding is a happy coincidence, but this property of cable armor must be used intelligently. Too often, the shielding effectiveness of cable armor is over-estimated. While the shielding effectiveness of various types of cable armor varies considerably, the greatest radio-frequency attenuation that can be expected from types now in use is approximately 40 db. Expressed as a voltage ratio, the maximum attenuation is approximately 100 to 1. It can be easily seen that considerable leakage of radio-frequency energy can be expected through cable armor, especially from armored cables which are carrying high levels of radio-frequency energy or radio interference.

Interference currents and voltages in armored cables can affect other circuits in two ways:

1—By direct radiation penetration of the interference through the armor itself, which of course is attenuated by an amount dependent on the effectiveness of the armor as a shield.

2—By radio-frequency leakage currents which travel on the *outside* surface of the cable armor instead of on the inside as they would if the armor acted as a perfect shield. These currents, flowing along the outer surface of the cable, can develop voltage drops along the armor by virtue of the impedance of the armor itself, which can be considerable at radio frequencies. These voltage drops along the cable armor can then cause the armor to act as a radiator or antenna. This interference radiation can be particularly severe at certain frequencies if the armor length is such that it is resonant at those frequencies. It can be seen that the proper grounding of cable armor is important. By providing a low impedance path to ground at both ends of a cable length, the leakage currents which would ordinarily flow along the outer surface of cable armor can be at least partly short circuited, and radiation of interference from the cable armor minimized. It is vitally important that ground connections have as low an impedance as possible. Important features in ground strap installation are short length, large continuous surface area, and good metallic connection.

The following instances of mutual interference between electronic equipments, caused by improper placement of high and low level cables, will illustrate several ways in which this type of interference coupling manifests itself. Although all of the following cases occurred aboard submarines, the principles involved apply equally well to all types of ships.

1—The first case concerned mutual interference between WFA–1 sonar and SS radar equipments. When the two equipments were operated simultaneously, the pulse repetition frequency of the SS radar could be heard in the output of the WFA–1 sonar. Equipment chassis were not grounded. Cable armor on the cables leading to the equipments were not grounded. Loop probe investigation with the Radio Interference Field Intensity Meter AN/PRM–1 disclosed high levels of SS radar pulse interference on each of two cables, one leading to the SS equipment and the other leading to the WFA–1 equipment. Lifting of several deck plates, beneath which the cables were run, revealed the source of coupling. The cables were run side by side adjacent to each other for about four feet in the same cableway. Physical separation of the two cables to opposite sides of the cableway, a distance of about six inches, reduced the interference to negligible proportions. In this case, complete elimination of the interference was effected by the proper grounding of equipment cases and cable armor.

2—The second case concerns mutual interference between a TCZ transmitter and an SV–1 radar equipment. When the two equipments were operated simultaneously, a bright flash would appear on the PPI scope of the SV–1 radar each time the TCZ transmitter was keyed. Investigation disclosed that the video cable running between the SV–1 receiver and console through the radio room lay very close to the TCZ antenna transmission line. TCZ transmitter energy was coupled into the low level video cable at this point. After the video cable had been rerouted so that it ran *around,* not through, the radio room, interference between the two equipments was eliminated.

These examples indicate, in part, the relatively simple precautions and corrective measures that are to be resorted to in improving performance by the reduction of electronic interference. It is becoming more apparent, as the Electronic Interference Reduction Program progresses, that proper utilization of cable armor in eliminating and confining interference resolves itself predominantly into a matter of good workmanship and "good housekeeping." Consistent attention to this will materially improve performance of the installed electronic equipment and render the vessel more secure from detection by further reducing the chances of spurious radiation.

tips and lights nt 10695 soldering guns

Many activities report difficulty in obtaining replacement tips and lights for Navy Type NT–10695 soldering guns (Navy Stock Number N16-T-3495–600), according to Lt. Cmdr. Lester Harlow, Assistant Electronics Officer, Norfolk Naval Shipyard.

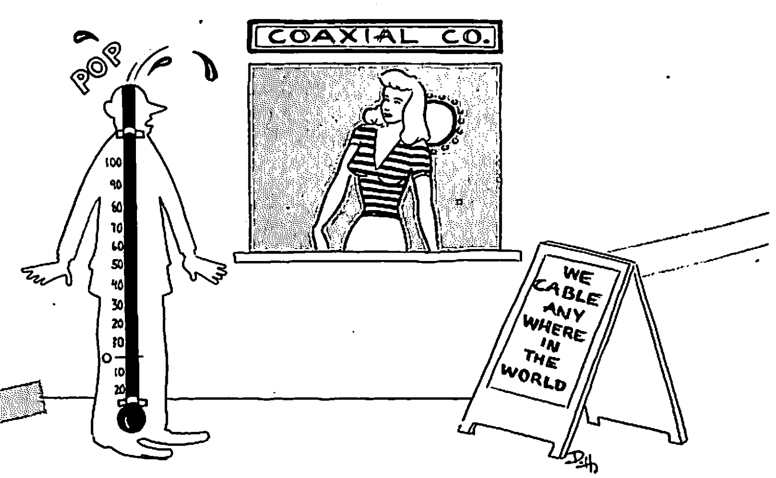
No activity need be without tips as long as they have some #10 copper wire. A six-inch piece of #10 copper wire, bent into shape and installed does equally as well as a "store-bought" tip. Experience has indicated that the average tip can be expected to last from 125 to 150 operations before requiring replacement. The so-called long life tips, despite the manufacturer's claims, do not appear to be worth the additional cost.

Replacement lamps, as far as can be determined, are not in the regular Navy supply system. However, they are identical to the lamps used in *single-cell* pen flashlights and can be obtained from the nearest ten-cent store. The replacement lamp is a 1.1-volt lamp. Some of the commercial designations for it are Eveready #1151 or Mazda 112.

Accordingly, no soldering gun need be out of service while waiting for a new supply of tips and lights to come through.

"LETTERS TO THE EDITOR" IS HERE TO CURE *YOUR* HEADACHES. SEE PAGE 32 OF THIS ISSUE

high temperature installations of shipboard coaxial cable



The Bureau of Ships has adopted the use of teflon insulated cables and connectors for high temperature applications aboard ship. Actual installations will be directed by the Bureau with applicable shipalts. However for emergency installations Bureau of Ships plan RE 62F 2000B may be used as a guide.

RG–116/U and RG–118/U are armored cables approximating RG–10/U and RG–18/U respectively, both in physical and electrical characteristics. Both cables are being procured by the Electronic Supply Office.

The characteristics of the teflon connectors and their status are shown below. Both Plug UG–21B/U and Jack UG–23B/U already have teflon insulation. However they use synthetic rubber gaskets which will not withstand high temperatures. They may be used above or below the heat zones.

Because of the high cost of teflon cable, it is the Bureau's policy to use teflon cable only in the heat zone and approximately 5 feet past each end of the heat zone. Instructions will be given for each individual case.

TEFLON CONNECTOR SUMMARY—AS APPLIED TO RE 62F 2000A

JAN TYPE	DESCRIPTION	TYPE	FITS RG–( )/U	ENDS	STATUS
UG–21B	Plug	N	10,116		ESO will procure with silicone rubber gaskets
UG–23B	Jack	N	10,116		
UG–29B	Adapter	N/N	—	2 Female	In stock (see below)
UG–532/U	Plug	LT*	118		In stock (see below)
UG–533/U	Adapter	LC/LT*	—	2 Female	In stock (see below)
UG–557/U	Plug	N	118		ESO is buying
UG–586/U	Adapter	LC/LT*	—	2 Female	ESO has been requested to procure

* LT is a modified LC connector used only with teflon cable. Will not mate with LC.

TEFLON CONNECTORS BOUGHT UNDER CONTRACT NObsr 42075

CONNECTOR	INITIAL DISTRIBUTION		
	SSD–NSC Oakland	ESO–NSC Norfolk	NSD Bayonne
UG–29B/U	100	100	93
UG–532/U	40	40	13
UG–533/U	40	40	13

In the Types I to IV standard installations, the UG–21/U, UG–21A/U, UG–23/U, UG–23A/U, UG–29/U, UG–29A/U, and UG–167/U may be used instead of the connectors shown but with much greater electrical loss and poorer mechanical features. They should be used only where the specified connectors are not obtainable in sufficient time to complete the installation. Similarly the Types IA and IIIA substitute installations are poorer electrically and should be replaced by standard installations as soon as practicable. The substitute installations introduce a mismatch into the line which should be tolerated only until the proper connectors become available.

Only the specified connectors should be used for the Types X to XII installations.

AN/FRR–3A BAND SWITCH GEAR LUBRICATION

The U. S. Navy Communication Station, Wahiawa, T. H., reported to the Bureau that numerous outages were encountered in the AN/FRR–3A radio receivers due to the freezing of the gear shafts in the band changing mechanism with consequent stripping of the fiber gears. Due to the high ambient temperature of the cabinets and the high speed of the band-change motors, ordinary greases were unsatisfactory. It was finally found that the following procedure effectively eliminated this type of outage. The gear shafts are removed from their housings, (with some difficulty), the shafts were greased with Bell System (teletype) KS–7471 grease and the gears were reassembled. This is done quarterly.

As the report indicates the above to be very effective, it is recommended for use where this type of outage is occurring.

BATHYTHERMOGRAPH REPAIRS

The Inspector of Naval Material, Bridgeport, Connecticut has informed the Bureau of Ships that operating vessels frequently request that office to recondition bathythermographs and return the unit to the vessel.

This article is published in order to acquaint ships and stations with the Bureau's established procedure.

Bathythermograph Repair Facilities have been established at Boston, Mare Island and Pearl Harbor Naval Shipyards, for the repair of all bathythermographs.

Contract NObs 2349 with the Bristol Company, Waterbury, Connecticut, has expired; therefore, the procedure is as follows:

1—Damaged bathythermograph equipments shall be turned in to the nearest supply activity.

2—Upon request, the Bureau of Ships will furnish disposition instructions and an Electronics Supply Office shipment order will be issued.

3—Replacement equipments will be furnished upon written request to the Bureau, or in case of an emergency, a supply activity may issue them upon approval of the cognizant Electronics Officer who will report this to the Bureau of Ships (Code 883).

NEW TYPE BATHYTHERMOGRAPH NOMENCLATURE

The Model OAM series bathythermographs consisted of a shallow and deep fish, complete with a winch and cable.

The new series bathythermographs which will be reflected in the Electronic Equipment Type Allowance Booklet, NAVSHIPS 900,115, could be confusing because the BT's and hoist are not a system under the new nomenclature.

The following bathythermographs are covered in instruction book NAVSHIPS 91340:

OC–1A/S. . . .Depth range. . . .zero to 200 feet
OC–2A/S. . . . " " " " 450 "
OC–3A/S. . . . " " " " 900 "

The new hoists are designated E–2/S and E–6/S which are described in instruction books NAVSHIPS 91175 and NAVSHIPS 91348 respectively. Either of these hoists and the allowance of bathythermographs completes the new system. The important point to remember is that the hoist is now separate.

NEW MODEL TDZ/RDZ SERVICE AND REPAIR MANUALS

The Bureau of Ships has contracted for service and repair manuals for certain specific equipments. The first two of these are now available for distribution. They are the RDZ Service and Repair Manual, NAVSHIPS 91331, and the TDZ Service and Repair Manual, NAVSHIPS 91328. The extension of this program to other equipments is, to a major extent, dependent on the reaction of the Naval electronic service to these manuals. The Bureau urges all activities to submit their comments on these manuals as quickly as possible. Automatic distribution will be made to major installation and maintenance activities. Other activities desiring copies should request them from the nearest District Printing and Publications Office.

DETECTING LEAKS IN QHB/QHBa TRANSDUCERS

by
R. A. WESTERVELT
U. S. Navy Underwater Sound Laboratory
Fort Trumbull, New London, Connecticut

Page 26 of the July 1950 BUSHIPS ELECTRON reports on leak detector tests made on several vessels of the fleet and shows a wide variation in readings as a function of time. It is thought appropriate to suggest an additional test used at this Laboratory for the detection of the presence of salt water in a scanning transducer. If salt water in some manner makes contact with any portion of a transducer element winding or leads therefrom, a small sea cell will be formed having as electrodes the metal casing of the transducer and the lead or element winding. If a high resistance voltmeter (20,000 ohms/volt or more) is placed across these two electrodes, a d-c voltage of the order of 0.25 to 1.5 volts can be measured. This measurement can be made at the scanning switch assembly by removing all transducer leads from ground and making the voltage measurement with respect to ground. It is also possible by measuring each element separately to isolate the portion of the transducer that has been flooded.

In the case of QHB/QBB–1 the measurements can be made by removing the common transducer ground on terminal board 4B. Lead 4B–A should then be removed from terminal 4E–11; this removes the ground from the preamplifier input transformers. The measurement should be made from the common side of all transducer elements to ground. This, of course, is a check on all transducer elements combined, and in order to isolate the trouble each element lead will have to be removed and tested separately. The above described measurement may also be made on the MCC ring as well as the leak detector itself.

In case of emergency, if it is found that a leak is affecting only one or two elements, these may be temporarily disconnected and operations resumed. The effect of disconnecting one or two elements is to impair the beam pattern at the bearing of the particular elements. However, in an emergency, operation will not be too greatly impaired.

It should be pointed out that an ordinary resistance check of transducer leads to ground is not satisfactory for the following reason: If the transducer has leaked, a sea cell will be formed and the resistance reading of the ohmmeter will be either very high or very low depending on the polarity of the sea cell with respect to the ohmmeter leads. Thus, a high resistance could be measured leading one to think the transducer had not leaked when it actually had. This may be part of the trouble experienced with the leak detector described in the July 1950 ELECTRON.

A simple experiment with a 1.5 resistor in series with a 1.5-volt battery and using the ohmmeter of a vacuum-tube-voltmeter to measure the resistance of the series circuit, shows that a low resistance of 1 megohm is measured with the ohmmeter leads one way and a high resistance of 15 megohms with the leads reversed.

It should also be pointed out that the sea cells formed have a fairly high internal resistance and the voltage will drop to near zero if measured with anything but a high resistance voltmeter. A vacuum tube voltmeter is recommended.

FAILURE REPORTS ON SUBMARINE ELECTRONIC EQUIPMENT

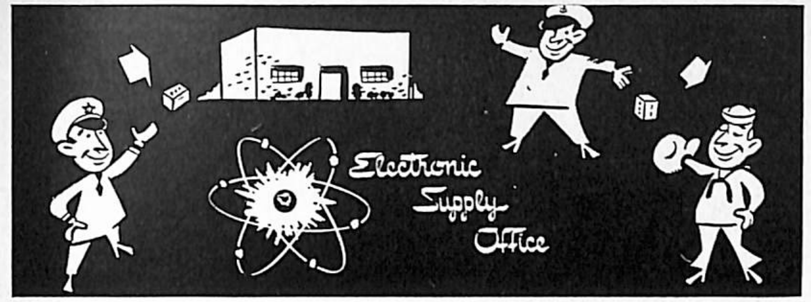
It is very important that failure reports (NAVSHIPS 383) be submitted on every failure whether it be mechanical or electrical. All Electronics Officers should stress this point to their technicians. It has been noted in particular that failure reports have not reached the Bureau on Model ST adaptor troubles. When the tender overhauls an adaptor, the repair personel should provide the submarine with such details as are necessary to correctly fill out the failure report. This responsibility lies with the submarine personnel and not the tender.

—*SubFlot One Electronics Newsletter*

BUREAU COMMENT: *Although this item was submitted from an individual type organization, it is strongly concurred in by the Bureau and is applicable to all Electronics Officers and technical personnel.*

MODEL RCK DIAL ASSEMBLY

Several reports of breakage of the ceramic shaft of Capacitor C–112 of the Model RCK have been reported. A large number of these failures can be attributed to improper maintenance. In some cases the five screws under the preselector unit which "jig" and secure the dial assembly in place have been replaced improperly. This has resulted in a loose dial assembly causing the ceramic shaft to crack. These screws should not be touched ordinarily and are painted red to call attention to this fact. Removal of the screws during routine removal of the preselector bottom plate places undue strain on the ceramic shafts causing breakage. Therefore—DON'T TOUCH.



E.S.O. MONTHLY COLUMN

IDENTIFICATION OF LEFT-OVER PARTS

The removal of material from equipment spare parts boxes for sorting, identification and binning will result in a certain amount of left-over items. As a rule these are items which cannot be quickly identified by the use of a Spare Parts Breakdown List and must be identified by other means and different techniques.

It is important that the equipment application for these items be preserved since it provides an essential clue to their identity. The loss of this clue may prevent these parts, which are usually of a mechanical nature, from being identified and made available for use in the system.

This office has become aware that some activities have consolidated the left-over items for special processing, without regard to their individual equipment application and as a result their identification becomes a difficult if not impossible task.

Activities consolidating or grouping together these left-over items, for the purpose of convenience and special handling, must make every effort to maintain the equipment application, thereby keeping to a minimum the amount of unidentifiable material in the system.

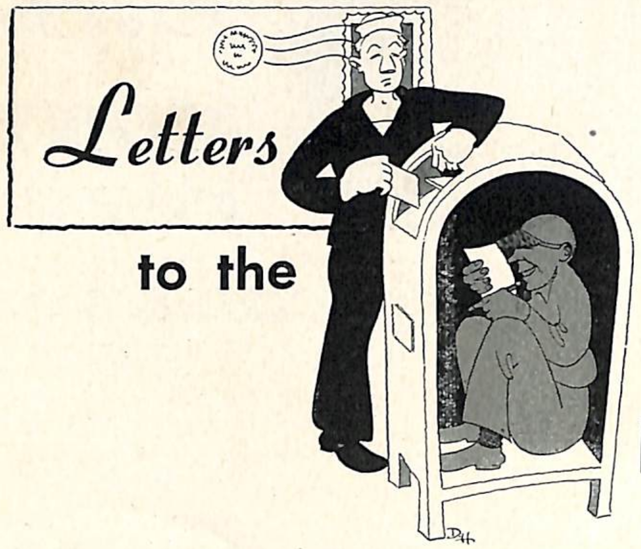
ELECTRONICS CATALOG STATUS

As part of its mission, ESO has been delegated the responsibility of preparing and distributing the Bureau of Ships Section, Part II (Electronics), Catalog of Navy Material. This section will cover all electronic maintenance repair parts used in the Electronic Supply System, and is to be used, where applicable, in the identification, requisitioning, receipt, storage and issue of these materials.

Bureau of Ships Part II will consist of many individual catalog sections, each devoted exclusively to a particular commodity and complete in itself. These sections will be distributed as soon as they are printed. Standard Navy Stock Numbers have been assigned to all the material included. The descriptions for the material are based on the descriptive requirements of the Joint Army-Navy-Air Force Manual of Standard Descriptions (JANAP 109) and the Munitions Board Cataloging Agency requirements.

EMCR #10 BEING PRINTED

The actual compilation, layout and printing of the 10th Edition of the Electronic Materials Cross Reference is now in progress. This publication, which had a cutoff date of 7 February 1950, will include: Foreword and Introduction (including JANAP 109 Pattern Descriptions, MBCA illustrations and abbreviations, ESO manufacturers, numerical code, cross reference to the manufacturers' names, etc.); Section A—Reference Number to Stock Number, and Section B—Stock Number Transaction Index. Section A will consist of approximately 1,500 pages with 310,000 reference numbers cross referenced to some 120,000 Standard Navy Stock Numbers. Section B, consisting of approximately 400 pages including an estimated 80,000 Standard Navy Stock Numbers, will include all stock number transactions (conversions, change of control cognizance and replacements) that have occurred since the inception of the Stock Number Conversion Program to Standard Navy Stock Numbers.



Letters to the EDITOR

This new feature is the answer to numerous suggestions and requests from fleet and shore personnel for a medium of presenting their individual problems, gripes and questions on electronics matters and obtaining answers to such queries. The continuance of this new feature depends entirely on you—the personnel in the field—since we must first receive correspondence from the field before we can search out the answers and print them. As a matter of convenience, it is suggested you write directly to:

The Editor
BuShips Electron
Code 993
Bureau of Ships
Navy Department
Washington 25, D. C.

Editor
BuShips Electron
Sir:

Why is it, when using an echo box on the SP radar, ring time is indicated by a loss of grass instead of a normal indication of energy being returned by the echo box?

W. H. ET1
F. K. ET2

When an echo box is used, a strong ringing signal is generated in the echo box and fed into the receiver. Due to the close proximity of the echo box to the receiver, the signal "seen" by the receiver has a very large signal-to-noise ratio—so large in fact that the normal noise pattern is obliterated from the scope and only a straight line is seen. As the ringing signal from the echo box decreases in strength, the signal-to-noise ratio decreases as evidenced by the reappearance of the noise at the trailing end of the ringing pattern. Another way of explaining the pattern is that the echo box signal "saturates" the receiver, thus eliminating the noise pattern. This condition is comparable to a strong radar signal which, as we know from observation, will be "limited" and flat on top with no visible noise pattern except on the lower leading and trailing edges. For further information on echo box operation and principles see ELECTRON *for August 1945, October 1945, March 1946 and November 1946.*

EDITOR

Editor
BuShips Electron
Sir:

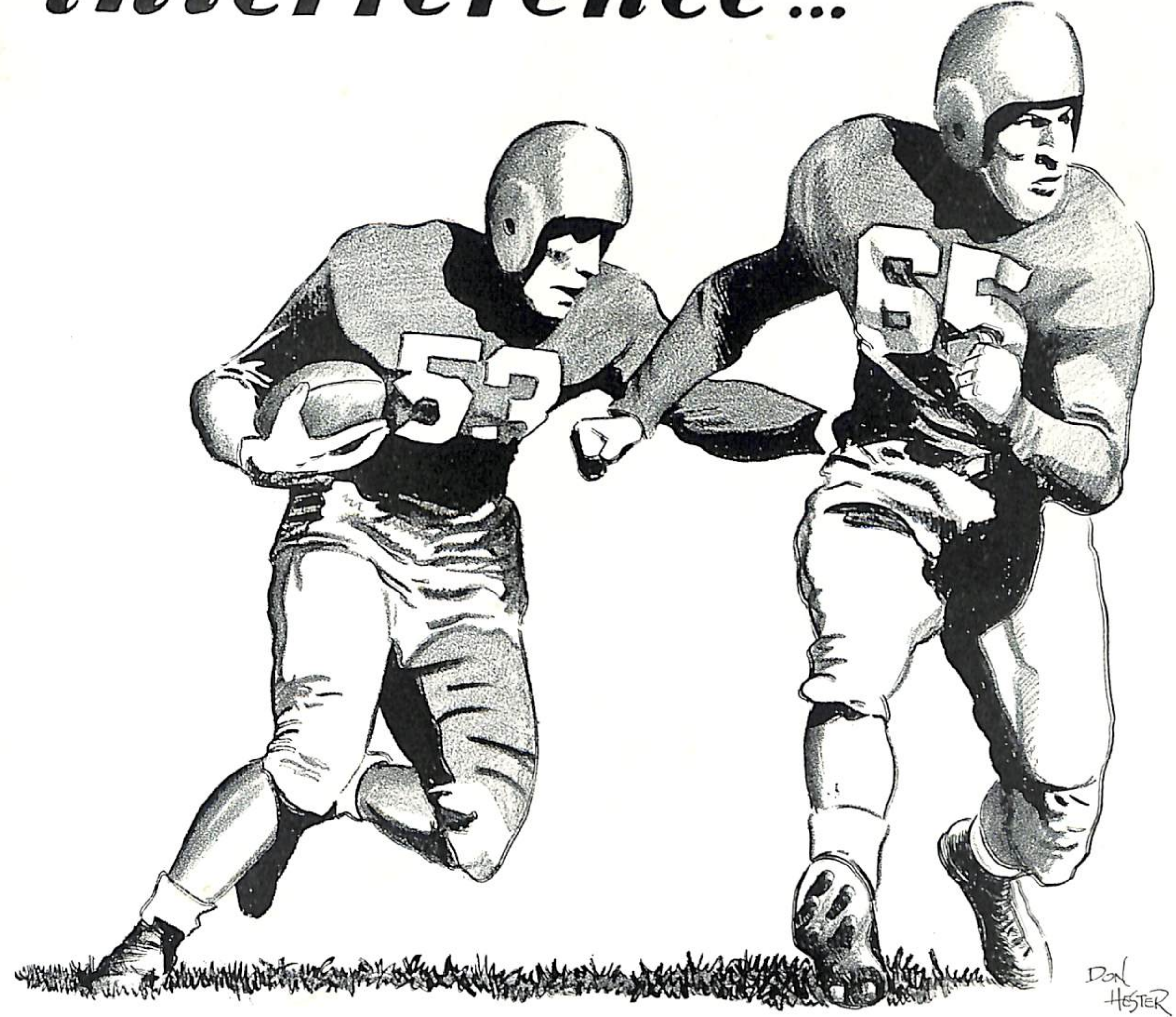
In reference to your beautiful illustration inside the back cover of the October 1950 ELECTRON (the electronics work bench), are these benches available to Electronics Repair Facilities at Shore Based installations outside the Continental limits? If they are available, how can they be obtained?

D. H. ET3

There are "Electronic Models A & B Unit Assembly Type Work Benches." Type A was illustrated in ELECTRON. *Check Section G allowance list for your type activity. If a workbench is included, order it through normal supply channels.*

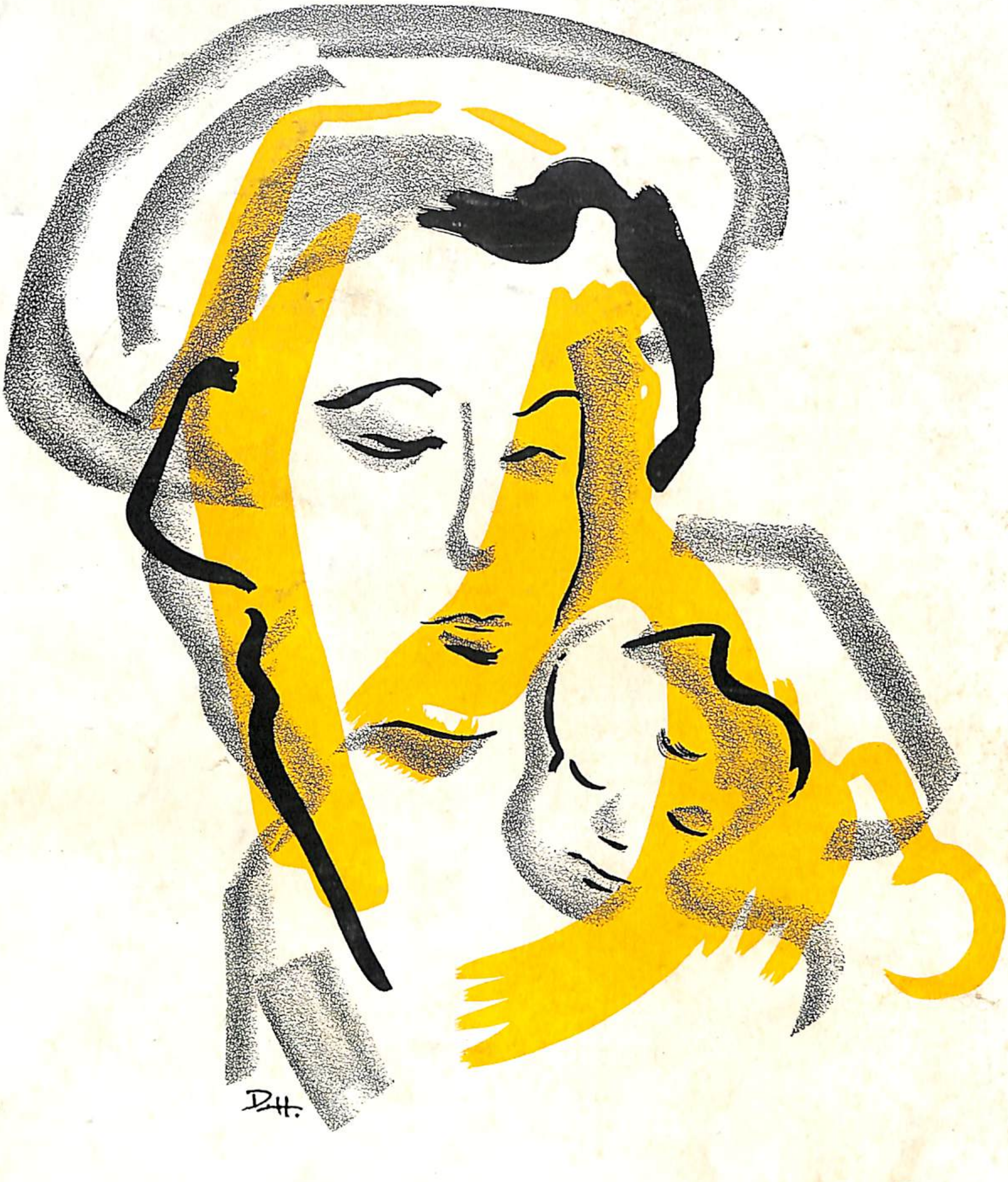
EDITOR

interference...



... MAY BRING VICTORY ON THE GRIDIRON ... BUT INTERFERENCE IN YOUR EQUIPMENT MAY BLOCK A VITAL DEFENSE MESSAGE AND CAUSE DEFEAT IN BATTLE.
HELP US HELP **YOU** ELIMINATE YOUR HEADACHES...
.... SEND YOUR PROBLEMS TO THE EDITOR OF THE **ELECTRON**

RESTRICTED



Seasons Greetings

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