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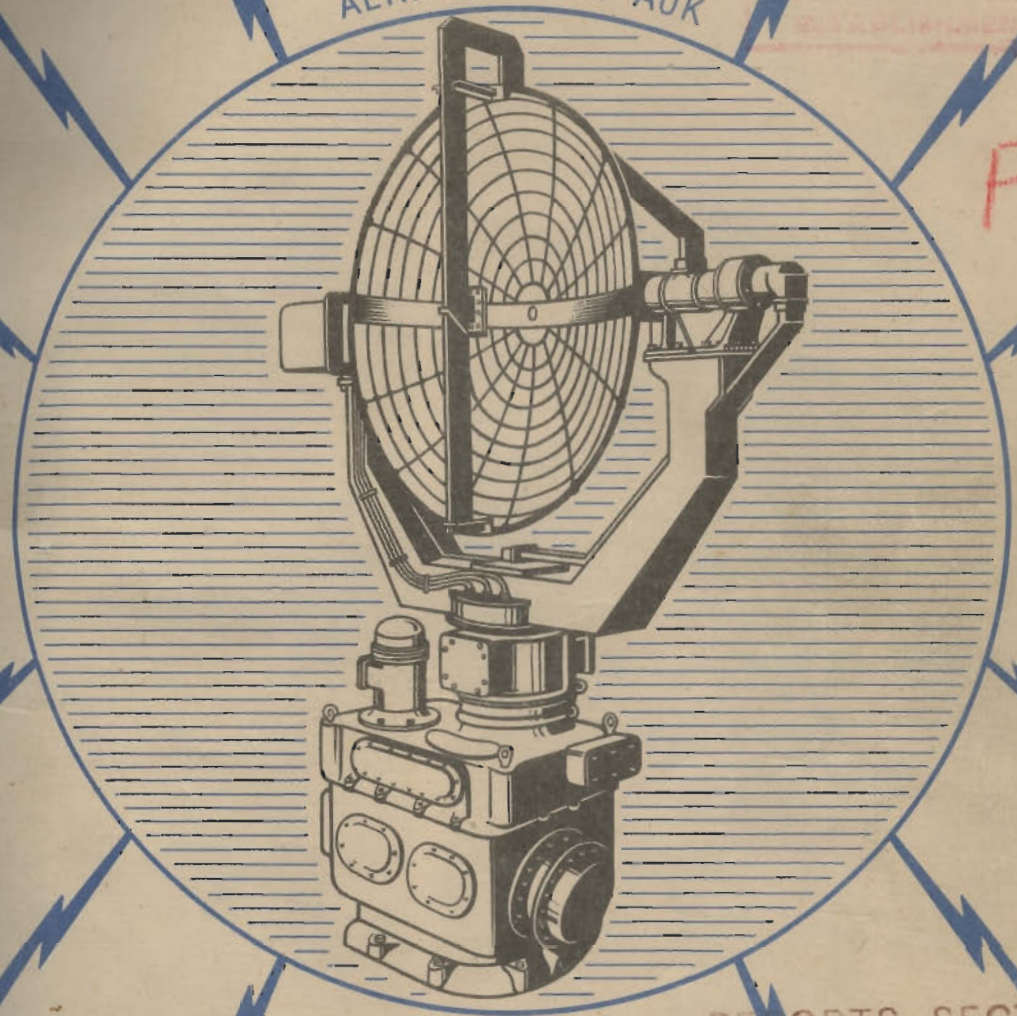
BULLETIN



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ADMIRALTY SIGNAL ESTABLISHMENT

R.H.600(1) MARCH, 1944

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Admiralty Signal Establishment.

March 31st, 1944.

The attached is the first edition of a quarterly A.S.E. Radio Bulletin which is primarily intended for the W/T and Radar officers under your command.

While the objects of the Bulletin are explained in the Editorial I would add a personal word to its readers.

"We, like yourselves, are concerned with the prevention and cure of Radio ailments. As such we are like the staff of a large Radio Hospital. Like a Hospital the Bulletin is dependent on voluntary contributions - so please be generous with your donations ! The £.s.d. that we need is in the form of Lessons, Suggestions and Data."

H.B. Brooker

To
All Commanders-in-Chief,
Flag Officers afloat,
Captains and Commanding Officers of
Battleships, Battlecruisers, Aircraft
Carriers, Cruisers, Flotilla Leaders
and Escort group leaders,
Flag and Naval Officers in charge
of radio fitting out or maintenance bases,
Directors, Captains and Superintendents of
Signal and Radar Training and Equipment
Establishments, and Officers Commanding
Naval Air and Shore W/T stations concerned.

ADMIRALTY SIGNAL ESTABLISHMENT,

MARCH, 1944.

THE MATERIAL IN THIS BULLETIN IS FOR INFORMATION, GUIDANCE AND INTEREST ONLY. IT DOES NOT NECESSARILY REPRESENT ADMIRALTY OPINION OR POLICY AND IN NO CIRCUMSTANCES MUST IT BE REGARDED AS SUCH. IT MUST NOT BE QUOTED AS AUTHORITY FOR SUPPLY OR MODIFICATION.

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TO BE DESTROYED WHEN SUFFICIENTLY PROMULGATED - CERTIFICATES OF DESTRUCTION BEING FORWARDED TO A.S.E.

EDITORIAL

In presenting this, the first issue, it would be appropriate for us to define the aims and objects of the A.S.E. Bulletin.

There is at present no means by which Officers afloat are kept informed of the activities of A.S.E., and in particular of new lines of development nearing completion, which they will shortly be called upon to use.

The only publication at present issued, the Monthly Report, has a very limited distribution, and is written primarily for the information of other experimental establishments; it is therefore of an extremely technical nature.

Our object in this bulletin is to present this information for your benefit, in a semi-official document with a wide circulation. Its contents must therefore obviously be restricted by security requirements, to matters of no higher grading than Confidential.

We also intend that the bulletin shall form a medium by which suggestions for the use and improvement of existing equipment can be circulated.

We like to know that the "customer is satisfied", that he is able to make the best use of the gear we have provided, and, equally important, we like to know if and where we have gone wrong.

We go wrong often. None the less, we are very concerned to hear of our mistakes. Naturally, we are likely to hear of our big mistakes very soon, but the small, seemingly unimportant things, which "user experience" brings to light are also important. The position of a switch, a fuse that cannot easily be replaced, an operator's cramped fingers. These things may decide the result of a battle.

It is with this in mind then, that we invite all concerned to join us in our endeavours to make this journal a success. Its pages are open to suggestions for the improvement of existing gear, or its operational and tactical use. We shall welcome "bright ideas". Tell us of the "snags" you encounter, and the way you overcame them, so that we can pass on the information for the benefit of the other chap and the common cause. Above all, let us know if we are not ringing the bell and what you want to see in the Bulletin.

As the above remarks indicate, we hope that all those who have an active interest in the equipment we provide will come also to have an active interest in the Bulletin, and that they will in fact eventually regard it, in some part, as their Bulletin, rather than A.S.E's private and exclusive property.

It should, perhaps, be first explained that the mystic symbol R.I.S. is an abbreviation of "RADIO INTERFERENCE SUPPRESSION".

The problem of radar/radio interference is one that has received the considerable attention of R.S.E., but it is one to which the answer is by no means easy to find. The major effort in the design of the various forms of R.I.S. which have so far been produced - or at present under development - has been towards "chopping" out the interference to V/T reception caused by radar transmissions. The following is a resume of the subject which indicates the difficulties encountered, the principles involved, and the work done or projected.

R.I.S.(1) - R/F MUTING.

The principle adopted in R.I.S.(1) is to feed a "pulse potential" from the offending radar equipment to the suppressor grid of the first valve of the V/T receiver, thus muting it momentarily. This muting is synchronised with the radar transmission which, consequently, is not heard in the headphones.

While this method is quite successful for removing radar interference from V/T reception, the length of time for which the receiver is muted is such that speech is mutilated and rendered unintelligible. It is therefore, unsuitable for use with R/T.

The muting period in R.I.S.(1) has to be made considerably longer than is strictly necessary to cover the short radar pulse, to allow for a comparatively slow build up and delay in the muting pulse which is necessary to prevent shock excitation of the R/T circuits in the receiver. Incidentally, this long muting pulse gives protection against jitter and makes the phasing adjustment non-critical.

R.I.S.(3) - A/F MUTING.

To avoid the necessity of modifying receivers and also to cover the case of interference entering other than through the aerial system, R.I.S.(3), employing a rather different technique, was produced. This suppresses the receiver output.

As - due to the "persistence" of the circuit - an interfering pulse, on its passage through the receiver, is lengthened very considerably (in some cases to as much as a thousand times), the length of the muting period has to be correspondingly long. On the other hand, the most that can be chopped out of speech without mutilation is about 10%, and the use of output muting is limited to interference of a repetition frequency not exceeding 50 cycles per second.

R.I.S.(3) provides suppression in two ways; firstly by pulse suppression of the V/T or R/T receiver output, and secondly by means of a noise suppression bridge (noise peak limiter) fitted between the receiver and the headphones. However, R.I.S.(3) has two disadvantages, it is critical to operate and for technical reasons associated with the noise suppression bridge, it is unsuitable for use where L/S reception is required.

To overcome the disadvantages of R.I.S.(3) and to incorporate latest technical developments, a new approach to the problem is being made - in R.I.S.(4). This is at present in the laboratory stage and will not come into production before the latter part of 1944. Basically R.I.S.(4) uses an output switching arrangement and incorporates an amplifier suitable for giving L/S output.

R.I.S.(5) FOR HIGH P.R.F.

The above forms of R.I.S. are designed for use only with WA and WR radar sets having a P.R.F. of 50 cycles per second, these being the main cause of interference in large ships.

The introduction of radar Type 291 has given rise to a new problem and to meet this, R.I.S.(5) now coming into production, has been developed. This incorporates R/F muting and a very short pulse is used (50 microsecs) to avoid mutilation of R/T.

Although Type 291 causes most interference in the combined radar and W/T offices of S/M's and coastal craft, trouble is also experienced with the V.H/F equipment of destroyers and with the normal communications receivers of trawlers.

It is interesting to note, at this juncture, that interference to communications is not normally caused by the radar set's legitimate radiation on its alloted frequency, but rather by the radiation of spurious frequencies in the communications band, which may be from Aerials, Panels or Wiring.

R.I.S. in any form can only be considered as a palliative which has had to be adopted because, in the past, radar sets were developed without sufficient appreciation of the interference problem which only became acute after the sets had been designed and fitted.

At the time of writing most promising results are being obtained on Type 291 by the use of filters and screening boxes. Work is being pressed ahead on the production of a small number of experimental outfits of this type of equipment, and trials are being arranged in selection of vessels fitted with radar Type 291. If these prove successful, R.I.S.(5) will become redundant and will be superseded by equipment consisting of

(a) A screening and mains filter box for the Type 291 transmitter,
(b) An aerial filter which passes only the Type 291 functional frequencies, and
(c) A radio receiving aerial filter tuned to pass only the normal communication frequencies.

This latter filter is being designed to prevent the radar frequencies from reaching the radio receiver and so causing interference by shock excitation of its tuned circuits.

The great advantage of this method is that operating adjustments to the suppression equipment are unnecessary, thus, when it is once fitted, it remains effective without controls and without power supplies. Fitting too, is likely to prove simpler than the fitting of full R.I.S.(5).

The problem of developing suitable filters which will not cause some attenuation to the legitimate radar transmissions has proved to be somewhat difficult, and a considerable amount of work has been necessary to get the present experimental equipment out of the laboratory stage and into its present position. The knowledge and experience gained, however, will be of considerable value in the development of similar equipment for other types of radar, providing that the ship trials referred to above prove satisfactory.

It should be noted that sets incorporating waveguide feed to the aerial are most unlikely to radiate spurious frequencies from the aerial system, as the waveguide is, of itself, a very efficient high pass filter. Nevertheless, good screening and filtering of leads will be required to prevent radiation otherwise than via the aerial.

INTERFERENCE TO RADAR BY COMMUNICATIONS.

No reference has been made in the above summary to interference that can be caused to Radar by communications. Fortunately this is of very much rarer occurrence; but a striking case occurred during the action with the battle cruiser SCHARNHORST, when a Radar Panel L.12 in one of H.M. Cruisers was badly interfered with by the R/T convoy wave. This type of interference is caused when the fundamental or a harmonic frequency of a communications transmitter falls inside the acceptance band of the radar receiver. Owing to the wide bandwidth required by radar and the close spacing of the higher harmonics of many of the communication frequencies it may not be possible to clear this interference by shifting the communication or Radar frequency, and in any case, this will usually be operationally impossible. An attempt is therefore being made to reduce the harmonic radiation of communication transmitters to the very low level necessary to prevent interference.

A second cause of interference is due to the break through of the Fundamental communication frequency to the mixer in the Radar receiver, whence interference is introduced into the I/F amplifier. Such interference can be eliminated by filters in the Radar receiver aerial input.

NAVAL WIRELESS TRANSMITTERS

Naval H/F and M/F transmitters can be divided into four categories:-

(i) Self Excited, e.g. Types 36, 49 and 50.

(ii) Master Oscillator Control, e.g. Type 57 (before modification to incorporate partial crystal control) Type 59 and most U.S. transmitters, e.g. TAJ, TBL.

(iii) Crystal Control, e.g. Type 89.

(iv) Partial Crystal Control, e.g. Type 57 (after modification to incorporate P.C.C.).

SELF EXCITED TRANSMITTERS.

The principle disadvantage of Self Excited Transmitters is lack of frequency stability. They are now considered obsolete and have been replaced by master control transmitters, Type 57 and U.S. transmitters TAJ, TBM and TBL.

MASTER OSCILLATOR CONTROLLED TRANSMITTERS.

In order to achieve the degree of frequency stability required of H/F Naval transmitters, particularly if these transmitters are to be used for control of aircraft fitted with Crystal Controlled Receivers, very careful design of the master circuit is necessary. This was not achieved with Type 57 and in order to obtain the necessary degree of stability, all Type 57's are being modified to incorporate the principle of P.C.C. The U.S. Navy has achieved a high degree of stability in its modern naval transmitters by careful design and temperature control of the master circuit. In certain cases a crystal oscillator has been incorporated to provide check points throughout the frequency range.

The advantage of Master Oscillator Control over Crystal Control is that tuning of the transmitter is continuous over the whole frequency range. To overcome the disadvantage of Fixed Crystal Controlled frequencies, certa crystal controlled sets, e.g. Types 89 and 65, have been modified by the addition of a Master Oscillator Unit. This allows the transmitter to be tu continuously over the whole range but the frequency stability of such trans mitters when using Master Oscillator Control must of necessity be of a low order.

CRYSTAL CONTROLLED TRANSMITTERS.

A very high degree of stability is obtained with Crystal Controlled Transmitters without the necessity of frequency stabilising devices such as temperature controlled circuits. Crystal control on spot frequencies is of particular value in ship to air communication and with inter-communication frequencies such as a Convoy R/T Wave where loud speaker watch may be maintained for long periods without the possibility of checking the frequency. Types 60, T/12 and TV5 have all been modified to incorporate crystal control but these 3 sets suffer from the disadvantage that they were not originally designed for crystal control and their operation by this method is not entirely satisfactory. Type 60 is to be superseded shortly by a 50 watt transmitter, the design of which is based on the principle of Partial Crystal Control. The T/12 will be superseded by a set known as Type 607 which will be provided with both Crystal and Master Oscillator Control. The TV5 has been superseded by CNY1 which is provided with Crystal and Master Oscillator control and by the American HT11 which is Crystal Controlled. The principal disadvantage of the crystal controlled transmitter is that a crystal is required for each frequency on which the transmitter has to operate.

PARTIAL CRYSTAL CONTROL.

In this system a fundamental or a harmonic of a crystal is mixed with a frequency produced by a Variable Frequency Oscillator to provide the resultant working frequency. The greater part of the resultant frequency is controlled by the crystal and only a small portion by the V.F.O. By the introduction of temperature compensating devices in the crystal and V.F.O. circuits, an overall frequency stability comparable to that achieved by crystal controlled transmitters is obtained with the advantages of continuous tuning over the whole frequency range and the avoidance of specially designed components and temperature controlled Ovens, both of which are necessary to achieve a similar stability in master controlled transmitters.

The principal disadvantage of the P.C.C. system is that in order to suppress unwanted frequencies, a unit of somewhat complicated design is necessary.

FUTURE DEVELOPMENT.

A new series of transmitters, based on the P.C.C. system, is at present under development and will reach the Fleet towards the end of 1944. This series consists of a 50 watt transmitter with or without M/F which will, in general, supersede Type 60, and a 400 watt transmitter, either with or without M/F which will supersede Type 49, TBL, T/J/TBI and Type 89 respectively. Further information concerning this series of transmitters will be contained in the next issue of this publication.

Production of these G.S. sets has just commenced. Where fitting space is available they will replace Type 284 in existing ships and will also be fitted in new construction cruisers and above.

The aerials which will be mounted on D.C.T's are of two types:-

(a) Stabilised (AUM)

(b) Unstabilised (AUO)

The transmitter will be mounted in the D.C.T.

The receiver (L.30), Modulator and Rectifier (3M) Ranging and Spotting Panel (L31), Bearing Panel (L32) and power boards, will, when space is available, be fitted in the T.S. When space is not available the L31 and L32 will be in the T.S. and the L30, 3M and power boards, in a separate office which, in retrospective fitting, will probably be the old 284 office.

Switching arrangements are in hand to enable the after Type 275, after Type 284, Type 277, and after 274 where fitted, to be shown on the Type 274 display by means of change over switches.

"WHAT SET IS IT ?

Of those unfortunates whose lot it is to digest and apply the numerous Fleet Orders dealing with gunnery sets, few can have realised that the lusty infant (Type 285) which first appeared in H.M.S. SOUTHDOWN just over three years ago was to set about multiplying itself with such vigour; the family tree, as it stands to-day, is indeed a striking picture, which, when displayed on the heading of a Fleet Order as the now familiar series of numbers and figures, is calculated to depress and bewilder the reader.

THE G.C. SET.

The chief cause of the trouble is the 282, which as might be expected of a younger brother has led a somewhat unsettled existence; a brief summary of its career may help to clear misconceptions and dispel any doubts which may exist.

Originally designed as a GC set for Pom-pom directors, the 282 developed normally through the M(1), M(2), M(3) and M(4) conversions, working with the L.12 and R.T.U. III or III*. With the arrival of the new ranging panel, L.22 and R.T.U.IX, the logical sequence faltered and for a short time the 282M(4) referred both to a set fitted with L.12 or with L.22. To clear the situation the L.22 version of M(4) was altered to P(1), although this was somewhat unfortunate as, for the first time in the family tree, an odd number represented a 3AH panel and not a 3HD. Subsequently, it was decided to fit the M(3)'s with L.22's as well, so they had to become 282P's. The 282M(3), therefore, became 282P and 282M(4) became 282P(1); all four types were, and still are, fitted to Pom-pom directors, and it is unlikely that the 282 fitted on Pom-pom directors will develop any further than the P and P(1).

The advent of the Bofors Mk.IV twin 40 mm. mounting provided another commitment for the 282, and for material reasons it was decided that the first 50 mountings of the programme should be fitted with L.12's, which is the reason why all Bofors mountings at present at sea have 282M(4)'s. These sets will therefore be found associated with either Pom-pom directors or Bofors.

The next 164 Bofors will, however, have the L.22 and will, in effect, have the equivalent of 282P(1), although it is called 282P(2). These sets are being fitted now.

The 282P(3) is another version of 282P(1) modified to fit the experimental S.T.A.G. (Stabilised Tachymetric Anti-Aircraft Gun) of which only about four models will ever see the light of day. They are destined for sea, however, and so have to be included in the family tree.

282Q was included in the tree for some time and was a 282P(1) modified to suit a Close Range Predictor. The requirement for the C.R.P. has now lapsed, however, and 282Q should be expunged from the memory.

Further modifications of any importance to 282 are unlikely, so that the final fitting position can be summarised as follows:-

Pom-pom director - 282P or 282P(1)
Bofors Mk.IV (1st 50) - 282M(4)
Bofors Mk.IV (Last 164) - 282P(2).

G.B. SETS FOR BARRAGE DIRECTORS.

Although no longer being fitted in Capital Ships (those which have them keep them), the 283 in some of the cruisers fitted with barrage directors will, in the course of 1944, take on a new lease of life and develop into a 283M. The change is called for when the A.B.U. is replaced by a C.P.U. (Continuous Prediction Unit) and when muzzle charging

The radar modification will involve extending the range of the L.22 to 10,500 yards and necessitates changing one resistance in the L.22; the panel then becomes L.45 and the set 283M.

G.A. SET REMOTE CONTROL.

The development of the 285 followed a normal course until the beginning of this year, when 285Q's started being allocated to certain fleet destroyers, which are fitted with 'K' Director Towers capable of being remotely controlled from Elevation and Training Control Units in the T.S.

These director towers will not take 275, the new GA set, so, in order to take full advantage of the R.P.C. Training for the director, the L.24 of the 285P(4) was redesigned to form the top of the "tallboy" formed by the Elevation and Training Control Units and Continuous Prediction Unit Mk. II and renamed L.34.

The L.34 is in fact, an L.24 on its side and the 285P(4) with an L.34 instead of an L.24 is called 285Q.

NEW SETS.

The replacement of the 282/3/4/5 series has already started and will gain in momentum as the months go by. Contrary to what might have been expected, subtraction is needed to arrive at the new type numbers:-

282 will be replaced by 262.
284 " " " " 274
285 " " " " 275

The future of the 283 is not yet clear.

GUNNERY RADAR

Miscellaneous notes on existing Gunnery sets which contain points of interest to Radar Officers and Radio Mechanics will be included in each issue of the Bulletin.

TYPES 282/4/5 "M" AND "P" CONVERSIONS AND 283.

REMOTE BEARING TUBES.

Now that Remote Bearing Tubes associated with any one GA or GS set are becoming so numerous, it is necessary to revise their nomenclature:-

Cathode Ray and Rectifier Unit Design "A". - a watertight C.R. Tube fitted in exposed positions, e.g. H.A. directors, Barrage Directors.

C.R. and R.U. Design "B" - not watertight, fitted in the T.S. with Type 284M(3)/M(4)/P(3)/P(4) only.

C.R. and R.U. Design 4 - not watertight, a Spotting Tube having the same dimensions as the Design "A" C.R. Tube.

Spotting Tubes will become available during the next three months and will be supplied and fitted in accordance with an Admiralty Fleet Order.

In all cases, the Spotting Tube must be fitted within 20 feet of Panel L.24, whether in the T.S. or Radar Office. The Tube receives its picture input from a paralleled line from Panel L.24 and has no connections from a Board Power Supply and Distributing.

C.R. and R.U. Design 5. - modified Design "A". Not watertight to allow of ventilation for use in offices, H.A.C.P. or T.S. with all types 282/4/5. (Note: Design 5 does not replace Design "A" already fitted in Radar Offices and H.A.C.P's).

BOARD POWER SUPPLY AND DISTRIBUTING PATTERN W3654

Type	Remarks	Location of Units. Director or Gun Mounting	Radar Office	H.A.C.P.	T.S.	No. of boards required.
282M(3)/M(4)	Pom-pom directors (M(4) with first 50 Bofors.)	-	L12	-	-	-
282P/1 (1)	Pom-pom Directors (with Joystick control)	-	L22	-	-	1
		-	L22 54478	-	-	1
282 (2)	Bofors (2nd 164)	W3664/A	L22	-	-	1
283	Barrage Director and A.B.U.	W3664/A	L22	-	-	1
283M	Barrage Director and C.P.U.I.	W3664/A	L45	-	-	1
284M(3)/M(4)	No CRT in D.C.T.	-	L12	-	W6671	1
	with CRT in D.C.T.	W3664/A	L12	-	W6671	1
284P(3)/P(4)	Panel L24 in office No C.R.T. in D.C.T.	-	L24	-	W6671	1 ✓
do.	Panel L24 in office C.R.T. in D.C.T.	W3664/A	L24	-	W6671	2 ✓
do.	Panel L24 in T.S. No C.R.T. in D.C.T.	-	W6671 or 54478	-	L24 W6671	2 ✓ ‡
do.	Panel L24 in T.S. C.R.T. in D.C.T.	W3664/A	W6671 or 54478	-	L24 W6671	3 ✓ ‡
285M(3)/M(4)	Destroyers	W3664/A	L12	-	L22	1
do.	Cruisers & above excluding 'Dido' Class	W3664/A	L12	L22	-	1
do.	'Dido' & Mod.'Dido'	W3664/A	L12	L22	54478 ✓	2
285Q	Destroyers & above	-	54478	L34 54478		2 ✓
285P(3)/(4)	Destroyers.					
	L24 in offices	W3664/A	L24	-	L22	1
	L24 in T.S.	W3664/A	54478	-	L24 L22	2
	Cruisers & Above. (Excluding 'Dido' & Mod. 'Dido' Cl.)					
	L24 in office	W3664/A	L24	L22	-	1
	L24 in H.A.C.P.	W3664/A	54478	L22 L24	-	2
	'Dido' & Mod 'Dido' Class.					
	L24 in office	W3664/A	L24	L22	54478 ✓	2
	L24 in H.A.C.P.	W3664/A	54478	L22 L24	54478 ✓	3 ✓

BOARD POWER SUPPLY AND DISTRIBUTING.

The chart on page 10 shows the number of Boards required with each Type 282/3/4/5.

When a second or possible third Board is fitted because of the number of display panels connected to a set, one of the following arrangements can be used:-

(i) The second and/or third board may be fitted in the Radar Office and be fed from the "direct" output from the first board. In this case no modifications are necessary, but the "CALIBRATE" switch on the second board must always be in the normal (upward) position.

(ii) When the cable run can be considerably shortened, the second and/or third board should be fitted remotely in the H.A.C.P. or T.S. if space is available (Specification B.216/43 Drawing 31018E). Any boards so fitted must be fed from the "REMOTE" output of the first board.

NOTES: The "CALIBRATE" switch on the second or third boards must be kept in the normal (upward) position.

The second and/or third board must be modified; the lead connecting C2 to the join of R1 and R2 being taken to the other side of R1 (Ref. C.B.4221 series circuit diagram Z13/11 Folio Z13).

* One Board Power Supply less when the C.R. Tube in the Radar Office is modified for "Local Strobe" to be used instead of "Remote Strobe". This modification entails the removal of Resistance R15 shown on circuit diagram Z15/11 Folio Z15 in any of the relevant Handbooks (C.B.4221 series).

/ When L.12 is retained for spotting purposes, and the L24 is fitted in the office, L24 is to be fed "Remote Picture" instead of "Local Picture".

When L24 is fitted in TS or H.A.C.P. the C.R. Tube in the office is likewise to be fed by "Remote Picture".

ø 'Dido' Class and Modified 'Dido' refers to those ships not fitted with Type 284 beam-switching. A Remote C.R. Tube is fitted in the T.S. fed from forward Type 285.

TESTING RECEIVER PERFORMANCE.

It has been found that a short burst from an Oerlikon gun on the same bearing as the aerials is a good method of testing the efficiency of Receivers P.16, P20 and P.24, fitted with the Gunnery Sets. Rounds should strike the sea at approximately 2,000 yards.

When the set is working with reasonable efficiency, it should be quite easy to follow the flight of the shell and see the splash.