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ADMIRALTY SIGNAL ESTABLISHMENT,

JUNE, 1945.

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EDITORIAL

Recovering from our VE Day celebrations we thought, a bit obviously perhaps - Bulletin - Victory Cover!

Artists are apt to be temperamental chaps who "see" things differently, but we like the look of satisfaction on the face of the matelot who symbolises the Navy's contribution to the Teutonic Downfall.

We think - and hope you will agree - that our artist, who incidentally is not a Naval type - has done a good job.

For sometime past the "Board of Directors" has done its best to curb Editorial enthusiasm for "Bigger and Better Bulletins". "Better", they say, "Not bigger! ". But this is a Victory Number and we are celebrating. So we have allowed ourselves to spread. For the first time - and we suspect the last - we have reached the 100 page mark. Withal we feel it is a better, as well as bigger, Bulletin.

We would gladly add the description Brighter - to carry the alliteration a stage further - and will do so just as soon as we can induce our readers to provide material which "Dink", with his special brand of genius, can treat.

We leave you then, with our VE Edition and look forward, with you, to the time when a VJ Edition will be equally appropriate.

RADAR DISPLAYS

In the last year or two there has been a marked shift in the centre of Radar interest from the set itself to the display. The change from the early arrangement when the only display was an 'A' scan in the office to the latest requirements of perhaps as many as a score of displays in various positions in the ship is most noticeable. Various displays have been devised to suit particular requirements, but the process of development is by no means complete.

It is the intention of this article to survey briefly the display now available, or under development, for use with Warning Radar Sets.

The first remote display to appear in the Navy was Panel L17/18, the remote ranging panel for Types 271/2/3. This display was designed to be fitted in the T.S. to give accurate ranges for gunnery purposes.

A real step forward in the tactical field occurred when the first P.P.I's (Plan Position Indicators) were introduced right at the end of 1943. This display, which is illustrated on page 4 is too common a piece of equipment to need describing here. By the time this number of the "Bulletin" is published, 4,000 models will have been installed. The P.P.I. has become a very important feature of the radar equipment of most ships. It has been modified to work in a number of appplications for which it was never designed, and a number of improvements have been described in a recent C.A.F.O. The unit can be adapted to other uses than plan position indication, such as the Height Position indicator for Type 277 and the Elevation Position indicator for Type 275.

The unit illustrated is not the only plan position indicator to be met with in British warships. Other P.P.I's include the remote display from Type 268 and the American remote displays VC, VD and VE.

During 1943, Fighter Direction - comparatively new technique in the Navy - began to grow in importance, and a requirement arose for a display with a larger scale than the P.P.I., and with a flat surface on which direct plotting could be carried out. This led to the introduction in the Spring of 1944 of the Skiatron, which projects the picture produced electronically on the Cathode Ray tube, by a system of lenses and a mirror. This display is fitted in Aircraft Direction Rooms only, and has the advantage of a large scale (5 miles to the inch), a flat horizontal screen for direct plotting, and the possibility of operation in somewhat greater external illumination than the P.P.I.

A more recent development is a combination of the Skiatron and the A.R.L Table. It is called the Auto Radar Plot and provides a true geographical display in which the echoes from fixed objects remain in the same position regardless of the motion of the ship. The apparatus is rather vast and only one experimental model has been sent to sea so far. A few further models are being produced.

A new P.P.I. which has been designed primarily for submarine application, but which may eventually be used in certain instances instead of the present standard model, is the Master P.P.I. It is so called because it can drive a Slave P.P.I. which can be mounted in a pressure tight box on the bridge of a submarine. Among the features incorporated in the Master are better definition, range transmission from a strobe and bearing transmission from a cursor, screening from the effect of the earth's magnetism and considerably easier setting up procedure.

The Slave P.P.I. does not contain any valves and all its controls are remote from the Unit. The Slave will give a relative display, the whole Cathode Ray tube rotating to avoid the smearing of the picture when the ship changes course.

Plan position indicators are not the only types of remote display. A Sector Display is required for certain applications. The display employs a long afterglow tube and gives an 'A' type scan on a selected bearing without the need of stopping the aerials rotating and so losing the plan display from the set required for other purposes. A sector display has been admirably described as "taking the spin out of the aerial". Sector displays for Height Estimation (JJ1) and Ranging (RTE) were illustrated in the "Bulletin" for December, 1944. We show now a sector display for Interrogation (JH2).

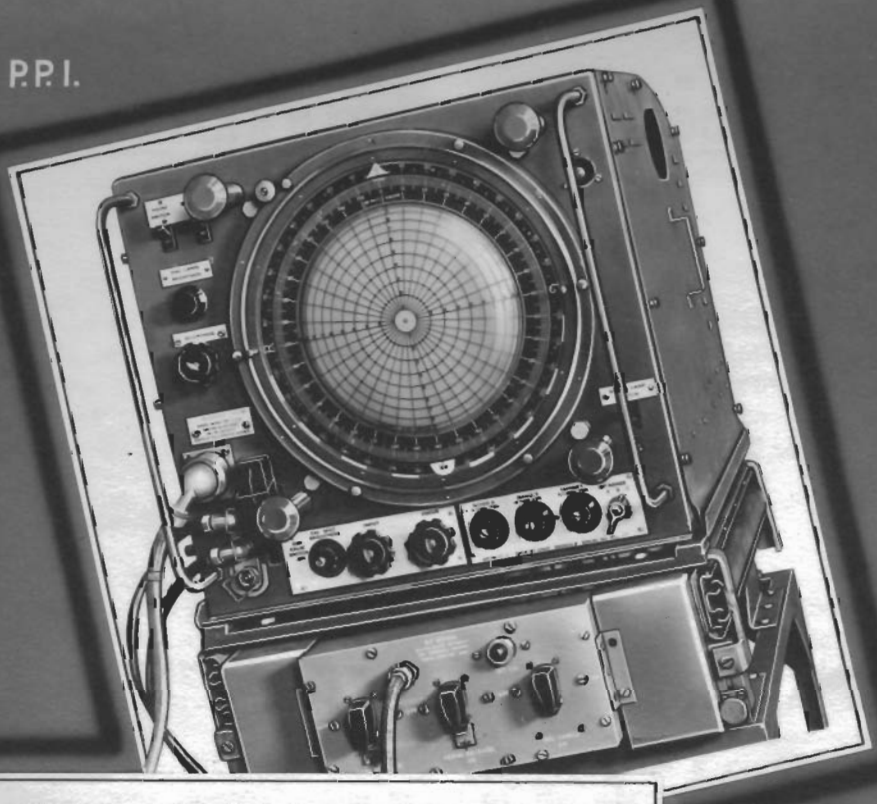
A new type of display will be introduced for use with Types 960/980/981 in the Radar Display Room and in the Radar Offices of these sets. This display is usually referred to as the U.D.U. (the Universal Display Unit) although its use can hardly be termed universal. It includes a P.P.I. as well as a sector display, the P.P.I. having similar advantages to the Master P.P.I. The centralisation of the operational controls has been attemped and it is believed that it will be considered a marked advance on previous equipment. In certain applications it is hoped to substitute a Range Azimuth Display (sometimes called a 'B' Scope) for the Sector Display. The unit is unfortunately too large to be substituted for the P.P.I. in positions other than the Radar Office or R.D.R.

Another new display to be introduced with Types 960/980/981 is the Type 981 Height Display. This will be a true height display on which the range of a target will be read horizontally and the height vertically. Echoes will appear as short vertical lines.

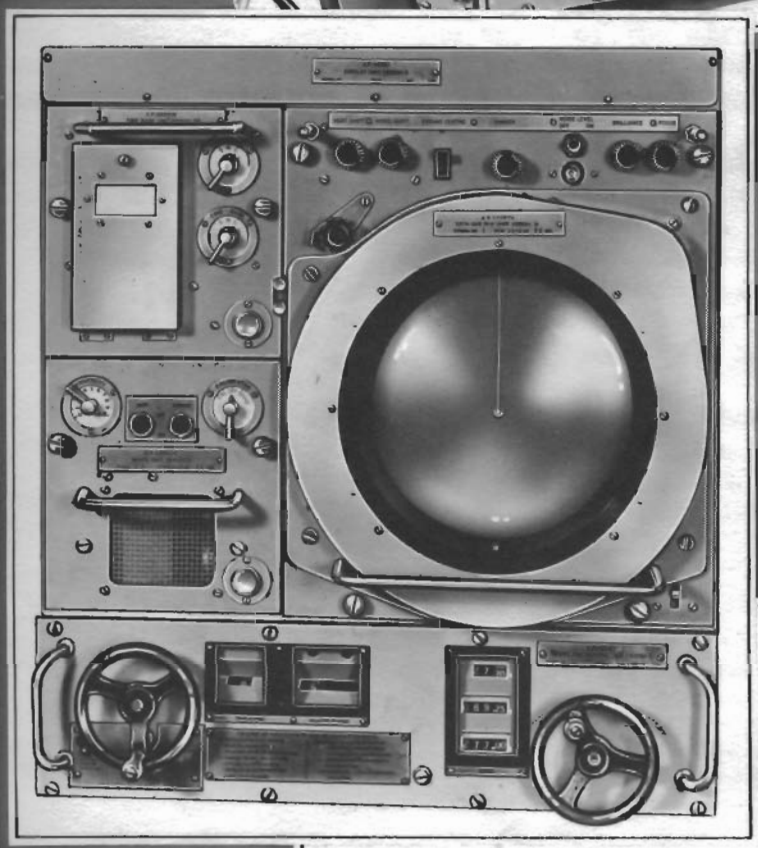
Development in the display field continues and the future will show many changes. We may expect in the more distant future the 'M' type transmission system and all rotating parts to disappear from the P.P.I., a true expanded picture of any portion of the P.P.I. scan to be readily available and a more simple operating and setting up procedure. The Action Information Organisation is based largely on the Radar Displays and the R.D.R. is an attempt to combine telling, height estimation and interrogation in one position. Sea experience will no doubt suggest many improvements on the present schemes.

The best Radar can be spoilt by unsatisfactory displays. An improvement of 6 db. in a Radar set may easily be offset by what is the equivalent of a 12 db. or greater loss in the efficiency of the display equipment. Unless the information obtained by Radar can be conveyed rapidly and in a suitable form to the command and to the controllers of the ship's various weapons, much of the value of this vital development will be lost.

P.P.I.



RADAR

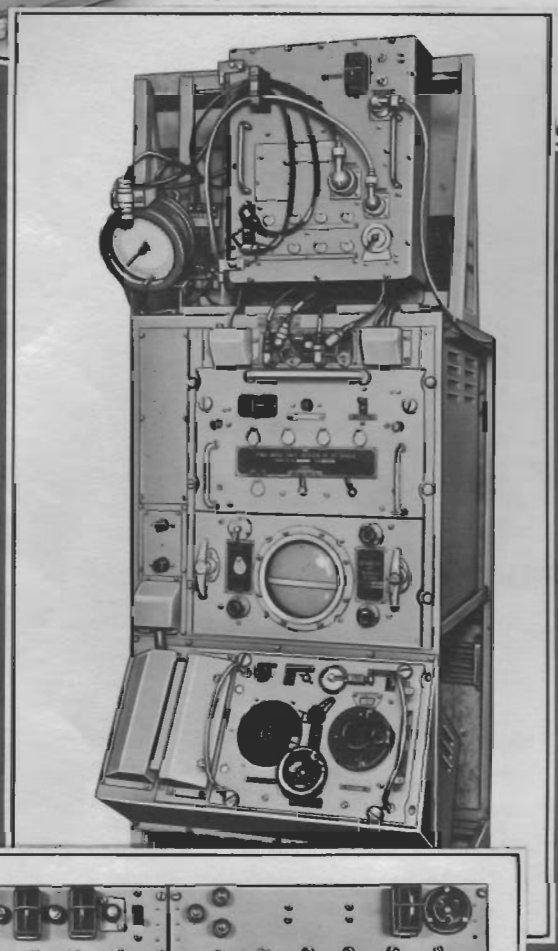


MASTER P.P.I.

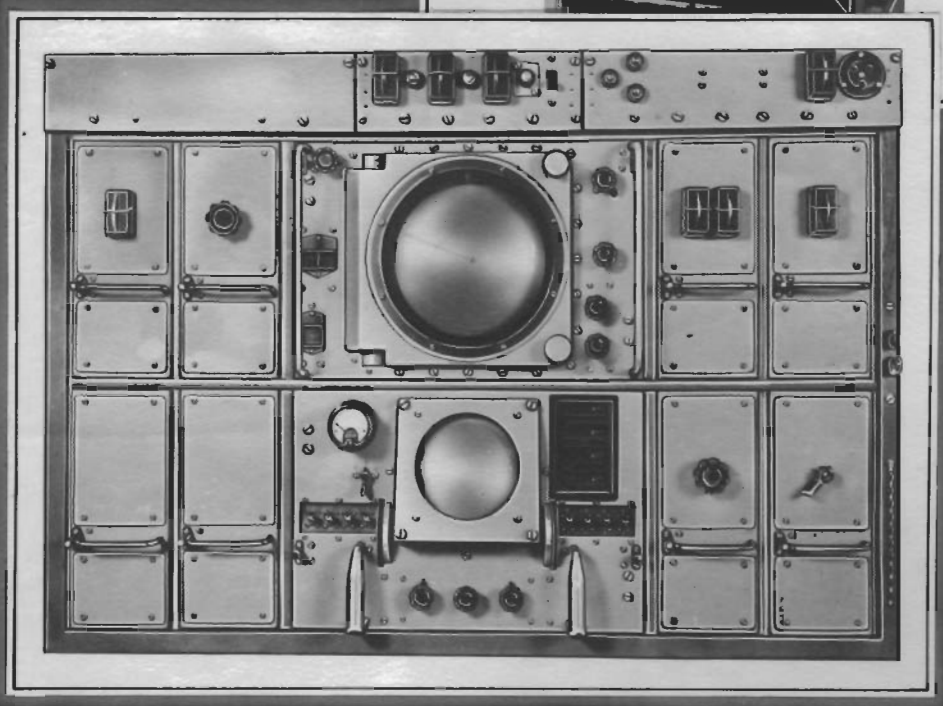
SKIATRON

AUTO RADAR PLOT

DISPLAYS



SECTOR DISPLAY



U.D.U.

THE PSYCHOLOGY OF GOOD HEIGHTFINDING

It is noticeable that some ships have developed a reputation for reliable height-finding. This may partly be due to the technical knowledge and keeness of individual officers, but experience at sea and at Fighter Direction Centre, Yeovilton, has revealed that the mental attitude of user officers and ratings towards the difficult, but not insoluble problem of heights is also of importance.

MENTAL ATTITUDES LEADING TO SUCCESSFUL HEIGHT-FINDING.

The three dimensional nature of the aircraft direction problem should be fully and completely appreciated. This cannot be sufficiently stressed, the best men do not express their attitude in words as above - it has become an unconscious habit of mind through long training and experience.

Further, an aircraft target should be appreciated as a rapidly moving object in three dimensional space. The speed of the aircraft under the control of the Fighter Direction Officer emphasizes the importance of rapidly observed and accurate height measurements.

The above must be firmly realised and become a habit of mind with every man connected with air direction. This together with the pilots of the aircraft themselves and all the senior officers of the ship.

If absolute necessity of good heights is squarely faced, then the problem of height-finding is a long way towards as successful a solution as can be managed with the gear we have to hand at the moment.

The underlined words above are important. It is no use sighing for the hearsay results of some laboratory set or waiting for the improvements promised in the near future. The war has reached a stage when it is more than ever necessary to stretch our present apparatus to the very limit of itspowers and finish the job quickly.

Finally, a W.A. set and its associated A.D.R. must be considered among its other duties as being an aggressive weapon by means of which our power to attack may be extended. Our defence is the better by the increased length of our striking arm.

PRACTICAL METHODS OF INCULCATING THE RIGHT ATTITUDE TOWARD HEIGHT-FINDING.

These methods are the result of experience at sea and in training establishments ashore.

W.A. Radar Display Teller.

Whether he is situated near the only W.A. set borne or whether he is lucky enough to be at a remote display in an H.F.P., the operator should be aware and continually reminded that he is the essential human link from whose accurate and rapid reports of height estimations are made.

He should thoroughly know the polar diagram of his own set. This should be readily available on the bulkhead or close at hand. It should be large, clear, and attractively coloured. His knowledge of the diagram will result in more intelligent telling, especially during calibration runs. He will warn the user officer of an impending fade and thus help in the economic use of the available Radar cover.

He should always see that all observed heights are entered in the W.A. Radar Log Book and should be informed of all accurate heights obtained by R/T communication from aircraft, or any other reliable source, such as Type 277 and the H.A.C.P. at close range, so that he may be keen to get the best results from his own set.

The psychological effect it has on the operator is to impress him with the equivalent importance of the three co-ordinates - range, bearing and height.

The Radar Officer.

He has responsibilities in connection with gunnery, navigation, meteorology and aircraft direction, as well as the operation and technical maintenance of the sets.

From varying angles all these activites may help him to appreciate and surmount the difficulties of height-finding by Radar. This line of thought could be continued much further beyond the scope of the present paper, but he and the F.D.O. should co-operate daily in the correction of the V.C.D. for their W.A. Their responsibilities in this problem are complementary and their technical and empirical knowledge have combined to solve the problem in some ships.

Pilots.

These officers are naturally keen to be controlled by an efficient team using good apparatus. They are more helpful in the daily calibration of the set if they are put in the picture concerning the importance of height estimation.

Gunnery Officer.

If full blind fire procedure is to be carried out on a target, indication in height, range and bearing is necessary and the Gunnery Officer can by his interest in the A.D.R. via the T.I.O. help in the building of height consciousness.

Also he may provide height of visual targets, from the H.A. Fire Control Tables for comparison with those obtained by Air Warning Sets.

If all the above personnel are height conscious and know the methods and difficulties of height-finding by W.A. sets, then the conditions are present for the best possible results.

(Editor's Note:

The above are extracts from a paper written by Lt.P.J. Pearce and submitted by H.M.S. COLLINGWOOD).

THE CARE AND USE OF CRYSTAL VALVES

(Concluded from Page 61 of A.S.E. Bulletin, March, 1945).

SAFETY OF TESTING METHODS.

When the article published in the March Bulletin was written, it was though that neither the Avometer Patt. 47A nor the Measuring Unit Patt. W3417 could safely be used for testing the backwards/forwards resistance ratio of crystal valves. As many recent cases of poor performance of microwave sets have been traced to damaged crystals, it was though advisable to warn Radar Officers immediately to that effect. Fortunately, however, subsequent experiments have shown that the performance of crystal valves is not affected by passage of current up to 7 milliamps D.C., so that they can therefore safely be tested by the methods described below.

TESTING BY AVOMETER ADMIRALTY PATT. 47A.

The forward and backward resistances may be measured by Avometer Patt. 47A set to the 10,000 ohm range, on which the short circuit current is 7 milliamps. (Testing on the 1000 ohm range is certain to destroy the crystal).

TESTING BY MEASURING UNIT ADMIRALTY PATT. W3417.

It is unwise to test crystals by the measuring unit Patt. W3417 unmodified; firstly, because the short circuit current of this instrument is 10 milliamps, which is about the danger limit for some crystals; and secondly, because the results obtained will not tally with those that would be given by the Avometer Patt. 47A.

However, since the measuring unit is fitted with a convenient crystal holder and reversing switch, holders of this instrument may like to modify it for use instead of the Avometer. For this purpose the shunting resistance (R3) across the meter should be increased from 8 ohms to 12 ohms, and the unshunted 100 ohm resistor (R5) increased to 150 ohms. The instrument thus modified corresponds exactly with the Avo Patt. 47A on its 10,000 ohm range, and may be safely and conveniently used for testing crystal valves.

REJECTION LIMITS.

It is considered that crystal valves measured on Avometer Patt. 47A or on measuring unit Patt. W3417 modified as described above should be rejected if either

Forward resistance is greater than 220 ohms.

or Backward resistance is less than 2000 ohms.

SIGNIFICANCE OF RESISTANCE TESTS.

It is re-emphasized that there is not complete correlation between the results of D.C. resistance measurements and the performance of the crystal at microwave frequencies. The resistance measurement serves as an indication of crystal stability only, and would not suffice as a factory acceptance test. Experience has shown, however, that a drop in back D.C. resistance to 2000 ohms is usually accompanied by a deterioration of 1 to 2 db. in the noise factor performance of the crystal (assuming that the initial backward resistance was greater than 4000 ohms).

Since an adequate check on the microwave performance of the crystal is made in the factory before despatch, the resistance test does afford a useful means of detecting deterioration in service.

It is suggested that the forward and backward resistances of a crystal should be measured and noted when it is first put into service; any subsequent deterioration in performance can then be detected by the accompanying increase in forward and/or decrease in backward resistance.

DON'T FORGET THE PRECAUTIONS IN HANDLING CRYSTAL VALVES -

SEE PREVIOUS ARTICLE !

(Also see notes on protection of crystals in the article on Type 275 on Page 18 of this issue).

A CATALOGUE OF RADAR TEST EQUIPMENT

AND KEY IDENTIFICATION INDEX OF ADMIRALTY PATTERN REPLACEMENTS FOR U.S. NAVY RADIO EQUIPMENT.

A comprehensive catalogue of Radar Test Equipment, now in Naval Service or projected, for general distribution during August, 1945, will consist of three volumes containing brief data and a photograph of each piece of equipment.

To assist in the replacement of spares for U.S. Naval Radio Equipment in H.M. Fleet, a cross index of U.S. Naval Components with Admiralty Pattern substitutes is being prepared in A.S.E. and will be known as the Key Identification Index. The first volume containing Condensers, H/F Cables, and Batteries will be issued in August, 1945, other volumes for Resistances, Potentiometers, Switches and Meters will follow as the information becomes available.

GUNNERY NOTES

TYPES 282/3/4/5.

Aerial Insulation.

Apart from designing a new array for Type 285, A.S.E. is very concerned with improving the maintenance of all the existing aerials. While still backing steel and dermatine washers, we are now putting our money on another horse from the other side of the Atlantic - Dow Corning Ignition Sealing Compound No. 4. (Either light or heavy grade). This American product is, unfortunately, not available for export at present but, if any ship or base can lay hands on an 8 oz. tube or an 85 lb. drum from a friendly U.S. Naval Store, here is the way to use it :-

(i) Unpack and clean-out all Lead Wool Packed Glands.

(ii) Smear the end of the cable and the banana plug with a liberal quantity of the compound. Smear a further quantity of the compound inside all arms of the Junction Box.

(iii) Then re-pack the gland in accordance with A.F.O. 4590/43 and A.F.O. 1553/44, omitting the use of vaseline.

(iv) Finally smear more of the compound around the mouth of the gland sleeves. Do not use any other material such as Henleys or Bostic Compounds.

(v) Tighten the gland sleeves periodically until they will tighten no further.

The Dow Corning No. 4 Compound does not melt at high temperature nor freeze at low temperature, and therefore will not run away from the point of application. If, however, it is accidentally wiped off a further quantity should be smeared over the place. About 1 lb. of compound per Type 285 array would be required.

Failing this, H.M.S. UNICORN provides the best answer to the problem to date in the following suggestion taken from her recent Radar Routine Report :-

"The modifications of packing these glands (A.F.O. 1553/44) have not proved satisfactory without the waterproof covering of Henley's Compound, insulation tape and Bostic. It is found that heavy downpours of rain penetrate on to the top of the elastic dermatine washer. This slightly perishes, after a time in the tropics, thus allowing moisture to percolate through, and resulting in reduced insulation, despite regular tightening of the gland nut. With the waterproof covering, the insulation of the whole aerial-run remains at 100 Megohms over long periods. A thin coat of "Torpedo Blue" over the Bostic, still longer preserves the high insulation."

The suggestion put forward by many for redesigning the Line Unit and Junction Boxes so that all the glands point vertically downwards is not liked for two reasons :-

(a) Several reports have been received of the one gland in the Line Unit which is made this way already being as bad as the three pointing upwards.

(b) It would take longer to design and produce than the new moulded array and also only applies substantially to Type 285.

Let us have your suggestions on this thorny problem.

Interference with Type 284/5.

H.M.S. BELFAST, during the Scharnhorst action, H.M.S. RODNEY, during a practice shoot, and others, have reported isolated cases of interference by own radio transmissions on Types 284/5. The common feature of all reports is the impossibility of all ships to reproduce this jamming afterwards.

After careful investigation in ships and experimentally, no positive conclusions could be arrived at. The only loophole through which interference of frequencies of the order of 5 Mc/s might affect 50 cm. sets is thought to be the screening of the main aerial feeder cable.

When carrying out routine maintenance on Types 284/5 aerials, ships should watch for indications of bad contact in the feeder input glands of Line Units and in the terminating sockets in offices.

H.M.S. DEVONSHIRE'S TEACHER.

(For Types 282/3/4/5).

The teacher gives a realistic echo which can be superimposed on a normal operational scan with ground wave and echoes. This echo can be varied in size, range, rate (opening or closing), and can be made to pulsate as an aircraft echo does. The real echoes can be varied in size from zero to normal so that the training of the operator can proceed in easy stages. Beam switching can also be used and the false echo identified as in normal practice.

The following apparatus is required :-

(a) For Type 282 and Type 283 - an office containing two of these sets.

(b) For Type 285 P(4) - an L22, which is operated from the Type 285.

(c) One spare M53 or M68. On the replacement of M53's by M68's ships were allowed to keep at least one spare M53.

(d) Three leads with breeze plugs, two breeze sockets, one normal three pronged A.C. plug and lead.

SETTING UP INSTRUCTIONS FOR TRAINING ON A TYPE 282 OR TYPE 283.

Let the set that produces the training echo be called set A and the set the training is to take place on be called B. Set B is switched on and operated in the normal way, producing ground wave and echoes. Set A - the Board Distributing, top panel of L22, and the rate motor only are switched on. A sync (local or remote) is taken from set B, and fed into sync local, Board Distributing set A. A lead is connected to the index socket of L22 (on drawer of top section) set A, and thence to the breeze plug secured at the rear of the panel. A lead from the plug is then taken to the input socket of the spare M53 or M68. The output from this is fed to the picture (LOCAL) of set B. This results in an echo being super-imposed on the trace. The size of this echo can be varied by the gain control on the spare M53 or M68. Its rate (opening or closing) can be varied by an alteration of the constant speed motor on set A by normal control wheels. Power supply for the spare M53 can be taken from the socket on the Board Distributing. The echoes produced by set B can be varied in size without affecting the size of the training echo.

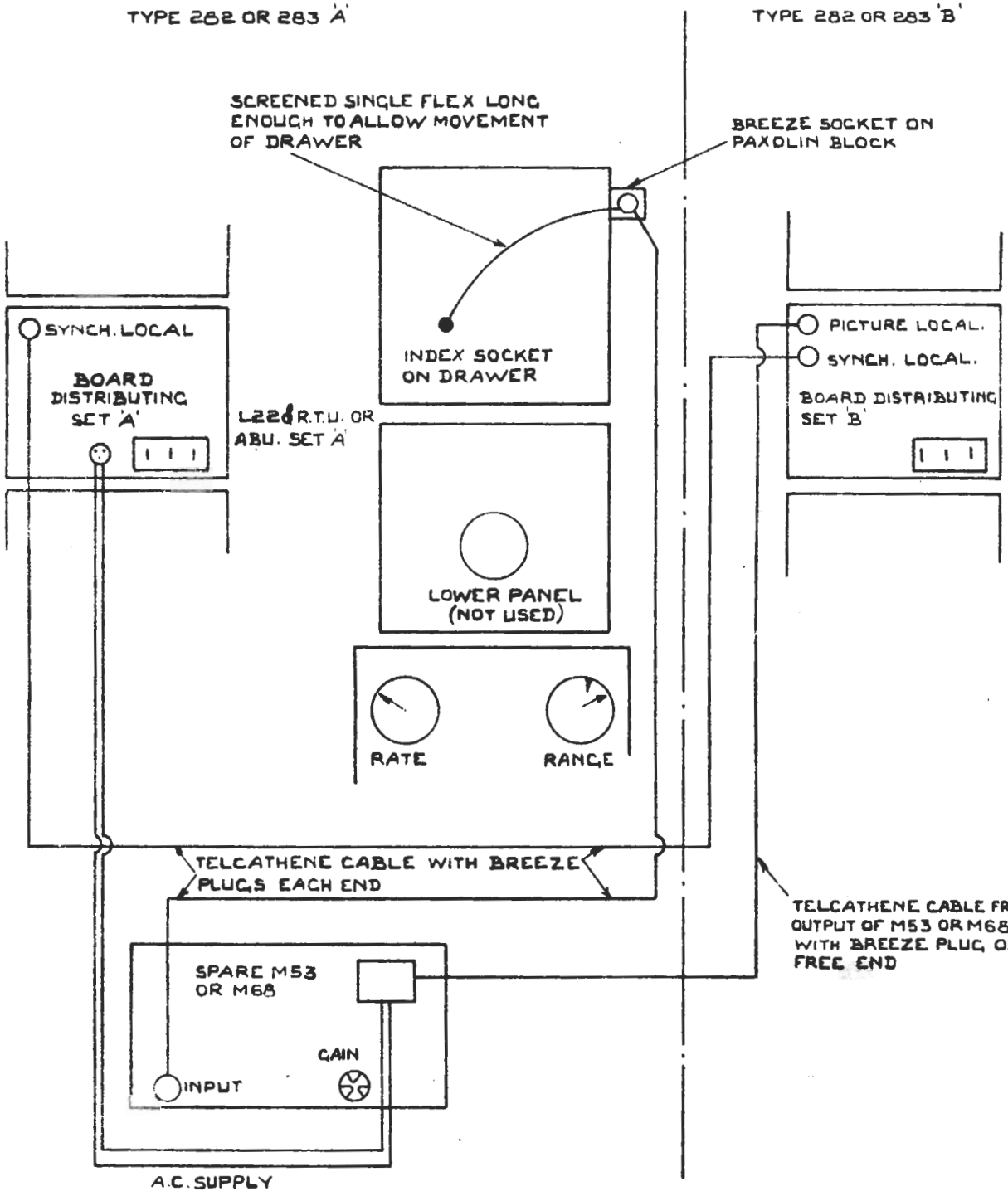
SETTING UP INSTRUCTIONS FOR TRAINING ON THE PANEL L24 OF TYPE 285 P(4).

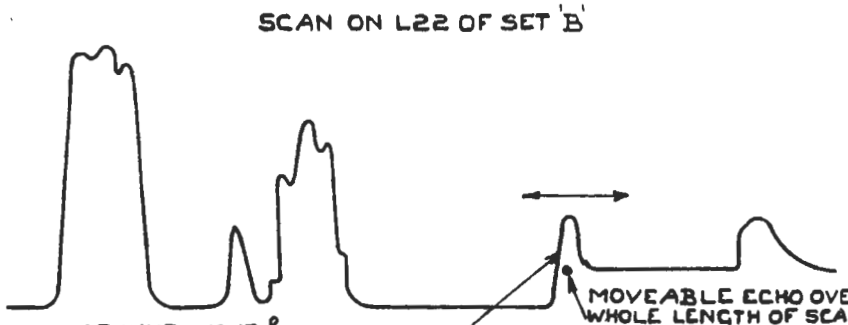
The top panel of the L22 is switched on and a lead taken from the index socket to a breeze socket secured at the rear of the panel. A lead from this socket is taken to the input socket of the spare M53 or M68. From the output of this panel a lead is run to a breeze socket secured to the side of the L24. This socket is joined in parallel with the picture input (14). Variation of gain control will vary the size of the echo, and the alteration of the constant speed motor will change the rate of the echo. The echoes produced by the Type 285 can be varied in size by the Type 285 gain control.

The diagrams on Pages 12 and 13 explain the connections more fully.

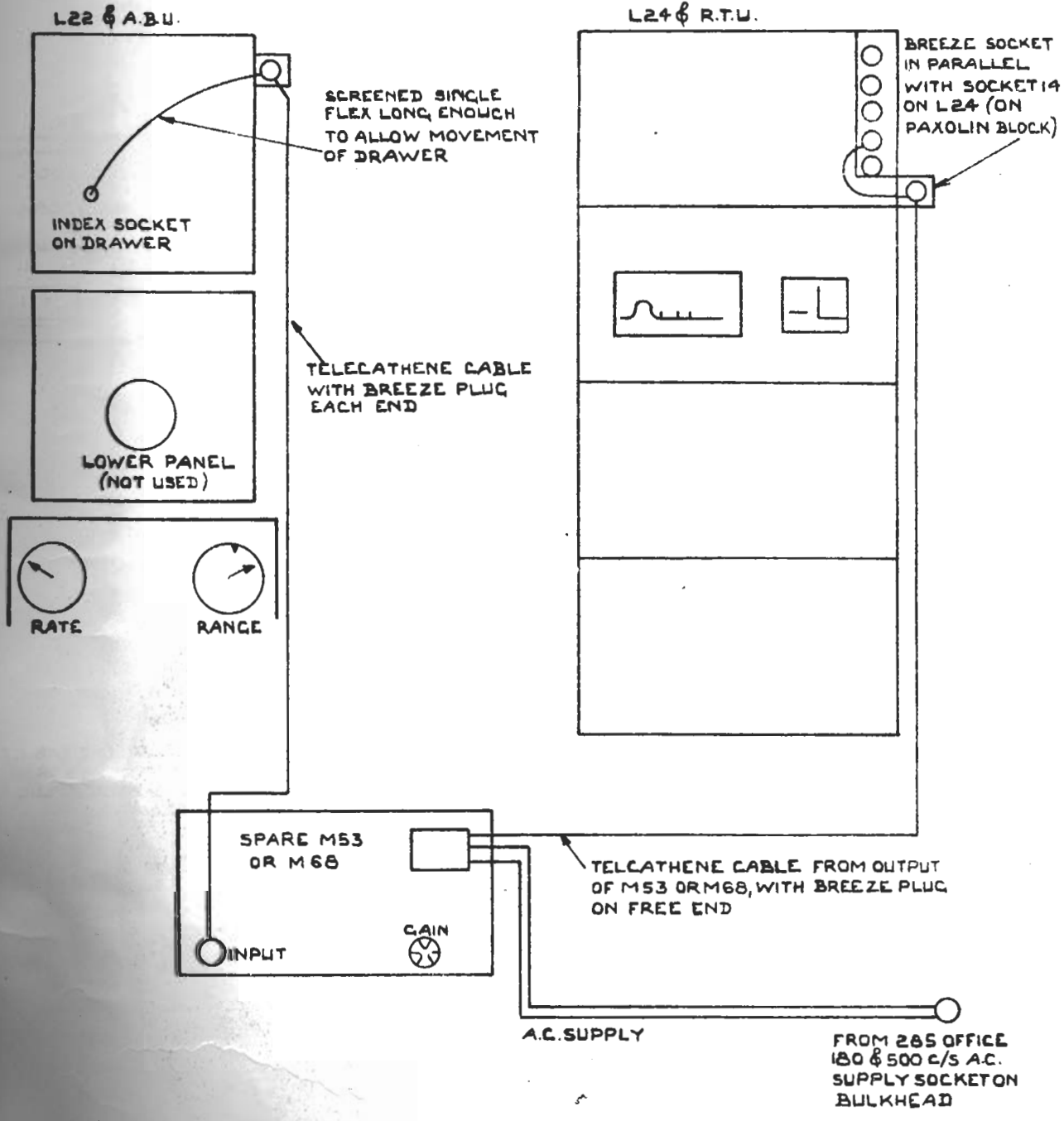
It is considered that this teacher is superior to either H.R.A. or H.R.B. in that normal echoes can be used on the trace. It is also much simpler and easier to set up and operate.

BLOCK DIAGRAM OF TEACHER FOR TYPE 282 OR 283



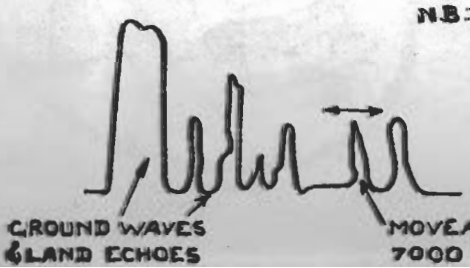


BLOCK DIAGRAM OF TEACHER FOR L24 WITH TYPE 285P (4)



L24 L.R. SCAN

N.B:- ECHO MOVES OVER 7000 YDS ONLY, DUE TO LIMIT OF RANGE ON A.B.U.



A.S.E. COMMENT.

This teacher is almost identical in principle with the KENT teacher with the addition of a separate I/F amplifier.

Modifications to teacher outfit HRB are being undertaken to enable the Radar echoes and the teacher echoes to be displayed simultaneously. Teacher outfit HRB already includes the alternatives of fast or slow fading (flutter) of the echo.

JAP JAMMING

Extract from an American report on Japanese Radar Jamming :-

"A GOOD COUNTERMEASURE IS A COOL AND CAPABLE OPERATOR".