BUSHIPS

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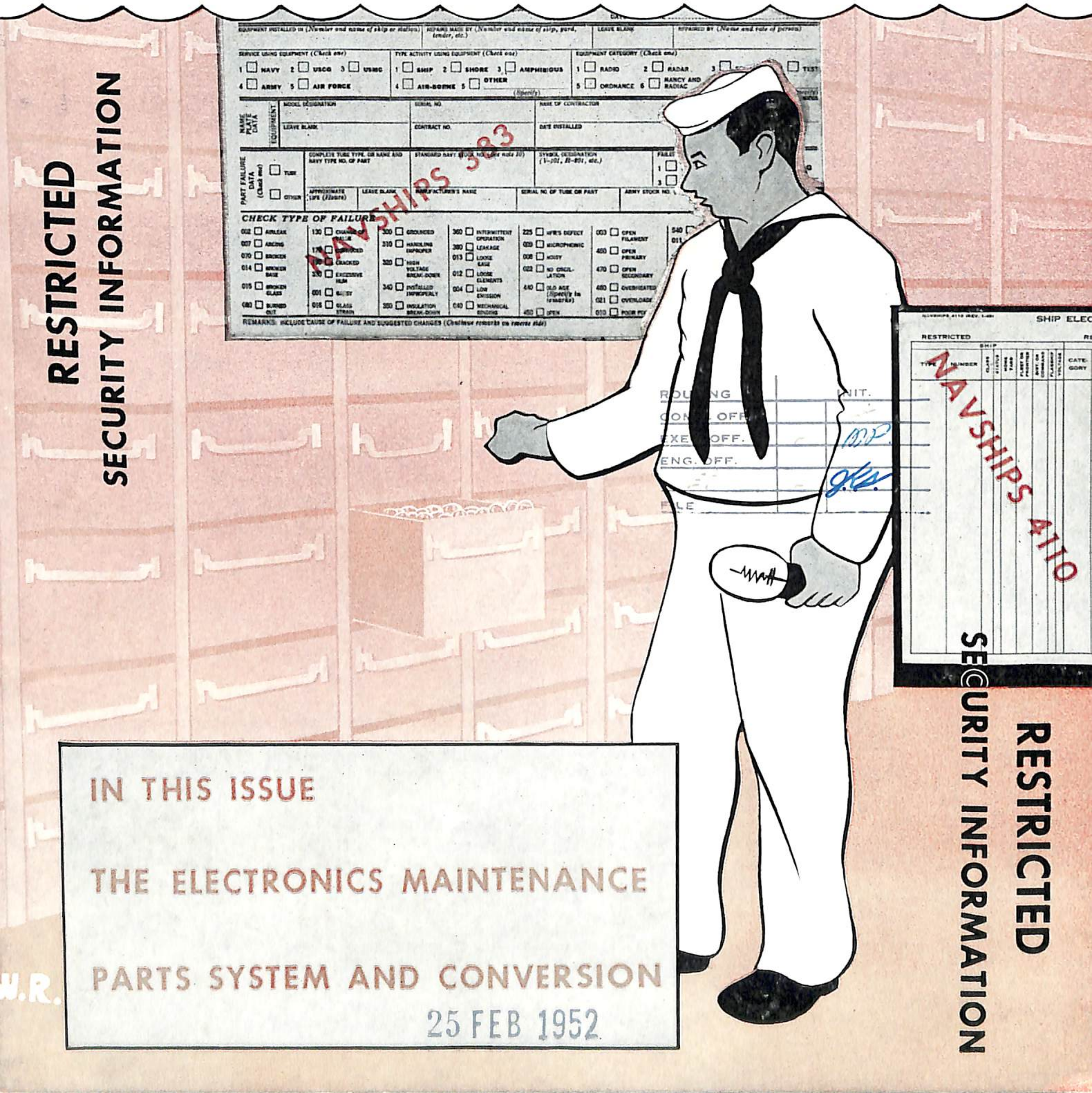
ELECTRON

NavShips 900,100



RESTRICTED
SECURITY INFORMATION

IN THIS ISSUE

THE ELECTRONICS MAINTENANCE

PARTS SYSTEM AND CONVERSION

RESTRICTED
SECURITY INFORMATION

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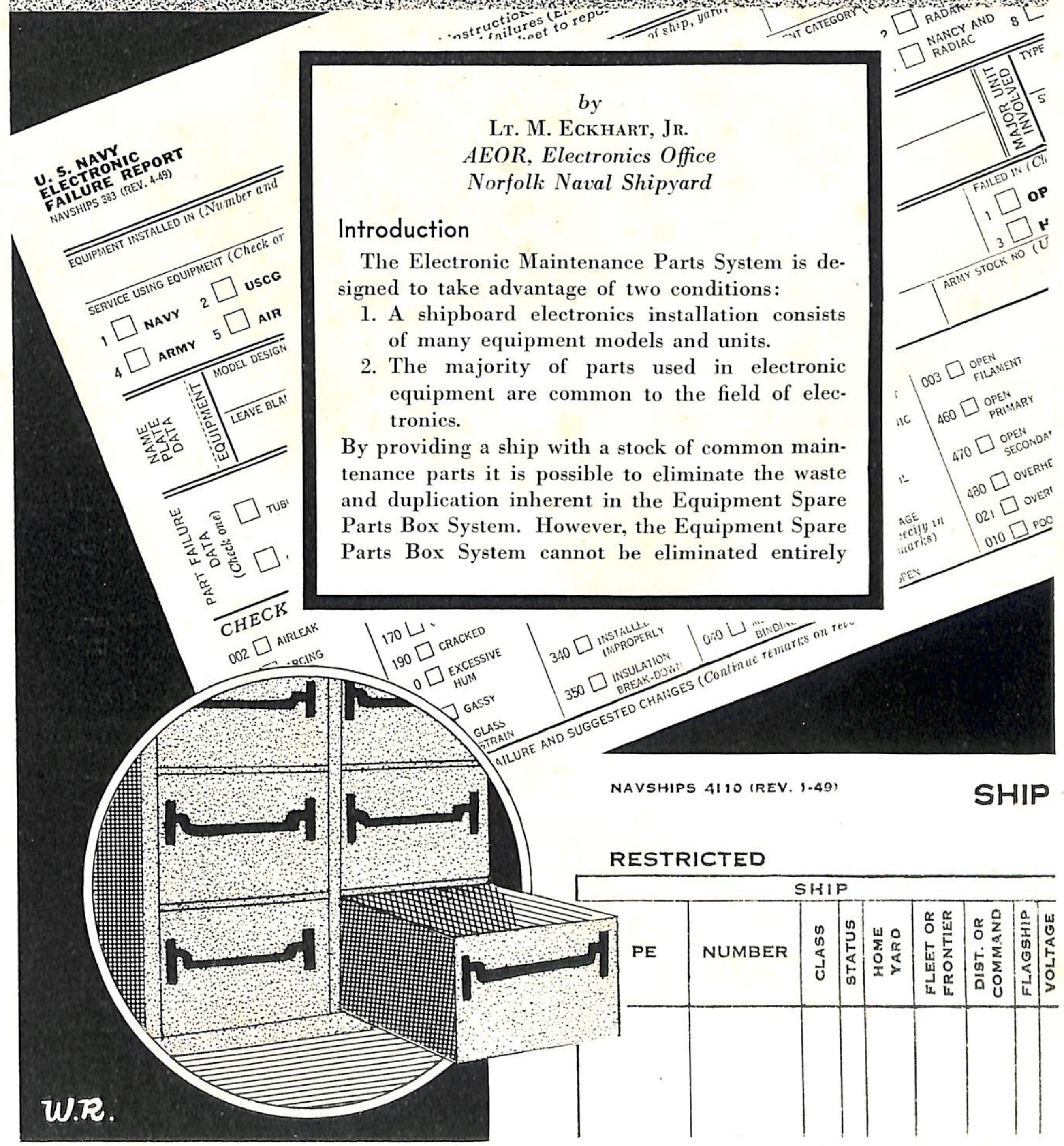
Electronics Maintenance Parts System And Conversion



by
Lt. M. Eckhart, Jr.
AEOR, Electronics Office
Norfolk Naval Shipyard

Introduction

The Electronic Maintenance Parts System is designed to take advantage of two conditions:

1. A shipboard electronics installation consists of many equipment models and units.
2. The majority of parts used in electronic equipment are common to the field of electronics.

By providing a ship with a stock of common maintenance parts it is possible to eliminate the waste and duplication inherent in the Equipment Spare Parts Box System. However, the Equipment Spare Parts Box System cannot be eliminated entirely since each equipment model contains parts which are peculiar to that model. It is most efficient and economical to continue to provide with each equipment model a maintenance parts kit which contains the initial stock of replacements for those parts which are peculiar to that model.

The nature of the Electronic Maintenance Parts System is such that gradual adoption of the system aboard ship is impractical. In contrast, the stock of maintenance parts stowed in equipment spare parts boxes is the only significant stock available for the initial provisioning of the Electronic Maintenance Parts System. It is necessary, therefore, that the initial Electronic Maintenance Parts System be a conversion system which is predicated on the ultimate system, but which results from a conversion of the Equipment Spare Parts Box System. The conversion system will contain the primary advantages of the ultimate system: standard identification, group stowage, and accessibility of maintenance parts. It will contain a few limitations which will not be present in the ultimate system, and will lack a few advantages which the ultimate system will provide, but will be a marked improvement over the Equipment Spare Parts Box System.

Building Blocks of the System

Before the Equipment Spare Parts Box System could be discarded in favor of the new Electronic Maintenance Parts System, it was necessary to establish standard descriptions and stock numbers for electronic maintenance parts. It was impossible to set up a general maintenance parts supply system until those parts were divorced from dependence on manufacturers' descriptions and equipment association for identification. In addition, the badly needed program for standardization of parts had to await the establishment of standard descriptions.

The stock description program would be of historical interest except for the fact that the program has not been completed as yet. There are many maintenance parts which are yet to be identified, and there are interim stock numbers in use which have been assigned temporarily until stable stock number patterns can be established for those parts. However, stock number transactions will be handled at the supply-support activities and will not affect the shipboard system if the shipboard personnel understand and comply with a few rules of procedure. These rules will be treated in detail in subsequent sections of this paper.

Once the stock description program is completed, it will provide a firm building block of the system which will remain stable except for the addition and elimination of stock items.

The second and third building blocks of the system have been published by information generated in the fleet during the last four years. Before a realistic allowance of maintenance parts can be established to support a certain electronic installation for a given length of time, it is necessary to have exact information on the composition of that installation and to be able to predict the failure rate of the individual parts. The Bureau of Ships has installation information for each ship recorded on the Ship Electronics Installation Record (NavShips 4110). The failure rate data has been obtained by compiling the information received on the Failure Report (NavShips 383) and from various other sources.

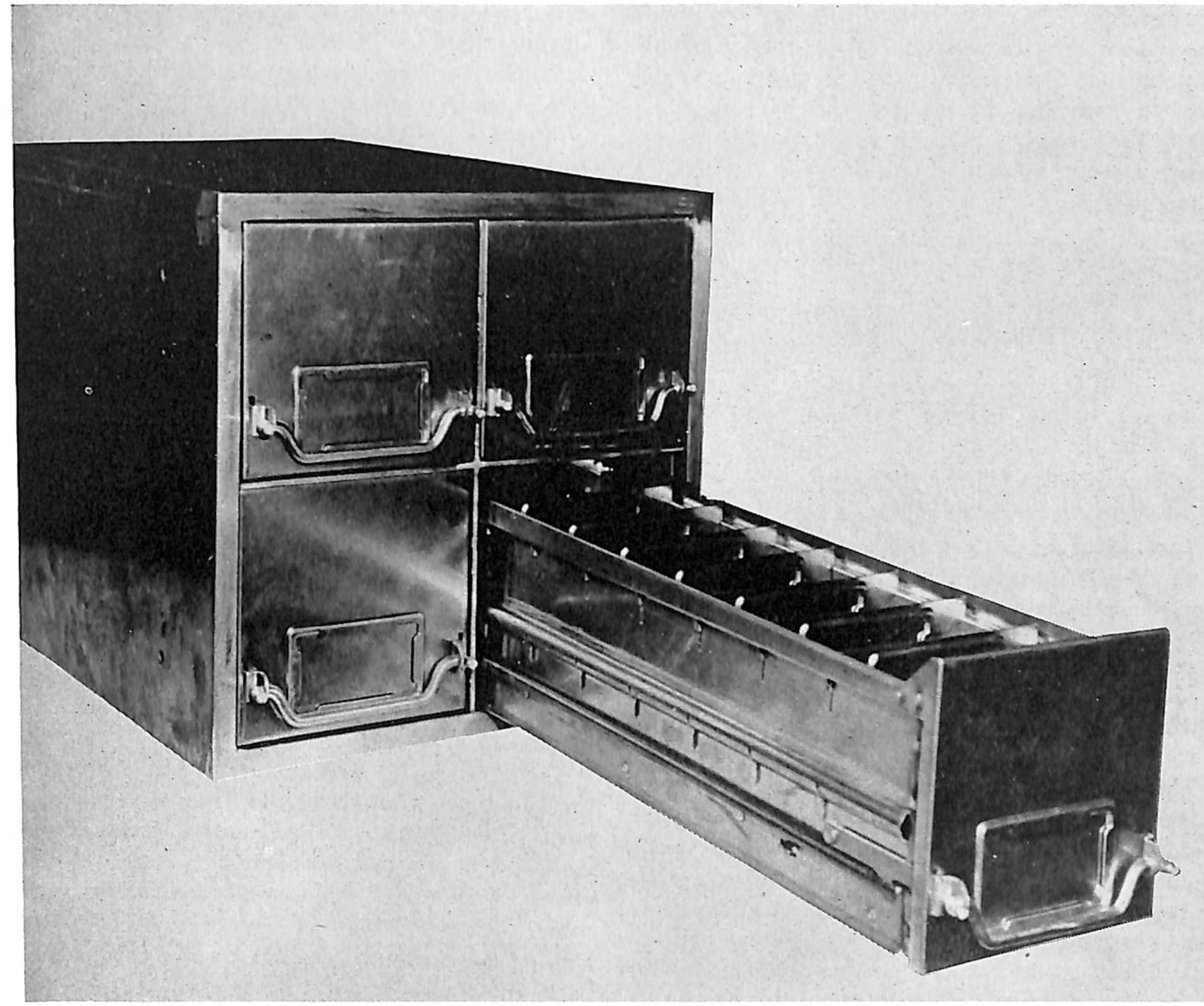
It will be noted that two of the building blocks, stock description and failure rate data, support the Electronic Maintenance Parts System on a Navy-wide basis. However, each ship must provide the installation information which is the third building block of the shipboard Electronic Maintenance Parts System. *The completeness of the Electronic Maintenance Parts Allowance for any ship will always be a direct function of the accuracy of the NavShips 4110 for that ship.* Likewise, the adequacy and realism of the number allowed of each allowance item will continue to be a function of the regularity of submission of failure reports by ships.

The Ultimate System

The ultimate Electronic Maintenance Parts System is outlined implicitly in the Bureau of Ships specification which contains the current instructions for determining electronic maintenance parts requirements. This specification is the basis for the following description.

The primary tool of the ultimate Electronic Maintenance Parts System will be the Parts Lists for each equipment model. These lists will be similar to the old Spare Parts Lists except that each list will be a complete parts breakdown of the particular equipment model, and each item on the list will be identified by SNSN (Standard Navy Stock Number) and standard description. Each

> The Shipboard Integrated Electronic Maintenance Parts System, NavShips 900,168, is a broad directive which outlines the functions of and responsibilities for the Electronic Maintenance Parts Conversion Program. This information does not conflict with NavShips 900,168, and is intended to amplify it and to provide implementation of the conversion program.



A four drawer stowage cabinet. One of the 5" drawers shown here can be replaced by two 2½" drawers.

Parts List will contain all replaceable parts, accessories, assemblies, subassemblies and components (major units) used in the basic equipment, except such items as the following:

1. Standard screws, nuts, bolts, washers, etc.
2. Mechanical parts not likely to be destroyed in use or which could be readily repaired or fabricated.
3. Simple gaskets made of standard gasket material.
4. Standard cables and wires.

The Parts Lists will be included as Section VIII of equipment instruction books.

The reader should note the function of the Parts Lists is completely different from that of the old Spare Parts Lists. The following facts are pertinent to the application of Parts Lists:

1. They *do not* establish an allowance of maintenance parts.
2. They include many items for which maintenance parts *will not* be provided.
3. Their sole function is to provide standard identification of the installed equipment parts.

Each electronic installation will be provided an Electronic Maintenance Parts Allowance prepared to support that specific installation. The allowance will be based upon the total "parts population" of the composite installation. The parts population will be obtained by collating the items included in the Parts Lists for the equipment models of the installation. Whenever the composition of the installation is changed, the Electronic Maintenance Parts Allowance for that system will be revised accordingly.

The preceding description of Parts Lists and Electronic Maintenance Parts Allowance contains no reference to "parts common" and "parts peculiar". This was done in order to avoid complicating the description of the basic system. Since the terms "parts common" and "parts peculiar" have received wide acceptance as being characteristic of the Electronic Maintenance Parts System, and in order to avoid further confusing the readers who have done so, they will be used hereafter in this paper. However, the terms have no more than subjective significance when used in connection with the shipboard system, and they will be used in that sense herein. The significant parts of the definitions of parts common and parts peculiar are as follows:

Part common: A part whose physical, electrical, and mechanical characteristics conform to Standard Military Specifications and/or is suitable for use in two or more different sets, such as models SR-1 and SX. It is distinguished in its basic identification by what it is and its high degree of interchangeability.

Part peculiar: A part which is distinguished by its basic definition of "where it fits", and its uniqueness. A part peculiar may eventually become a part common through usage. Such parts are primarily designed for use in but one model of equipment and are generally obtained from the manufacturer of the basic equipment into which the parts fit.

The Electronic Maintenance Parts Allowance will include parts peculiar as well as parts common. However, whenever the allowance is revised to support a new equipment model, the ship will be required to requisition only the initial stock of parts common. The initial stock of parts peculiar (maintenance part kit) will be furnished with the equipment in accordance with quantities noted on the Parts List. The purpose of this procedure is to bridge the period required to stock the supply system with those parts. After completion of this initial procedure, ships will need to make no further differentiation between parts common and parts peculiar. The entire stock of maintenance parts provided by the allowance will be stowed in SNSN sequence, and there will be nothing in the identification of a maintenance part to indicate whether it is a part common or part peculiar.

The Conversion System

The ultimate system will not be in effect until shipboard electronics installations consist entirely of equipment for which Parts Lists have been prepared in accordance with the current instructions. During the interim ships will utilize a "conversion" system which adapts the Electronic Maintenance Parts System to the support of electronic equipment presently installed in the Fleet. Such an adaptation is necessary since existing Spare Parts Lists do not include the total parts population of equipment, and the items on the lists are not identified by SNSN's.

Stock Number Identification Tables (SNIT's) have been prepared to provide SNSN identification of parts installed in equipment for which Parts Lists are not available. At the present time SNIT's are approximately 80% complete; hence, the Electronic Maintenance Parts Allowances are not complete in all respects. The missing items will be added to the SNIT's as soon as possible, but in the meantime ships must retain a reduced version of the Spare Parts Box System to supplement the allowances.

The Electronic Maintenance Parts Allowance

Many of the difficulties which have attended the Electronic Maintenance Parts Conversion Program result from the misconceptions concerning the significance of the present form of the Electronic Maintenance Parts Allowance. First of all, it is not an "allowance list" according to the usual application of that term. Secondly, at the present time it does not provide all of the maintenance parts required for maintenance of an electronic installation.

The Electronic Maintenance Parts Allowance furnished to a ship is divided into two sections: parts "Less Electron Tubes" and "Electron Tubes Only". The division was made as a matter of convenience since tubes are stowed separately aboard ship.

Rigid adherence to the Electronic Maintenance Parts Allowance is not expected if a ship determines that any number in the "No. Allowed" column is either inadequate or excessive. Those numbers are intended to provide replacement support for the line-items concerned for 90 days, and if the predicted quantity is in error, it should be changed as necessary. However, the Bureau of Ships should be notified of any permanent changes required in order that the probable usage data may be adjusted accordingly. The easiest means of doing this would be to utilize the "miscellaneous remarks" feature of the Failure Report (NavShips 383).

In order to dispel any doubts which may persist concerning changes to the Electronic Maintenance Parts Allowance, the following is quoted from the form letter used by the Chief of the Bureau of Ships to forward the allowances to ships: "The allowance was prepared to serve as a parts stocking guide and should not be considered mandatory; items may be added and quantities changed at the discretion of the Commanding Officer to satisfy varying operating conditions."

With due regard to the fact that each Commanding Officer is responsible for maintaining the military efficiency of his ship, the authorization quoted above should be applied sparingly and judiciously. Changes to the allowances should be made only when the need for such change is clearly indicated. Each reader is reminded again that the action which will serve best to eliminate errors from failure rate data is conscientious submission of Failure Reports. Also, the Failure Report data is essential to the timely initiation of maintenance parts procurement to prevent the development of shortages in the stock system.

Before leaving the discussion of the Electronic Maintenance Parts Allowance, it is desirable to point out the fact that it is a considerable task to prepare an allowance for a ship. Also, the method used to print the allowance makes it necessary to completely re-run it whenever major changes are made. This will have to be done whenever major changes in the electronic installation of a ship are made. However, until the Fleet has completed the conversion to the new system, the tabulating machine facilities and personnel available for this work will be overloaded by the task of preparing new allowances. It is incumbent on the electronics personnel of each ship to insure that the Ship Electronics Installation Record (NavShips 4110) is complete and accurate in order to insure the receipt of an Electronic Maintenance Parts Allowance which is complete and adequate.

The Stock Number Identification Table

The SNIT is the device for making the cross-reference from equipment circuit symbol identification to SNSN identification. A SNIT has been prepared for each equipment model which is supported by the Electronic Maintenance Parts System. Equipment models which are of variable composition (such as the TBL-7, which operates from several applicable power supplies) require separate SNIT's to fit each possible composition. It is essential that each ship have a SNIT for each equipment model supported by the Electronic Maintenance Parts Allowance.

The SNIT contains information tabulated in columnar form as follows:

1. Noun Name: same nomenclature as used in Electronic Maintenance Parts Allowance.
2. Symbol Designation: same symbols as used in equipment instruction book lists and circuit diagrams. The tabulation of information is in alpha-numerical sequence according to circuit symbol.
3. Replacement or Preferred Replacement: SNSN. Discussed below:
4. Furnished with Equipment: SNSN. Discussed below.

Column 4, "Furnished with Equipment", is superfluous to shipboard application of the SNIT since column 3, "Preferred Replacement", contains the SNSN identification of the material provided by the Electronic Maintenance Parts Allowance. In the majority of cases columns 3 and 4 carry identical SNSN's. Wherein they differ, column 4 identifies material which will be eliminated from the supply system, and column 3 identifies the "Preferred Replacement" material which will be used henceforth.

Tenders and repair ships will be furnished SNIT's for all models of electronic equipment which are installed in the types of ships which they will be expected to support.

SNIT's are furnished by the Electronics Supply Office, and they are forwarded to the ship at approximately the same time as the Electronic Maintenance Parts Allowance.

Changes of Standard Navy Stock Numbers

The conversion of the Fleet to the Electronic Maintenance Parts System could not await the completion of the stock number description program. For this reason many of the stock numbers printed on SNIT's and Electronic Maintenance Parts Allowances are obsolete. This is not of primary concern to Fleet personnel since it is intended that the Fleet should continue to use those obsolete numbers, and supply-support activities will make such cross-identifications as are necessary when parts are requisitioned.

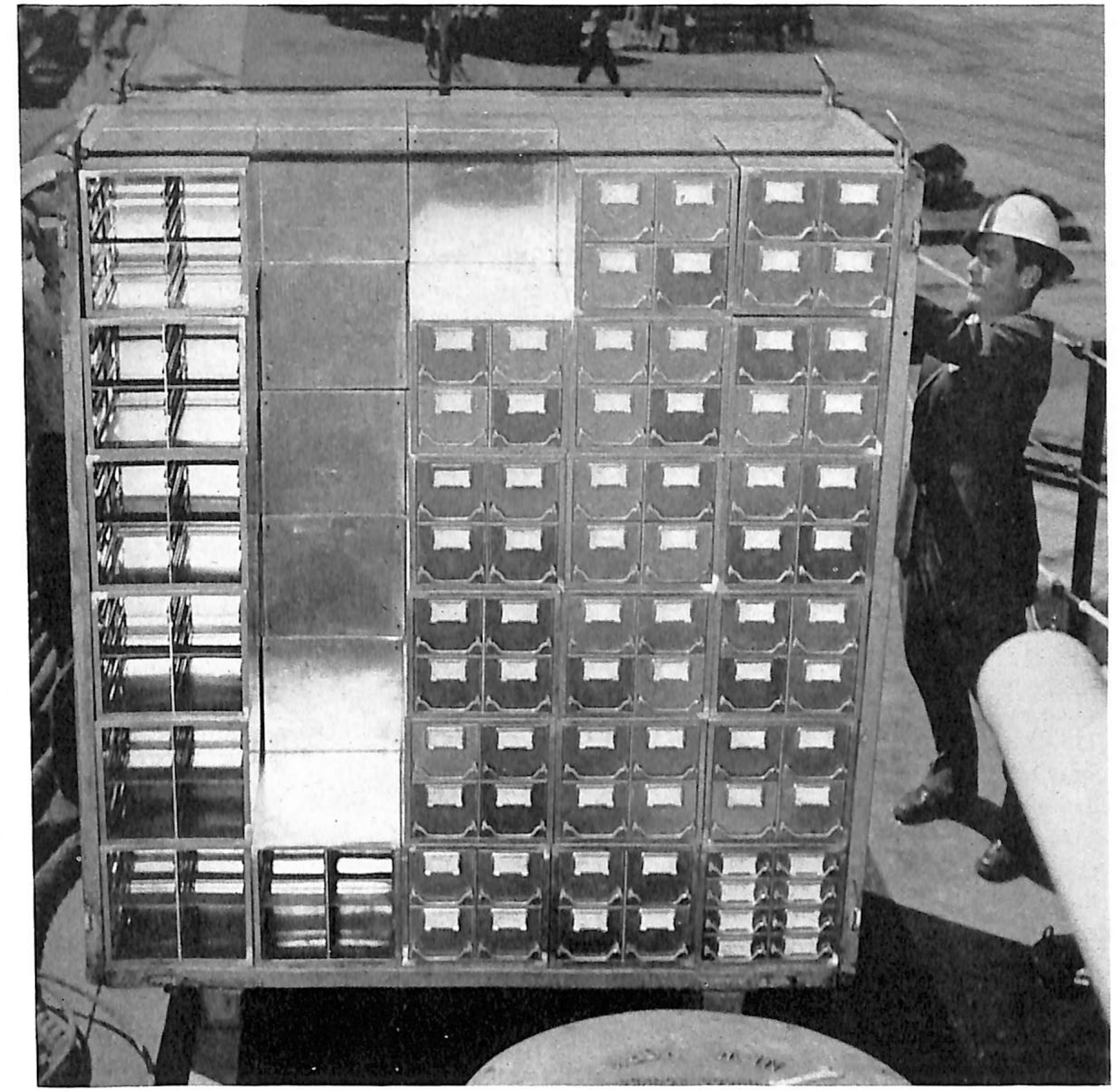
The SNIT's are being revised periodically to replace obsolete stock numbers and to include additional items, but as long as a particular SNIT is in use, the associated machine deck must be maintained in exact correspondence with the "Preferred Replacement" column of the SNIT. That is the essential point—the SNSN associated with the part installed in the equipment must remain in agreement with the appropriate line-item in the Electronic Maintenance Parts Allowance, which is the SNSN under which the corresponding maintenance part is stowed. No attempt should be made to utilize SNIT's with effective dates other than those of the SNIT's provided with the Electronic Maintenance Parts Allowance.

A possible difficulty may arise when a ship requisitions a part under an obsolete SNSN, and receives the part under the SNSN currently in use by the supply system. It will then be necessary for the ship's personnel to refer to the original requisition to obtain the SNSN under which the part is to be stowed and used (in case the supplying activity does not include this information on the part or on the invoice).

Ship personnel should not attempt to replace the obsolete SNSN's in the allowance and SNIT's. Although the allowance indicates the SNIT's in which a given line-item occurs, and the number of occurrences therein, the SNIT entries are not in SNSN sequence. In addition, there is not sufficient space between the entries to insert corrections. As a result, it would be a time-consuming task to correct the SNSN's in the SNIT's, and there would be no way to insure that the corrections had been made completely and accurately. If ship personnel wish to keep a record of current versus obsolete SNSN's, this record should be maintained external to the primary system and used only for requisitioning purposes.

Despite any contingency which may arise, the primary precaution to be observed is the preservation of the correspondence between the SNSN's used in the SNITS, the Electronic Maintenance Parts Allowance, and the parts stowage plan. Ships will not be furnished the cross-reference information needed to maintain current SNSN's. If the correspondence of the ship's SNSN system is disrupted, those maintenance parts will become mere

Loading the allowance material aboard ship.



Close up view of the allowance material being loaded aboard.

inventory items, for the ship will have lost its ability to associate the maintenance parts with the parts installed in equipment.

Equipment Not Supported by the Electronic Maintenance Parts Allowance List

Each ship is furnished a list of the equipment which the Electronic Maintenance Parts Allowance will support. There are several possible reasons for the fact that this list may not include equipment which is installed in the ship. These reasons are as follows:

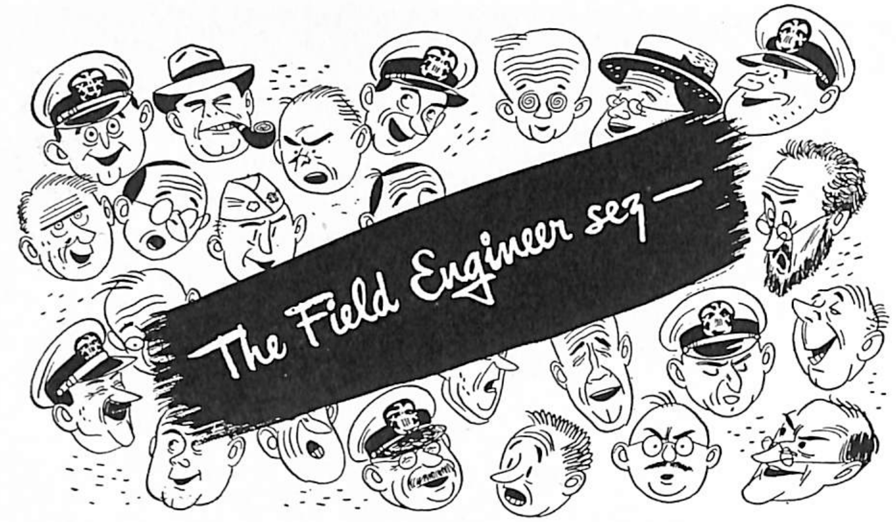
1. The NavShips 4110 for the ship is inaccurate or incomplete.
2. The equipment has not been processed in the stock number identification program as yet. Equipment cannot be supported by Electronic Maintenance Parts Allowances until SNIT's have been prepared for the equipment.
3. The equipment does not have sufficiently wide application to warrant inclusion in the system.

Each ship must retain complete sets of equipment maintenance parts to support any equipment not supported by the Electronic Maintenance Parts Allowance.

Parts Not Included in the Allowance

There can be no concise definition of the scope

Continued on page 24



SG–1b

USS Sitkoh Bay (TCVE 86)

An inspection of the equipment indicated a low power output and low sensitivity. After replacing the magnetron V–110 and the T-R tubes V–112 and V–113, the RF assembly was retuned for maximum signals. Video amplifier tube V–920 was replaced, increasing the signal presentation on the range scope.

The ship's force reported that this equipment had not been obtaining the normal number of hours from the magnetrons. The past six magnetrons lasted between 300 to 700 hours and then seemingly lost all emission. A check was made on all components and operations affecting the life of magnetrons. It was found that after extended warm-up period, the filament voltage would decrease to a negligible value. Operating the magnetrons below their rated filament voltage appreciably decreases the life of tubes. A new filament transformer T–105 will be installed by ship's force.

W. J. HAGSTROM

SJ–1

USS Aspro (SS 309)

An inspection of the radar system found that the operation was good; that is, the ringtime was normal and the tuning of the transmitter-receiver was optimum. However, the range results were abnormal. An inspection of the wave guide tuning stubs revealed that they were frozen by corrosion. When these parts were removed from the feeder assembly, it was discovered that the threads on the tuning stubs were badly stripped. When the moisture valve and the lower rotary joint were removed, corrosion and deposits of salt were found on the rotary joint and wave guide.

All parts of the feeder assembly D–151385 were completely cleaned of all foreign material and corrosion. The assembly was reinstalled and the tuning stubs adjusted. This action increased the range of the radar to double its former range.

H. C. BRODERSEN

SX

USS Tarawa (CV40)

No echoes were obtainable on the height system. The transmitter frequency was checked on the TS–275 echo box and an attempt was made to adjust the local oscillator to 30 mc above the transmitter frequency. The first local oscillator would not reach this frequency. The second tube that was tried did reach this frequency but had a very low output resulting in weak echoes. The third tube proved satisfactory and echoes were obtained. The Ship's ET was instructed in this method of pretuning the local oscillator by the echo box (TS–270 for E.W.) (TS–275 for H.F.). It was recommended that the local oscillators also be tested for maximum signal-to-noise ratio and that the echo boxes be kept in the igloo.

The stops on the height system modulator were set too far apart so that at the actuating point of the switch, binding of the modulator time delay resulted. Re-setting the stops cured this trouble.

The search and height system noise generators were inoperative. The noise klystrons were checked and found to be conducting. However, the output coaxial leads were found to be reversed. Reversing the connections resulted in a noise figure of a fair value for the E.W. system, but none for the H.F. system. Visual inspection revealed that there was no probe for the H.F. waveguide insert. A polystyrene insulator and a brass rod probe identical to the E.W. probe was constructed by the ship's machinists. A noise reading was obtained on the H.F. system when this was installed. Selection of TR's, pre-TR's, and crystals resulted in reducing the noise figure to a very low value. Operating condition of equipment upon completion of work accomplished was good.

C. F. THOMPSON

SJ–1

USS Croaker (SS246)

Found pulse rate control R(1)20 too high resulting in double sweep. When this control was adjusted for 1650 cps the On Time current measured 100 ma (160 ma normal). Replacing V(1)9 gassy 5D21 Modulator tube and R(1)11 (wrong value) had no effect. However, normal On Time current resulted when it was discovered that the bias regulator tubes V(1)7 and V(1)8 were VR–105–30's instead of the correct VR–150–30's and the proper substitution made.

Low signal response was corrected by adjusting tuners A and B in the transmitter for a maximum power output at the antenna. Measured SWR 15:1 was then reduced to SWR 2:1 by adjusting antenna tuning plugs. After replacing V(1–B)1 and V(1–B)2 in the oscillator amplifier unit to increase i-f gain and retuning with 60 ABM wavemeter, signal response was good.

M. H. WILSON

QHBa

USS Bristol (DD857)

The Remote Indicator (CIC unit) was out of focus because of low focus coil current. The circuit calls for 250 volts for proper focusing but only 230 volts were available from the power supply. It was necessary to shunt R–304 and R–305 resistance net with 56 thousand ohms to get the voltage high enough for proper focusing.

The external hand key was removed from the Control Console to prevent accidental and continuous keying of the equipment, with possible transmitter damage. A peculiar and excessive noise level in the Control Console was traced to an improper Razor input. The Razor input was being energized from radio central and affecting the Sonar equipment.

J. W. CROWE
W. B. SHELDON

QGA

USS Sperry (DD 697)

The 30 kc driver was inoperative because of open line fuses. These fuses were found to be opening due to improper connections to transformer T–411. This transformer was reconnected properly and defective tube 866 was replaced. The 30 kc tilt mechanism was found to be overtraveling its limit switch at one end of its travel due to maladjustment of the limit switches and the associated potentiometer. The limit switches on the tilt mechanism were adjusted for proper operation, R–301 and R–1101 were set properly, and the bias adjustment in the tilt circuit was adjusted. The 30 kc training mechanism was corrected by adjusting the bias and by replacing the thyratron and fuse. The bearing deviation indicator was found to have weak indications on one side; this was improved by replacing a weak 6SH7 tube.

G. K. ATKINSON

TBL–12

USS Samoset (ATA 190)

High filament voltage and MO plate voltage were indicated on the panel meters. Examination of the motor-generator while in operation showed a variation in speed. The slip rings on the regulator were examined and were found dirty. After cleaning these rings and readjusting the contact points on the speed regulator centrifugal switch, normal operation of equipment resulted.

R. BACK
H. KENNEDY

VF

USS Bristol (DD857)

While checking the B scope calibration with an A&J scope, it was found that the train of oscillations from the one thousand yard marker was damped. This damping could not be compensated for by adjusting R–306. A resistance check revealed L–301 had increased resistance to 20 ohms. When L–301 was replaced, oscillations were normal. To save the time, the phasing bridge unit was replaced and aligned. The B spot vertical centering and slope controls would not adjust properly. The range correction potentiometer was re-aligned and the windup spring tightened to eliminate backlash.

J. D. MYERS
R. J. TRIPICIAN

STANDARDIZATION OF COMMUNICATION EQUIPMENT INSPECTIONS ABOARD SHIPS

A ship that is to undergo overhaul or conversion at a naval shipyard has all of its electronic equipment inspected by engineers representing the yard electronics officer. All of this electronic equipment is classified into one of three groups (i.e. radar, communications, and sonar). This article will deal with the program of standardization of inspection of the communication equipments on ships arriving at the Philadelphia Naval Shipyard.

Need for Standardization

For many years the inspection was conducted by an experienced engineer who might have the aid of shop personnel to make minor equipment repairs. By making operational checks on each piece of equipment data was gathered from which the engineer wrote an inspection report. The report included recommendations to correct all deficiencies noted. Several undesirable features accompany the above method of inspecting equipment. Some of these features are:

(a) Lack of consistent reports. Different engineers might give reports on the same equipment that vary in detail.

(b) The lack of standards in determining if receiver sensitivity is satisfactory.

(c) The uneconomical use of an engineer's time in performing simple routine portions of the inspection. In order to assure that no minor deficiencies are missed by inexperienced assistants, the engineer personally checked all equipment.

(d) No standard method of noting data. Often the original data could be interpreted only by the person who collected it.

Development of Standardization Program

Late in 1950 a committee of engineers undertook to set up a program that would eliminate or reduce the undesirable features of the existing inspection procedure. It was decided to outline an inspection procedure for individual equipments. Initially communication receivers only were considered. To date the standardization procedure has expanded to transmitters and motor-generator sets. A description will be given of the general procedure followed in inspecting each of these three classes of equipments.

Standardization of Communication Receivers

In setting up an inspection procedure for communication receivers the feasibility of bringing signal generators aboard ship to make sensitivity checks was studied. The comparative value of such a check over an operational check is very great. The problem was in determining whether or not prohibitive additional time would be required to check the sensitivity of every receiver aboard ship. The answer to the problem was pleasing to the committee. It was found that a technician who is provided in detail with both equipment and instructions can make a sensitivity check in actually less time than would be required to make an operational check.

It was then desided to outline the inspection procedure by using a check off list or inspection form. These forms provide spaces to fill in sensitivity data; they list all controls and switches in order that none will be overlooked; field changes are listed; checks peculiar to individual type receivers as outlined in instruction books, or as found desirable from experiences are listed; finally, space is provided to note any peculiar condition or defects.

To date forms have been prepared for some of the more common receivers. Sensitivity checks are now made on all receivers and forms for all receivers normally found aboard ship will be available by the end of 1951.

Even the limited use now made of forms has established their value. The completion of the form forces a thorough inspection carried out in a logical order. The result is a reliable report that can be gathered in a minimum of time by a relatively inexperienced technician. In general one man can inspect four to six receivers per day depending on the physical location of the equipments. Where large quantities of receivers are located in the same area as in an AGC vessel, it is possible to double the number of equipments inspected in one day.

RBB/~~RBC~~ -1 Ser # 478 LOCATION RADIO I Date OCT, 1 1951
Signal Generator: LP-1 Ser. # 117

BAND	SENSITIVITY FREQ.	SENSITIVITY VOLTS
1	lo	11.2
1	med	9.8
1	hi	11.2
2	lo	19.0
2	med	10
2	hi	14
3	lo	11
3	med	13
3	hi	20
4	lo	18
4	med	8
4	hi	11.1

DIAL CALIBRATION

STATION FREQUENCY	DIAL FREQUENCY
610 KC	610. KC
1.050 MC	1.050 MC
1.540 MC	1.540 MC
2.500	2.550

FIELD CHANGES
1) audio ✓
2) pwr supply choke ✓
3) band switch * NOT CHECKED

COMMENTS
* RECORDS DO NOT INDICATE FIELD CHANGE 3 BEING ACCOMPLISHED

CHECK OUT OF CONTROLS

WAVE BAND SWITCH	✓	POWER SWITCH	✓
ANT COMP	✓	RECEPTION SWITCH	✓
RADIO SELECTIVITY	ERRATIC	AUDIO SELECTIVITY	✓
NOISE LIMITER	✓	INPUT METER	✓
OUTPUT LEVEL	NOISY	OUTPUT METER	✓
SILENCER	NO MECHANICAL STOPS	DC VOLTMETER	✓
FREQ. VERNIER	✓	ADD DECIBELS	✓
RF GAIN	✓	PHONES	✓

PHYSICAL INSPECTION

CHASSIS	✓	GRD. (RCVR)	NO
ANT RECPT & CPLG	✓	GRD. (pwr supply)	✓
SHOCK MOUNTS	✓	GRD. (CABLES)	✓
PWR. SUPPLY	✓	PWR. SUPPLY SER.	117

Form used in checking RBB/RBC series receivers. The above form was used in making an arrival inspection on a destroyer. Because of the similarity of these equipments one form serves for both type receivers.

Standardization of Transmitter Inspection

Communication transmitters are checked by an engineer who is responsible for their operation. It is possible, however, to make a form similar to the receiver forms that would enable a less experienced person to make all routine checks.

Such forms would show meter readings on selected frequencies with the transmitter loaded into a specified dummy load. The form would show controls and switches in order to insure that all of them are checked operationally. Field changes, modulation checks, and checks peculiar to each equipment type would complete the form.

Standardization procedures are complete for only two transmitter types as of now. Forms for all common transmitters will be ready for use at the Philadelphia Naval Shipyard early in 1952. As in the case of receivers, experience has shown that a standardized check allows a thorough check in a minimum of time.

Standardization of Checks on Motor-Generators

Inspection of motor generators associated with communication equipment has left much to be

RBS -2 Ser.# 41 Location RADIO I Date 5-31-51

Signal Generator: LP-1 Ser. # 117

BAND	SENSITIVITY FREQ.	SENSITIVITY VOLTS
1	2.0	1.6
1	2.82	1.6
1	3.6	1.8
2	3.6	*3.0
2	5.0	3.0
2	6.5	3.5
3	6.5	*4.0
3	9.0	4.0
3	11.4	4.8
4	11.4	*7.0
4	16.0	*9.0
4	20.0	*9.0

DIAL CALIBRATION WWV	DIAL
2.5	2.50
5.0	5.00
10.0	10.00
15.0	15.10
20.0	COULD NOT PICK UP

BACKLASH (USE BFO) VERNIER READING FREQ.	CW	CCW
2.8		
16.0		

COMMENTS

* NOISY-DIFFICULT TO GET CONSTANT READINGS

CHECK OUT OF CONTROLS

ANT COMP	✓	OUTPUT LEVEL	✓
SELECTIVITY	INTERMITTENT	BEAT NOTE	✓
FREQ BAND	NOISY	RECEPTION	✓
GAIN	NOISY	PHONES	✓
NOISE LIMITER	✓	OFF/ON (pwr supply)	✓
TUNING	✓	PHONES (pwr supply)	✓

PHYSICAL INSPECTION

CHASSIS	✓	SHOCK MOUNTS	✓
CASE	✓	GROUNDING	✓
ANT RECEPTACLE	✓	GROUNDING (pwr supply)	NO

Form used in checking RBS series receivers. The above form was used in making the arrival inspection on a destroyer.

desired. The inspection depended completely on the experience and judgment of the engineer in charge. Here the radio group has been given assistance from another group in the electronics office.

The sonar section is responsible for making mechanical noise tests on certain types of vessels. This word introduced them in the use of a vibrator meter with a contact pick up to locate defective bearings, poor alignment, and unbalance in the equipment. The use of this meter allows a very satisfactory mechanical check that can be made in a period of five minutes. This mechanical check, together with an electrical check made by observing meters on associated equipments allows a very desirable type of inspection.

Summary

The data gathered on these forms is not submitted directly to the ship but is analyzed and put in the form of a standard inspection report. Reports written from these forms tend to be consistent regardless of who writes them.

The forms used in the Philadelphia Naval Shipyard have proven to be desirable. It is planned to expand this standardization program to include all components of communication systems aboard ships.

CONDITION YOUR MAGNETRONS

Experience indicates that it is often necessary to condition magnetrons for operation at high current and long pulse lengths after they have been inoperative for a period of time. Conditioning is necessary in order to activate the cathodes. The following procedure is quoted from a memorandum prepared by a manufacturer of electronic material and is passed along for information.

"The procedure for conditioning is dependent upon the equipment available and while many tubes may be successfully processed on a conventional radar equipment, it is advisable to have a method of reducing the power supply voltage to zero under continuous control. A variac in the primary of the power transformer is a very satisfactory method of control. Similar control of the magnetron heater supply circuit is also desirable."

"When a tube is turned on after being inoperative for a period, it is first essential to allow the specified heater warm up time (4 minutes for the 4J52.) Power should then be turned on at the specified current (15 amperes peak maximum on the 4J52) at the shortest pulse length. In most cases, the tube will operate satisfactorily immediately. It should then be operated for a period at that pulse length. If the tube has been operated within the last 48 hours, two minutes is probably sufficient time, but if the time since the last operation is considerably longer it may be necessary to operate the tube 10 minutes or longer under this condition. The tube should then be operated at the next longer pulse width for a similar length of time. If sufficient instability takes place at this pulse width to cause the average current meter to fluctuate greatly, additional operating time should be carried on at the shorter pulse lengths."

"This procedure should be followed at each subsequent pulse length until satisfactory operation is attained at the longest pulse length. Certain tubes will probably be encountered which will not operate stably at the longer pulses after as long as 30 minutes operation on the next shorter pulse. These tubes may be handled in a manner described below for tubes which would not start satisfactorily initially."

"Tubes which arc continually when first turned on or tubes which appear not to draw current when first operated fall into two categories. Those tubes that apparently break down with 300 volts pulse voltage applied require processing beyond the scope of the equipment available in the field. Tubes which withstand a considerable voltage may usually be made to operate stably by adjusting both the cathode potential and the heater current. In some cases, this must be done successively at each pulse length starting at the shortest. The procedure used is to first allow full warm up time with voltage applied only to the heater. Then without reducing heater voltage, the cathode is increased slowly until a moderate degree of arcing in the tube occurs. The tube is allowed to operate in this condition until the tube operates stably. In cases where the arcing becomes more severe and appears to be nearly continuous, it is necessary to reduce the cathode voltage. When stable operation is attained the heater voltage should be reduced gradually until a voltage is attained that is the proportion of normal heater voltage that one would have if heater voltage were a linearly inverse function of cathode current. The cathode current is then increased again until some arcing takes place and the process is repeated. If increments of more than 5 amperes in cathode current are taken, it will prove desirable to reduce the heater voltage before allowing the sustained operation that may be required to reduce arcing."

Tests from supply activities indicate tentatively that 7 to 15% of one type of magnetron in stock may be defective, due to excessive gas which cannot be eliminated by conditioning, or to air leaks. A program has been undertaken by ESO to eliminate these defective tubes from stock by installing testers at major supply points. A magnetron tester is now in the advanced design stage and contracts are expected to be let for its production within a few months. Until these testers can be installed, it is recommended that vessels test tubes drawn from stock by actual operation in the equipment.

It must not be forgotten that magnetrons can age aboard ship as well as on a shelf in a supply activity. Tests made by SSD, NSC, Oakland verify that a high percentage of magnetrons which initially appear gassy can be rehabilitated by baking-in. In addition to the article quoted above, electronics personnel are urged to re-read the article on the treatment of magnetrons in the Shipboard Radar Maintenance Bulletin, Section 1, paragraph 5-5. Many vessels have constructed "baking-in" equipment from spare transformers and scrap material.

Electronics officers are invited to write to ESO, Attention Code 6, for information concerning testing equipment which has been devised locally.

TRANSISTORS

by
Lt. (jg) C. E. Gremer, USN
U.S.S. New Jersey (BB62)

Having read "Bistable Transistor Circuits" by E. Eberhard, R. O. Enders and R. P. Moore in the October issue, I thought that perhaps a few remarks about transistors themselves might be apropos. There are listed at the end of this article several publications and papers which are of interest in the fields of transistors.

A transistor is a crystal of germanium to which three contacts are attached. There are two types of germanium crystals which will operate as a transistor: the p type, which has a deficiency of electrons in its crystal structure and is therefore positive; and the n type which has an excess of electrons in its crystal structure. Either type will support current flow as is known in a vacuum tube. That is an electron entering the left side of the n type shown here in Figure 1 "pushes" out an electron on the right side. This is much the same as the transmissibility of forces witnessed by moving the number six ball of Figure 2, when the number 1 ball is dropped. The same process occurs with a p type crystal. As with a vacuum tube, a finite time is present.

The three contacts which are made on the crystal are called the base, the emitter, and the collector. Figure 3 gives the schematic representation of a transistor. Thus far, transistors have been made of p type, n type, p-n junctions and n-p-n junction crystals.

An n–p–n transistor is shown diagrammatically in Figure 4.

Perhaps we should next see wherein the transistor differs from a vacuum tube. With a triode we place a signal voltage on the grid and obtain an amplified voltage on the plate. With a transistor a current change on the emitter is reflected as an amplified current change on the collector. A variation of this is immediately possible with the transistor. Figure 5 plots a transistor characteristic curve set. Since the emitter voltage has a change of only a few thousandths, it can be seen that a large collector current change will result for a small emitter voltage change if the collector voltage is constant.

Conversely if the collector current remains constant a large collector voltage change occurs for small changes of emitter voltage. This manifests the fact that whereas a vacuum tube provides a high gain with a high input impedance and relatively low output impedance, the transistor provides a high gain with a low input impedance and a high output impedance.

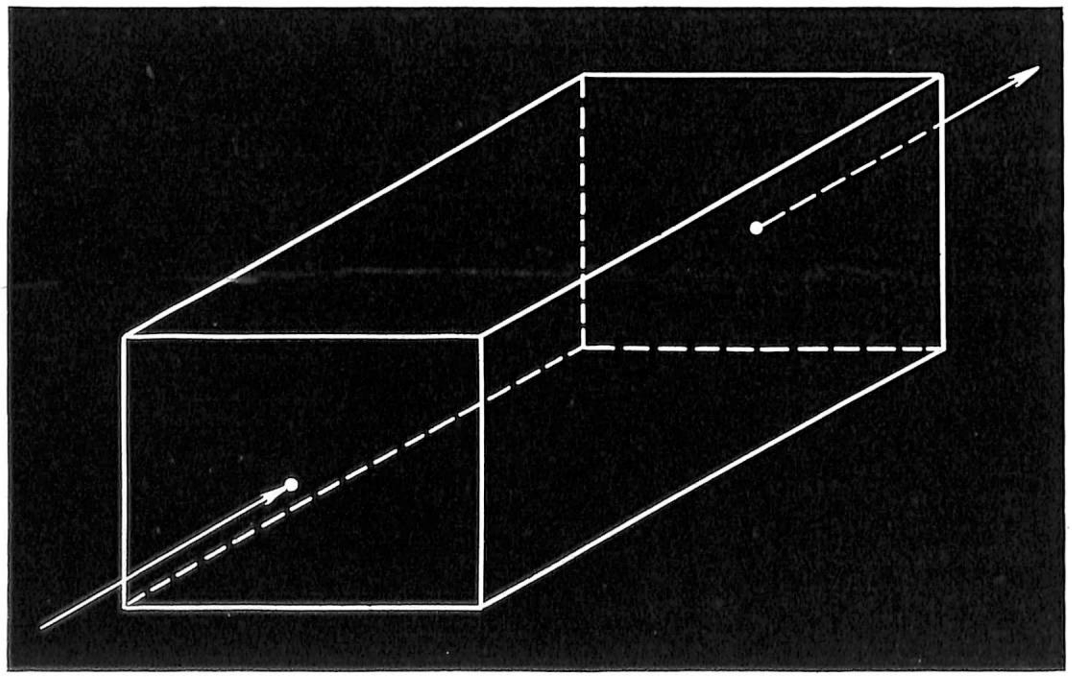


FIGURE 1—An electron entering the left side of the N–type transistor pushes another electron out at the right.

Table I gives the transistor properties beside the corresponding vacuum tube properties.

The main circuit differences may be stated as follows: the vacuum tube is more efficient when biased negatively whereas a transistor is more efficient when biased positively; whatever *qualitative* statements can be made concerning e_g and i_g of the vacuum tube can be made concerning i_e and e_e respectively; linearity in the vacuum tube is forsaken whenever e_g is allowed to swing into the positive region and i_g rises, and linearity in the transistor is forsaken when i_e is allowed to swing into the negative region and e_e rises. By the comparisons in Table I and the foregoing remarks, it appears that the transistor is the *inverse* or *dual* of a vacuum tube. This would be the case except that the phase reversal required of an absolute inverse is not obtained in a transistor. It may be made an absolute inverse by the inclusion of an 1:1 ideal transformer. That such a transformer will be satisfactory is proven below.

Let r be the impedance transformation between a vacuum tube and a transistor and $1:n^2$ the impedance ratio of an ideal transformer. Now in the transformer

$$e_2 = ne_1 \quad \text{and} \quad i_2 = i_1/n. \qquad (1)$$

In an inverse we replace e_2 with e_2', i_2 with i_2', i_1 with i_1' and e_1 with e_1' such that

$$e_2 = i_2'r \qquad e_1 = i_1'r$$
$$i_2 = e_2'/r \qquad i_1 = e_1'/r$$

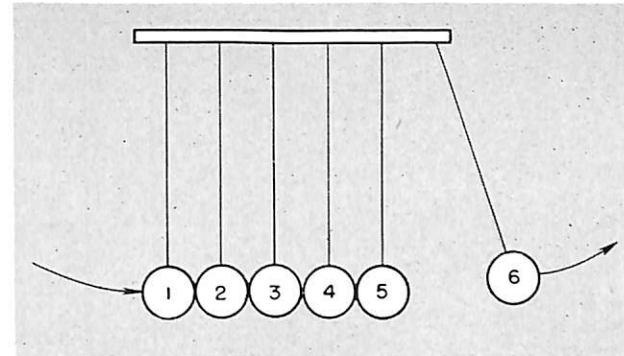


FIGURE 2—Transmissibility of a force. When ball 1 strikes, ball 6 moves out.

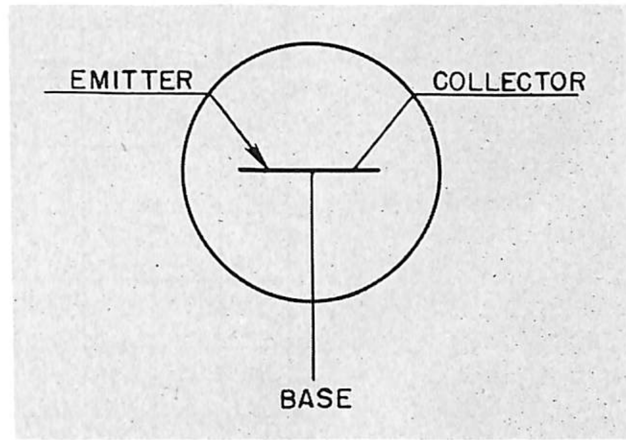


FIGURE 3—Schematic representation of a transistor.

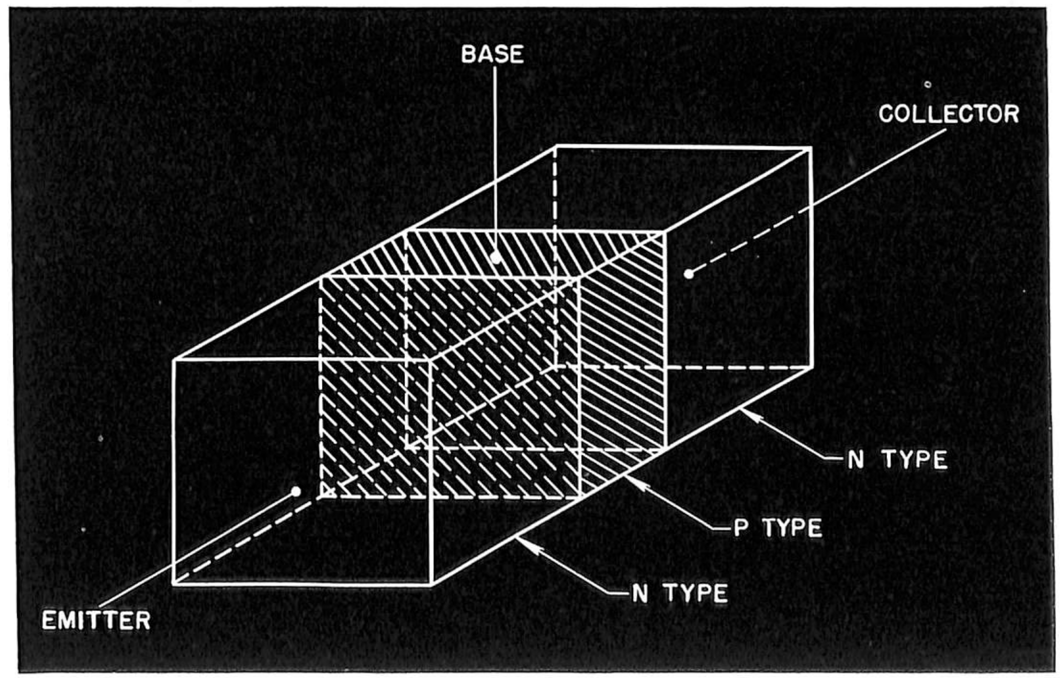
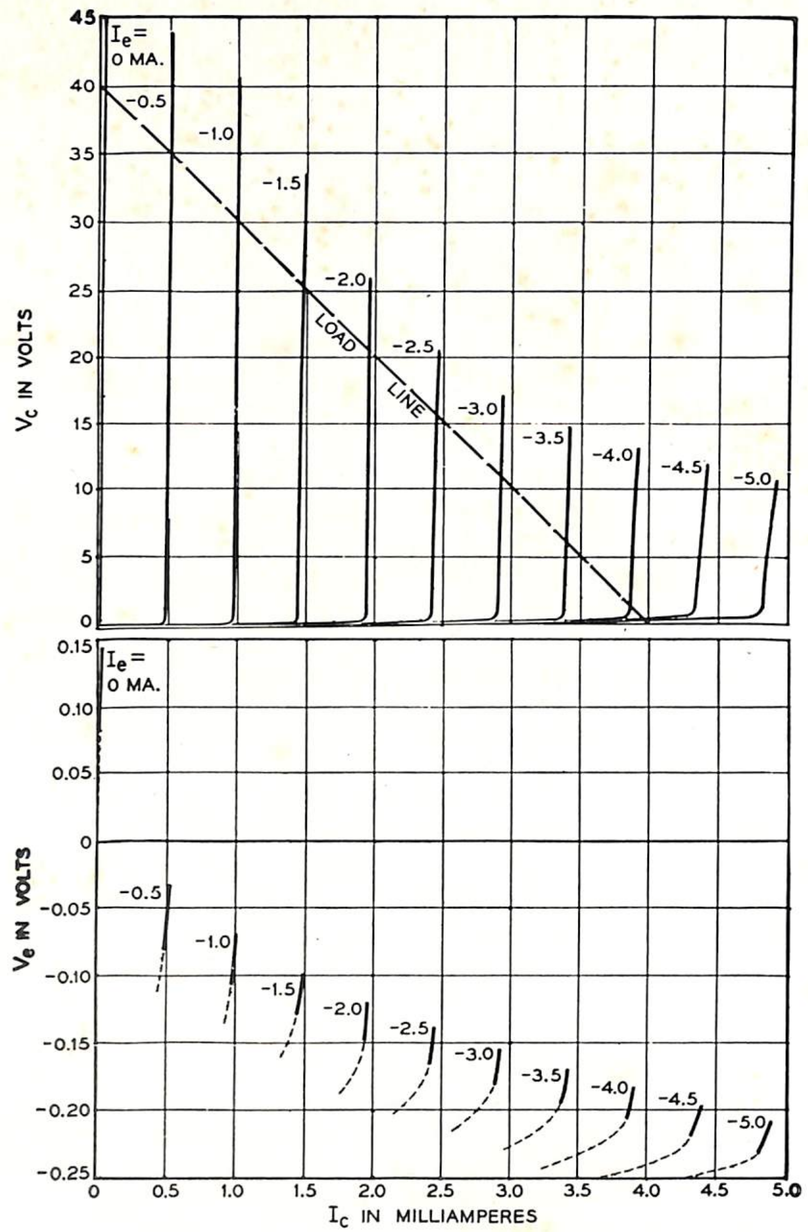


FIGURE 4—Construction of N–P–N type transistor.



—Static characteristics of an *n-p-n* transistor.

FIGURE 5—Static characteristics of an N-P-N transistor. "Some circuit properties and applications of N-P-N transistors", R. L. Wallace Jr. and W. J. Pietenpol, courtesy of American Telephone and Telegraph Co.

Substituting these into the ideal transformer equations, (1), we obtain

$$ri_2' = ni_1'r \quad \text{and} \quad i_2' = ni_1'$$
$$e_2'/r = e_1'/rn \quad e_2' = e_1'/n$$

These equations show that the inverse of an ideal transformer with an impedance ratio of $1:n^2$ is another transformer with impedance ratio $n^2:1$. If $n = 1$ it is seen that a 1:1 transformer coupled with a transistor will provide the inverse of a vacuum tube.

Applications of the inverse circuits appear to be limited but they offer an excellent guide for transistor circuit design and do demonstrate some of the transistor properties.

One of the striking aspects of the transistor is the low power consumption. This in itself will be a great factor when it is recalled that one of the great drawbacks to miniaturization is heat dissipation for power consuming vacuum tubes.

Thus it appears as if the science of electronics is now at the brink of a new era equally as exciting and unlimited as it was when Dr. Lee De Forest provided the triode.

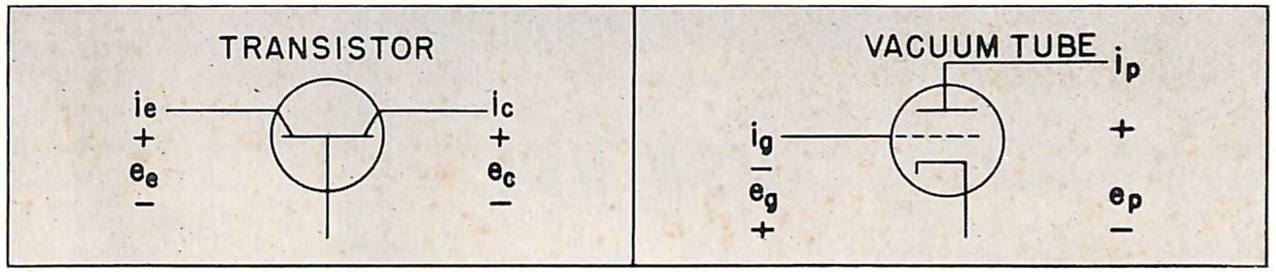


TABLE I

TRANSISTOR	VACUUM TUBE
1. emitter	1. grid
2. collector	2. plate
3. base	3. cathode
4. $\alpha = \frac{\Delta i_c}{\Delta i_e}$	4. $\mu = \frac{\Delta e_p}{\Delta e_g}$
5. current amplifier	5. voltage amplifier
6. low input impedance	6. high input impedance
7. high input impedance	7. low output impedance
8. i_c (n type, electron I flow)	8. e_p
9. e_c (n type, electron I flow)	9. i_p
10. i_e (n type, electron I flow)	10. e_g
11. e_e (n type, electron I flow)	11. i_g
12. low power consumption (microwatts)	12. high power consumption
13. rugged	13. susceptible to shock
14. small in size	14. large in size
(for p type, i_c, e_c, e_g and i_g are negative; for conventional current flow the n and p type are reversed)	

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TRAINING OF ELECTRONICS PERSONNEL

The Chief of Naval Operations through OPNAV Instruction 1510.3 directs each organizational element (fleet and shore activities) to make the necessary plans to operate with present electronics personnel and to establish an in-service training program with the end in view of being self-sufficient.

Long desired material improvements in electronic equipment will be ready for installation and use by the operating forces within the next two years. It is expected that with the requirements for uniformed and civilian personnel increasing, the personnel to carry out electronic jobs will become more critical. Formal rate training (Class A, B, and C) and group training in fleet training commands will not appreciably expand. Therefore, it is necessary to increase existing in-service training programs and establish other in-service training programs both in shore and fleet commands in an effort to get along with minimum outside assistance and improve the use of electronic equipment. The Bureau of Ships is making every effort to assist by providing equipment, facilities, and, in some instances, training courses at contractors' plants.

To make the most effective use of improvements in electronic material is a challenge to *ALL HANDS* afloat and ashore and must be met. Each organizational element *MUST* contribute its part wholeheartedly and in full measure and *NOT* rely on another element to solve its problems except where the problem is definitely beyond the ability or facilities available.

USN USL notes

A MAGNETIC RECORDER WHICH PROVIDES RESOLUTION OF SIGNAL ENERGY PRINTED THROUGH THE MEDIUM BY MEANS OF A VARIABLE SCAN RATE PICKUP

The necessity for the extension of the human faculties for aural and visual recognition of signal energy in modern military applications, and especially in the fields of underwater sound and sonar, is quite evident. By means of magnetic recording and reproduction techniques, the following functions can be provided:

(1) Recording and storage of phenomena occurring during a specific time interval for reproduction at will;

(2) Strengthening signal differentiation;

(3) Stimulating memory or recognition; and

(4) Enhancing signal-to-noise ratio.

In the past, it has usually been necessary to reproduce stored signal energy at the rate of recording; otherwise, a change in the speed of the storage medium for reproduction would interrupt the continuity of the recording process. The method to be described provides for a normal record-reproduce-erase process and simultaneously permits material which has been recorded on a continuous medium to be scanned from the back, or reverse, side of the magnetically recorded surface at a rate higher than the rate of recording. These requirements necessitate the use of a recording instrument which has a recording and erasing head mounted on the periphery of a magnetic recording medium and a rotating playback head mounted in such a manner that it makes the desired number of revolutions per single revolution of the medium. A recording instrument of this type has been designed and constructed by the Underwater Sound Laboratory for use in an evaluation of the method under consideration.

The first approach to a recording suitable for this purpose was a strip of unannealed Permendur, ¾ inch wide by 0.004 inch thick, mounted on edge and fitted into a groove cut in the surface of a rotating brass disk. For rigidity, a clamping arrangement consisting of two brass rings, one inside and one outside the tape, was mounted on the upper edge of the tape. Approximately three-eighths of the total width of the tape surface was exposed to the heads.

The erase and record heads face and contact the outer tape surface. The reproduce head is located behind the tape, mounted on an arm connected to a pulley and shaft which are independent of the tape drive pulley. The pulley for the reproduce head is driven directly from the motor shaft with a 1:1 speed ratio, whereas the tape is driven from the same motor through a 1:10 reduction. Thus, the reproducing head makes 10 revolutions per single revolution of the magnetic tape for the tests described, although it is possible to vary its angular speed over a wide range and also to change its rotational direction to fit a given need.

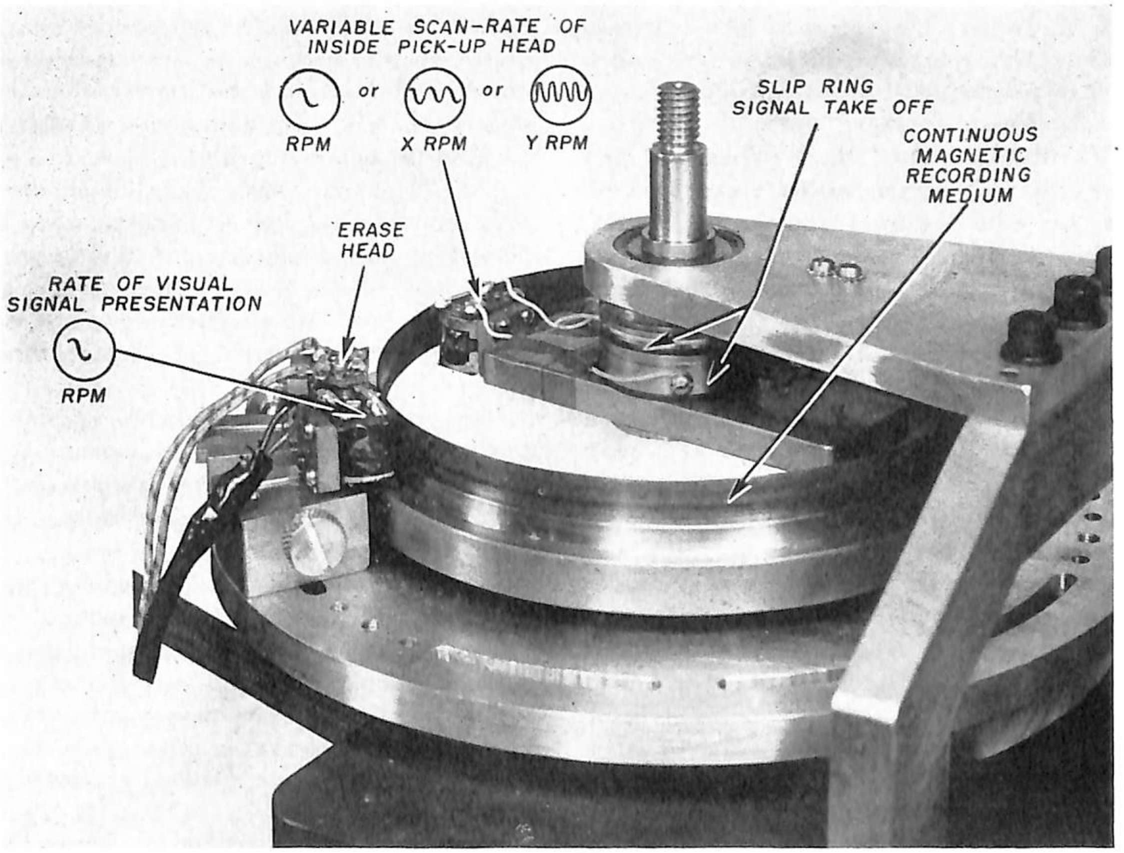
Head connections are made to insulated slip rings, mounted on the drive shaft, from which the signal is removed by means of wiping contacts.

This arrangement proved very satisfactory, and no objectionable noise was contributed by the friction between the contacts and the slip rings.

Although the evaluation proved that the proposed method was practicable, from the first test it was apparent that the joint in the tape created a magnetic discontinuity, which, of course, would not exist with a continuous homogeneous medium. The discontinuity in magnetic structure, when scanned by the high-speed reproducing head, set up transient signals of considerable magnitude which fell into the 7- to 200-cps frequency range being investigated. Furthermore, the shock experienced by the reproduce head as it repeatedly encountered this butt joint brought about permanent magnetization of the head, which resulted in increased noise in the reproduced signal.

Since the effects caused by the tape joint were predominant throughout most of the tests conducted on this device, another tape, this one a continuous band, cut from a solid piece of tool steel, was subsequently installed in place of the Permendur strip. No effort was made to determine the magnetic recording characteristics of the steel other than to establish the fact that it was posible to record and reproduce a signal, store it, and erase it. With the steel tape, the transient effect was eliminated, and a greater signal-to-noise ratio and decreased intermodulation distortion resulted.

Although this device was conceived originally for an investigation of its possible use in a passive detection system, demonstrations of the unit to several interested groups have resulted in indications of additional applications, especially in the field of auto-correlation studies. The recording method may also be utilized in devices for torpedo detection, single-ping echo ranging, and signal strength enhancement. Adaptations of this recording device are now being constructed for several of these applications.



Magnetic Recorder.

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TROUBLES WITH RELAY CONTACTS

Reprinted from ELECTRONICS

by
A. W. CLEMENT

The increasing attention being given to relays in electronics prompts the writer to offer points concerning telephone and moving coil relays, the results of experiences over thirty years.

Contacts are the most vital part of relays. Their performance depends upon the material used, the shape, pressure, voltage, current, atmospheric and circuit conditions, maintenance methods.

Of primary interest is the pressure of a contact—or rather, two pressures, mechanical and electrical. A deficiency in one can be compensated by an increase in the other. The pressure serves mainly to penetrate film upon the contact surface and is also used to prevent microphonic action (chattering) and to adjust the relay.

Metals will form films due to chemical combination with gas (oxygen in the air being most common) but with the usual "contact metals" such films are easily penetrated by low voltages, under two. Platinum is outstandingly superior for minimum film formation, and is followed by gold and silver. Poor metals such as brass, tungsten, phosphor-bronze and as an extreme, lead, require higher voltages or mechanical pressure for penetration.

Films of the greatest seriousness are formed by deposits of grease from the atmosphere and by handling the contacts with files or in other manners. *It may be said that over 90 percent of contact troubles are due to grease.* The metal used becomes a minor factor in view of the comparatively high pressure (electrical or mechanical) required to penetrate the grease.

Carbon is the next in order of contact surface troubles. It is the residue of burnt air and grease, and forms in small rings about the actual point of contact, building up until the rings hold the contacts open. It is very instructive to examine contacts under a microscope of twenty or so diameters. A good contact pressure will aid in crushing the rings, keeping the contact usable.

Another surface condition is that of "cone and cratering", where the metal of one contact is transferred over to the other, leaving a hole or crater in one and a point or cone upon the other. The crater eventually clogs with carbon and is difficult to clean out. In some cases, with springs of light tension (10 grams or so) the cones can stick in the craters preventing natural opening. Occasional reversal of current will prevent this surface trouble. In some telephone plants using vibrator ringing generators, clocks have been installed to reverse the driving current every half-hour; daily or more frequent contact cleaning became a matter of once a week or more.

Again, there is damage caused by the contact of two different metals due to the *contact potentials* of the particular metals used. This also forms a cone and crater effect. Different metals should never be used. A number of years ago a large number of strips of break-jacks were replaced throughout the country by a manufacturer whose assembly department had slipped up and used platinum and silver in the opposed springs.

For telephone relays the contact mechanical pressures may be rated as medium when between 20 and 40 grams. When under 15 grams they tend to be "microphonic", easily disturbed by jars from adjacent relays, etc. At low pressures they might also "sizzle" when currents of a few hundred milliamperes are passed.

Moving coil relays have almost zero mechanical pressure but they operate with reasonably high voltages and are almost always associated with telephone relays so the microphonic and sizzling effects are less disturbing.

Voltage pressures used with medium mechanical pressures and average "contact metals" ought to be over 20 volts for ordinary operations but for rapid and frequent use 40 or more volts is highly desirable. Manual telephone plants use 22 volts (called 24) where simple relay operations are involved, but automatic plants have used 48 volts for years.

Average good contact metals require only a couple of volts to penetrate their natural films or tarnish, but grease will soon appear and demand the higher voltages mentioned, so actually the kind of metal used is a minor matter if it is not subject to heavy tarnish. Phosphor-bronze, for example, is a poor metal that needs about 48 volts to penetrate its tarnish with almost zero mechanical pressure), though with over 32 volts or so it serves very well, with medium mechanical pressures. Tungsten is another poor metal, worked best with around 50 volts for medium pressures, though at very high pressures (100 grams or more) it can operate with only 3 volts or so.

What of Contact Shapes?

And now for contact shapes. They should be ball-faced and as small as practical alignment and reserve material for wear permits. Large contacts will not carry more current than small ones.

Two plane surfaces free to align with each other can only touch at three points unless there is sufficient pressure to distort the surfaces. If the surfaces are not free for alignment they can touch at only one point—one molecure. Practical pressures encountered actually crush the molecules out of position slightly so several will be in contact, but this is still only a microscopic portion of the entire contact face. Therefore a ball contact can function as well as a flat one so far as the amount of metal in contact is concerned, the maximum current capacity being about one amp. at medium pressures; more current can be carried at greatly less reliability up to about two amps. Moving coil relays can carry about .25 amp. as a maximum and .10 amp. is safer.

The chance for dust to lodge between contacts is far greater for flat than for ball faces; also, a greater area of film is present requiring more mechanical pressure for puncture. Some contact pairs consist of a point and a flat; this type only halfway approaches the ideal with a disadvantage that craters develop in the flats.

Smooth, polished contacts are poor, there being less points to pierce the grease film and actually effect contact. A rough contact is essentially a multiple contact by virtue of the greater number of points crushed together. As a test, two sheets were chromium plated: one was highly polished, the other left with its natural granular surface. With about 5 grams pressure, a blunt pointed copper contact upon the sheets showed the polished plate as having eight times the contact resistance of the granular plate.

Vertical or Horizontal Contacts?

The writer believes this to be immaterial. Theoretically, normally closed vertical contacts can form a rest for floating dust which might settle between the contacts when they open, preventing their closing when released. With horizontal contacts the upper spring should catch the dust, sprinkling it over the sides by vibration as the relay operates. However, Brownian movements shoot dust in all directions and potential differences make attractive traps regardless of position. It is a different case with stepping switch bank contacts where the horizontal types are markedly worse.

Free floating dust is of no consequence in relays. Blowers or vacuum cleaners are positively ruinous, forcing large chunks of dirt into contacts they could never reach by natural air currents. In the dust plagued industrial belt of India, from damp Bengal to hot and dry Punjab, the writer installed a number of all-relay automatic exchanges, each being entirely without dust protection from the moment of unpacking to several weeks after starting service. They were positively filthy yet gave no trouble from dust. On the other hand, one plant in the Jherria Coal Fields (surface mining largely) had abnormal grease trouble. A day would be bright and quiet when suddenly, in five minutes time, the whole plant would go bad from a gas wave. Filtering the air in this plant was of small benefit and it was left up to the maintenance men to do fast washing.

An interesting test was made concerning grease. A bay of 100 relays having three sets of break contacts and a like number of relays with three makes was unpacked, after about two years storage in Bombay. All contacts were ball shaped gold alloy with tensions of about 30 grams and worked with 40 volts. One would suppose the normally closed contacts to perform better than the open ones, but they were worse. Grease had forced apart the normally closed contacts so the applied voltage could not penetrate. Of course there was grease upon the open contacts, but mechanical force of operation aided the penetration. Further, while the closed contacts that failed would break through if flipped electrically and repeat properly, yet after being idle for a day they would be bad again—the grease had time to creep back.

Associated circuits have important effects upon contacts. It is highly desirable that contacts spark a little when opening as this burns the grease away quite well, the resulting carbon not being as troublesome. Thus inductive circuits are markedly better than non-inductive, up to the point where excessive sparking causes too much carbon. Useful sparks are such as can be fairly easily seen but not near a "spitting" condition.

Non-inductive circuits (slow relays and particularly lamps) are bad for contacts. Any contact will vibrate or chatter every time it closes, regardless of tension, and each vibration is a current interruption. In an inductive circuit the average transient current is low during the period of vibration whereas in a non-inductive circuit the current is practically full value for the entire period. There are several effects: the carbon-forming sparks are less but their grease burning is also less, so failures increase.

When any contacts carry current they are welded together—very minutely as a rule: in fact, no weld, no current. The non-inductive current welds at each vibration of the contacts, rapidly destroying the contacts. In one case observed, certain relays, operating almost continuously through the day, had two sets of make contacts—one driving a switch magnet, the other a lamp taking about one-fourth the current. The magnet contacts lasted over two years but the lamp contacts had to be replaced about once every three months.

Condensers when shunted directly across contacts are terrible, ruining the contacts quickly by excess welding. In some cases the weld prevents the contacts from opening. Assume that a condenser of any size is charged to 50 volts—a dead short upon it would produce an initial current limited by the resistance of the short. Assuming the short resistance is .02 ohm then there would be 2500 amps. at the first instant of closing. Just imagine the welding effect. *A resistance should always be in series with the condenser and have a value of about one ohm per volt of power supply, limiting the maximum current to one ampere.* For moving coil relays about 20 times this resistance is better.

A particular use of this welding was made in the case of about 75 valves used with pneumatic ticket carriers. Tickets and "cleaners" (dipped in powder) shot between the two German silver contact springs, opening a circuit supposed to close when the ticket was removed. A small narrow slot in one spring, aligned with a semi-penetrative embosure upon the other spring helped, but adding a 2.0 microfarad condenser without resistance positively cured all contact troubles. The system operated with 22 volts. Of course, the weld was too small to interfere with ticket entries but it held the contacts electrically.

In many cases spark-killing can be better and more cheaply accomplished by shunting the inductive load (not the contact) with a non-inductive resistance. The value is better found by cut-and-try, depending upon permissible sluggish release of the coil involved. For average apparatus, a good starting value to try is around ten times the resistance of the coil.

Condensers in series with contacts cause much failure but do not damage the contact. In such circuits there is always some appreciable resistance so welding effects are not troublesome. It is really a lack of weld that gives trouble, for by the time a contact has ceased vibrating the condenser voltage will have risen to that of the power supply so the last "make" of the contact finds no current flow to weld it. Shunting the condenser with a few thousand ohms (the less the better) or otherwise maintaining a potential difference across the contacts cures the fault.

Another trouble is the contact that closes when there is no voltage across the pair (no current flow). This is particularly aggravated if the contact remains closed for any number of hours (sometimes minutes) before a potential is applied, allowing time for the grease, displaced by mechanical pressure when the contact closed, to creep back and separate the pair. Such "non-potential" contacts were found by a test in a new plant to give about ten times the trouble found in live contacts. This test was at 40 volts with gold alloy contacts.

Moving coil relays are annoying due to the light mechanical pressures and to the long period of vibration holding the contacts. Stocking or welding is another nuisance. Further, when operated or released the hair-springs may vibrate excessively since they carry a circular current of several turns in a magnetic field—near a neutral point, but never really neutral. This vibration is carried to the contacts.

Moving coil contacts should always be of platinum-iridium, the iridium supplying a useful degree of stiffness. They should be mounted as close to the axis of coil rotation as possible so that the greatest pressure may be obtained.

How to Clean Contacts

As for cleaning contacts, the writer is still puzzled. A number of definite comments can be made. Never use a piece of paper as there is always some fuzz that usually stays upon the contact. Filing a contact often fixes it but frequently the trouble will soon return—the grease that was pushed away returns and the contact shape and mass have been changed. Theoretically, washed files should be used, but who goes to that trouble? Files sometimes put more grease upon the contact.

Having tried it upon thousands of relays, the best, but not perfect, method is a double operation—washing and wiping. Chamois cemented on the end of a thin strip of bakelite, dipped in carbon tetrachloride, washes the contact (one quick jab is enough) and another dry chamois stick wipes off the residue. Most carbon tetrachloride is old enough so it leaves a residue. Thus wiping is quite necessary. Carbon deposits may need a touch with a file followed by washing and wiping.

HAZARD IN TV-4/U TUBE TESTER IN TEST-TOOL SET AN/USM-3

A report has been received by the Bureau of Ships of the existence of a personnel hazard in Tube Tester TV-4/U which is included in the Test Tool Set AN/USM-3. The report stated that with the Circuit Selector switch S-101 in the "OFF" position and a metal shelled tube in socket X-108, line voltage is present on the tube shell. This voltage is not present between the tube shell and the chassis of the tube tester, nor is it on the metal shell of the tube when S-101 is in any other position.

It is suggested that in testing metal shelled tubes in Tube Tester TV-4/U, the operator place the Circuit Selector switch on the "LINE-SHORT CHECK" position when inserting or removing the metal shelled tubes.

Corrective measures have been taken by the Bureau of Ships to prevent a repetition of this hazard in future procurements of subject tube tester. A field change is being investigated by the Bureau of Ships to correct the hazard in equipments already in the field.

ELECTRON TUBE REPLACEMENT CONSIDERATIONS

Electronics maintenance personnel are reminded to be cautious when replacing defective glass tubes with metal shelled tubes. Pin #1 of metal shelled tubes is connected to the tube shell, while pin #1 of the corresponding glass tubes is usually not connected. Pin #1 of the sockets in some equipments is sometimes used as a circuit tie point where the equipment has been designed for glass tube use.

It is recommended that defective glass tubes be replaced by glass tubes whenever possible. Where glass tubes are not available, metal shelled tubes may be used as replacements after the actual equipment wiring has been checked and the fact verified that no connections have been made to pin #1 of the tube socket.

For example, in the decoder of Model PO Radar, a jumper exists between pin #1 and pin #6 of all tube sockets for 6SA7G/GT. When the glass 6SA7G/GT is used no harm is done. When the metal 6SA7 is used the sync pulses fed to pin #6 are grounded through pin #1, the metal shell and the tube clamp. In this particular case the jumper has no function and could be removed. If removed either the glass or metal tube could be used as a replacement.

MAINTENANCE PARTS FOR SUBMARINE SIGNAL COMPANY 896 COMMERCIAL FATHOMETERS

Requests for maintenance parts of the Submarine Signal Company commercial fathometers should be addressed to ESO. Nearly all of the parts of the Submarine Signal Company type 896 Amplifier and Driver may be obtained from stock parts of the NJ-3, NJ-7, and NJ-9 equipments. The indicator units have fewer parts in common. Submarine Signal Company (now Raytheon Manufacturing Company) specification 8045E applies to the 405YU parts of the 896 fathometer, 115/60/1 system. A breakdown of these parts is available upon request. Repair activities should salvage useable parts of the 896 fathometer that are removed from vessels and place the parts in SERAD for reissue until all of the CBM-896 series fathometers have been replaced. The replacement of all commercial fathometers is being made as soon as practical. The instruction book for the 896 is NAVSHIPS 365-1138 and the instruction books for the NJ series are NAVSHIPS 95150 and 95152.

LOCTAL TUBES FOR SHIPBOARD FACSIMILE EQUIPMENT

It is to be noted that the following vacuum tubes, not normally carried aboard ship, are used in TT-41A/TXC-1B transceiver and PP86C/TXC-1 power supply:

Quantity	*Loctal Type*
6	7C5
5	7L7
5	7N7
1	7S7

It is recommended that all ships which have facsimile equipment included in their allowance check their stock of these tubes. If necessary supplement their stock from normal supply sources.

Electronics Maintenance Parts System and Conversion

Continued from page 7

of the inadequacies of the present Electronic Maintenance Parts Allowance since those inadequacies follow no more than a general pattern for various models of equipment. Each allowance must be compared with the old Spare Parts Lists for the equipment installation which the allowance is designed to support before it is possible to determine the maintenance parts which must be stocked to supplement the allowance.

equipment have been identified by SNSN's and added to the SNIT's.

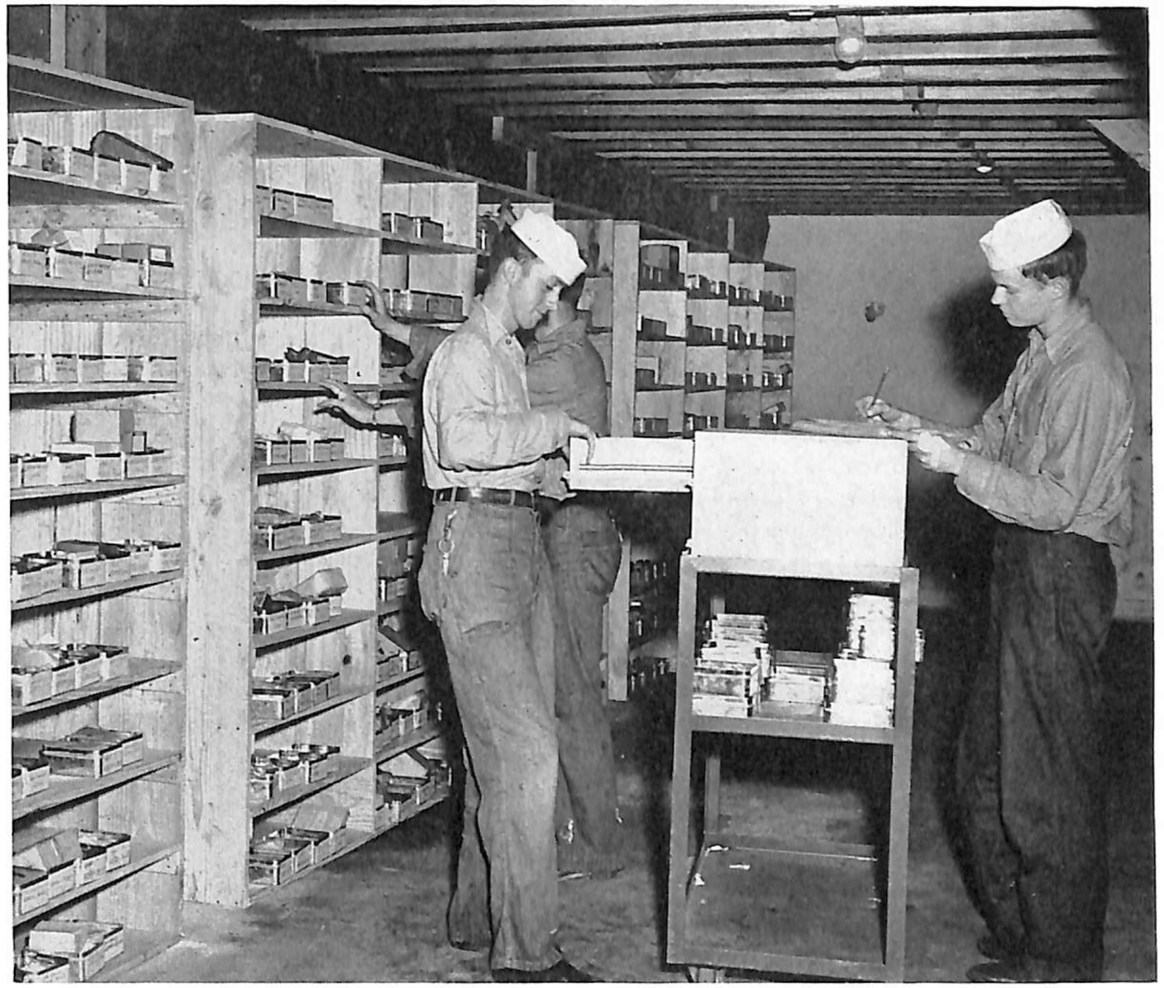
In general, the allowance includes nearly all of the parts common which are in N16 and N17 stock classes. The percentage of parts peculiar which are included in the allowance varies for different models of equipment. Of course, all parts peculiar belong, by definition, in stock classes N16 and N17. The allowance does not generally include equipment accessories and special tools which were included in Equipment Spare Parts.

No accurate prediction can be made of the quantity of material which a ship should retain to supplement the allowance. However, BuShips has estimated that the present allowances are approximately 80% complete, using the number of line-items as the determinate. In contrast, the volumetric quantity of the supplementary material retained by ships which have completed the conversion usually has approximately equaled that of the allowance material. This is due to the fact that many of the supplementary parts are bulky mechanical parts, while the allowance includes many small items, such as capacitors and resistors.

Breakdown and identification of the spare parts boxes.

There is one general category of material which is now omitted from the allowance. That category includes those maintenance parts common which are in stock classes other than N16 and N17—that it, maintenance parts which are not stocked in the Electronic Supply System since the applications of the parts are not peculiar to electronics. These parts are included in the Catalog of Naval Material, General Stores Section. This material will be included in Parts Lists for new equipments; hence, it will appear subsequently on allowances to support that equipment. However, the allowances will not include this material to support equipment presently in use until such parts in that

The material and parts described above have proved to be a matter of major concern to those who have observed closely the execution of the conversion program. A relatively large number of ships have converted to the new system only to find that too little or no attention was given to the problem of screening the residue material which remained after the maintenance parts which are are included on the SNIT's were identified by SNSN and removed from equipment spare parts. If this residue material is not screened during the conversion period, or if it is not retained intact for subsequent screening, that ship-owned material which should be retained to supplement the allowance is irrevocably lost to the ship and must be repurchased.



Filling the allowance with identified material taken from off loaded spare parts boxes.

Elimination of Excessive and Unnecessary Maintenance Parts

The subject of maintenance parts which were excessively and/or unnecessarily provided under the Equipment Spare Parts Box System, and which are eliminated by conversion to the Electronic Maintenance Parts System, has been deliberately avoided thus far in this paper. The reason for this was to avoid the natural tendency to over-sell any new system by emphasizing the advantages and over-looking the limitations of the system. This tendency, coupled with a lack of comprehensive information on the Electronic Maintenance Parts System, has given substance to the popular misconception that the Electronic Maintenance Parts Allowance is the solution to all maintenance parts problems. The primary result of this misconception is the tendency to overlook the importance of the residue material discussed in the preceding section.

The conversion to the Electronic Maintenance Parts System accomplishes the elimination of three types of material.

1. Maintenance parts common and maintenance parts peculiar which were provided in excessive quantities in equipment spare parts.
2. Miscellaneous material which served no useful purpose.

3. Maintenance parts, usually parts peculiar, which should not be stocked aboard ship since it is beyond the capabilities of ships' forces to install the parts if the need arises.

The existance of excessive and unnecessary material in equipment spare parts boxes was the result of the fact that the Navy did not supervise the preparation of Spare Parts Lists and the assembling of the material. The elimination of the material listed above will be accomplished as a result of participation by the Navy in the preparation of the Parts Lists, and subsequent preparation of the allowances from those lists. It is the responsibility of ship personnel to determine the amount of the residue material, discussed in the preceding section, that is in excess or is unnecessary, and to remove it during the screening process.

Supplementary Allowance

A previous attempt has been made in this paper to justify the statement that the Electronic Maintenance Parts Allowance was not an allowance according to the usual application of the term. A consideration of the two preceding sections should lend further substance to that statement. The Electronic Parts Allowance does not supersede the entire Spare Parts List which is included as part of the instruction book for each equipment. It is the responsibility of the electronics personnel of each ship to screen the material which is not included in the allowance, and to retain that which is necessary for the proper shipboard maintenance of electronic equipment. The spare parts list for each equipment remains in effect as authority and a requirement for maintaining, as necessary, a stock of those parts not included on the Electronic Maintenance Parts Allowance.

The use of an Equipment Spare Parts List, in its original form in conjunction with the Electronic Maintenance Parts Allowance, is unwieldy and confusing. The following procedure is recommended for revision of an equipment spare parts list.

1. Annotate all items which are included on the appropriate SNIT. Those parts are included, as necessary, in the Electronic Maintenance Parts Allowance.
2. Annotate all items which are equipment accessories and special tools. Those items should be recorded on a separate list.
3. Annotate all items which are standard material, such as lamps, fuses, hardware, etc. Those items should be added, as necessary, to a combined list to serve as a guide for stocking standard material.
4. Screen the remaining items and annotate those items which the ship personnel do not consider necessary for retention.
5. The non-annotated items will be those which should be retained as the set of equipment maintenance parts to supplement the Electronic Maintenance Parts Allowance. This set will include parts peculiar, parts common, and miscellaneous special material.
6. If the equipment model is part of a multiple installation of that model, the individual sets of maintenance parts should be combined to make up a composite set. A reduction in the quantity of the parts in the composite set, compared to the sum of the individual sets, should be possible.

The old Spare Parts Lists should be retained in their entirety since they contain approximate descriptions of the parts identified in SNIT's.

Maintenance Parts Stock Records

The possibility of making comparatively rapid inventories of maintenance parts and of maintaining accurate stock accounts constitutes two of the advantages of the Electronic Parts System. For these purposes it is necessary that each ship establish stock records on which to record receipts, expenditures, and inventories for each active line-item on the allowance list. The information on each stock record form should include component noun name or tube type, SNSN, number allowed, location code (if used), unit price, and all stock transactions.

It would be possible to maintain the necessary stock record information in the four blank columns on the allowance. However, these columns were provided for use in establishing the system. In addition the pages of the allowance are not sturdy enough to withstand the wear to which they would be subjected if used for stock record purposes.

The following are recommended for use as maintenance parts stock records:

1. Files, visible record, book-type, with 98 celluloid tipped 8″ x 6″ kraft pockets. Stock No. G54–F–2316–250.
2. Spare Parts Stock Record, NavSandA Form 488. The Bureau of Ships now furnishes these cards, preprinted with SNSN, with the allowance for all except tender and repair ships.

Allowance quantities of the book-type files are given in General Amendment Number 474 to Bureau of Ships Allowance Lists for all ships except tenders and repair ships. The latter are covered in General Amendment Number 457.

The record cards, Form 488, are of the Chaindex type, and they link together to form a deck of the visible-index type. The kraft pockets are punched to hold two decks of six cards each.

Stowage Cabinets

Special cabinets are provided (by Shipalt) for stowing the Electronic Maintenance Parts Allowance material according to SNSN. The cabinets are designed to provide maximum flexibility of cabinet installation as well as parts stowage arrangement. An appropriate amount of shelving is installed for stowing parts which are too large to be stowed in the cabinet drawers.

While it is true that conversion to the Electronic Maintenance Parts System results in a reduction in weight and volume of maintenance parts carried aboard ship, it is not necessarily true that there

Maintenance parts cabinets installed aboard ship.

will be a corresponding increase in usable stowage space aboard ship. In those ships in which there were no spaces designated as storerooms for equipment spare parts boxes, space must be provided for the installation of cabinets and shelving.

The Bureau of Ships now furnishes, with the allowance, preprinted bin tags showing SNSN for each item on the allowance.

Supply Aspects of the System

Some personnel, both ashore and afloat, have been rather quick to assume that the establishment of the Electronic Parts System has placed electronic maintenance parts in the same category as beans and swab handles. Such an assumption includes no provision to insure that the personnel who maintain a stock of maintenance parts can match a part to the part description which applies. If the ship's cook draws beans and then finds that the ship received coffee beans instead of soup beans, the menu can be changed. If an Electronics Technician draws a maintenance part, and then finds the wrong part was stowed under the right number, the ship will be without the use of an equipment, unless the ship happens to be carrying a suitable substitute (stowed under the right number)

The method of maintaining the Electronics Maintenance Parts System will vary according to ship organization and the number and qualifications of personnel. However, proper maintenance of the system on any ship will require at least partial supervision of the system by technically-qualified personnel. Supervision of the Electronic Maintenance Parts System is an electronic maintenance problem, not a pure supply problem.

Summary

If it were possible to convert a ship from the Equipment Spare Parts Box System directly to the ultimate Electronic Maintenance Parts System, this paper could have been made considerably more brief. The ultimate shipboard Electronic Maintenance Parts System cannot be achieved at present, however, for ships can be supplied only the first element, the Electronic Maintenance Parts Allowance, of a two-element system. The units of the second element, Equipment Parts Lists, must be assembled during the course of the system transition period, which is the period required to gradually outfit the Fleet with equipment for which Parts Lists have been prepared. In the meantime, it is the responsibility of the personnel of each ship to establish a conversion system which is predicated on the ultimate shipboard Electronic Maintenance Parts System.

The establishment and use of the conversion form of the Electronic Parts System should be governed by the consideration that the system is not an entity. It is one element of an "integrated" system, the function of which is the maintenance and operational support of shipboard electronic equipment. It is true that the Electronic Maintenance Parts Allowance is the result of a transformation of data received on Failure Report (NavShips 383) and Ship Electronics Installation Record (NavShips 4110), but it is far from true that the allowance is the sole product of these data. Conversion of the Fleet to the Electronic Maintenance Parts System completes the loop of the integrated system. The nucleus of the integrated system is, and will continue to be, the data from NavShips 383 and NavShips 4110. The efficiency with which the integrated system, as well as the Electronic Maintenance Parts System, supports Fleet electronics is, and will continue to be, a direct function of the accuracy and completeness of these data.

Two major misconceptions are serving to complicate shipboard conversions to the Electronic Maintenance Parts System and to obstruct efficient application of the system. These misconceptions are:

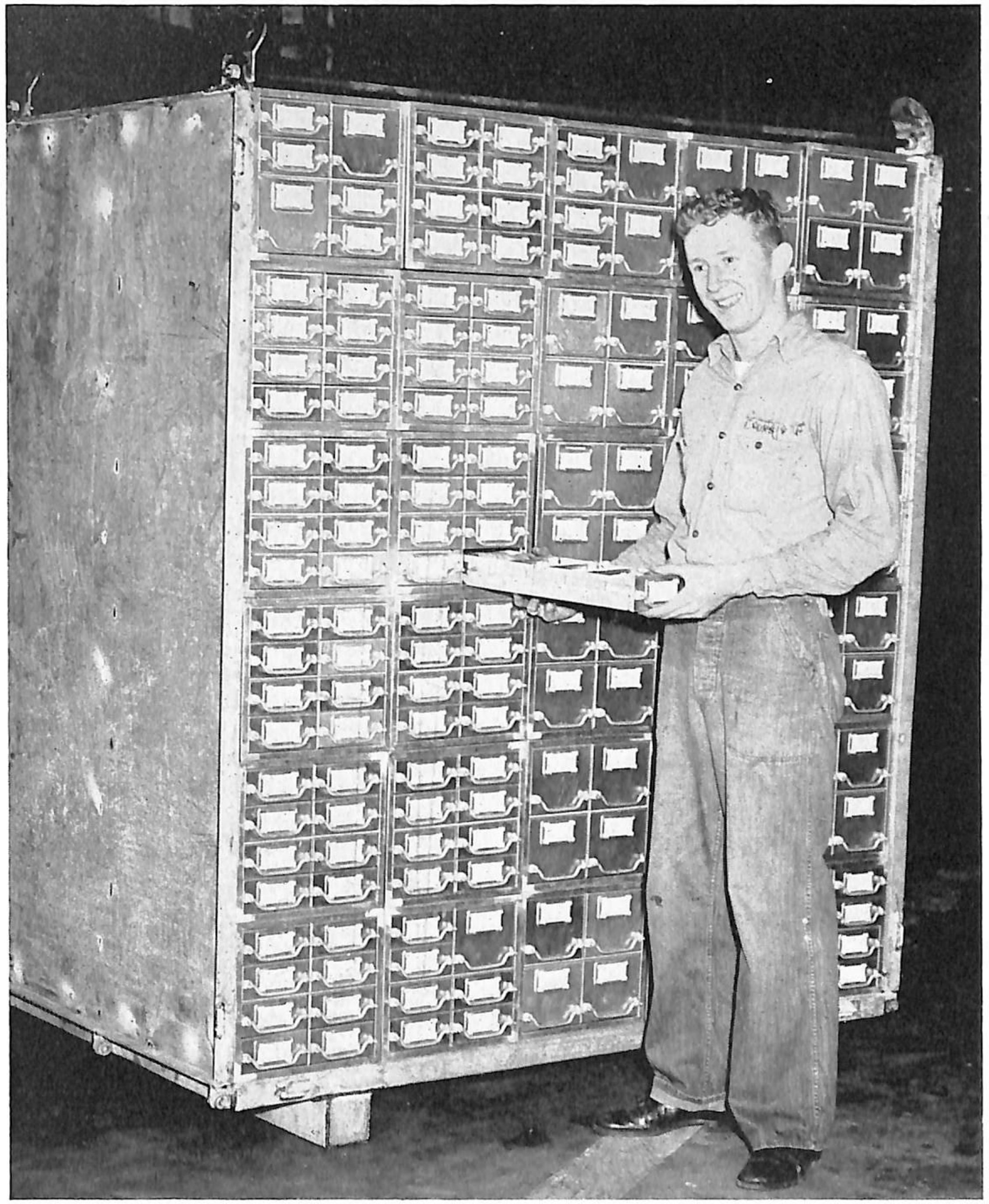
1. That rigid adherence to the Electronic Maintenance Parts Allowance is required, and that all maintenance parts authorized for shipboard stocking are included in the allowance.
2. That it is necessary to differentiate between parts common and parts peculiar aboard ship.

The first misconception must be quickly dispelled wherever and whenever it exists. The only allowance for maintenance parts which could be wholly accurate and dependable would be one which provides multiple replacement support for every part in each electronic equipment. It is the responsibility of ship personnel to adjust the Electronic Maintenance Parts Allowance as necessary, and to decide which parts of each old Equipment Spare Parts List remain applicable.

The terms "parts common" and "parts peculiar" should be of concern to ship personnel only during the planning and execution of the conversion. These terms will continue to be of concern only to those persons on the Bureau level who are responsible for procurement of maintenance parts.

Conclusion

The Electronic Maintenance Parts System is the culmination of wide-scale efforts to establish an efficient and coherent system for maintenance support of shipboard electronic equipment, and it has been proved that a shipboard conversion which has been intelligently planned and properly executed will produce a conversion system which has many important advantages over the Equipment Spare Parts Box System. However, the conversion represents a radical departure from most of the procedures connected with the Equipment Spare Parts Box System, and impedances to efficient adoption and application of the Electronic Maintenance Parts System are appearing in various levels of responsibility, as well as aboard ship, due to a general lack of knowledge concerning the structural and procedural details of the system. Self-education of electronics personnel is a prerequisite to the indoctrination of all others who are concerned with the Electronic Maintenance Parts System.



A maintenance parts cabinet completely stocked with allowance material.

PACKAGING AND PRESERVATION

A Packaging and Preservation Branch has recently been activated at ESO to discharge the responsibilities assigned to all Supply Demand Control Point. BuSandA defines these responsibilities as follows:

1—Development of preservation, packaging, and packing requirements, for inclusion in procurement requisitions where such requirements do not exist.

2—Inclusion of adequate preservation, packaging, and packing requirements, conforming to the policies set forth by the Secretary of the Navy in all procurement requisitions.

3—Periodic review of contracts resulting from procurement requisitions to assure that adequate preservation, packaging, and packing requirements are being included therein.

4—Final action on any requests for waivers of preservation, packaging, and packing requirements included in contracts.

5—Review and action on Reports of Damaged or Improper Shipments (DD Form 6) pertaining to material received on contracts resulting from improper preservation and packaging. Such reports will be furnished the Supply Demand Control Points concerned by this bureau. Action will include revisions of methods and procedures which prove inadequate.

6—Field contact with industry and field activities in order to provide that contractual preservation, packaging, and packing requirements are consistent with anticipated hazards of shipment, storage, and handling requirements.

In order for preservation, packaging and packing problems to be effectively met, deficiencies must be reported to the procuring activity. Form DD–6 is the proper vehicle for this report, but to date it is apparent that receiving activities are not utilizing this form. Failure to report, destroys the intent and purpose of the above mentioned directives.

While it is desirable that these forms be prepared by technically qualified personnel, it is not mandatory in those instances where such personnel may not be available. The lack of such personnel should not deter an activity from submitting a DD Form 6 and having it accomplished in the best way possible with the personnel available. Analysis of the information contained on these forms enables BuShips and ESO to incorporate packaging requirements in their contracts and issue instructions to the field designed to insure that Navy electronics parts will be handled in the supply system with a minimum amount of effort and arrive in the hands of the ultimate user in a ready-for-use condition. Thus, the importance of submitting a "Report of Damage or Improper Shipment", DD Form 6, is obvious.

As an aid in submitting this report, it is desirable that all hands become familiar with the Navy Shipping Code, Article 1850–4 and comply with the instructions contained therein.

Attention is invited to the fact that DD Form 6 has superseded NAVSANDA Form 712. This form has been especially designed to include all pertinent information relative to the evaluation of and initiation of corrective action in connection with the improper preparation of material for shipment or storage. Use of the form should not be limited to reporting damage alone. It must be submitted for all deficiencies, including overpackaging as well as underpackaging.

Copies of DD Form 6 should be requisitioned through regular publications supply channels.

Electronic Supply Office

REVERSE ROTATION OF STYLUS OF MOTOR—MODEL QDA

The Bureau has received reports from the field of the stylus motor in the QDA depth determining equipment running backwards. This is indicated by the motor index wheel turning to the left. The index wheel is attached to the magnetic clutch shaft and can be observed by removing the front cover of the recorder and control console. The condition frequently is a result of the depression angle (Eq) follower in the OKA resolver (OKA–1 computer) synchronizing at a point 180 degrees out. A 180 degrees of Eq resolver rotation is one full rotation (360 degrees) of the Eq dial. This error can be detected by noting the rotation of the Eqr (refracted depression angle) dial in comparison to the Eq dial. If the QDA stylus motor is running backwards and the Eqr dial is moving in a direction opposite to the Eq dial, turn the OKA off and manually rotate the Eq dial through one complete revolution. Turn the OKA back on and the trouble will be remedied if it was a result of incorrect synchronization.

REPLACEMENT OF SPUR GEAR ON B–404—MODEL QHBa

Replacements for the spur gear on the shaft of motor B–404 of the QHBa equipment are stocked by ESO under N16–G–2475–111 and under SNSN N17G–413880–824 (Sangamo drawing 871466). The gear was designated as B–404*A*, in order to prevent the delivery of the motor when only the gear is required. Steps are being taken to add this symbol number to page 8–8 and as a note on page 8–45 of NAVSHIPS 91125, as well as to the microfilm 26508. This same gear is also used in the Scanning Switch Assembly of the AN/SQQ–11 equipment.

The gears are furnished with the hub drilled, tapped, and counter bored for a filister type head screw. The screw used is a combination screw-taper pin shown on Sangamo drawing 971234. When the original gear was attached to the motor shaft, the hole in the shaft was taper-reamed so that the screw cap and pin seat simultaneously. As a screw-pin is not furnished with the replacement gear, the original screw-pin should be retained and re-used.

No special installation instructions are supplied other than that the distance from the motor to the gear teeth must be measured to insure that the full width of the new gear teeth are meshed.

AN/SPS–6A AND AN/SPS–6B RADAR EQUIPMENT

It has been found that poor operation of several AN/SPS–6A and AN/SPS–6B Radar Equipment in the fleet was due mainly to the presence of horn tilt adjusting shims originally used but no longer required after making radar Field Change No. 6.

When the original antenna feed horn support was manufactured, it was not practical to hold this fabricated structure to tolerances which would insure the exact angle of tilt of the feed horn with respect to the reflector. Since the AN/SPS–6B and the AN/SPS–6A antennas are sensitive to this angle of feed tilt, it was necessary in some cases for the manufacturer to use shims between the support and feed in order to obtain the specified gain and coverage pattern. The AN/SPS–6 type antenna is *not* sensitive to this tilt angle, and no shims were ever used on this feed.

At the time of replacement of the support beams by Field Change No. 6 on the AN/SPS–6, sufficient experience in fabrication of the beams enabled Westinghouse to control the tolerances so that each horn is tilted properly with respect to the reflector. Therefore, *no shims should be used between horn and support beam when Field Change No. 6 on the AN/SPS–6 is accomplished.*

This angular position of the feed with respect to the reflector is critical, as explained above. However, the actual distance from reflector to feed is not so critical. Any change in position of the feed within the limit of motion allowed by the slotted mounting holes will not affect the performance of the antenna. The slots are intended as an aid to assembly only.

TRAINING FILMS ON RADIOSONDE AND COMMUNICATION SWITCHBOARDS

Two new training films have recently been completed under the sponsorship of the Bureau of Ships.

The twenty-five minute film entitled "Radiosonde Observation and Operation" shows the overall purpose and operation of the equipment used in radiosonde observations. Prints of MN6904 are available at District Training Aids Sections and Central Aviation Film Libraries.

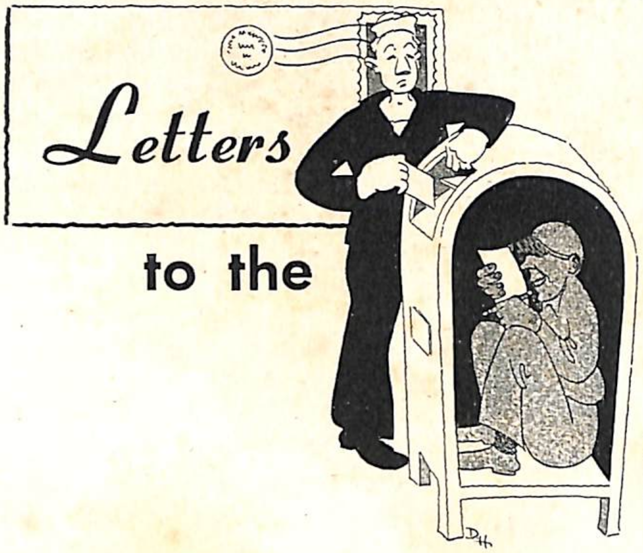
The ten-minute film entitled "Shipboard Radio Communication Remote Control Transfer Switchboards" describes the new switch-type remote control panels designed to replace the cumbersome patch cord type. Prints of MN6836 are available at District Training Aids Sections.

ERROR IN MODEL OKA–1 INSTRUCTION BOOK

The markings of the 1G Synchros, B–318 and B–320 of Figure 7–51 NAVSHIPS 91333(A), are transposed, that is, the synchro having a drive gear meshing with only one other gear is *B–318*.

The fact that the two synchros concerned are those involved in a conversion of the Eq servo drive system for 1X and 36X speed input and output make this information of prime importance.

This information will be included in listed changes and corrections to the subject publication.



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:

I have finally gotten around to reading the September issue of the Electron. I was doing fine until I reached the "Letters to the Editor" column. G. E. S. and G. K. appear to be understandably confused concerning the painting of radomes, antenna fittings, and insulator fittings. This is quite understandable since fleet practices are not entirely consistent and Chapter 67 of the Bureau of Ships Manual is not entirely specific. However, it would appear to me that upon reading your reply regarding the painting of antennas, they are still as confused as they were before receipt of the September Electron. Although a lot of "long haired" electronics people consider that electronics is primarily radar with its antenna framework, dipoles, etc., there are a lot of us in the Navy who cannot forget that the radio equipment still performs a vital electronic function and still uses pedestal insulator, entrance insulator, phosphor-bronze cable for antenna, etc. It has been standard practice, with regard to lead-ins and fittings, to paint such fittings red when associated with transmitting antennas and blue when associated with receiving antennas. Chapter 67, prior to revision, further specified that exposed metal lead-ins inside of ship spaces were also to be so painted.

May I suggest that the editor of the Electron investigate and promulgate the latest bureau thinking with regard to the care of antenna fittings associated with the old "workhorse" electronic equipment, i.e., radio.

K. N. S.

Where it meets the approval of local command the following applies to radio equipment; out of the weather metal rings, antenna transfer switches, other hardware and accessories associated with transmitting antennas should be painted with red enamel (Spec. 52P31, Stock No. 52–P–7890), as a finish coat. Hardware and accessories associated with receiving antennas should be painted with blue enamel (Spec. MIL P2852, Stock No. 52–P–7826) as a finish coat.

The question of repainting electronic equipment has come up many times in the past. In order to clarify this issue the April Electron *will carry an article on Repainting, Touching Up and Polishing Electronic Equipment.*

Editor

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FAMOUS FIRSTS IN ELECTRONICS

Georg Simon Ohm (1784-1854) wrote in 1826 that the flow of electricity in a wire was analogous to the flow of heat along a rod—temperature and electrical potential, quantity of heat flowing per second and current were corresponding quantities. He showed that current through a wire equals electrical potential times a constant. This constant is conductivity or the reciprocal of resistance. Thus, the familiar Ohm's law.

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UNDERSEA TV

UNDERSEA TELEVISION IS BEING DEVELOPED UNDER THE DIRECTION OF THE BUREAU OF SHIPS TO PROTECT AND AID NAVY DIVERS. TELEVISION CAMERAS CAN EXPLORE UNDERSEA AREAS WITH GOOD VISIBILITY TO HELP DIVERS SPOT AND PREPARE FOR DANGEROUS SITUATIONS. IN ADDITION, TELEVISION MAY BE USED TO OBSERVE AND COORDINATE UNDERWATER ACTIVITIES.