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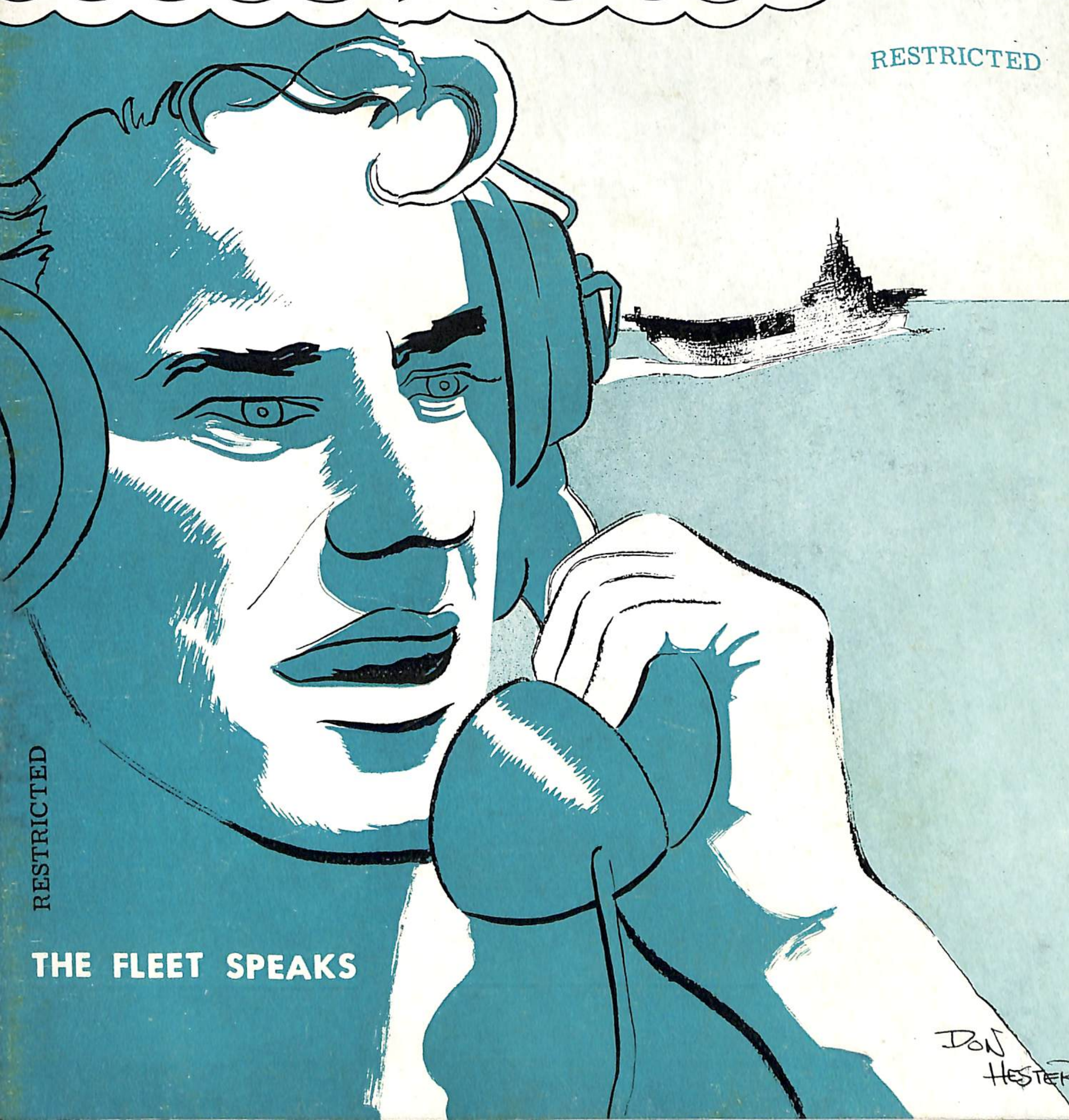

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THE FLEET SPEAKS

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THIS ISSUE

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Maintenance Problems ... a fleet view

by
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The recent series of articles concerning electronics organization and maintenance has been followed with much interest on this vessel. Unfortunately, in the writer's opinion, the fleet viewpoint has been conspicuous by its absence. The electronics officer afloat, regardless of the type of ship, will in most cases be unable to solve all his problems by the methods and techniques recommended in the Electron articles. Commander Thomas certainly hits the nail on the head as far as the long-range problem is concerned, but it is my intention, in discussing a few aspects of the maintenance problem in the fleet, to propose what I consider the logical solution to the immediate problem.

To start from common ground, I think we are all agreed on the following points: (1) that electronics is of vital importance to the Navy; (2) that electronic equipment requires constant maintenance, both corrective and preventive, if its performance is to be optimum; (3) that trained personnel in adequate numbers are required to perform this maintenance; (4) that, in general, the equipment is *not* being kept in optimum condition; and (5) therefore we are faced with an electronics problem.

In solving the problem, there are certain variables beyond the control of the fleet which are too often dismissed casually as of minor importance or brushed aside by summarily directing the fleet to overcome them anyway. Although specific examples will be mentioned here, they are intended to be representative of general problems, as I believe their counterparts will be encountered on practically any ship.

First, there is the personnel problem. Ships do not enlist their own personnel nor are they free to eliminate the misfits without a great deal of trouble. The results of the assignment of men by the various shore commands are often such that the ship cannot make the most effective use of the skills of its personnel. To cite a minor instance, ten graduates of Class C AEW school, mostly nonrated, have been assigned to this ship. Unfortunately we do not have that equipment, so the men are rapidly losing the skill they acquired at school. As another example, a man with excellent qualifications in guided missiles was recalled to service and sent to us. Since it was felt that his services might be needed elsewhere, considerable effort was spent in requesting his reassignment, which was approved. The few months he spent aboard were therefore wasted in large part.

Much stress is placed on the utilization of training schools, but as far as this vessel is concerned, the only courses available up to now have been in SP and UHF. We would like more schools covering maintenance, specifically such equipments as stable elements, teletype, SG–1b radar and the various repeaters.

Another aspect of the personnel problem is the fact that the Electronics Repair Officer is generally of low rank and in charge of a relatively small group of men. It is easy to say that he must make use of operating personnel to perform maintenance, but he has no direct control over these men. In fact, according to Navy regulations the radio and radar operators are in the Operations Department while electronics repair falls under Engineering. I point this out merely as a fact, not as a complaint. What is of much greater importance is the fact that most operating personnel do not meet the qualifications for entrance to ET school. Are they any more qualified to perform maintenance on the equipment they operate?

Second is the material problem. Granted that we must make the most of what we have, age and obsolescence not withstanding. This may be a minor point, but one of the most persistent complaints on the part of the technicians is the lack of a decent instruction book and prints on the SG–1b trainer. This and other equipment of similar age has been so altered that it bears little resemblance to the original, but the instruction books have lagged far behind. Another complaint is the inadequacy of instruction books on equipment which was designed for use in aircraft but has been adapted for shipboard use. Such installations are little more than "lash-ups" and any information on their peculiarities has long since been forgotten.

The repair parts situation is a dead horse by now and there is no use kicking it again, but suffice it to say that certain functions of the SP radar have long since been inoperative for lack of parts which are just plain unobtainable. We make the most of what we have, but frankly, the best is not good enough.

Finally we come to the problem of making the man-hours which are available cover the work which must be done. Here the fleet's problem is unique. Ships customarily spend about 2/3 of their time at sea. While at sea it is a demonstrable fact that practically all equipment is in use and practically no preventive maintenance can be accomplished. Therefore during the short time in port the ET is faced with the dual problem of repairing the breakdowns of the period at sea, and also performing all of his preventive maintenance and improvement work. But—he is now called on for working parties, shore patrol, and all the other in-port details. And—he must take his leave now or never, as well as his liberty, recreation and personal business. The ET is just as human as any other sailor and cannot reasonably be expected to stay aboard week-ends while other divisions shove off on early liberty. The Electronics Officer likes to see his wife and family too, even if the gear gets neglected. All these factors greatly reduce the maintenance which can be accomplished on week-ends or short stretches in port.

The solution to this problem is actually quite logical. Assigning more ET's to the ship does little good, as they merely get in each other's way when at sea. Taking them off of special details in port, besides being a practical impossibility, has undesirable repercussions in seeming to set them apart from the rest of the ship. The obvious solution is to supply the additional men only when the ship is in port. To this radical suggestion I would hasten to point out a precedent which has proven successful, and an existing organization which is capable of undertaking the job.

During the war, submarines returning from patrol were turned over to a relief crew, whose members performed a complete overhaul and returned the ship to its crew ready for the next patrol. I propose the establishment of electronics "relief crews" whose function will be limited to assisting the ship's force rather than relieving them completely. Picture how such a system would operate. The ship ties up for a two-week upkeep period and is met by an Electronics Officer with a crew of ET's. The ship's officer and the "relief crew" officer confer, go over records and procedures, pass information along. The men, specialists in particular groups of equipment, pair off with the ship's technicians and dig into the equipment. Another member of the team acts as liaison with supply ashore and assists in tracking down those elusive, but always vital, repair parts. When the upkeep period is over, the equipment is left in tip-top shape, field changes properly completed, records up to date. It seems an impossible picture, doesn't it?

Now how about the organization to take over this function? The obvious choice is the ServLant (and ServPac) Electronics Group. This organization already performs services similar to those of the "relief crew", but only at the request of the ship. Obviously it does not have the personnel to attempt such a program at once, but the men are available in the fleet. Take this ship as an example. This class of CVE is allowed 15 rated ET's and about 5 strikers. This number of men is hard-pressed to keep up with the maintenance of the equipment assigned, yet is greater than is required at sea. Let us assume that 6 could be spared. The men would be overjoyed to be assigned ashore or intermittent sea duty, and the reduction of complement would benefit the berthing problem on the ship. In return, the ship could expect the services of a gang of 12 men while in port. Yet the total of man-hours available has not changed, since, on the average, the ship loses the services of 6 men for 2 weeks at sea, and gains the use of 12 men for one week in port. Therefore this plan will require no net addition of ET's to the fleet.

In addition, this plan will provide a training program far better than anything which could be arranged on board. Now, there are more strikers than petty officers so that individual instruction is all but impossible. But with the "relief crew", each man on board will be paired with a specialist. Even more important will be the value of comparing the performance of equipment in various ships, passing along hints, correlating complaints and difficulties. The officers will be in a perfect position to act as a fleet clearing house, sifting the problems and complaints and passing them along to the Bureaus concerned. The establishment of a liaison with supply will save thousands of man-hours spent in chasing down parts and making emergency trips for "Priority B" material, the necessity of which could have been avoided by proper maintenance or the foresight of experience.

I hope I will be forgiven having taken an attitude which may verge on the provincial. After all, my viewpoint has been chosen to be strictly that of the fleet. Staff, shore based and Bureau officers will undoubtedly hold different views on the same subjects, and I respect those views. For whatever differences may exist, the goal of all of us is the same—to insure that our Navy gets the best possible operating from the best electronic equipment available.

Many ships have been making the mistake of considering certain motors, generators, and synchros beyond repair merely because the bearings have become defective and are not listed in the instruction book spare parts list. The procedure for obtaining and installing bearings is as follows:

1—Remove the old bearing and check the manufacturer's number which is stamped on the bearing.

2—With this number enter Table "C" in the Class 77, General Stores Section of the Catalog of Navy Material (in the possession of the Supply Officer) and obtain the Item Number. Then go to the numerical list of Item Numbers Groups 1 through 3, and obtain the Standard Navy Stock Number and a description of the bearing.

3—Have the Supply Officer requisition the bearing.

4—Install the new bearing and lubricate, where required, in accordance with the equipment instruction book. Use the following precautions when installing the bearing:

a—Be sure that the bearing and shaft are in perfect alignment to prevent scoring the shaft.

b—If the bearing is a tight fit on the shaft, use pressure on the inner race *only*.

c—If the outer race is a tight fit in the housing, use pressure on the outer race only.

d—In no case force the bearing by hammering on it!

5—The following is an example of how to obtain the Standard Navy Stock Number of a particular bearing.

a—The blower motors B–101–A, B–102–A, and B–103–A for the TDZ and the blower motor B–101–B for the REM are the same identical motor, Navy Type 211371, ESO stock #N–17–M–54310–5681. The small inner bearing of this motor has a tendency to become defective.

b—Examining this small inner bearing we find a manufacturer's number, 77R2. From Table "C" in the Class 77, General Stores Section of the Catalog of Navy Material we find the Mfr. Name Code, ND (New Departure) and the Item Number 21989. We then go to the numerical list of Item Nos. in Groups 1 through 3 and obtain the Standard Navy Stock Number, G–77–B–115–00209–2000 plus a description of the bearing. We can now requisition the bearing.

Maintenance Notes on the... MARK III IFF ABK

by G. E. Roberts, ETC
Electronics Service Group
Service Forces
U. S. Atlantic Fleet

WHILE it is true that ABK series transponders cannot be thoroughly checked out and maintained without adequate test equipment, a maintenance and operational check program can be set up whereby the ABK series transponders can be kept operating at least satisfactorily even though this special test equipment is not immediately available.

Most of the failures render an ABK inoperative or cause it to squitter. These troubles can be immediately determined by headphones when connected into J–304 located on the "switching unit". If the set is not responding to interrogations, there will be no sound in the headphones except possibly a clicking sound. Squittering can usually be determined by the nature of the noise heard in the phones. Squitter is irregular firing of the sender tube by noises in the ABK circuits. Since these noises are irregular, the sound of squitter is an irregular, scratchy-like sound without definite pitch. This condition when serious enough, will render an ABK incapable of answering an interrogation.

When an ABK is replying to an interrogation, for each reply, a definite tone will be heard in the headphones. The pitch of the tone will be determined by the pulse recurrence rate of the interrogation.

Ships in company at sea can arrange for an IFF check between each other at definite prearranged times by challenging each other. This way the entire IFF system can be checked at least to some degree. Such a check when conducted at short ranges, would not insure that all ABK's concerned are capable of being triggered throughout their specified frequency range and incapable of being triggered outside of this range. There would be no assurance that the ABK's were radiating enough power. Neither would this sort even though apparently successful, insure that an interrogator is operating at optimum performance and capable of interrogating ABK's at great enough ranges.

To encourage technicians in the fleet to take more of an active interest in IFF equipment and benefit from some of the valuable experience and knowledge to be gained, some of the important irregularities found in most ABK equipments requiring immediate attention, and what to do about them follows. All references to figures and symbols where the ABK is concerned will be found in NAVY MODEL ABK SERIES AIRCRAFT RADIO RECEIVING EQUIPMENT "CSP 1375". There are a number of TS–182/UP portable test sets in the fleet and many technicians who do not have one will be able to borrow one. Unless the frequency calibration of this test set is known to be accurate, it should be checked and points corresponding to 154, 158, 186, and 190 megacycles should be marked or otherwise identified on the test set's frequency scale. A convenient way to calibrate the TS–182/UP is to tune a receiver such as that used in BN, BL, or BM equipment to these frequencies by the use of an OAP. The TS–182/UP can then be accurately tuned to the receiver.

Checking Voltage Regulator

The output of the voltage regulator supplies voltage for the filaments and the dynamotor. An improperly functioning voltage regulator may greatly affect the performance of the transponder.

The range of input voltages over which the regulator must operate are as follows:

For 12-volt models, regulator output voltage must lie between 8.55 and 9.45 volts for all input voltages between 10.5 and 15 volts.

For all 24-volt models, the output voltage must lie between 17.1 and 18.9 volts for all input voltages between 21 and 30 volts.

The transponder should be operating under full load conditions and preferably having the set transponding on emergency.

The regulator must be able to give these output voltages when the supply voltage is suddenly changed from zero to any value within the above range of applied voltages.

Checking Regulator Performance

When the behavior of the voltage regulator is to be checked, it will ordinarily be most convenient to connect the output voltmeter between the bottom terminal of R–116 and TB–101 (the terminal) and pin #2 on J–302 of the control unit (the terminal). This assumes that the interconnecting cable between the control unit and the receiver is not over 2 feet long and that all plugs are clean and making good contact. Many of these plugs are found to be corroded and a source of trouble causing squitter and erratic operation.

To make the above checks on the performance of the voltage regulator, the following power requirements or equivalent should be met:

A battery supply of 15 volts for the 12-volt models and 30 volts for 24-volt models, should be connected to the set through an adjustable resistor so that the full range of input voltages can be varied. A variable resistor capable of carrying about 4.5 amperes for 24-volt models and about 9.5 amperes for 12-volt models will be required.

If the regulator does not meet the requirements stated above as the input voltage is varied within the specified limits, and if when the input voltage is increased suddenly from zero to input value within the limits listed above, the output of the regulator does not fall within the limits, the regulator must be readjusted.

Readjusting Voltage Regulator

Before any attempt is made to adjust the regulator it should first be determined whether the nominal voltage (regulator output) is incorrect or whether the regulation is improper or both. It may not be necessary to go through the entire adjustment procedure. The following procedure, when followed, will determine whether it is the nominal voltage or the regulation that is incorrect, or both.

Vary the input voltage within the specified limits given above and note the values of the regulated voltage. Call the highest regulated voltage HIGH and the lowest regulated voltage LOW. Subtract the LOW value from the HIGH value and divide this difference by 2 (LOW subtracted from HIGH and divided by 2). If this value is equal to or less than .45 volt for 12-volt models or .9 volts or less for 24-volt models the regulation is satisfactory and the pile compression (C) (see CSP 1375 Fig. 67) may not need adjustment. The next step is to add the value just determined to the LOW value. If this value differs from 9 volts on 12-volt models and 18 volts on 24-volt models, the magnetic plug (B) (see CSP 1375 Fig. 17) will require adjustment to bring the regulated voltage to proper value. If only the regulated voltage was found to be incorrect, adjust the power supply to supply 24 volts to the set. Connect a voltmeter between the bottom terminal of R–116 on TB–101 and pin #2 on J–302 and then adjust the magnetic plug (B) for a regulated voltage of 18 volts. The regulation should be checked again to determine that it is still proper.

Where it is found that both the regulation and the nominal values are incorrect, the following procedure may be followed.

1—Loosen the lock screws that hold the magnetic plug (B) in place and back out magnetic plug (B) one turn.

2—Loosen the lock screws that hold the compression screw (C) in place. Turn the compression screw clockwise until the armature springs are almost fully compressed, then back the compression screw (C) out one-half turn.

3—Energize the set. The set should be operating under full load conditions as stated above. Adjust the input voltage to 12 volts for 12-volt models or 24 volts for 24-volt models.

4—Turn magnetic plug clockwise until the nominal voltage drops not over one volt.

5—Turn compression screw (C) counterclockwise ¾ of a turn and then clockwise ¾ of a turn. Within the ¾ turn counterclockwise the nominal voltage should fall and rise and within the ¾ turn back clockwise, the voltage should again fall and rise. It will be noted that the voltage will drop to a lower value when turning the screw counterclockwise than when turning it clockwise. The minimum value found when turning the screw (C) clockwise should be made to fall at 18.5 volts for 24-volt models and 9.5 for 12-volt models, by adjusting the magnetic plug (B).

6—Turn the compression screw clockwise then counterclockwise until the voltage falls and then rises to 20 volts on 24-volt models or 11 volts on 12-volt models.

7—Turn the compression screw clockwise until the voltage reaches its minimum and then rises 0.5 volts. Mark the position of the compression screw slot. Continue turning the compression screw clockwise until the voltage reaches 20 volts on 24-volt models or 11 on 12-volt models.

8—Turn the compression screw counterclockwise until the voltage reaches its minimum and rises 0.5 volts. Mark the position of the compression screw slot. Turn the compression screw slot to the position midway between the two marks just obtained. Tighten the compression screw locking nut and put the two covers back on the voltage regulator.

9—Adjust magnetic plug (B) to give a regulator output voltage of 18 volts with an input voltage of 24 volts on 24-volt models or 9 volts on 12-volt models (after the covers are back on the regulator).

10—The input voltage should be varied within the specified limits and the regulation again checked. The variation in the regulated output voltage as the input voltage is varied should be centered at 18 volts on 24-volt models and 9 volts on 12-volt models.

11—The regulator should be checked for sticking by suddenly increasing the supply voltage from zero to maximum by turning on the ON-OFF switch and noting that the regulated output voltage falls within the specified limits.

Automatic Gain System

Another source of frequent troubles encountered in ABK sets is the automatic gain system (AGS). Most frequently the trouble lies in improper alignment. A malfunction in this system may render the set capable of being triggered by weak circuit noises and the set may squitter.

A convenient method of aligning the AGS system to the quench oscillator is outlined below:

1—Remove the bottom and top covers and separate the RF and Power Chassis.

2—Remove the plate and grid leads from V-101 and V–102, being sure that these leads are not touching anything.

3—Connect a d-c voltmeter across R–132 observing proper polarity. When viewing TB–106 from the front, the right hand end of R–132 is positive (see CSP 1375 Fig. 58A).

4—Ground B— to the chassis. This may be conveniently done by placing a jumper across R–130.

5—Clip one end of a test lead to the control grid pin 4 of V–108, the AGS amplifier tube, and position the free end near the plate leads of the quench oscillator tube V–110. This loosely couples the quench oscillator to the AGS amplifier so that the amplifier may be tuned to the quench oscillator frequency.

6—Energize the set.

7—Tune the primary and secondary of Z–102 by means of the screwdriver adjustments on both ends of the coil for a minimum volt meter reading.

8—If a minimum reading cannot be obtained on the voltmeter, the quench oscillator frequency may be beyond the range of Z–102. In that event the quench oscillator frequency may be changed until it comes within the range of Z–102.

It can be determined whether or not the oscillator is functioning by the use of an r-f indicating device such as the R-F Indicator-Probe ID–263/U found in the Test-Tool Set AN/USM–3.

Improper Suppressor Action in Sets Affected by I.B.C.N. #9

In several sets it has been found that when suppressor voltage is applied, that the sets are triggered through the suppressor circuit. Almost invariably the cause of this trouble has been a leaky capacitor C–152.

Squitter

The most common causes of squitter are listed below:

1—AGS system not aligned properly.

2—Voltage regulator not functioning properly. Particularly when the regulated output is high.

3—Gassy V–101 and V–102.

4—V–102 too high. It should be between 2700 to 3300 micromhos.

5—Resistors controling the voltages at the grids and cathodes of V–101 and V–102.

6—Arcing at the commutators of the dynamotor.

7—Arcing or leaking in the insulation of R–163.

8—Loose grid and plate caps on V–101 and V–102.

9—Corroded jacks J–104 and J–105, or not making good contact.

10—Arcing keying contacts.

Lubrication

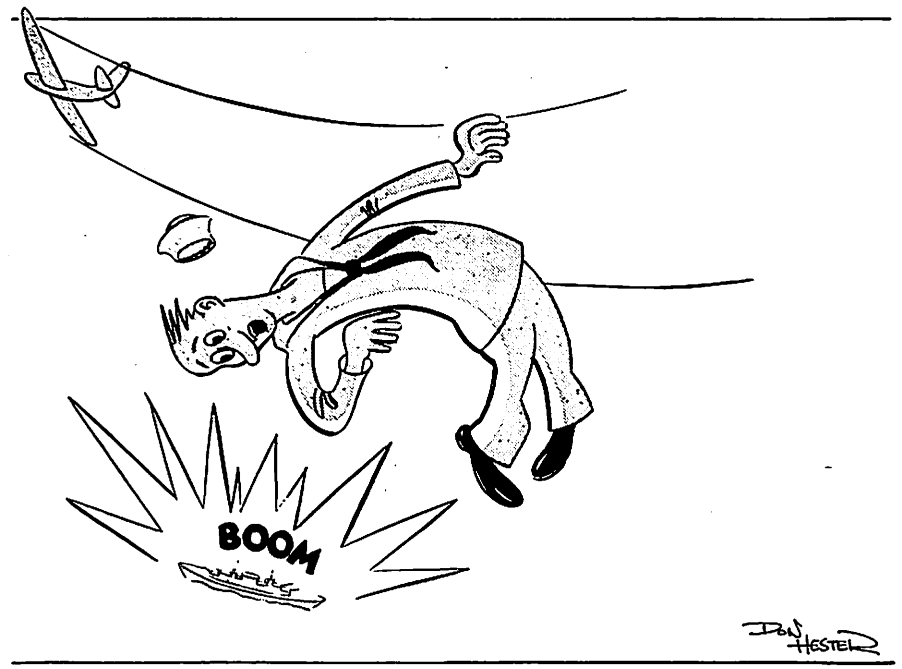
Many sets are found to be improperly lubricated and to contain an intolerable amount of dust.

A little draft and this dust may end up on the contacts of the keying system. The system then starts to squitter due to arcing. Many sets are found to be failing to transmit some part of the coded reply because this dust is allowed to accumulate over many months.

As far as lubrication is concerned, many sets either have too much or none at all. Too much lubrication invariably ends up with some of it getting on the keying contacts with arcing following.

For proper mechanical check and lubrication, Chapter 6 of CSP 1375, should be referred to.

I thought the manual said they were friends if we DIDN'T get a signal!



Troubles and Their Answers

Most problems and their answers encountered in ABK equipments will be found in CSP 1375, Chapter 8.

Check List of Electrical Performance Test Procedures

Provided that the set is anywhere near normal in performance, it will be able to pass the more detailed tests if it can pass the tests listed below:

1—FREQUENCY LIMITS—(After 30 minutes of operation) Must respond to and transmit at all frequencies from 158 to 186 megacycles on a challenging signal of more than 70 db below one volt (less than 316 microvolts). Must not respond at all (even irregularly) at frequencies of 154 and 190 megacycles and beyond, at the measured sensitivity at 158 and 186 megacycles. It is permitted to respond irregularly at 154 and 190 megacycles and beyond when the applied signal has a level of 2 db higher than the measured sensitivity at 158 and 186 megacycles. (The phrase "2 db higher" means that the number of decibels below one volt is 2 less or that the number of microvolts is 1.25 times greater. The actual applied voltage is to be increased.)

Sets which do not meet the above frequency requirements should be aligned provided that the sets are otherwise electrically and mechanically in satisfactory operating condition. The alignment consists of getting the "rotor" in the RF tank to make the proper excursion and by adjusting the trimming capacitor C–109. (See CSP 1375 section 5 for detailed alignment procedure.)

2—SENSITIVITY—Make test on N at 186 megacycles. The sensitivity should be between 70 db below one volt (320 microvolts) and 84 db below one volt (63 microvolts).

3—RECOVERY TIME—(Described in Section 8.7 CSP 1375.) Not covered here because it cannot be properly checked with the TS–182/UP.

4—MAXIMUM PULSE RATES—(Described in Section 8.8.) Cannot be checked with TS–182/UP.

5—PULSE DURATION—Test at 158 megacycles and a signal level of 60 db below one volt (one millivolt) for:

a—N from 5 to 9 microseconds wide.

b—W from 13 to 25 microseconds wide.

c—Ratio of W/N should be 2.37 or higher.

d—Emergency from 50 to 100 microseconds wide.

6—POWER OUTPUT—Make test at a signal level of 60 db below one volt for N, W, and emergency pulses at any convenient test frequency. The power output should be at least 4 watts.

7—SUPPRESSOR ACTION—Make test with maximum possible challenging signal level at a frequency of 172 megacycles and a suppressor voltage of 12 volts. When using TS–182/UP Test Set, application of the "Pulse Out" voltage from the TS–182/UP to the "Suppressor" jack of the ABK should render the ABK completely unable to respond to a challenge signal fed from the "RF Output" jack of the TS-182/UP to the "Antenna" jack of the ABK.

8—TS–182/UP TEST UNIT—The TS–182/UP is a portable test equipment for use with IFF equipment. Contained in one unit, the unit consists of an oscilloscope, pulsing and timing circuits, r-f oscillator, r-f attenuator and rectifier. The equipment will operate from any power source capable of supplying 100 watts at 115 volts plus or minus 5%, 50 to 1200 cycles single phase power. It is capable of making the following measurements:

a—Receiver sensitivity.

b—R-F pulse power. (up to 3000 watts)

c—Transponder sensitivity and power output.

d—R-F pulse shapes and durations.

e—Video pulse shapes and durations.

f—Suppressor circuit operation.

Checking ABK Equipment With TS–182/UP Test Equipment for Power Output, Sensitivity, Tuning Range, Suppressor Action, Pulse Duration, Proper Coding, etc.

To measure the sensitivity of a transponder, the following steps should be followed:

1—Connect the "Power 1:1" jack to the antenna terminal of the transponder.

2—Set "Vert. Gain" at "50".

3—Set "Selector" switch at "Pulse Shape".

4—Set "Pulse Level Selector" at either "0" or "20 microseconds".

5—Set "Attenuator" dial at "40".

6—Set "Frequency" control at a point which will cause the transponder to trigger as noted by the pulse pattern appearing on the oscilloscope screen.

7—Reset "Pulse Level" selector switch to "Adj. RF Level".

8—Adjust "RF Level" control until the pointer of the meter is on the red line (100).

9—Reset "Pulse Level" selector switch to either "0" or "20μs" position.

10—Rotate the "Attenuator" control in a clockwise direction until a point is found where the transponder firing becomes intermittent. The setting of the "frequency" control should then be checked to make certain that it is correct. If necessary, the attenuator should then be rotated further in a clockwise direction to the point where firing begins to become intermittent. The "Attenuator" dial now reads directly the sensitivity of the transponder below one volt.

11—Each time the frequency is changed, steps 7 and 8 should be repeated.

12—The transponder should be checked to determine its frequency limits. The transponder should transmit at all frequencies between the "low" and the "high" positions on the frequency scale. The transponder sensitivity should be determined at the "low" and the "high" positions. The "Frequency" control should then be moved two scale divisions above and then below the "High" and the "Low" positions, to determine its ability to be interrogated at these points. It is permitted to transmit irregularly when the applied signal has a level of 2 db higher than the measured sensitivity at 186 and 158 megacycles.

13—The transponder should be checked to determine that it is transmitting on all codes by rotating the ABK Code "Selector Switch" to all six positions and throwing the "Emergency" Switch to the "UP" position.

To measure the power output of a transponder, the following steps should be followed:

1—Connect the power 1:1 jack to the antenna terminal of the transponder.

2—Set the "Attenuator" dial at "40".

3—Calibrate the scope as follows. The scope is to be calibrated for 10 watts by first throwing the selector switch to the "Calibrate watts 10 or 1000" position and adjust the "Vert. Gain" until the pattern on the oscilloscope covers 10 vertical scale divisions. When this calibration has been made, a maximum of 10 watts may be measured by applying the power to the "power 1:1" jack.

4—Reset the Selector Switch to "RF Power".

5—Count the number of vertical scale divisions covered by the pattern on the oscilloscope. Use the chart furnished with the TS–182/UP to convert this figure to watts.

Checking the Suppressor Operation

To check the operation of the suppressor circuit, the following steps should be taken:

1—Set the "Selector" switch to "RF Power".

2—Set the "Attenuator" control for minimum attenuation.

3—Connect "RF Output" jack to the "Antenna" jack of the transponder.

4—Adjust "Frequency" control such that a pulse is seen on the oscilloscope.

5—Set the "Pulse Level Selector Switch" to the "0" position.

6—Connect "Pulse Out" jack to the "Suppressor" jack of the transponder.

7—The pulse that was appearing on the oscilloscope will disappear if the suppressor circuit is functioning properly.

Pulse Shapes and Durations

To observe the envelope shape of r-f energy and determine the approximate pulse widths the following steps should be taken:

1—Connect "Power 1:1" jack to the "Antenna" jack of the transponder.

2—Rotate the "Selector" switch to the "Pulse Shape" position.

3—Set the "Pulse Level Selector" switch to the "Delay 20 μs" position to *observe pulse shapes.*

4—Advance "Vert. Gain" sufficiently to give a pulse pattern on the oscilloscope approximately one-half inch high.

5—The duration of a pulse may be approximated by adjusting the test set as described in the above steps except that the "Pulse Selector Switch" is set to the "0" position. After adjusting the "Sensitivity" control to give a moderately bright pattern, the actual portion of the total sweep occupied by the pulse should be checked with the aid of a graduated scale. The approximate duration of the pulse may then be determined by comparing this information with the curve included in the instruction book. A portion or all of the leading edge of the pulse will probably not be shown on the scope. This will not introduce any appreciable error in determining pulse widths.

TESTING TYPE 6F4 TUBES IN THE TV–4/U TUBE TESTER

by

H. C. Seyffer, ETC, USN

One of the most common questions asked by shipboard electronics technicians is "How can I test the Type 6F4 electron tube?" This tube is used in a critical circuit in the Model RDZ receiver and is subject to a high failure rate. Therefore, the following procedure has been developed utilizing the TV–4/U tube tester from the Tool Set AN/USM–3 which is included in the test equipment allowance of most ships:

Preliminary Adjustments

1—All toggle switches to the OUT position.

2—FILAMENT SELECTOR to the 6.3 position.

3—Insert the tube in the Acorn socket.

4—CIRCUIT SELECTOR to the LINE CHECK-SHORT position.

5—Adjust line voltage to LINE CHECK on the meter.

Short Test

1—CATHODE LEAKAGE: Throw toggle switch "A" to the IN position. Leakage will be indicated by the neon lamp at the left. Return toggle switch "A" to the OUT position.

2—PLATE TO OTHER ELEMENTS: Throw toggles "B&C" to the IN position *simultaneously.* A short will be indicated by the neon lamp at the left. Return the toggles "B&C" to the OUT position *simultaneously.*

3—GRID TO OTHER ELEMENTS: Throw toggles "D&H" to the IN position *simultaneously.* A short will be indicated by the neon lamp at the left. Return the switches to the OUT position *simultaneously.*

Tube Test

1—Set TUBE SELECTOR to 45.5.

2—Turn CIRCUIT SELECTOR to NORMAL TUBES.

3—Throw toggle switches "B&C" to the IN position *simultaneously.*

4—Throw toggle switches "D&H" to the IN position *simultaneously.*

The meter will now indicate the condition of the tube.

—*ServLant Monthly Bulletin*

Editor
BuShips Electron
Sir:

It may be of interest to personnel in the Fleet using NMC–1 fathometers (Submarine Signal Company), to note the interesting trouble that appeared recently in our electronic gear.

Visual indications were as follows—Transmitted pulse and correct echo were received on both Sounding Indicator and Stylus Recorder. However a constant echo between 40 and 90 fathoms was received on both. Line voltage and tube voltage were normal. Casualty was found to be Keying Contacts—Shoal Scale Length Adjust (E–305) had failed due to loose rivet on breaker points. Replaced E–305, readjusted equipment—Operations normal.

John S. Reese
U.S.S. Graffias (AF–29)

Editor
BuShips Electron
Sir:

As you can see, I am stationed on an LST. Most LST's still use some type of SO radar. Ours has an SO–1. During the last war I was in England working on the same LST's and the same radar. Quite often it becomes necessary to tune the local oscillator and adjust crystal current, set the tuning cavities and the pick up loops. For maximum results I have taken two indicator patch cords and put them together and brought the indicator into the degaussing room where the transmitter-receiver is located. There is a field change out that will enable the technician to read the maximum receiver output at the transmitter but as yet we are not blessed with such new stuff. If you do not have two patch cords you can probably borrow one off the base or off another ship. Our SO–1 reaches out to the 80-mile range and drags them in to the end of the sweep.

David L. Dennis, ET1, USNR
U.S.S. LST–762

Editor
BuShips Electron
Sir:

The instruction book for the Model DAS–4, (Ships 322), contains the following error. Page 7–13, "Figure 7–15–Indicator, CFE55175, Test Oscillograms at indicated points on unit" No. 1 "V 101, Grid, Pin 1, 6V" should be corrected to read, "V 101, Grid Pin 4, 6V".

R. R. Hart, ET2, USN
U.S.S. Takelima (ATF–113)

Editor
BuShips Electron
Sir:

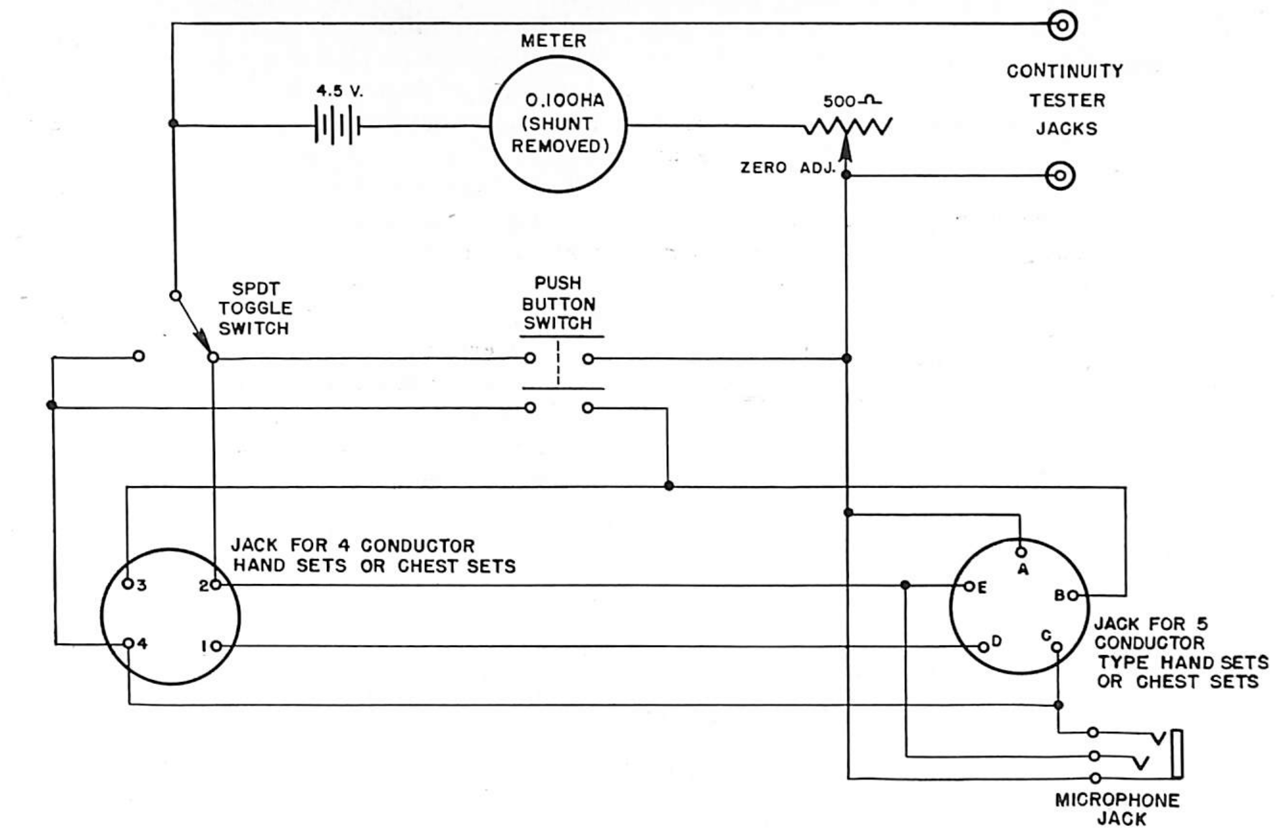
During the recent operation, Convex II, while steaming on course 235°T, at speed 15 knots, the SU–1 radar of the *U.S.S. Shadwell (LSD–15)*, picked up a surface contact bearing 355°T, distance *51.5* miles. This occurred at 0357 R, on 15 May 1951. The contact was reported to CTG 80.3 and was verified as a friendly warship by the planes of the aircraft carrier *Siboney*, which were on patrol at that time.

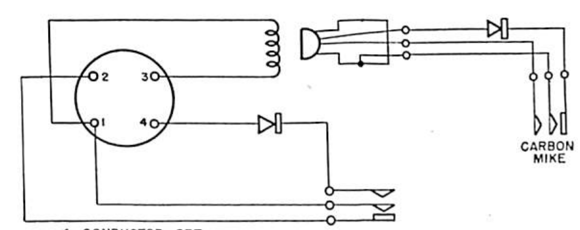
Approximate position—39°N, 70°W; Temperature 51°F; Barometer 30.39; Sea—smooth; Two tenths of the sky covered by cirrus stratus clouds at 5000ft.; Visibility—30 miles; Wind velocity —10 knots.

Louis F. Volk, Capt., USN
Com LSDRon Two

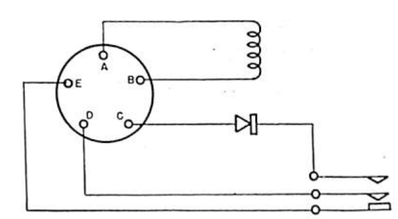
Editor
BuShips Electron
Sir:

I am enclosing a diagram for a device which has proved itself invaluable aboard the *De Haven (DD727)* for speedily and effectively pointing any trouble so that repairs can be made quickly. By





4 CONDUCTOR SET



5 CONDUCTOR HAND SET OR CHEST SET

using the two pin-jacks provided, other pieces of equipment can be tested where a continuity check is desirable.

Functionally, the tester is an ohm-meter with a switching arrangement to check the continuity of various circuits making up a handset, microphone, or chestset. The ohm-meter portion is made up of a 4.5-volt battery, A 500-ohm potentiometer, and a 0-100 ma. meter with shunt removed. Any number of types of microphones, handsets, or chestsets can be checked, if the proper jacks are incorporated into the makeup of the tester.

With the toggle switch in the position shown, pressing the pushbutton switch will allow zeroing of the meter. With the pushbutton switch released, the ability to key of the unit being checked will be shown by a short indication on the meter.

Throwing the toggle switch to the other position and pressing and releasing the pushbutton switch should result in clicks in the phones of either handsets, or chestsets. When keying the set to be tested (with toggle switch in same position) the meter will indicate the resistance of the carbon button, and should vary when the microphone is modulated.

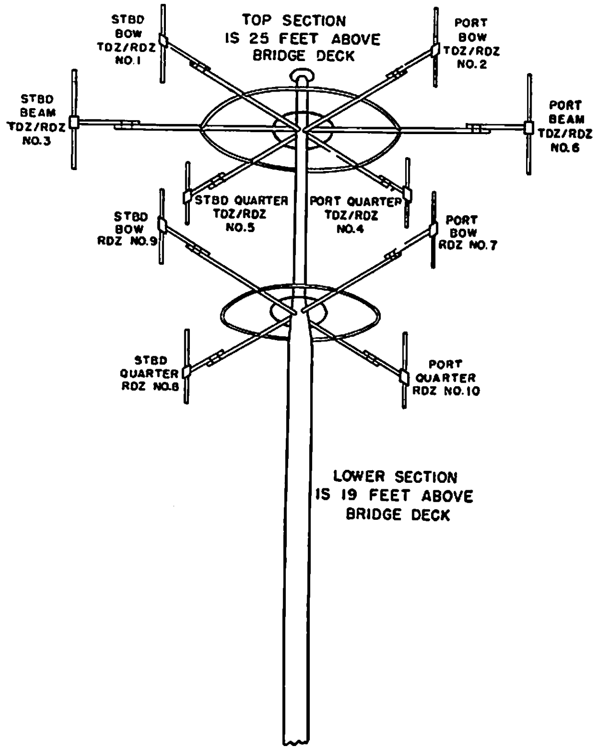
Although the idea is not new, I thought that possibly this circuit would be of interest to you.

J. E. Elliott, ET2
U.S.S. De Haven (DD–727)

The Bureau of Ships recommends that the 4.5-volt battery, 500-ohm potentiometer and 0-100 ma meter be replaced with the ohmmeter portion of Multimeter TS–352/U or Navy Model OCR or OE.
Editor

Editor
BuShips Electron
Sir:

Concerning the April issue of Electron, we most wholeheartedly agree with the author on the article entitled "Shipboard UHF *Can* Work". Under the UHF conversion plan this ship was equipped with six TDZ transmitters and ten RDZ receivers.



This installation was carried out at an east coast yard (NNSY Portsmouth, Virginia). Prior to transfer to the Pacific Fleet, these units were in extensive use, giving satisfactory operation. While operating with the Pacific Fleet for the past eight months, we have been disappointed with the lack of UHF communication. The only instances in which UHF communications were employed were while participating with other former units of the Atlantic Fleet, during the operations at Inchon and Chinnampo.

Before becoming familiar with the UHF equipment, the ship's technicians experienced considerable trouble with this system of communication. With the extensive use of this system, the technicians became familiar with the equipment out of necessity. If this program were adopted throughout the Navy, ET's would become skilled at the operation and maintenance of the TDZ and RDZ.

Troubles encountered aboard ship have been similar to those reported by the Naval Electronic Laboratory in the article. The life span of lighthouse tubes has been increased approximately *ten* times by the use of the "CEMB" tuning procedure and by the constant check of the cathode adjusting potentiometers (R–172 to R–175). It was found that if one of these pots were burned out tube life in the associated circuit would be reduced to almost zero.

The advantages of UHF communication are innumerable. Chief among these is the fact that high frequency circuits are left open for their intended use as harbor control frequencies etc. The disadvantages, we admit they exist, are being overcome by experience and employment of latest UHF information from the Bureau.

We are enclosing a diagram of our antenna system and a table showing power loss through our transmission lines.

Test made with all transmitters tuned to 20 watts on 277.8 Mc. Power measurements made with ME–11/U wattmeter.

Transmitter	*Input to Antenna*	*Loss in Filter*	*Loss in Line*	*Resistance To Ground*
TDZ #1 SER #3064	14	2	4	10,000 Megs
TDZ #2 SER #1549	13	6	1	10,000 Megs
TDZ #3 SER #3050	12	8	*0	10,000 Megs
TDZ #4 SER #3277	13	5	2	Infinite
TDZ# 5 SER #3469	13	4	3	Infinite
TDZ #6 SER #3077	7½	6	6½	Infinite

* Loss in line found by subtracting loss through filter from total loss. This accounts for the apparent perfection in transmission line to TDZ #3.

To sum up our argument, we are of the opinion that if one ET–2, one ET–3, and two ETSN are capable of properly maintaining six TDZ's and ten RDZ's, in addition to the normal shipboard electronic equipment, then there is no excuse for Pacific Fleet ships having more ET's and less UHF equipment not being able to cope with their responsibilities along this line!

E. H. Cramer, ET–2
R. B. Dinwiddie, ET–3
R. I. Freeman, ETSN
J. R. Jessell, ETSN
U.S.S. Catamount (LSD–17)

Editor
BuShips Electron
Sir:

Symptoms: The TDO would stay keyed (on the air) when test switch was thrown on, if the transmitter was tuned to any frequency in the 2 to 5 megacycle range. This trouble persisted only when the transmitter was on local control. As soon as the transmitter was thrown to remote, the trouble would clear up. Subject transmitter would also key in conjunction with any transmitter nearby which was tuned to a frequency in the 2 to 3 megacycle range, but only when the local-remote switch was in the local position. This trouble was not experienced on two similar TDO installations in the same room.

Remedy: Connection of a .01-mf capacitor from Terminal #4 of J118 to ground cleared this trouble up completely.

Conclusions: This equipment had been connected to a remote patching panel, from the microphone jack J118, for the purpose of interconnection with the AN/SGC–1 teletype terminal equipment. The lead from Terminal #4 of J118 to the remote patching panel, which is approximately 12 feet long, was acting as an antenna and picking up r-f energy, which, on the local position of control switch S114, was fed to the grid of the keyer tube V107. The grid and cathode of V107 acting as a diode rectified this rf and charged C–139 sufficiently negative to cut off the keyer tube, causing bias to be removed from the oscillator and the equipment remained on the air as if it were being constantly keyed. This occurs only in the 2 to 5 megacycle range due to L–120 and C–139 becoming series resonant to that range of frequencies or harmonics of same. Recurrence of this trouble could be avoided, in all probability, by the use of shielded leads between J118 and the patch panel, which were not used in this installation.

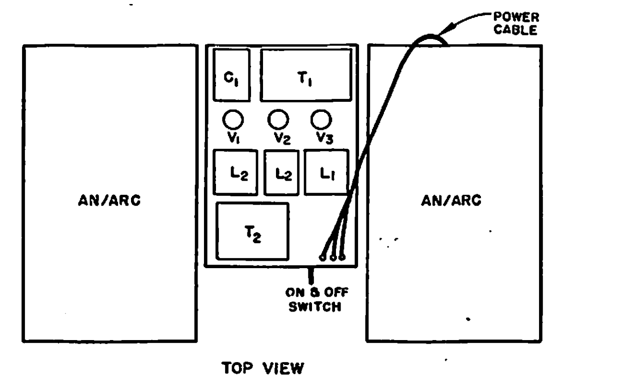
R. E. Rogers, ET1, USN
U.S. Naval Base, Newport, R. I.

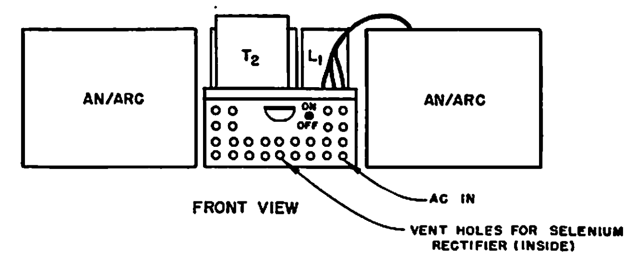
There is no doubt that the 12-foot patching lead is acting as an antenna and picking up enough rf to make the equipment act as if it were being continuously keyed. The remedy that you suggest is not the answer, since it probably will not work in all cases. The proper procedure is to install a piece of shielded cable, as short as possible, in a workmanlike manner. This will cancel the antenna effect of the patching lead.

Editor

Editor
BuShips Electron
Sir:

During Mediterranean maneuvers we've had considerable trouble with the motor-generators and dynamotors used with Aircraft Radio Transmitter-Receiver AN/ARC–1. Inasmuch as constant communication was a must during these events, our Electronics Officer suggested an a-c rectifier type supply, to act as an alternate in case of generator failure.

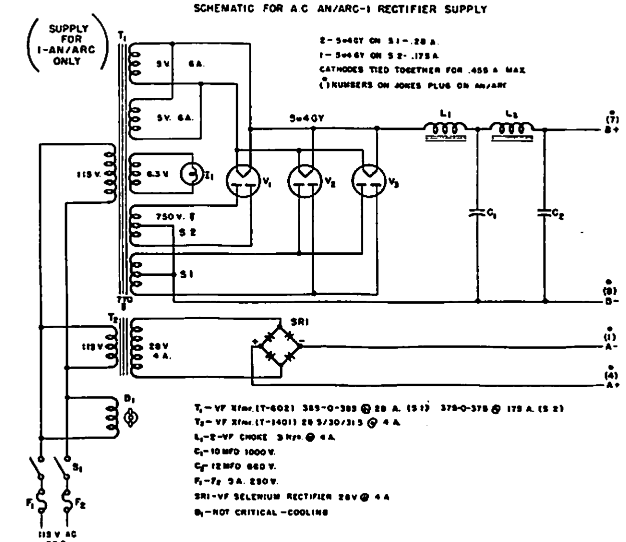




POWER SUPPLY IS UNGROUNDED INTERNALLY –(B–) IS FED INTO AN/ARC AND GROUNDED THROUGH BLEEDER.

BLOWER MOTOR IS MOUNTED INSIDE POWER SUPPLY, SUCKS AIR PAST SELENIUM RECTIFIER AND BLOWS IT OUT THROUGH TOP, PASSING RECTIFIER TUBES AND COOLING THEM ALSO.

SCHEMATIC FOR A.C AN/ARC–1 RECTIFIER SUPPLY



This supply, built up from spares and parts from our 'loot' box, took the form shown in the enclosed sketch and schematic. Everything was mounted in a spare-parts box of a size slightly smaller than the AN/ARC–1 itself. In order to offer interchangeability, the power output cable was fitted with a Jones plug identical to the dynamotor plug. Removing the dynamotor also removes the cooling fan integral with it, but so far we've encountered no unusual heat. The unit has been in service for over a week, 24 hours a day and we've had no trouble so far. We keep checking each watch to determine how everything is standing the strain, and so far the experiment is a success.

If you desire any more information, I'll be glad to be of service to you.

Edwin R. Campbell, ET3, USN
U.S.S. Wm. C. Lawe (DD–763)

Editor
BuShips Electron
Sir:

During instruction on the Mark 25 radar, we find the probe (1) of Figure A is very easily broken off. We are unable to find replaceable points in the spare parts—only the complete lead.

We have found a standard pin jack, Figure B, Stock Number 16–P–3285–200, can very easily be used if the following minor changes are made:

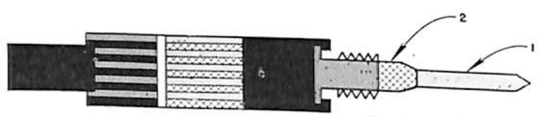


FIG. A

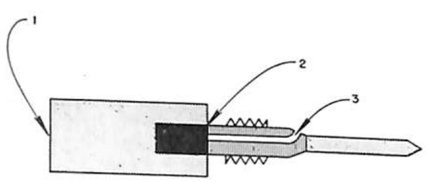


FIG. B

1—Remove plastic (1), Figure B.

2—Tap out pin (2), Figure B, with 10–32 tap.

3—Leave out opening (3), Figure B, to strengthen probe.

4—When test point (1), Figure A, is broken off, area (2), Figure A, must be cut off, in order for this to work.

J. J. Johnson, FTC
D. C. Boyd, FCC
R. J. Torghele, FCC
U.S. Naval School, Class A
USNTC, San Diego, Cal.

OTHER USES FOR TS–182

by
C. R. Lake, ETCA
U.S.S Agerholm (DD–826)

The Model TS–182 test set was primarily designed to take system performance checks of MK III IFF equipment. It also can be used very easily to take sensitivity checks of any radar or pulse type receiver operating within its frequency band (150 to 240 megacycles). Sensitivity checks of radar receivers in this band (SA, SC, SK, SR, etc.) can be taken in less than a minute by operators. All that is required is to:

1—Connect the RF OUTPUT jack of the TS-182 to the receiver's input coaxial fitting.

2—Set the radar's gain for about ¼-inch of grass on the radar's "A" scope, leaving the "A" scope on the 200-mile or its longest range. The TS–182 is self synchronized with a repetition rate of about 300 cycles. Using the long sweep on the radar's "A" scope allows you to see several pulses from the TS–182.

3—Tune the FREQUENCY dial on the TS–182 for maximum height of pips or pulses on the "A" scope.

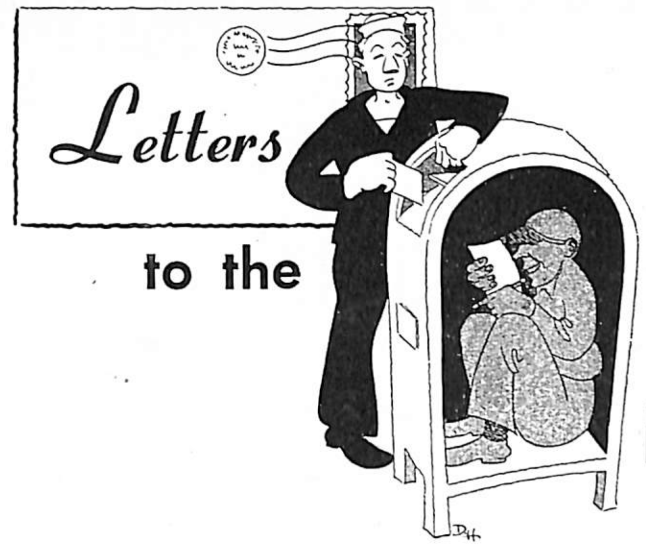
4—Set the TS–182 on ADJUST RF LEVEL and adjust RF LEVEL until the RF LEVEL meter is on the red line. This assures calibration of the output from the TS–182.

5—Turn the attenuator dial on the TS–182 to 110 (minimum signal output) and increase signal (turning dial towards 30) until the height of the signal plus noise is three times the noise level. (¾-inch signal with ¼-inch of noise).

The receiver's sensitivity is read direct on the ATTENUATOR dial in DB below one volt, or can be converted to microvolt sensitivity by using the graph on Page 6–2 of the TS–182 instruction book. Our SR–A receiver sensitivity stays around 2 to 3 microvolts.

By using the same method (using the r-f signal generator in the TS–182 to generate a calibrated signal) the overall sensitivity of ship's RCM receivers, analyzers, and adaptors can be found. Just tune the RDO receiver to the TS–182 frequency, set the RDP and RDJ for about ¼-inch of grass, and decrease the signal by turning the attenuator dial on the TS–182 until the signal is three time the noise level (on the RDP or RDJ scope). The overall sensitivity of an RDO/RDP or RDO/RDJ combination should be less than 30 microvolts with the RDO/RDP sensitivity usually the poorer of the two.

Watch for an article on DIELECTRIC AMPLIFIERS, a BuShips-sponsored development. These tubeless amplifiers supplement the magnetic amplifier. Laboratory models show gains of 1,000,000 per stage at one megacycle!!



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.

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:

According to "General Specifications for Building Vessels of the United States Navy" (BuShips Serial 3830), Appendix 6 and BuShips Manual Chapter 19, Radomes and antenna and insulator fittings shall be painted haze gray. We have noticed most ships paint antenna and insulator fittings red and that some DD's paint DBM radomes black because of smoke and soot. At our last administrative inspection we were informed the correct specifications pertaining to antenna and insulator fittings were blue for receiving and red for transmitting antennas.

We have checked Electron, C.E.M.B., and BuShips Manual Chapter 67 but found no comments on this subject. Because red is indicative of danger we believe transmitting antenna and insulator fittings should be painted red; we believe DBM radomes located on #2 stack on DD's should be painted black.

Will you please give us your opinion and advise us the correct colors for these items?

G. E. S., ET2, USNR
C. K., ET1, USN

In the past, numerous questions and suggestions have been received by the Bureau concerning the color and type of paint to be used in painting and repainting shipboard antennas.

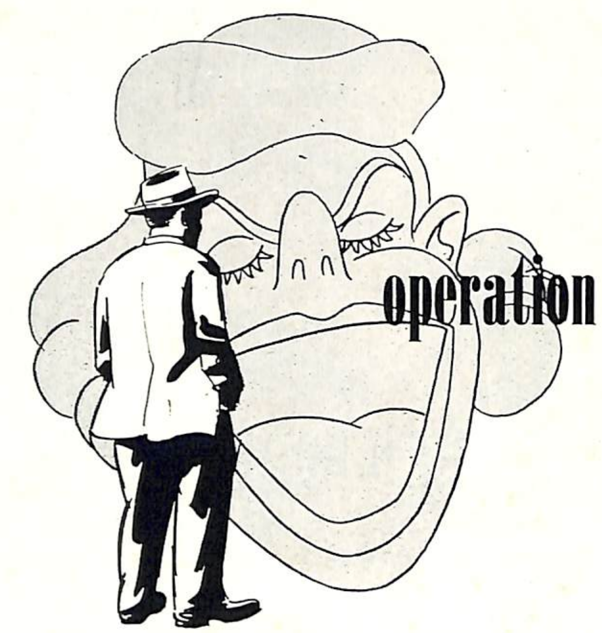
Antenna framework and dipoles should be inspected quarterly, and those installed directly aft of the stack should be inspected monthly. The gasses and high temperature in the vicinity of the stacks tend to dry out and crack the paint, which accelerates corrosion.

When paint has started to crack or peel, and there is an indication of rust on the dipoles or framework of antennas, immediate action should be taken to clean the entire surrounding surface of old paint, soot, and rust, etc. The clean surface should then be repainted with two coats of JAN–P–735 zinc-chromate primer, stock number 52–P–20630–2 (1 gal.) or 52–P–20635–2 (5 gal.), and with not less than two coats of number 27 outside haze-gray paint (Spec. MIL–P–15130, which supersedes 52–P–45a), stock number 52–P–961 (5 gal.).

Brass dipoles need not be coated with the zinc-chromate primer. Under no circumstances should metallic paints be used.

Forces afloat, Navy yards and repair activities should use only the paints described above in repainting antennas.

Editor



operation of the WFA-1 talkback system

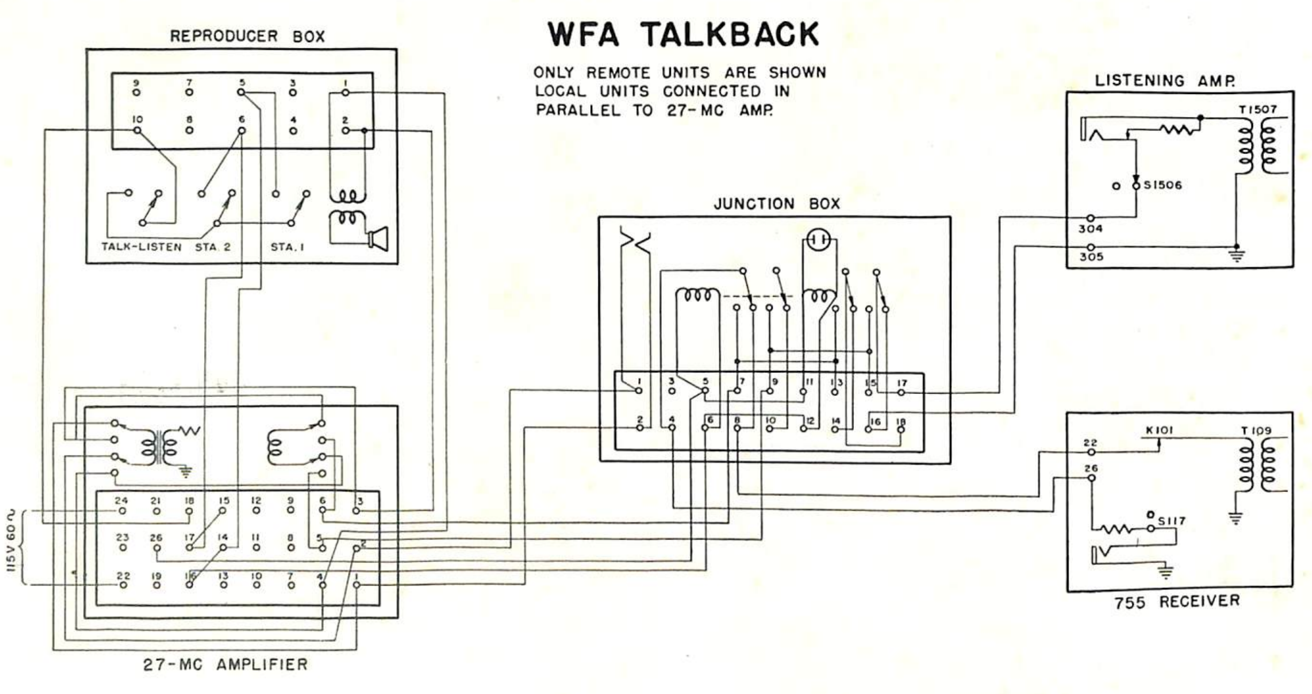
by
George T. Rager,
Philco Field Engineer,
New London, Conn.

A talkback system is incorporated into the WFA–1 equipment to permit communications between the forward torpedo room and the conning tower. A 27-Mc amplifier is employed as the amplifying unit, and its output is fed selectively to the receivers and listening amplifiers, and also to a reproducer box in the conning tower. Besides the amplifier and the reproducer box the system is composed of two junction boxes, one of which is mounted in the forward room, and one in the conning tower. These junction boxes contain switching relays and have jacks into which the microphones are plugged.

The reproducer box contains a speaker, which is normally used as a speaker, but which can be switched to the input of the amplifier and used as a microphone. Three switches are mounted on the front of the box. A talk-listen switch, and two switches labelled Station 1 and Station 2. With the talk-listen switch in the listen position, all of the switching relays are de-energized. The speaker is connected to the output of the 27-Mc amplifier. The microphones at both junction boxes are connected to the input of the amplifier. The phone jacks at the receivers and listening amplifiers are connected to their respective receivers, and have no function in the talkback system. In this position of the switch, operators at either control position can talk to the operator at the reproducer box.

In order for the operator at the reproducer box to talk to the control positions, he must select the station with one of the two station selector switches, and move the talk-listen switch to the talk position. The operation of these switches operates relays in the respective junction box and in the amplifier. The speaker in the reproducer box is switched to the input of the amplifier and is used as a microphone. The phone jacks in the receiver and listening amplifier at that station are disconnected from the receivers and connected to the output of the 27-Mc amplifier. The receiver and listening amplifier at the other station are still connected normally, but the microphone at the junction box at that station is inoperative.

The relays are operated through the switches from the 115-volt a-c line, and neon lamps at the junction boxes indicate when the relays are energized. Even though the talkback system may be seldom used, routine maintenance on the WFA–1 equipment should include cleaning of the relays in the junction boxes. Dirty contacts on these relays cause increased noise level and decreased sensitivity of the receivers and listening amplifiers.



MODEL SP ANTENNA TRAIN FAILURE

by
Rele Harry E. Witherwax, USN
U.S.S. Bataan (CVL–29)

The Model SP radar antenna train system was noticed to have an excessive amount of gear noise. Checking the oil reservoir showed it to be full. One of the oil feed lines of the system was removed and, with antenna rotated by hand, visual observation showed no pumping of lubricant, localizing the trouble to the oil pump. The gear assembly was taken from the pedestal and the oil pump removed for inspection. The apparent cause of the failure was the pump piston accentuator which had sheared off. This accentuator is a case hardened hexagon shaped steel fitting fastened to shaft of the main gear, one side being eccentric for pumping action. The eccentric side had a groove along its surface with four shallow worn places within the groove. These were caused by the normal rotation of the antenna, but because of the generally clockwise rotation of the system, two worn spots were deeper. It was believed that the piston became locked in one of these depressions, causing the shearing.

The accentuator was machined down for removal of groove and depressions and a new shaft manufactured. The entire assembly was cleaned and reassembled. Upon rotation of the antenna by hand, it was found to work freely in the counter clockwise direction, but jammed in the clockwise direction. Once again the unit was disassembled and inspected. It was then determined that the cylinder was out of round and when a side pressure was exerted on the piston, it froze in the cylinder. The cylinder was machined true, a new piston made to fit snugly but freely inside the enlarged cylinder, and unit assembled. Operation was then normal.

The inspection of the oil pump is not a normal maintenance check and it is highly recommended that activities having SP's make an oil pump inspection for determination of wear. The SP has now been in operation in the Navy for many years, and yours may be next. Damage experienced was small compared to what could have happened had the accentuator become jammed.

NAVSHIPS 4110

Perhaps you have been wondering what has happened to the NavShips 4110 you submitted several months ago. It hasn't been forgotten; Bureau action has been delayed because of the increased workload. The situation is now improved, and 4110's are being returned at a very rapid rate.

When you receive yours, check it carefully for any errors. If there is an error, return a corrected copy to the Bureau of Ships, Code 970. THIS IS IMPORTANT TO YOU. The Bureau requires a correct copy of your NavShips 4110 to determine your allowances and to plan improvements for your ship.

If you have not submitted a NavShips 4110, don't complain about not having your correct allowance of tubes and parts.

To expedite completion of the NavShips 4110 program, all type commanders will be advised of those ships which have not yet submitted 4110's to the Bureau.

START A LUBRICATION PREVENTIVE MAINTENANCE PROGRAM FOR YOUR ELECTRONIC EQUIPMENT

by LTJG J. R. DANGL
Electronics Service Group, ComServLant

What is a lubrication preventive maintenance program?

It is a system of periodic lubrication procedures with check-off lists to record their completion. These check-off lists are incorporated as a part of the over-all preventive maintenance program for each equipment.

Why is a lubrication preventive maintenance program required?

A high percentage of expensive material failures involving motors, generators, antennas, gear boxes, differentials, bearings, etc., are directly attributable to improper lubrication and could be prevented by an intelligent preventive maintenance program.

Who designs and carries out the lubrication program?

The Electronics Officer and the ETs design the program, and the ETs carry it out, aided in the simpler phases by the Radiomen, Radarmen, and Sonarmen.

Why is it confusing to try to set up such a program?

The lubrication schedules are based upon the lubrication charts in the equipment instruction books. Each manufacturer may list several different lubricants for each equipment. This number multiplied by the number of different types of equipment installed on board a ship results in a tremendous number of lubricants which must be ordered to fill the manufacturers' specifications.

How can this confusion be avoided?

Three issues of the ELECTRON Magazine (NavShips 900,100) provide charts which list Navy equivalents for the various lubricants specified by manufacturers in their instruction books. Using these Navy equivalents reduces the different types of lubricants required to a convenient number. These three ELECTRONS are:

August 1945, Page 30, Radar Equipment.
January 1946, Page 27, Sonar Equipment.
September 1945, Page 28, Radio Equipment.

What are the steps in setting up a lubrication preventive maintenance program for a unit of equipment?

1—Consult the lubrication chart in the equipment instruction book (usually the Preventive Maintenance Section, Section 6).

2—List the lubricants in the chart and obtain the nearest Navy equivalent from the proper ELECTRON.

3—Using the Navy equivalent and the times for lubrication given in the equipment instruction book, draw up a schedule, for daily, weekly, monthly, etc., lubrication.

4—Place this schedule in front of the 5″ x 8″ green log book used for regular preventive maintenance of the equipment.

5—Order the required lubricants using the Stock Numbers given in the ELECTRON chart.

6—As the lubrication is accomplished, record its completion in the green log book.

COMMON SOURCE OF NOISE IN THE JP AMPLIFIER AND SUPERSONIC CONVERTER

by GEORGE T. RAGER,
Philco Field Engineer, New London, Conn.

A great many JP amplifiers and supersonic converters have, from time to time, a very high background noise level, which renders them useless as a listening equipment. The noise is characterized by the whine of rotating d-c machinery. In most cases the noise is not a fault of the equipment itself, but is caused by voltage grounds on the d-c line.

With no grounds on the d-c line, the line filter installed with the equipment is capable of reducing the amount of interference to a point where it is negligible. When voltage grounds exist the filter is effectively by-passed by C101, a 12-mf capacitor which is connected from floating ground to ship's ground.

If the noise level is high, and it is suspected that grounds on the d-c line are the cause, it can be established by removing the JP amplifier from its case with the cables still connected to isolate the amplifier from ship's ground. If the noise disappears, grounds exist which are the cause of the high noise level. The noise will return as soon as the case of the amplifier is grounded. Removing the grounds will eliminate the noise.

If the cables to the JP amplifier are not long enough to allow its being removed from the case, any piece of insulating material, such as a newspaper, when slid under the amplifier will isolate it from ground to make the above check.

MODEL QHB TRANSFORMER T-708 FAILURES

by
R. E. WILT, ET2, USN
U.S.S. Saipan (CVL-48)

Recently T-708, the high voltage transformer for the Model QHB sonar equipment, failed. The first indication of trouble was an odor of burning insulation and oil. The source of the odor was immediately traced to T-708 which was found to be leaking oil and to be very hot. The insulator at Terminal #5 was broken due to the heat. When the transformer was removed and checked, the resistance of the half of the secondary of T-708 from Terminal #5 to Terminal #4 was found to have decreased from approximately 950 ohms, its normal value, to approximately 450. ohms. Extensive checks were held on associated circuits and no further troubles were found.

It was assumed that T-708 had failed due to high-voltage breakdown. T-708 was replaced and the equipment energized and peaked in the "listen" position. When the high voltage meter, M-701, reached approximately 4,000 volts, it was observed to drop suddenly to about 2,000 volts, then to build up to 4,000 volts then drop down again as before. Bright blue flashes were observed to appear in the lower portion of the transmitter-receiver stack. This observation was made from the upper portion of the stack through the grillwork separating the upper and lower sections of the stack. From this observation point the 866/866A, mercury vapor rectifiers, are not directly visible. The bright blue flashes were thought to be caused by arcing inside the rectifiers. Upon inspection of the rectifiers, V-729 and V-730, small burned spots were found on the plate and cathode of V-730. V-730 and V-729 were replaced and the equipment is now operating normally. Reference to Figure 7-5 of the QHB instruction book, NavShips 900,976, makes it obvious that the reason for the failure of T-708 was that the high voltage storage capacitors, C-796 through C-799, were being discharged through the small impedance of one half of the secondary of T-708 by the arcing of V-730 which was evidently caused by the tube breaking down due to high peak inverse voltage. Repeated discharge in this manner caused the transformer to heat excessively and fail.

Fuse clips have been installed in the plate leads of V-729 and V-730 and one-ampere fuses have been inserted as an emergency measure. It is believed that this precaution will eliminate any future failure of T-708 from this source. In addition, it is suggested that small ports be made in the lower door of the transmitter receiver cabinet to permit observation of V-729 and V-730 while the equipment is operating. Failure of either or both of the fuses will be indicated by non-ionization of the associated rectifier and will indicate with fair reliability when these tubes should be replaced. Where fuses are not installed in QHB equipments, it is suggested that V-729 and V-730 be replaced at regular intervals.

It is noted that the QHB instruction book specifies that the nominal rectified voltage developed in this power supply should not exceed 3,700 volts. The reason of M-701 indicating 4,000 volts is believed to be due to line voltage fluctuations, since there is no line voltage regulating transformer installed for this equipment.

SX BLOWER MOTOR B-2061

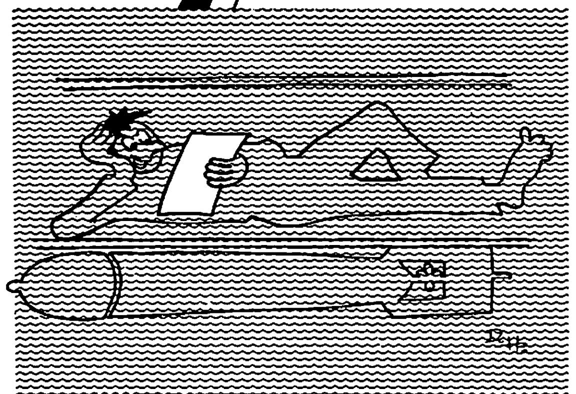
by
J. M. CARSON
U.S.S. Valley Forge (CV-45)

Recently when our Model SX radar receiver blower motor, Symbol B-2061 failed it was discovered that the motor listed in the parts list for Navy Model SX Radar, Volume 2, Ships 379, did not correspond to the nameplate data of both the installed and spare motors.

The nameplate data of the installed and spare motors is: General Electric a-c motor, Model 5KH23AC279, Type KH, Frame 23A, HP 1/20, 1 phase, 60 cycles, 8A, 115 volts, 3450 rpm, No. YC8011, temp. rise 50°C, Navy Type No. CG 211659. The descriptive data for motor, symbol B-2061 listed in the book is blower, centrifugal; electric; non-guarded; 7.5 W, 2590 rpm, 115-volt AC, 1 phase, 60 cycles; 8¾″ approx. lg x 5⅝″ approx. wd x 7 3/16″ h, Navy spec. 17M10 Service A except for grease cups and conduit box.

A check was made with the *U.S.S. Philippine Sea (CV-47)* and it was found that the same discrepancy existed.

Bureau Comment: The instruction book parts list is in error.



SUB FLOT ONE ELECTRONICS NEWSLETTER ITEMS

TCZ Data

For those vessels having a TCZ transmitter it might be well to note that this unit is nearly identical to the Army ART-13 series and the Naval aircraft ATC units. This is good information in case you should need spare parts some time in an emergency. The ART-13 is used extensively in the Army and spares should be available at most bases or airfields.

5D21 Connector Assemblies for SS

The plate connector assembly between 5D21 modulator tubes and the modulation network often is found broken. It is hard to identify in spare parts but is Item 028. The Navy Stock Number is N-17-C-815501-113.

HV Load Current Trouble in SV

If your HV load current (read at Position 3 of the test meter) should take a notion to increase gradually to an excessive value (over 180 ma) and cannot be set properly by means of the "on time" adjustment, the trouble is undoubtedly in the 5D21 modulator tubes. Replacing them will usually correct the situation. Make certain the test meter is indicating properly at Position 3.

False Echoes on SV

Several vessels have encountered trouble with a false echo following the SV transmitted pulse. This echo is fixed at some range (usually below 5000 yards) and exists at all bearings.

Listed below are some causes for this trouble:

1—705A clipper tubes.
2—Double moding magnetron.
3—Coaxial cable shielding from pre-if amplifier.
4—Echo box leakage and cables.
5—Modulation generator trouble.
6—Modulation network.

Installation of Capacitor in Field Change No. 12-SS

Care must be taken when installing the capacitors C62, C80 and C81 that are associated with Field Change 12. These units are all facing the same way, that is, with the word "Sangamo" facing up. If they are indiscriminately intermixed the lugs will short out between units in the stack thus causing loss of sweep.

"A" Scope Troubles (Focusing)

Focus troubles are quite common on the SS and SV/1 type consoles. Listed are possible causes:

1—Cathode ray tube itself (very common).
2—Intensifier lead off (side of CRO tube).
3—Trouble in PPI HV supply (supplies intensifier voltage for both PPI and "A" scopes).
4—Resistors changed in value in "A" scope HV supply. R(1P)5 in particular.
5—C(1L)41.
6—Intensity and focus adjustments.
7—Intensity grid amplifier tube.

BO Tuning

In tuning your transmitter/receivers remember that the beat oscillator is adjusted for maximum ring time at the same instant the repeller controls are adjusted for maximum receiver crystal current. (Repeller controls merely keep the BO oscillating while you search for the ringtime position with the BO adjustment).

Along this same line some of you may wonder why the 2nd ringtime indication is used instead of the 1st when tuning the BO. Either one will allow proper operation of the equipment in all respects except that the AFC unit will not function on the 1st indication. (BO must be 60 Mc above the magnetron for AFC to work).

PPI Spot After Equipment Turned Off

A large "spot" or glow in the center of the PPI screen after the equipment is turned off is usually the result of an open bleeder resistor in the 5000-volt supply.

Short PPI Sweeps on SS or SV/1

Considerable trouble has been encountered on the SS and SV/1 type consoles in the form of short PPI sweeps, open center on PPI, intermittent sweeps, etc. These troubles are more common to the 80-mile and 40,000-yd sweeps than the others. If you are having such troubles try the following:

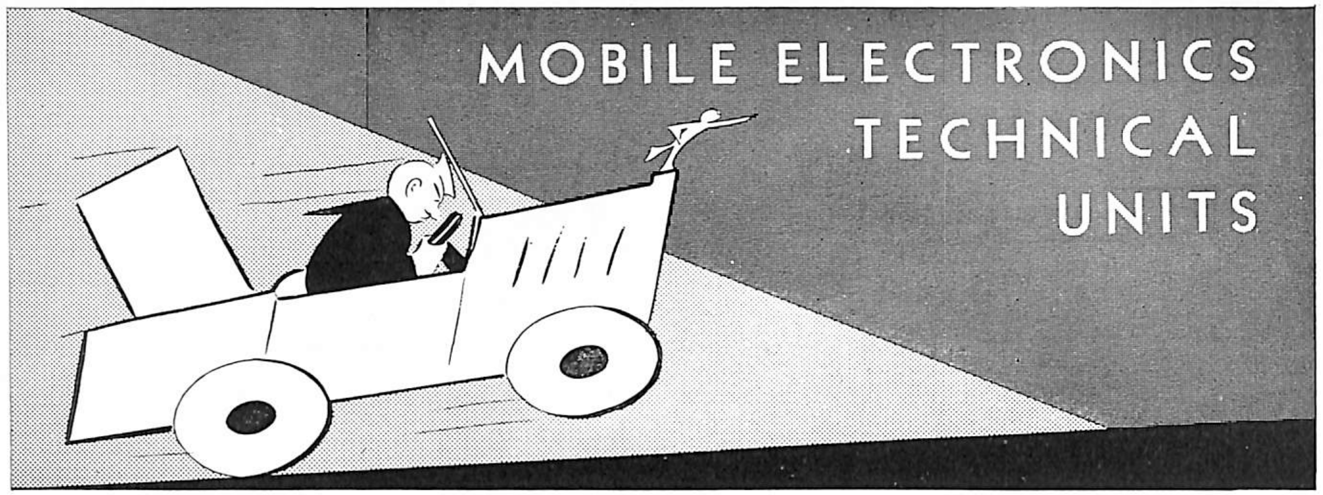
1—Change the 807 tube V(1C)2 (becomes gassy).
2—Change C(1C)22, C 1C)23, etc. associated with S1.1 for the sweep range concerned. (These change value or become intermittent).
3—Change C(1C)18, C(1C)17, etc. associated with S1.2 for the sweep range concerned.
4—Check switch contacts on S1 (dirty or poor contact).

"Hopping" of Range Step on SS or SV/1

This trouble is a very common one and is usually intermittent in nature. We have found the following procedure to be necessary in the majority of cases:

1—Replace V(1K)10.
2—Turn off equipment.
3—Set range counters to 99300 (SS) or 00000 (SV/1).
4—Remove "A" scope to enable access to range pot R(1J)4.
5—Loosen three screws which hold the body of pot R(1J)4.
6—Connect a good ohmmeter to Terminals 1 and 4 of the range pot R(1J)4.
7—Observe meter closely and rotate range pot body until the resistance between Terminals 1-4 is at a minimum value (2-5 ohms) *after* passing the first peak value from zero first peak is approximately 40 ohms). This is the trickiest part of the adjustment as this is a special range pot and goes from 0 to 40 ohms very rapidly (actually about 1/16″ from zero end of winding), then drops to about 2 to 5 ohms sharply and then gradually increases again all the way out to the limit of the pot winding. You must avoid the sharp drop off or the slope from 0 to 40 ohms. The proper setting is right at the dip or a bit on the side of the gradual slope.
8—With the pot adjusted to this dip tighten down on the three retaining screws making certain it does not slip.
9—Now replace the "A" scope and fire up the gear for a check. You will probably find a range step hop at the low end (usually between 500-5000 yds).
10—Adjust R3 (pot under "A" scope) until the transmitted pulse is fairly close to the normal zero set position. This is just a starting point to get R3 near its final adjustment.
11—Now determine where the first jump is from zero yards. If the jump is at say 800 yds, adjust R3 slightly and try again. Perhaps the jump will now be at 400 yds. Keep this up until the jump is well below zero yards (far enough so that you can make a minus zero set anyway). A jump well below zero is to be expected and hurts nothing.
12—Next run the range unit out and watch for jumps at high ranges (above 20,000 yds). If jumps are noticed adjust C38 (on front of console) until they are eliminated.

Refer to Page 7-39 of the SS instruction book Section 10 for additional details if needed or Page 7-40 of the SV/1 book Section 10).



Four Mobile Electronics Technical Units (METU) have been established as miscellaneous units afloat in SERVPAC to supplement other service activities and fleet operating and maintenance personnel in increasing the efficiency of fleet electronics systems. METU have a complement of one OinC and eight ET ratings augmented by a varying number of civilian electronics technicians. The four units are operating at Pearl Harbor, Sasebo, Japan, and San Diego under COMSERVPAC, COMSERVRON 3, COMSERVDIV 31, and COMSERVRON 1.

METU operating instructions are believed to be of general interest and are quoted from COMSERVPAC letter Serial 11935 of 20 March 1951:

"(1) Under the direction of the Service Force Staff or other activity to which attached the METU will act as coordinating agency in providing electronic maintenance service to fleet units and will furnish electronic technical service when necessary.

"(2) Technical service is considered to include: Inspection of electronic installations to determine operational performance and status of operation in system concerned, recommendations as to steps to be taken to improve operational performance, trouble shooting and minor repairs found necessary to improve performance, emergency installations, advising on all matters pertinent to electronics maintenance and record keeping procedure and instruction to personnel on all phases of maintenance and upkeep.

"(3) Unless specifically directed by cognizant Service Force Staff, or other parent organization, METU personnel will limit the technical services rendered to fleet units assigned availability or undergoing overhauls at Navy Yards, Naval Stations, or other shore based Ship Repair Facilities to inspection, recommendations on improvements, advise on maintenance problems and instruction of personnel.

"(4) Technical service will be furnished on an informal basis, without a requirement for written work requests.

"(5) METU's will insure that routine inspections of electronic equipments on ships arriving in port are made without request, but with the consent of the Commanding Officer and in the company of ship's electronics personnel for the purpose of recommending corrective measures found necessary or desirable.

"(6) The presence and assistance of ships personnel

"Technical services will be furnished on an informal basis, without a requirement for written work requests".

is desired when engaged in repair of electronic equipment, in order that the ship technicians will be cognizant of the nature of the trouble and the remedial steps taken.

"(7) Advise ship on proper entries to be made in the equipment history and data necessary for submission of required "Failure Report" (NAVSHIPS 383).

"(8) Assist ship's personnel in preparing suitable work requests for work which can best be accomplished by the repair ships, tenders or Navy yards.

"(9) METU personnel should be well acquainted with the local electronics supply system and render all possible assistance to ships in effecting expeditious requisitioning and receipt of electronics maintenance parts required.

"(10) Make recommendations to Fleet Units concerning alteration requests for improvement of electronic installations and operations.

"(11) Utilize to the fullest the services of civilian electronics technicians available in training METU and ship's personnel in the repair and maintenance of electronic equipments. This can best be accomplished by having METU personnel work with the civilian technicians while making repairs to equipments and by formal class instruction when workload permits."

ALL SERVPAC SHIPS ARE ADVISED TO TAKE ADVANTAGE OF THIS SERVICE OFFERED BY MOBILE ELECTRONICS TECHNICAL UNITS.

—*ComServPac Information Bulletin*

MODELS SS AND SV SENSITIVITY CHECKS

Low sensitivity is a very common headache on the Models SS and SV equipments as indicated by poor echoes, low "grass", and low ringtime. Here are a few of the more common items to check in such cases.

1—Adjustments to BO and repeller controls.

2—Adjustments to "A" video control.

3—Adjustments to i-f gain control on SS type console.

4—TR tuning.

5—Check for proper type signal crystal (1N23B for SS and 1N21B for SV and SV–1). Try replacing crystal.

6—Change TR tube and retune.

7—Check by replacement method the following tubes: Pre-i-f amplifier, i-f amplifier, video amplifiers.

8—Check all video cables for shorts, opens, etc.

9—Change magnetron.

10—Change BO tube.

11—Set rep rate of modulation generator to proper frequency.

12—Voltage and resistance measurements on Pre-i-f, i-f and video amplifier stages.

When good ringtime is obtained but echoes are poor or periscope antenna results are unsatisfactory, check the following:

1—Paint on antenna windows? Masking tape?

2—Replace windows in waveguide.

3—Overhaul periscope adapter.

4—Set phase adjusters and examine them for mechanical defect.

5—Examine waveguide switches for proper operation.

6—Make spectrum analysis as per instruction book.

—*SubFlotOne Newsletter*

YE–1 TRANSMISSION LINE FAILURE

The *USS Saipan (CVL–48)* reports the following failure of the Model YE–1 transmission line:

"Recently this ship experienced a peculiar failure in connection with the YE–1 homing beacon. All pilots were reporting that they heard all sectors at equal amplitude, regardless of their position relative to the ship. Strong signals were reported out to forty-five miles.

"Since this is a directive antenna with a thirty-degree horizontal beam width, it was suspected that the transmission line had parted and was acting as an omnidirectional antenna. No abnormal front panel indications were noted. However, an inspection with a neon lamp revealed that energy started to radiate from the coaxial transmission line two feet below the drive box. At this point it was discovered that the coaxial cable with its attached probe, which fits into the concentric line insulator connector, was not secured by the packing gland located at the bottom of the concentric line. Consequently, the center assembly of the concentric line dropped down, because of the vibration of the mast, a distance of two inches, forming a radiating element. No energy was being radiated from the antenna.

"The packing gland dropped down because there is no lip or flared section on the outer conductor of the concentric line, for the packing gland nut to compress against. This line is shown in Figure 28 of the Model YE–1 instruction book, and appears to be perfectly smooth."

It is therefore recommended that all ships check this connection periodically to insure proper radiation of the Model YE–1 equipment.

Loran Alignment and Servicing

by
A. H. Berg, ETC, USN

Alignment

Experience has shown that many Electronics Technicians are having difficulty aligning the DAS series radio navigation equipments. An alignment procedure is given in the December 1950 issue of ELECTRON as well as the one in the equipment instruction book. These procedures are clear and easy to understand but they do not cover the following three points which have caused a great deal of difficulty in the past.

1—The first point concerns the adjustment of the output transformer (T–101) of the standard frequency generator (V–101). If the equipment appears unstable and cannot be calibrated, this transformer may be incorrectly adjusted. This transformer is inductively tuned to 115 kilocycles by means of a permeable core to insure stable oscillation at all times.

To adjust T–101 proceed as follows:

a—Remove the squaring amplifier (V–102). (This is done because V–102 draws grid current and will affect the waveform.)

b—Connect a general purpose oscilloscope between Pin #4 of V–102 and ground.

c—Energize the equipment and the oscilloscope.

d—Synchronize the sweep so that the waveform may be observed. (This waveform will have an approximate frequency of 100 kilocycles; therefore it will be necessary to use the highest sweep frequency available.)

"B" Jitters

e—Turn the adjustment on top of T–101 completely counterclockwise resynchronizing the oscilloscope as necessary. The waveform should decrease in amplitude as this adjustment is made. In making this adjustment be very careful—do not break the slug away from the screw by applying too much pressure. The fingers or a small alignment tool should be used.

f—Now turn the adjusting screw clockwise, resynchronizing the oscilloscope as necessary. As the adjusting screw is turned clockwise, the waveform will increase in amplitude and then will reduce in amplitude abruptly. Once the waveform has passed through this maximum point, stop turning the adjustment clockwise.

g—Now start turning the adjusting screw slowly counterclockwise, noting the point at which maximum amplitude of the waveform occurs. When this point is known, give the adjusting screw a half turn further in a counterclockwise direction from this point. The tank circuit is now inductively tuned to a frequency of approximately 115 kilocycles.

h—Disconnect the oscilloscope and replace V–102. We are now ready to adjust C–111.

2—The second point concerns the setting of C–111, the coupling capacitor between the squaring amplifier and counter No. 1. The instruction book states that "coupling capacitor C–111 is adjusted at the factory and this adjustment should not be disturbed afterwards". However, shock and vibration can—and does—change the setting of this variable capacitor thereby delivering an incorrect input to counter No. 1. Therefore, it has been necessary to adjust this capacitor in the field, contrary to directions in the instruction book. When C–111 is set correctly, varying the "A" control (R–109) from fully counterclockwise to fully clockwise will change the number of 10-microsecond markers appearing between the 50-microsecond markers from three to seven. C–111 is adjusted as follows:

a—Set the SWEEP SPEED switch at FAST, the FAST SWEEP switch at 1 and the RECEIVER switch at its OFF position.

b—Set the "A" control fully counterclockwise.

c—Adjust C–111 so that three 10-microsecond markers appear between the 50-microsecond markers. (When C–111 is correctly set it will be almost ¾ closed.)

d—Check the adjustment of C–111 by setting the "A" control fully clockwise and observe that seven 10-microsecond markers appear between the 50-microsecond markers.

e—When the above requirements have been met, set the "A" control in the center of the range where four 10-microsecond markers appear between the 50-microsecond markers and leave it there.

Misadjustment of C–111 will cause the stations to disappear from the sweeps when switching between FAST SWEEP positions and can also cause unstable pedestals or "B" trace jitter.

3—The third point concerns the counter feedback adjustment. For explanation purposes, this adjustment as given in Step 14, Pages 5-7 and 5-8 of the DAS–4 instruction book will be used. Figures 5-8 and 5-9 show the counter feedback block pattern as it appears with the STATION SELECTOR switch on 1 and the P.R.R. switch at L and H respectively. We are interested in the left-hand column of dots only. With the STATION SELECTOR switch at 1 there should be seven dots in the left-hand column but, and this is true for all positions of the STATION SELECTOR switch, the top dot should be slightly to the right of the rest of the dots in the column and should be of less intensity. The incorrect and the correct appearance of the left-hand column of dots is shown in Figure 1, with the STATION SELECTOR switch on position ONE.

Servicing Hints

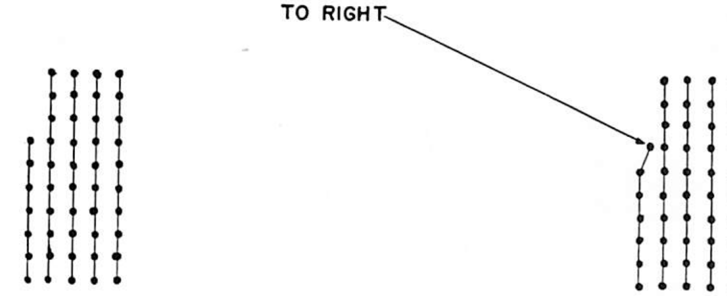
"B" Trace Jitter

A great number of equipments which the Electronics Service Group have been called on to repair have had a "B" trace jitter. The cause of this trouble in the first equipments repaired was generally due to a defective coupling capacitor to Counter No. 2, 3, or 4, (C–113, C–123, or C–128 respectively) but the cause of the trouble in the last equipments repaired has been due to a defective coupling capacitor, C–161 or C–164 in the B1 delay circuit, a defective grid bypass capacitor, C–139 or a defective coupling capacitor, C–140 in the B2 delay circuit. These capacitors were found to be defective as indicated by an unsatisfactory megger reading. Occasionally it will take a small amount of heat to cause the capacitor to break down. This can be conveniently furnished by a soldering iron applied on or near the capacitor.

C–140 was found to be the cause of a "B" trace jitter in eight of the last ten equipments repaired. A voltmeter placed between Pin #1 of V–112A and ground will show a slight variation every time the "B" trace jitters. Unsoldering one side of this capacitor and megging it will produce a reading of anywhere from two to eight megohms.

SEVENTH DOT SHIFTED TO RIGHT

FIGURE 1.



INCORRECT (AS SHOWN IN INSTRUCTION BOOK)

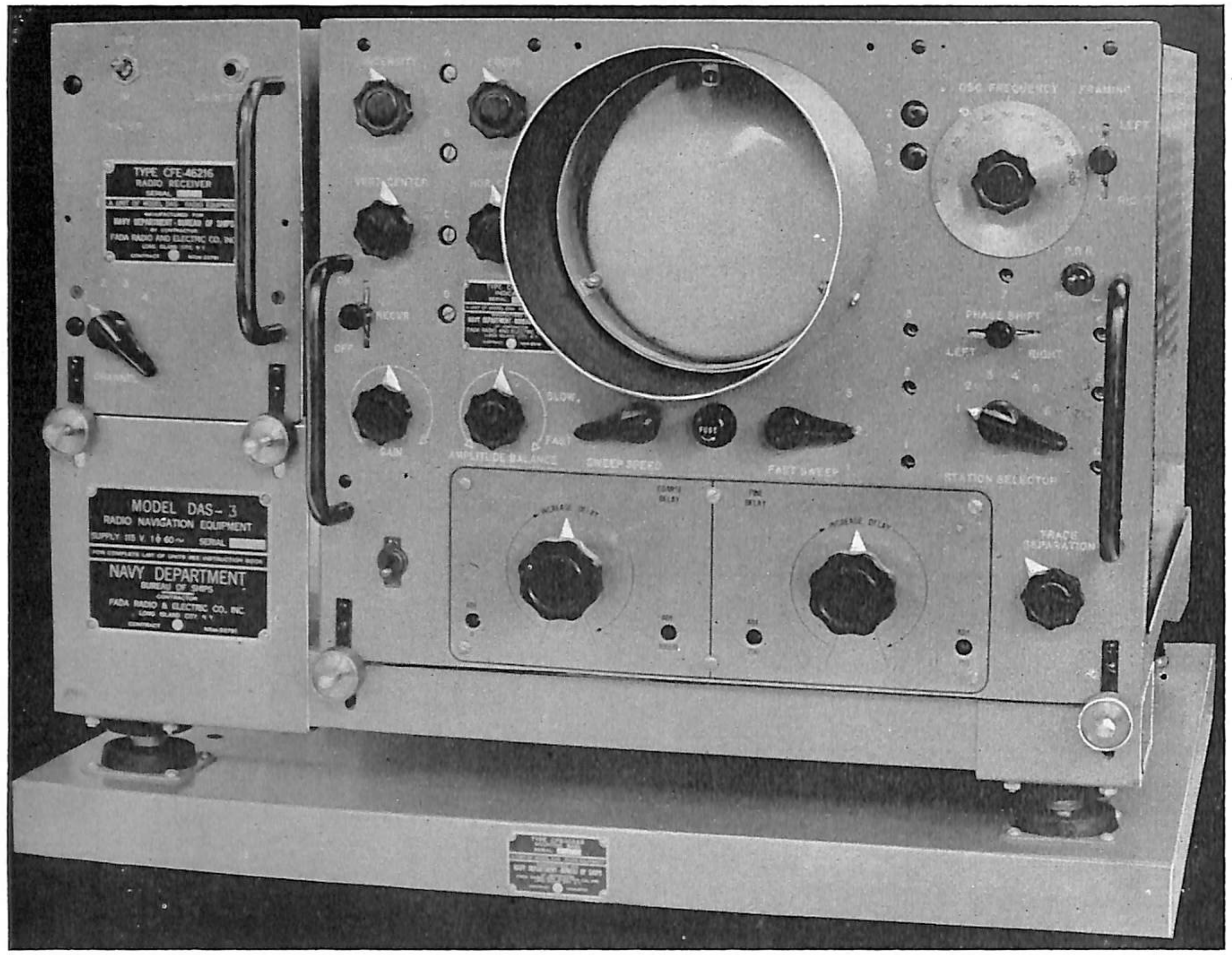
CORRECT (AS IT SHOULD APPEAR ON OSCILLOSCOPE SCREEN)

Improper Focus and/or Low Intensity

Another common trouble is the inability to obtain proper focus and/or sufficient intensity. Resistance measurements in the negative high voltage circuit will locate the cause of this trouble. R–232 and R–234 are the most frequent offenders.

Low Receiver Sensitivity

One of the most common causes of low receiver sensitivity is a burned out antenna coil. These antenna coils are easily burned out by a high power transmitter operating on a frequency near the loran frequency or on a harmonic of the loran frequency provided the trans-



mitter antenna and the loran antenna are relatively close to each other. Since the loran is operated only on Channel one at present, this is the only channel which will have a burned out antenna coil. To check for a burned out coil, disconnect the antenna, set the gain to give a high level of grass on the oscilloscope screen and rotate the channel switch through all four positions. A decrease in a grass level on Channel one indicates the above trouble. Inspection will show the coil to be burned and charred. When repairing, all four coils can be replaced as a unit or the coil for Channel one can be replaced separately.—*ServLant Monthly Bulletin.*

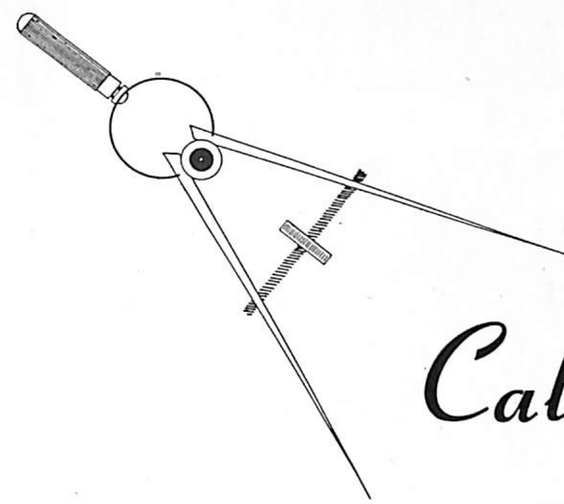
SHORTENING MODEL TBL M–G SHAFTS

Norfolk Naval Shipyard has submitted a recommendation to BuShips that the ends of the shafts on the Model TEL motor-generators be shortened sufficiently to allow replacement of coupling discs without removal of individual units from the base.

There is only 13/64″ clearance between shaft ends of the individual units and the coupling disc is 3/8″ thick, making it necessary to remove one or more of the units from the base to make the necessary repairs. This upsets the alignment and balance which is difficult to restore and impractical to accomplish by ship's personnel.

It has been found that by shortening the shaft ends, approximately 3/8″, bringing them flush with the coupling flanges, insertion of a new coupling disc may be made without disassembly of the unit. Repairs then may be made by ship's personnel, eliminating the necessity of a yard overhaul.

The Bureau has no objection to the shortening of the shafts as indicated when found necessary by activities making repairs to Model TBL motor-generators.

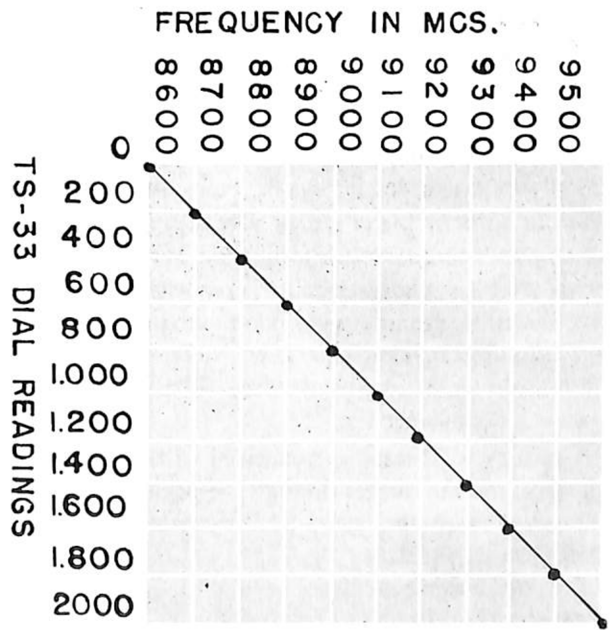


Calibrating the TS-33

by
C. R. Lake, ETCA
U.S.S Agerholm (DD–826)

The Model TS–33 frequency meter is required equipment for tuning the klystron and r-f plumbing sections in the MK 34 radar transmitters. When the micrometer tuning section on our TS–33 was broken, we found a similar section in one of our "junk, miscellaneous" boxes which would make the meter work. However, without a calibration chart for that tuning assembly, we could not determine frequency. The tenders and naval station said they couldn't possibly calibrate the meter, so we made up a calibration chart by the following method:

Set the TS–33 on 000, turn the magnetron down until the TS–33 meter dips. Measure this frequency by the TS–147 and record. Set the TS–33 to 100, 200, 300, etc. and repeat the steps. Construct a graph plotting TS–33 micrometer readings against frequency, plot in the recorded points, and connect (see Figure 1).



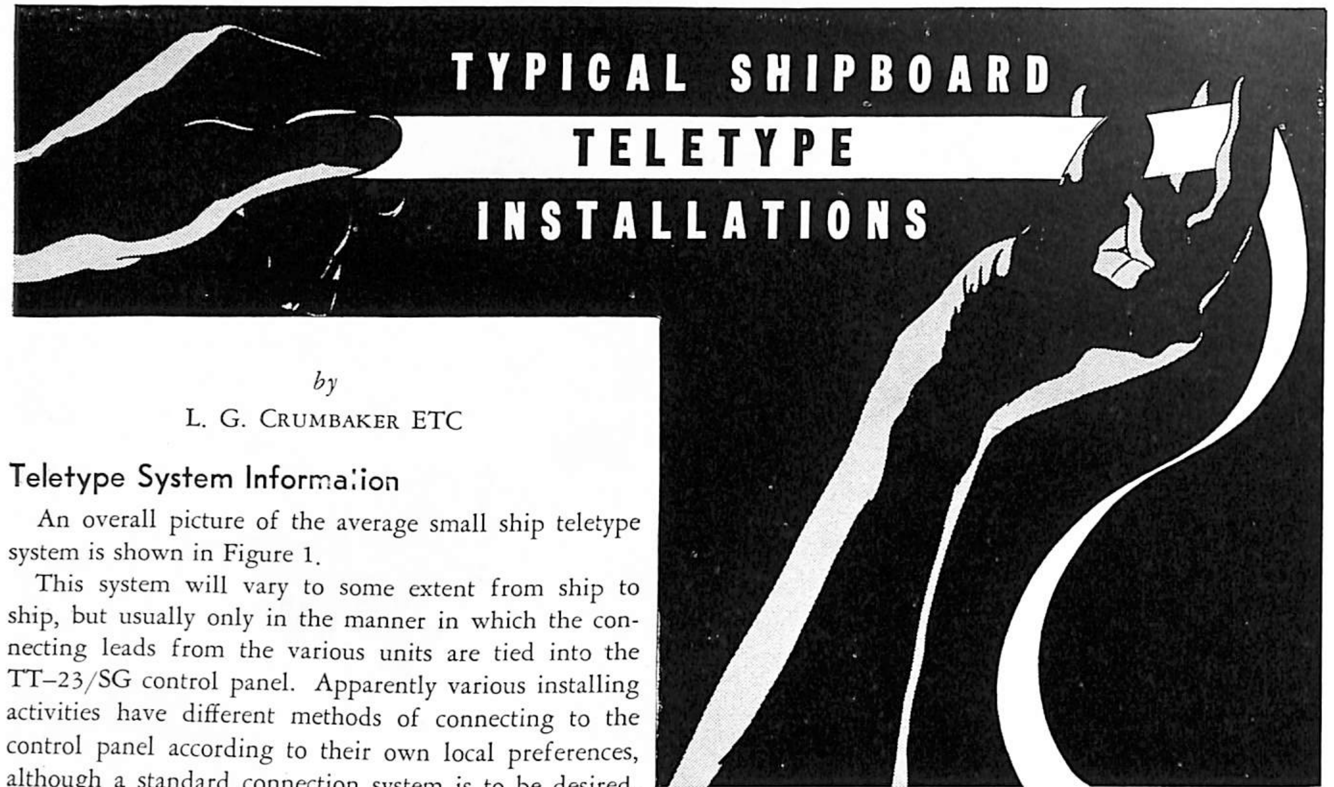
The principle is elementary, just calibrating one meter from another in the same frequency range and using a convenient variable frequency source. There are many pieces of test equipment laying around in the fleet (calibration charts lost, tuning head was changed, etc.) which could be used if the ET's would only use a little imagination. Signal generators can be calibrated, if required, by using a common receiver. We used our RDO and RDP combination to recalibrate our TS–182.

U-H-F PERFORMANCE ITEM

A DM recently submitted this report on its TDZ/RDZ equipment:

Total hours of operation to date	11,579
Hours of operation lost (due to failure)	None
Operational difficulties	None
Maximum reliable range	15 miles

Can the u-h-f equipment in your ship match this?



TYPICAL SHIPBOARD TELETYPE INSTALLATIONS

by
L. G. CRUMBAKER ETC

Teletype System Information

An overall picture of the average small ship teletype system is shown in Figure 1.

This system will vary to some extent from ship to ship, but usually only in the manner in which the connecting leads from the various units are tied into the TT–23/SG control panel. Apparently various installing activities have different methods of connecting to the control panel according to their own local preferences, although a standard connection system is to be desired. The installations have been altered in many cases by shipboard personnel, and no explanatory diagrams prepared for aid to other repair personnel.

In any case, the method of patching used in the TT–23/SG panel will probably be more or less peculiar to any one installation. Therefore, this discussion is meant to serve as a guide to a starting point for an understanding of the workings of a shipboard teletype system.

Transmitting and Receiving Techniques

The most commonly used methods of teletype reception and transmission are: (a) Tone keying; (b) Frequency-shift keying.

In the system of tone keying, the transmitter frequency is held constant, and the carrier is modulated by two separate audio tones, one corresponding to a "mark" (current) impulse, and the other corresponding to a "space" (no current) impulse, as seen by the receiving teletype machine. With this method, the output of the receiver is fed to a sharply-tuned filter network in the TTY converter. This filter has dual low-pass sections, one of which will pass the "space" tone and reject the "mark" tone, while the other accepts the "mark" tone and rejects the "space" tone. Thus the two tones are fed into separate channels for amplification from which they control polar relays which serve to make and break the d-c line to the printer, according to whether the received tone is representative of a mark or a space signal.

In the system of frequency-shift keying, which ships using an FRA converter employ, the transmitter is frequency modulated by the sending teletype machine through a frequency-shift converter. There is produced a resting frequency, corresponding to a mark impulse, and a slightly higher (or, in certain cases, lower) frequency, corresponding to a space impulse, as seen by the receiving teletype machine.

Output is taken from the plate circuit of the second intermediate frequency amplifier, is fed to a 6AB7 connected as a cathode follower, then through a low pass filter to the output jack, from where it is cabled to the input of the FRA converter.

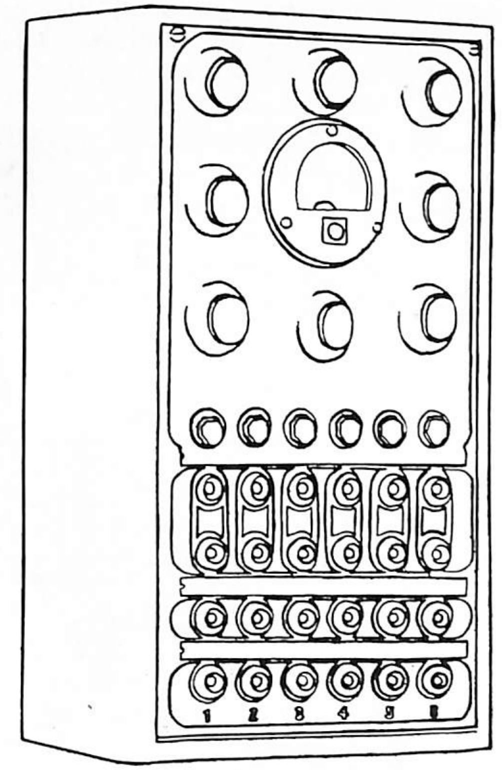
The 400-kc, i-f frequency plus (or minus) the spacing frequency, is amplified in the FRA and beat against a locally-generated 400-kc signal. From there, the signal passes to a discriminator circuit which produces no output on the resting, or mark frequency, but does produce output voltage under spacing frequency conditions. This serves to produce a marking or spacing impulse by controlling an electronic keyer system using 6L6's, which make or break the d-c line to the printer in a mark or space manner.

A meter and rheostat is connected to the printer circuit to control the current through the printer magnets in conjunction with the meter and rheostat in the TT–23/SG control panel.

The steady-current value of the printer d-c line, should be set to as near 60 ma. as possible, as the printers are adjusted mechanically to operate with best results with that value of line current.

In the printer itself, a start (no current) pulse is used to trip off the machine and start the main shaft rotating in preparation for the reception of the five separate mark or space pulses. These serve to set up mechanical linkages, enabling the selection and printing of one particular character or function, (space, carriage-return, bell, and the like). After the machine has completed its selecting and printing operation, a stop (current) pulse is sent, allowing the main shaft to come to rest, and freeing the mechanical linkages from the preceding selection, so that they will be free to respond to a new character when the next start, select, stop signals arrive. This system of signalling is known as the start-stop, five-unit code, and consists of combinations of current and no current pulses in 32 arrangements corresponding to letters, figures and various machine functions.

Teletype printers are precision-adjusted machines. This makes it absolutely essential that untrained personnel should not be permitted to attempt adjustments of the mechanism. Beyond the proper use of the "range-



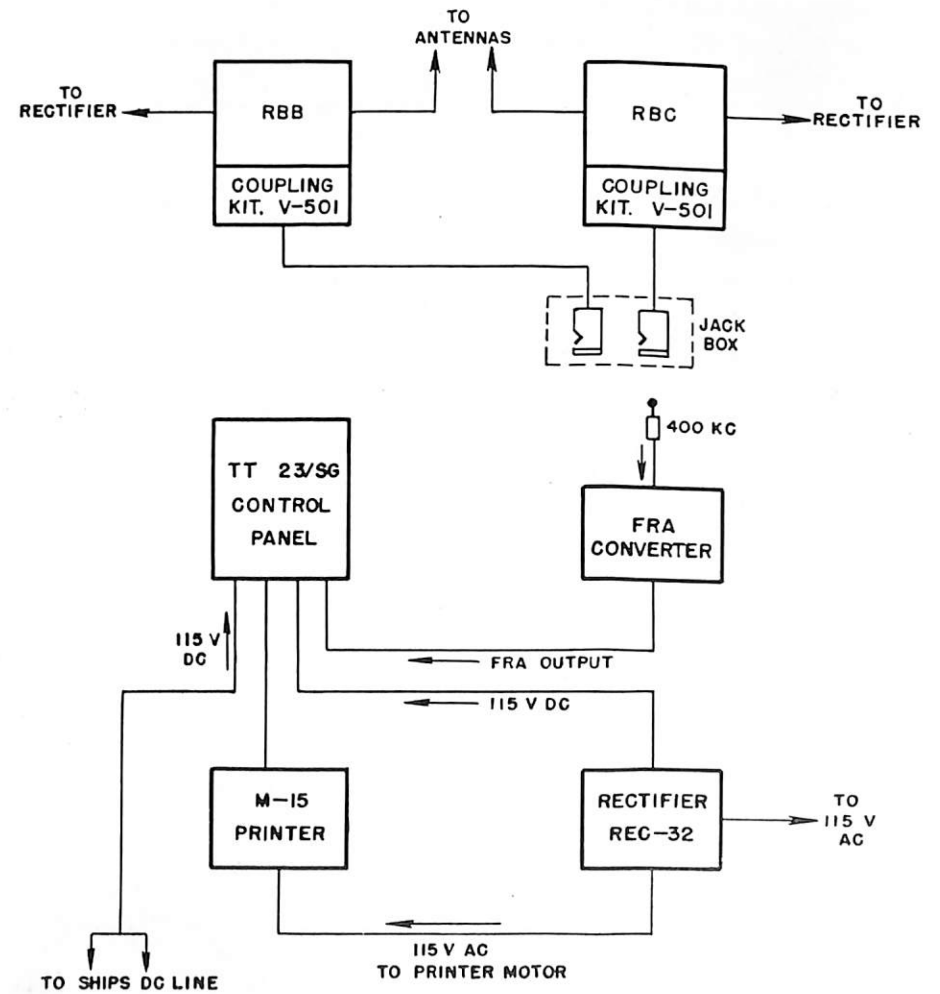


FIGURE 1—Small ship typical teletype system.

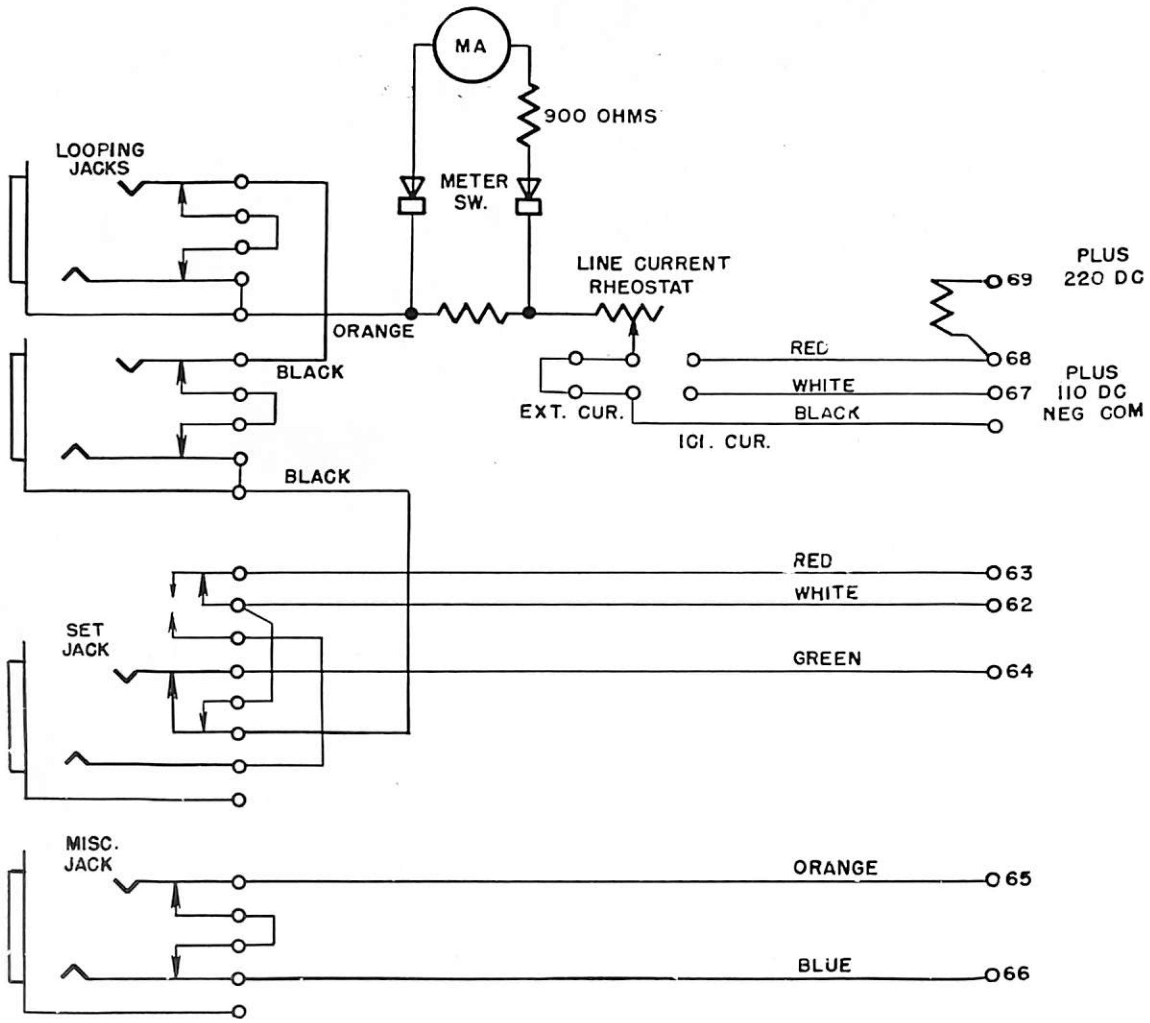
finder", located behind the small flap-door on the left of the machine, no other adjustment should be made, except by technically-qualified personnel.

It is realized that due to the non-standard hookups of many of the TT–23/SG control panels, some changes of unit connections may, on occasion, seem desirable. This, however, should *never* be done without prior information which can be secured from technicians qualified in teletype maintenance on the Staff of Commander Service Force, Atlantic Fleet, Electronic Service Group.

In any instance where such modification of a teletype installation seems warranted *due to non-standard wiring of the control panel,* a telephone call or work request to ESG should be made, and personnel familiar with teletype adjustment and repair will help solve the problems that may arise.

A simplified diagram of one representative channel of the TT–23/SG control panel is included in this article (see Figure 2) to aid the shipboard technician in understanding the functioning of the jack system employed. This is necessary, not only because there is usually no instruction book on hand for this particular panel, but also because the main source of trouble in shipboard systems has come about because of open contacts through the jack system. This is caused by fatigue of the metal in the spring levers of the jacks themselves, and often necessitates removal of the jack and adjustment with a pair of longnose pliers. This operation, while not especially precise, is sufficiently touchy that it should not be attempted unless it becomes evident that the jack levers are making faulty contact due to loss of tension in the levers.

—ServLant Monthly Bulletin



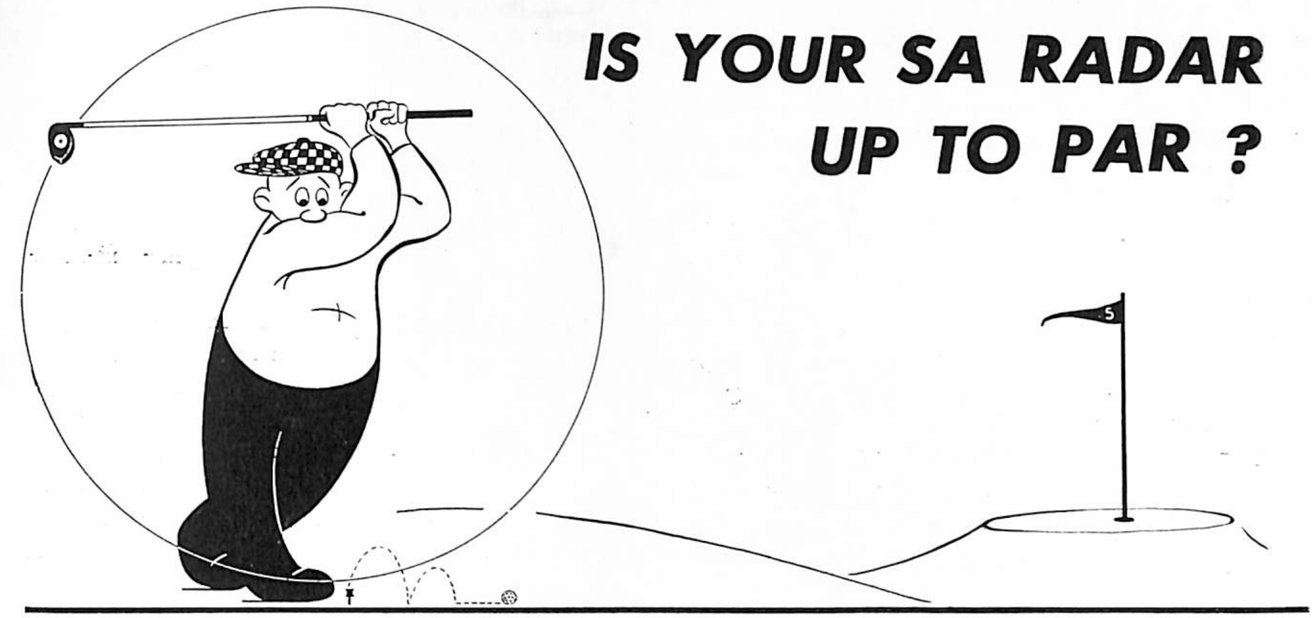
MODEL TT-23/SG TTY PANEL.

CHANNEL #6 SCHEMATIC

(CHANNEL TERMINALS COMMENCE WITH FIRST FIGURE OF CHANNEL USED)

FIGURE 2—Simplified diagram of one representative channel of the TT–23/SG control panel.

IS YOUR SA RADAR UP TO PAR ?



by

F. E. Lumbard, N. T. Evans, C. F. Thompson, *and* E. J. Wirtz

Philco Field Engineers

Are you struggling to obtain 20-mile ranging with a 70-mile radar, when using a single aircraft for your echo? Many ET's are experiencing this trouble which is usually traceable to a misconception of the SA tuning procedure or misuse of the OAA wavemeter. The following information should be of good assistance to those who are required to tune the SA.

Dirty tuned lines are frequently the cause of arcing in the transmitter, even at low plate voltage. This will result in low power output from the transmitter and consequently weak echoes at the receiver. Before tuning is begun it is suggested that the tuned lines be thoroughly cleaned to prevent erratic tuning. Use brightwork polish, silver polish or jeweler's rouge, followed by cleaning with carbon tetrachloride. Clear water may be used if carbon tetrachloride is not available.

SA Transmitter Tuning Procedure

1—Determine which band your SA antenna is designed for. The three general types are for Band 3, Band 4 and a combination of Band 3 or 4. The type of antenna used with your SA may be determined from the nameplate located on the antenna frame. (Not the nameplate on the pedestal.) Due to changes and modification of equipment your present SA antenna may be different from that recorded on your equipment history cards. Be sure of your antenna type and save time tuning.

2—With the antenna type known, the SA transmitter may be set to the correct frequency. The Band 3 antenna covers a range from 215 to 219 megacycles. The transmitter frequency should then be set for 217 megacycles. The Band 4 antenna covers a range from 221 to 225 megacycles. If operating on Band 4, the transmitter should be adjusted to 223 megacycles. If the antenna is a Band 3 or 4 (combination), adjust the transmitter to 220 megacycles for optimum performance.

3—Measure the filament voltage on the 8014–A tubes directly at their pins.[1] This should be 14.5 volts. Once this exact voltage is obtained note the reading on the transmitter voltage indicator and use it as a reference point for maintaining correct filament voltage when using the "Filament Voltage Control."

4—Adjust the transmitter "Grid Tuning", "Filament Tuning" and "Antenna Coupling" for a center frequency of the band being used. These settings may be determined approximately from the curves found in the instruction book of your SA.

5—Increase the "Plate Voltage" setting until plate current is at 7 milliamperes. If this setting causes arcing, reduce the plate current to a setting just below the point where arcing occurs.

6—Check the transmitter pulse on the indicator. If the transmitter is double pulsing, half pulsing or pulsing erratically, correct this by adjusting the "Locking Voltage" and the grid-leak resistor, which is adjusted by the link switch S102.

7—Use the OAA wavemeter to indicate the transmitter's frequency. (See Figure 1.) Caution—The OAA antenna is physically constructed so that its resonant frequency is approximately 205 megacycles. Therefore, it will be possible to obtain higher output indication on the OAA as the transmitter is tuned lower in frequency

[1] The Bureau cautions all technicians to observe Bureau-approved procedures for measuring high voltage when performing this operation.

(towards 205 megacycles). This should *not* be understood to mean the transmitter is putting out more power on the lower frequencies. To guard against this very common misadjustment always set the OAA wavemeter to the correct transmitter frequency and do *not* change this OAA frequency setting during the balance of the SA transmitter tuning procedure.

8—Tune the transmitter "Grid Tuning" control for maximum indication on the OAA. Maximum pickup will be obtained with the OAA and SA dipoles parallel (for maximum coupling).

9—Vary the "Filament Tuning" control by steps, retuning the "Grid Tuning" control for maximum OAA indication after each step.

10—Repeat steps 8 and 9 until absolute maximum indication is obtained on the OAA. Record this maximum reading. Now adjust the antenna coupling taps slightly in either direction until a point is reached which will give the highest peak reading after again performing steps 8 and 9 for each change in tap setting. This completes the transmitter tuning procedure.

SA Receiver Tuning Procedure

1—Reduce the "Sens" control to a point just below that where the noise interferes with determination of the echo.

2—Rotate the "Rej." control to maximum clockwise position. Turn "Rej. Bal." and "Balance" controls to zero. Place "Time Const." switch to position 1. Adjust "Loc Osc." and "R-F" controls for maximum echo. The "Loc Osc." control should be rocked while the "R-F" control is adjusted.

3—Tune the TR (duplexer) for maximum signal.

4—Tune the ATR for maximum signal, using the most distant steady echo.

5—Pull out the receiver drawer until it is possible to reach the two r-f tuning trimmer condensers, C–1460 and C–1461. Adjust both of these trimmers for maximum signal. (The alignment tool for this should be found under the range indicator cover).

6—Raise or lower the r-f amplifier tubes, V–1401 and V–1402 (Type 446–A's) until maximum signal is obtained. Note: The anode cap, grid and cathode elements position in the r-f box has a slight tuning effect on the r-f amplifier. This adjustment compensates for the variation in interelectrode capacities in the r-f amplifier tubes.

This completes the receiver tuning procedure. Careful adherence to the tuning procedure should result in obtaining the maximum capabilities of your SA radar.

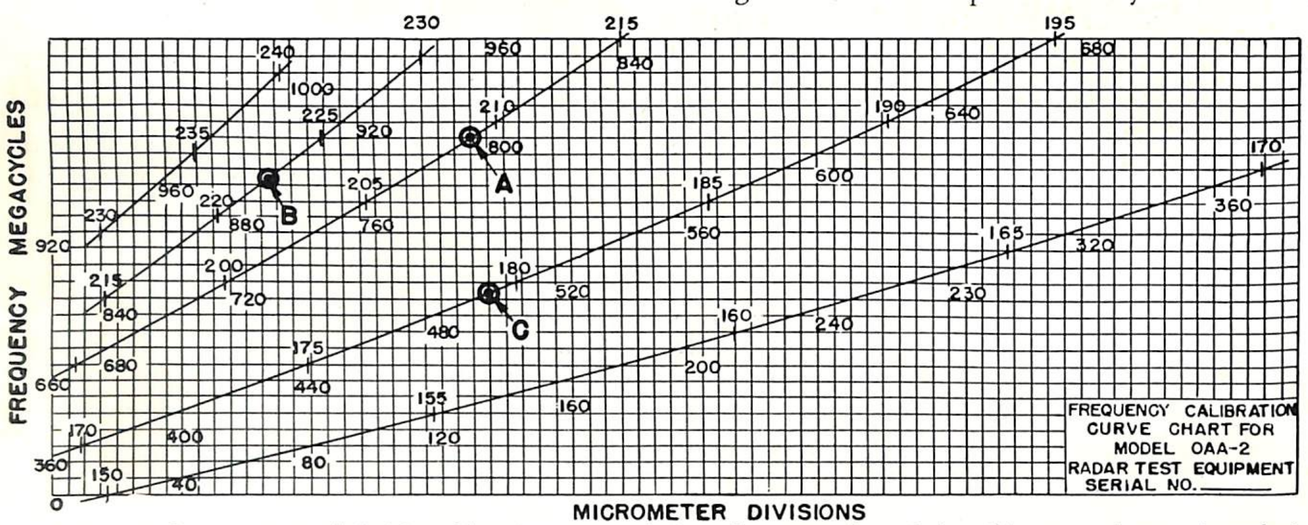


Figure I shows a typical OAA calibration curve. It is to be remembered that this curve does not apply to your particular OAA; it is given here as an example to show how the OAA calibration curve is read. The curve for your OAA is located in the metal pocket on the side of the OAA in a cardboad folder. A separate calibration curve is prepared for each OAA and only the curve corresponding with the serial of your OAA may be used.

You will note that the micrometer divisions are indicated by the vertical lines and frequencies in megacycles are indicated by the horizontal lines. Each of the slanting lines is a separate curve with frequencies written above the lines and micrometer readings written below the lines.

The following example indicates the interpretation of a point on curve A:

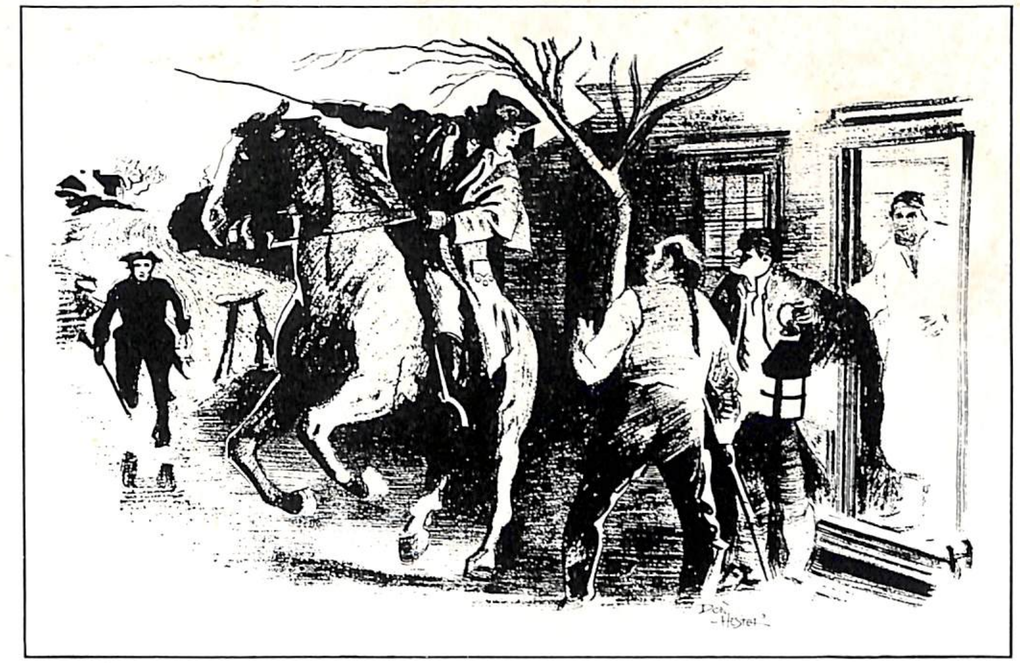
The heavy vertical line which passes through the "6" in 760 indicates a micrometer reading of 760. Thereafter, each heavy vertical line is equivalent to 5 micrometer divisions and each light vertical line is equivalent to I micrometer division. Therefore the micrometer reading at point "A" is 790.

The second heavy horizontal line below the figures "205" (which is crossed by a short vertical line) is the 205 megacycle line. Each heavy horizontal line thereafter is equivalent to I megacycle. Therefore, the frequency reading at point "A" is 209 megacycles.

Thus point "B" is 222.5 megacycles at a micrometer reading of 887.5, and point "C" is 179.4 megacycles at a micrometer reading of 496.

Fast?

Yes, this was high speed communication in Paul Revere's day.

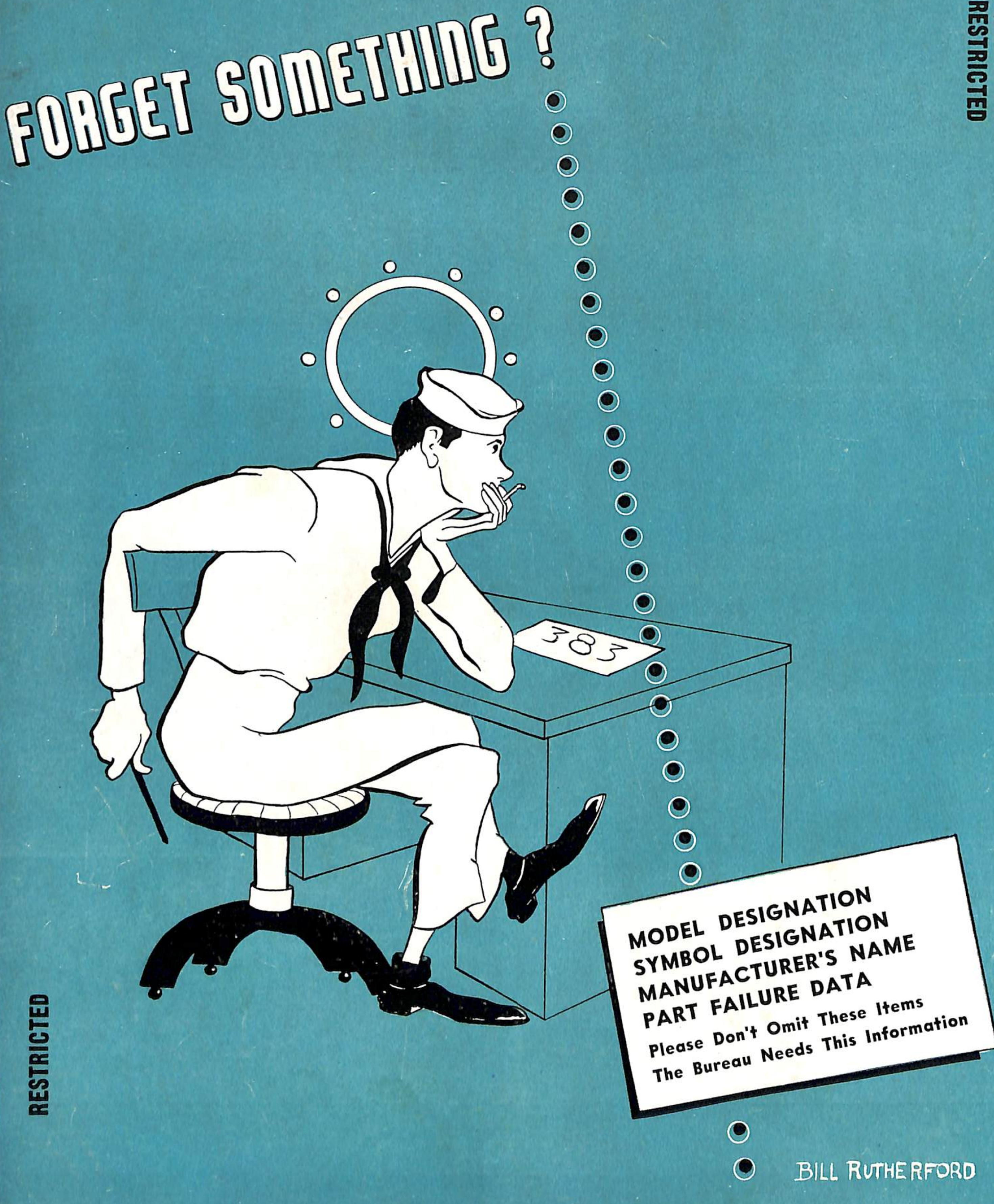


"One if by land, two if by sea". His orders in mind Paul Revere rode at what was then flank speed, to carry the vital message. You would be sorely pressed though, if you had to wait for a man on horseback to bring you the latest info on enemy operations. As a matter of fact, even a racing driver in a high powered car would be too slow for your purposes. You need speed, Speed, SPEED—the speed of light itself—in your communications; and you get it —

— through ELECTRONICS

Symbol of Tomorrow

RESTRICTED



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