PROJECT "BUBBLY"

A special programme of improvements to existing warning sets was planned in the Autumn of 1944. In order to rush this programme through, without delaying longer term developments it was limited initially to some 15 ships and given the short title of Bubbly. Most of the conversions are within the capacity of ship's staffs assisted when necessary by base staffs in the case of small ships, and very little dockyard work is involved. Nearly all the modifications will therefore be suitable for general retrospective fitting.

The main objectives of the programme are:-

W.A. Sets (Types 281 and 79).

Improved Skiatron display due to higher repetition rate (Type 281).

Increased performance, due to pre-amplifier, Transmitter Blocker, etc. (Type 281).

Improved operational facilities due to re-arrangement of receiver rack (Type 281).

Improved facilities for height estimation.

W.S. and W.C. Sets (Types 277 and 293).

Improved performance in the "average" ship due to simpler setting-up and maintenance procedure.

Increased reliability resulting from fewer pye plugs and front connections.

Improved performance to be achieved by making use of certain new features developed for Types 980/1.

Displays.

P.P.I. Most of the modifications are small but in the aggregate should enhance the operational value of the display.

Skiatron. Improved focus and contrast. Easier setting up.

TYPE 281.

In the September issue we gave a formidable list of modifications to Type 281 and mentioned Type 281BM, and the December issue contained a photograph of Type 281BQ receiving, and display equipment. These panels (Receiver Outfit CFL) convert,

Type 281 to Type 281B; Type 281B to Type 281BQ;
and Type 281BM to Type 281BQ.

Types 281BM and BQ are fitted with the new aerial outfit and control table giving continuous aerial rotation.

100 Cycle Repetition.

To improve the display of Type 281 and Skiatron it has been decided to increase the repetition rate from 50 to 100 when a Skiatron is fitted. This will involve removal of the trigger unit and gas triode and fitting a new hard-valve sub-modulator chassis which can be switched to give a triggering pulse either every cycle or every half cycle. Minor modification to the rectifier panels is also required.

It is intended to make this modification retrospective when conversion parts become available which will not be for some time. Although not a simple conversion it is considered to be within the capabilities of ship's staffs and detailed instructions will be issued with the necessary box of parts.

R.I.S. Filter.

The suppression of communication receivers 100 times per second is not acceptable and new R.I.S. measures are therefore required when Type 281's p.r.r. is increased. For this purpose a filter for harmonic suppression is being developed and will be fitted in the Type 281 feeder system.

Isolating Condensers.

To reduce the mismatch at the slip-rings of Types 281BM/BQ, an inductance to earth has been fitted. This provides a D.C. short circuit of the resistance employed to monitor the grid current pulse, and isolating condensers in the feeders are necessary to enable the transmitter to be set up. The R.I.S. filter incidentally performs this function but until it is fitted a separate condenser unit is required. This is mounted on the insulators above the transmitter and left permanently in circuit.

IMPROVEMENTS TO TYPES 277 AND 293M.

The improvements to Types 277 and 293M can conveniently be separated into two groups. The first group consists of a number of major modifications which must all be carried out at the same time. Sets which include these modifications will be called Types 277P and 293P and ships already fitted with Types 277 and 293M will be supplied with a "P conversion" equipment. The "P conversion" is also applicable to Type 277 ships' sets fitted ashore (Type 277F). These sets after conversion will be called Type 277FP. The second group of improvements consists of a number of independent modifications which are applicable to Types 277 and 293M as well as to sets converted to Types 277P and 293P. These modifications will reach most ships as modifications to be carried out under the authority of an A.F.O. Some of these are already in production and authority for fitting has been given but they have been included below for the sake of completeness.

The "P" Conversion.

The main objects of the "P" conversion to Types 277 and 293M are to improve the sets' reliability, to simplify the tuning, to increase the receiver sensitivity, to tidy up the equipment on the control table and eliminate the pye plugs and to include some anti-jamming precautions.

The principal changes that are entailed by the "P" conversion are as follows:-

(a) Receiver P.51 is replaced by Frequency Changer Unit Design 6.
(b) Output Unit SE2 is replaced by Output Unit Design 3.
(c) Panel L.26 is replaced by Panel L.53.
(d) Framework for two pattern W.5212 Ae/gyro repeaters is replaced by Patt. 58439 Bearing Repeater Unit.

(a) Frequency Changer Unit Design 6. (see drawing on page 39).

The frequency changer unit comprises the mixer and head amplifier. The new mixer is designed to mount directly on to the gas switch and the head amplifier is then built on to the mixer thus eliminating all cable couplings. The principal advantage to be gained from the new mixer is a great simplification of tuning since the majority of the adjustments previously allowed for on Type 277 have been eliminated firstly by a careful choice of dimensions and secondly by selecting crystals which

have the correct R/F impedance for the new mixer. Since both a new head amplifier and a new receiver panel were required in Type 277P the opportunity was taken to change the I/F frequency to 13·5 Mc/s; this frequency gives a slightly better noise factor for the receiver. The complete assembly of CV76 output circuit, common aerial switch and frequency changer unit is known as output unit Design 3.

Received signals are fed direct from the upper gas switch (CV293 which replaced CV193) by a section of waveguide to the crystal. This waveguide is made with dimensions below the critical dimensions for S band frequencies but it is made to pass signals from the CV293 without attenuation, by filling it with polythene. Beyond the crystal the waveguide is not so filled and signals are rapidly attenuated. Into this attenuating section of waveguide the signal from the local oscillator is fed by means of a Pattern 58425 cable coupling adaptor. All the dimensions of these items have been determined so that the coupling is fixed over a wide band of frequencies and no adjustment is necessary. For this arrangement to work the crystals used must have an impedance fixed between narrower limits than the existing CVs. Specially selected crystals therefore must be used. The following tuning and coupling adjustments are eliminated by this system :-

Matching line between gas switch and mixer, signal coupling into mixer, L/O coupling into mixer, and mixer box tuning.

In addition the receiver sensitivity is improved by the change of I/F frequency, an improved type of holder for the crystals used and a stowage for a spare crystal provided.

(b) Output Unit Design 3.

(see drawing on page 43).

The changes to the output unit are in general the physical changes required by the alterations to the mixer system described above. The following points are however of interest.

The upper gas switch CV193 is replaced by a CV293. This change is to allow direct coupling into a waveguide instead of via a coupling loop and lead. The valves are basically the same and a defective CV293 can in an emergency be replaced by a good CV193 by removing the casting from the CV293 and fitting it to the CV193.

The lower gas switch of the common aerial switch is replaced by a spark gap in front of a blocker stub (a tuned cavity). This spark gap must be tuned as the position of the electrodes affects the resonant frequency of the blocker stub. Its tuning replaces the tuning of the lower CV193 in existing sets. If the blocker stub or electrodes are not available a CV193 can be used as in the existing Types 277/293M arrangement.

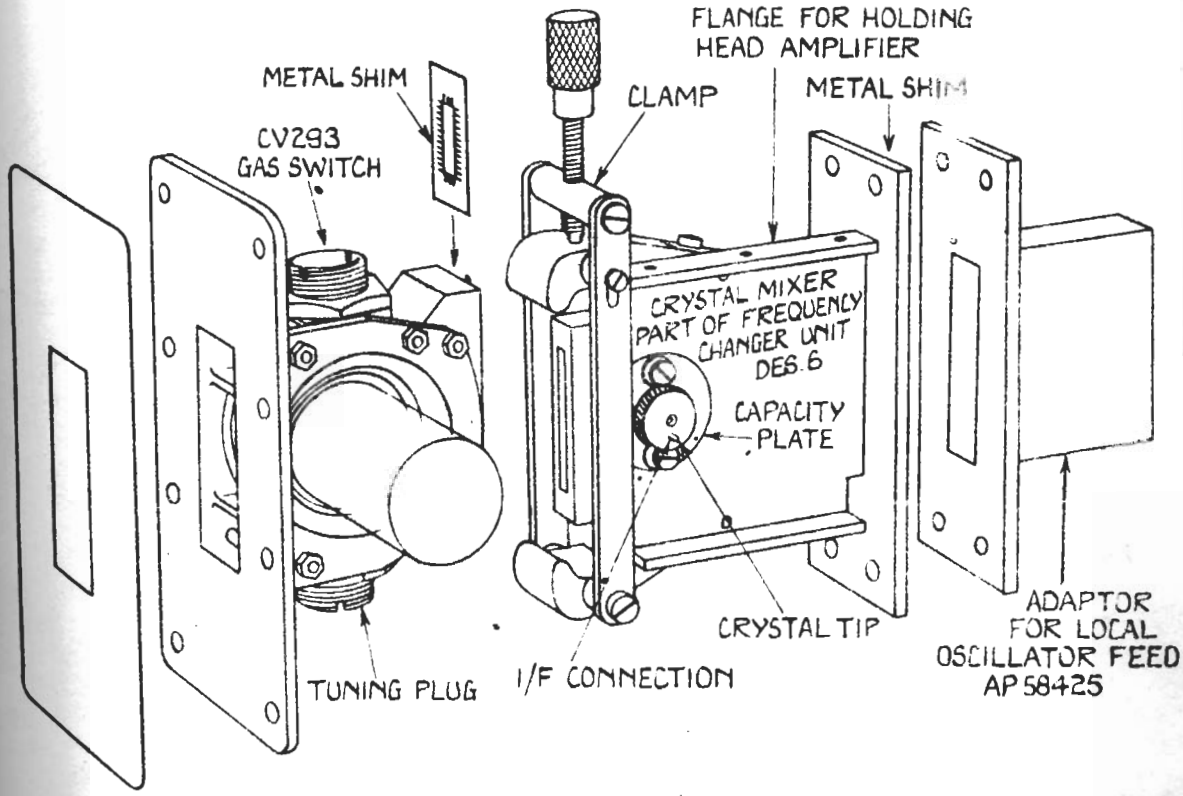
NOTE:- The blocker stub assembly will also be used with unconverted Types 277/293M sets. In addition, on existing sets, a spark gap assembly will be fitted in front of the T.R. switch in order to increase its life. This cannot be done on Type 277P since the presence of the spark gap assembly upsets the all important impedance matching of the new mixer.

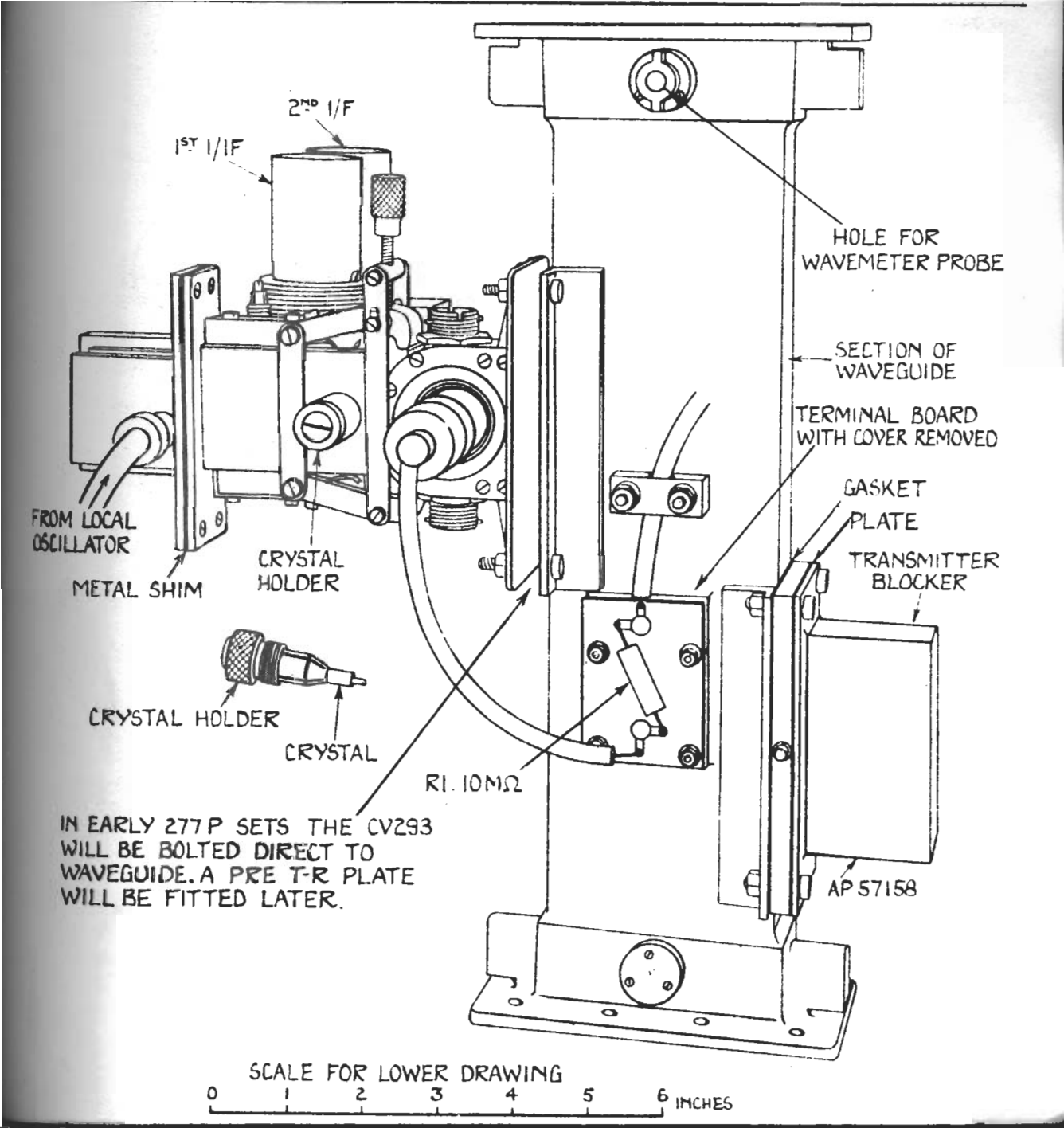
(c) Panel L.53.

This panel contains the following units :-

Cathode ray unit design 36.	(existing design N slightly modified).
Rectifier Unit SE6.	(existing Rectifier Unit).
Oscillator G.225.	(existing G.50 slightly modified).
Amplifier Unit design 5.) Amplifier Unit design 7.)	(replace existing Amplifier M.70).
Control Unit design 37.	(replace anti-wave clutter unit design 1/2).
Cathode follower unit design 12.	(existing design SE2 slightly modified).
Meter Unit design 4.	

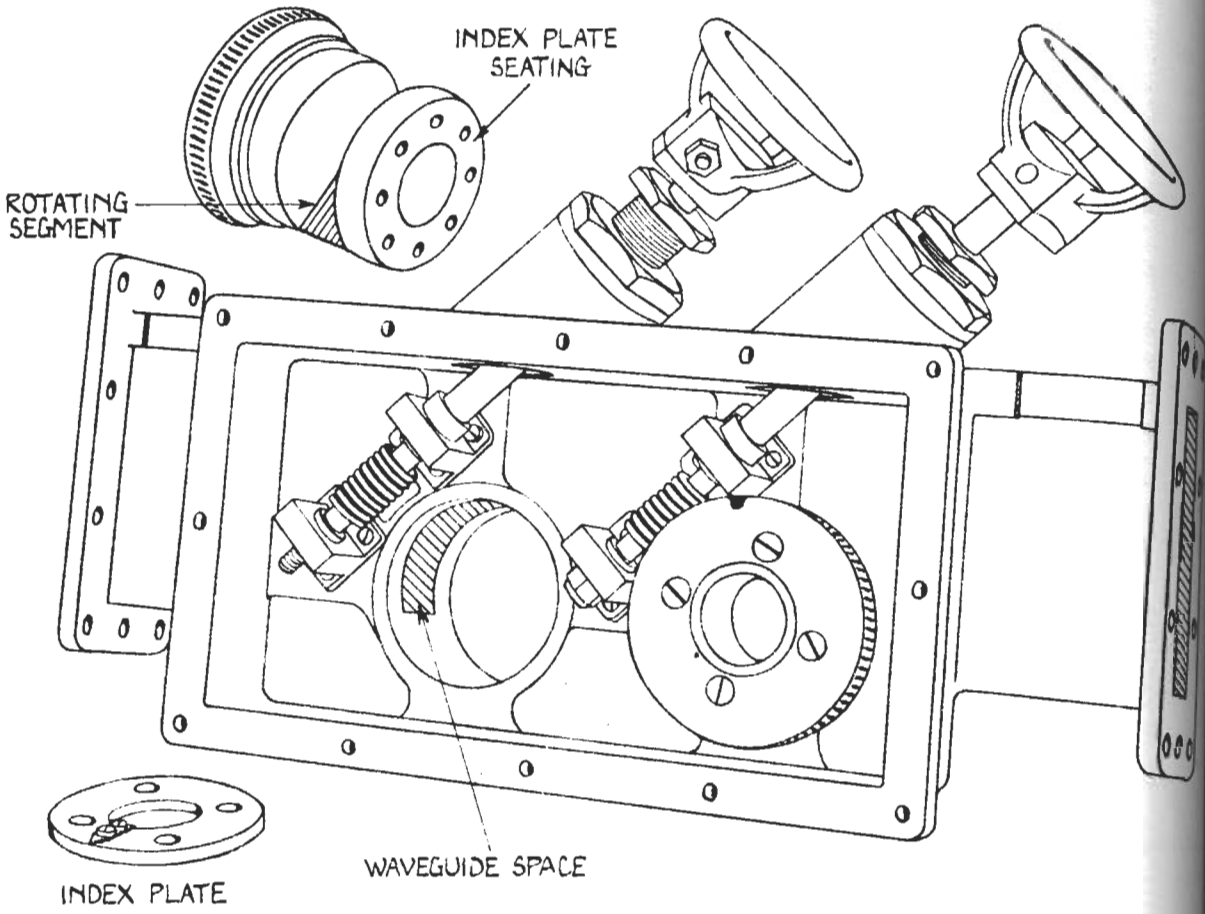
R/F RECEIVER ASSEMBLY

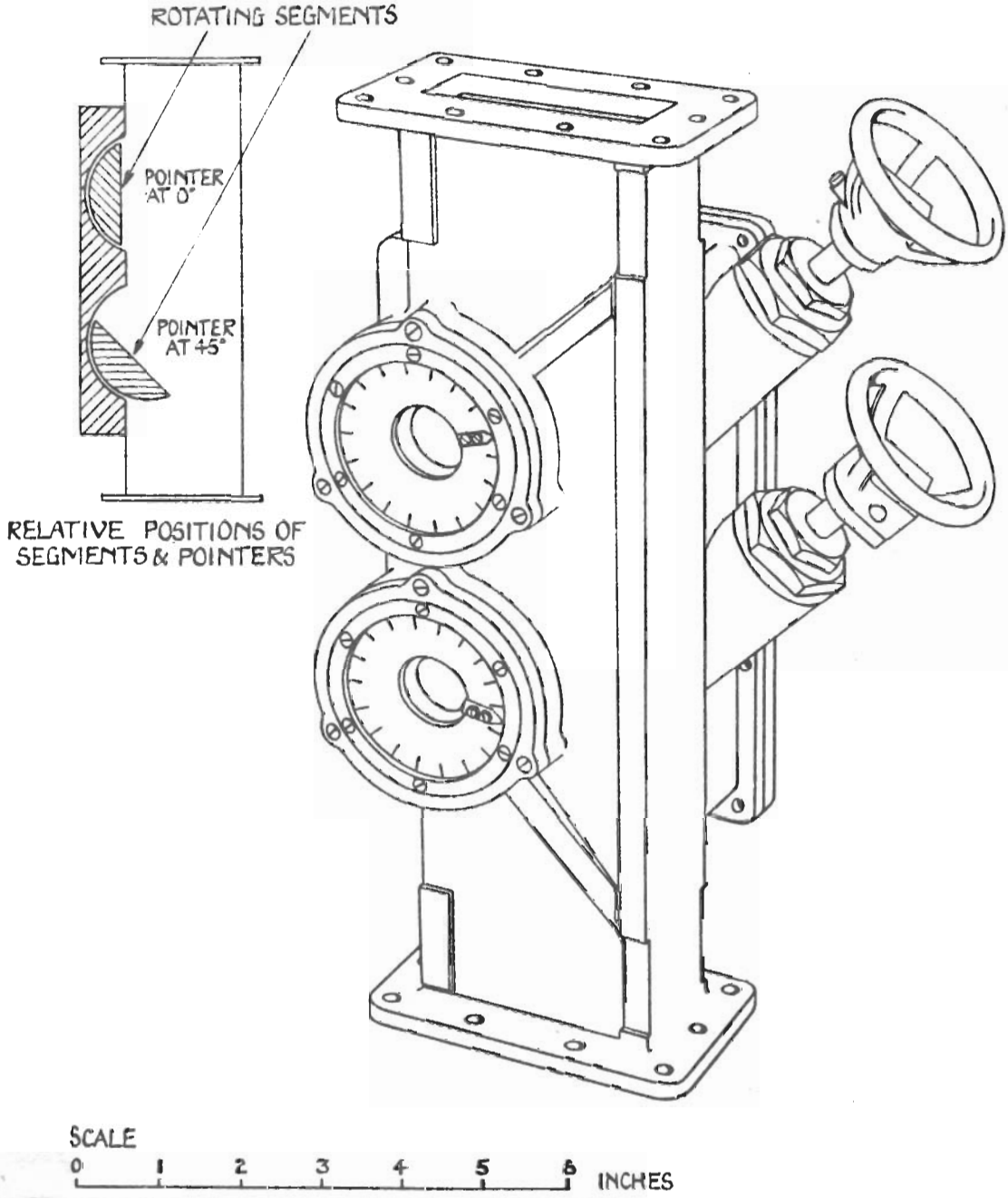



2ND I/F
1ST I/IF
HOLE FOR WAVEMETER PROBE
SECTION OF WAVEGUIDE
TERMINAL BOARD WITH COVER REMOVED
GASKET
PLATE
TRANSMITTER BLOCKER
FROM LOCAL OSCILLATOR
METAL SHIM
CRYSTAL HOLDER
CRYSTAL HOLDER
CRYSTAL
R1. 10MΩ
IN EARLY 277P SETS THE CV293 WILL BE BOLTED DIRECT TO WAVEGUIDE. A PRE T-R PLATE WILL BE FITTED LATER.
AP 57158
SCALE FOR LOWER DRAWING
0 1 2 3 4 5 6 INCHES

AERIAL MATCHING UNIT PATT. 56773

TYPES 276/277/293




ROTATING SEGMENTS
POINTER AT 0°
POINTER AT 45°
RELATIVE POSITIONS OF SEGMENTS & POINTERS
SCALE
0 1 2 3 4 5 6
INCHES

In addition arrangements are made to fit an RTU 56 (RTU 52 slightly modified) in the panel if RTA or RTC is approved for the set. If an RTU is not fitted a blanking plate is fitted in lieu.

The design 7 amplifier replaces the old M.70 and has switchable bandwidths of 4 Mc/s and 1 Mc/s with an I/F frequency of $13\frac{1}{2}$ Mc/s. In addition an entirely independent I/F amplifier with $\frac{1}{2}$ Mc/s bandwidth is fitted for use if the set is being jammed. A switch marked wide band, narrow band and AJ on the front of the panel selects the amplifier and bandwidth to be used.

A small side panel is fitted on the right of the panel L.53 (between it and the P.P.I. if both are fitted on the control table). This panel carries a range counterdrum receiver (if RTA/C is fitted) the Type 253P control unit and a gain control and switch unit for Type 242.

The design of the panel L.53 has been "cleaned up" by bringing all leads (except L/O output) to a terminal board at the top of the panel so that no pye plugs need to be used and the units have been mounted in drawers of the "opening jaw" design used for Types 274 and 275 for easier maintenance.

(d) Bearing Repeater Unit.

This unit is mounted on top of the panel L.53 or the H.P.I. if the L.53 is not on the Control table (R.D.R. etc.) and contains lighting and dimming circuits and three Aerial Gyro repeaters. These are (1) the Auto aligning repeater with 1° M type relative drive from the Radar aerial, (2) a Magslip repeater with Magslip drive from the aerial relative shaft in the Type 293P control Table or AUK pedestal, (3) A W.5212 with 1° M type drive from the interrogator aerial. All these repeaters have gyro drive in addition to the aerial drive.

(e) Minor Changes.

A rectifier unit is required for test oscillator G.208 as the supplies from P.51 used at present are no longer available. Certain new frameworks are essential.

A new supply board for P.P.I's is required in some installations. This will be design 5.

An adaptor plate to support the panel L.53 on the control table is required.

Independent Improvements.

A New Variac.

A new variac (Patt. 57703) for Modulator H.T. control will be fitted in all Types 277/P and 293M/P. This variac will be considerably more reliable than the existing pattern and will incorporate a switch to break the magnetron filament circuit automatically when the H.T. is raised. This will enable the filament warning lamp on the control table to be removed thus reducing the Christmas tree effect and will prevent the operator accidentally leaving the filaments running with H.T. on.

The Video Filter Unit.

This unit is an additional box to be fitted in the Radar office for Anti-jamming facilities. It consists of two switched filter circuits with associated valves and a third switch position to bypass the filters. No filters, half filters and full filters are thus available.

The Air Conditioning Unit.

Reports of burnt out heaters in air conditioning units frequently indicate that this is due to the heaters being left on after the blower motor has been stopped. As it is possible to do this by stopping the 230 volt 50 cycle alternator instructions are being promulgated to ships to feed the A.C.U. heaters with A.C. More detailed instructions will show wiring modifications to the Board 2AM to put heaters and blower motor supplies on the same switch. Boards 2AM thus modified will have pattern numbers W.8129[illegible] Boards 2AM in store and in production are being modified to the B pattern and will be supplied with future sets as soon as they are available.

The Aerial Matching Unit. (Patt. 56773) (See drawing on page 40).

This unit provides two brass segments which can be rotated into the waveguide by any required amount thereby introducing a reactance into the guide to balance out reactances due to the waveguide run. This allows the match of the waveguide to be improved thereby improving the magnetron stability and output. The improvement of match is indicated by an improvement in the standing wave ratio as shown on a Patt. 56807 standing wave ratio indicator or on the wattmeter in the Radar office. The Aerial Matching Unit will be fitted as close to the aerial as possible with the S.W.R. indicator on the magnetron side of it.

The Standing Wave Ratio Indicator (Patt. 56807) (See drawing on page 46).

This unit consists of a section of waveguide with a slot in the longer side into which projects a probe on the end of a neon tube. The height of the glow in the neon tube is an indication of the field in the waveguide at the point of insertion and the ratio of the minimum to the maximum lengths of glow as the probe is moved along the guide is an indicati[illegible] of the standing wave ratio in the waveguide. The neon tube holder is calibrated by means of the bars across the opening so that the S.W.R. can be read off distinctly. This unit is used for setting up the aerial matching unit and in general a comparative measure of S.W.R. between successive adjustments of the aerial matching unit is all that is required.

Thermocouple Units for Radiation meters.

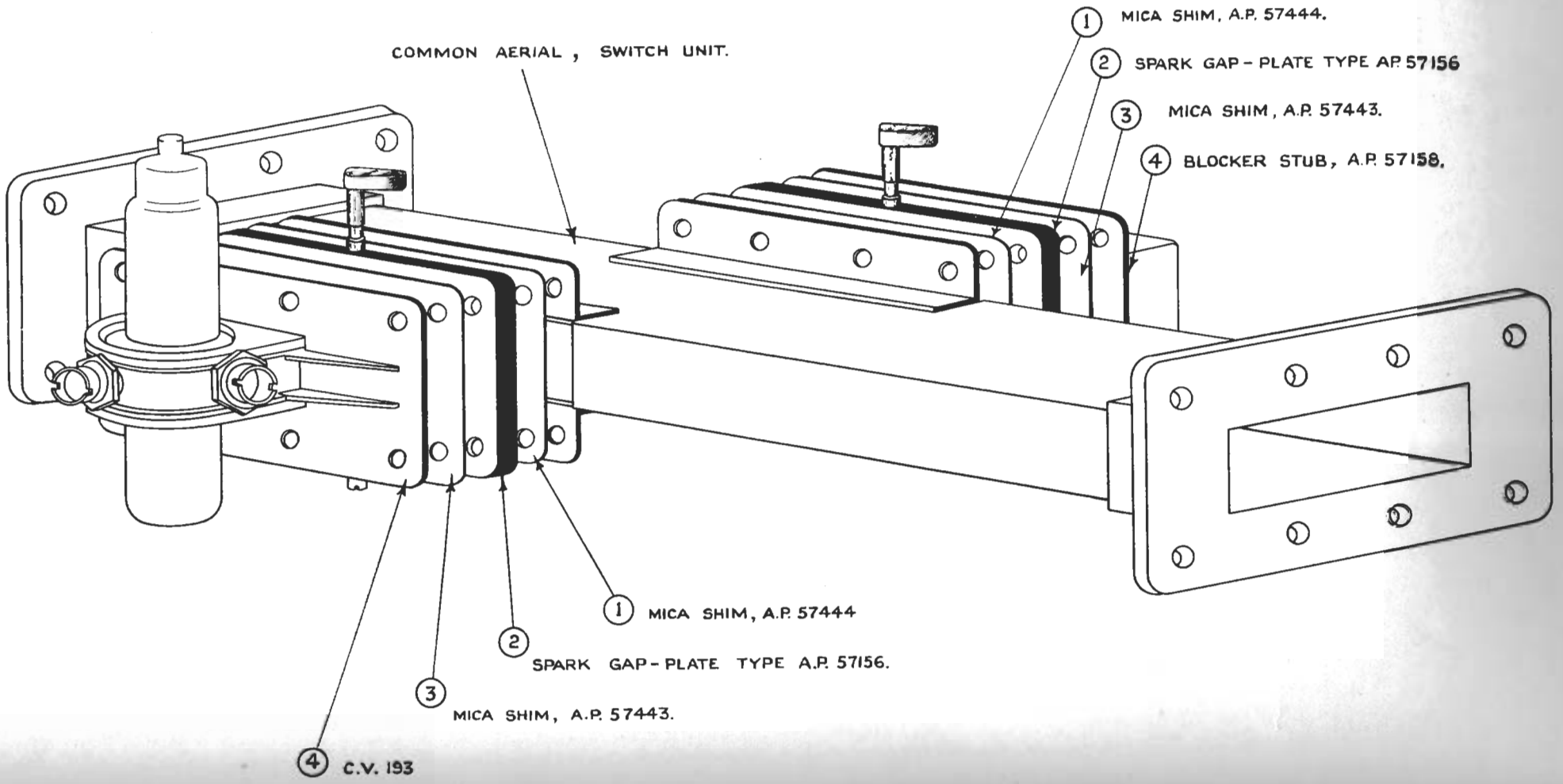
Two new thermocouple units have been designed for measuring transmitted radiation. These are aperiodic i.e. they are flatly tuned over the whole Types 277/293 frequency band and therefore require no adjustments when the magnetron frequency is changed. Their pattern numbers are 56828 for Types 277/P and 56168 for Types 293/M/P.

The Pipe Wattmeter (Patt. W7283).

The failures of this instrument have at least in part been tracked down. They are due to a hitherto unsuspected variation of calibration with frequency. A C.A.F.O. on how to make allowances for this variation is being issued; it can be briefly summarised as "1% decrease in frequency requires 10% increase in multiplication factor m" and vice versa. The frequency change is measured as departure from the nominal frequency of the Types 277/293 series of sets. A second cause of trouble is believed to be movement of the thermocouple on its mounting. Steps are being taken to mould this solidly in plastic. A third cause of trouble is believed to be that the spare thermocouple unit is not completely shielded from electromagnetic waves and that consequently the spare thermocouple ages even if not in use. Arrangements are being made to replace the plastic cover of the stowage position by a metal one.

The multineon wattmeter.

This is a new form of wattmeter being developed to replace the existing pipe wattmeter. It consists essentially of a section of waveguide slotted along the longer side with a row of thin neon tubes projecting through the slot slightly into the guide. The height of glow in each neon will indicate the field in the guide at the point of insertion.


COMMON AERIAL , SWITCH UNIT.
1 MICA SHIM, A.P. 57444.
2 SPARK GAP - PLATE TYPE AP 57156
3 MICA SHIM, A.P. 57443.
4 BLOCKER STUB, A.P. 57158.
1 MICA SHIM, A.P. 57444
2 SPARK GAP - PLATE TYPE A.P. 57156.
3 MICA SHIM, A.P. 57443.
4 C.V. 193

The row of neons will thus show a glow pattern and the tops of the glows will form a sine wave depending on the standing wave ratio in the waveguide. The amplitude of this sine wave will be a measure of the S.W.R. and the height of the mean of the sine wave will indicate mean transmitter power and will be calibrated in watts.

Type 277P Elevation Control.

In certain ships arrangements are being made to increase the elevation of the AUK aerial to 75 degrees. This entails replacement of the elevation control unit design 2 by design 3 and a modification to the position of the stop in the elevation stabiliser unit. It is doubtful however whether this modification will ever be applied to more than a few ships.

P.P.I's.

Under the title of "P.P.I. News" some notes on modifications to P.P.I's (Outfit JE) were given in the last number of the Bulletin. These notes were intended to give readers some ideas of what was being planned in the way of improvements in P.P.I. displays.

A new P.P.I. Handbook (C.B.4298/44) has been issued. This, it is hoped will be found to be an improvement on the old one. It embodies among other new matter, information on the correct feeding of a number of P.P.I.s with sync. and signal supplies. Do not just file the Handbook away in your safe, give it at least a short study.

The modifications already referred to and some new ones will be issued very shortly, probably in the form of an Admiralty Letter. This letter should be studied carefully. First it will contain a number of worthwhile modifications to the P.P.I. which will improve its efficiency appreciably. Most of these modifications are optional, that is to be carried out as considered necessary. It will be found that most of them are well worth while and do not require much work by the ship's staff. Secondly there will be a number of modifications to make the P.P.I. suitable for special applications. Examples of these are, the "coupled pair" of P.P.I.s for use with Type 281BP/BQ to provide telling facilities up to 160 miles. The "Elevation Position Indicator" for use with Type 275, and rapid switching of a display between Type 281 and Type 277. There will be details of a simple instructional label to be placed adjacent to each display. This should avoid some of the reports that a P.P.I. is not working properly, when the fault lies with the operator. There will be a useful note on the checking of the calibration of P.P.I.s Other sections of the letter will deal with such matters as "Spider's Web Dials" and a new anti-static powder to replace the rather messy anti-static varnish. Please take note of the instructions for recording the modifications carried out.

"Bubbly" ships will get these P.P.I.s modernised for them. Ships already fitted with P.P.I.s must carry out the modifications themselves. It is hoped that new P.P.I.s will be supplied already modified.

SKIATRONS.

In order to improve the performance of the Skiatron, so that an operationally satisfactory display of Type 281 will be achieved, a number of modifications have been put in hand and are listed below. All these items with the exception of the modification to Type 281 will materially improve the performance of the Skiatron when operating with either Type 281 or Types 277/293; it is, however considered that provided the correct optical and electrical lining-up procedure is followed, performance with Type 277 is already operationally satisfactory.

IMPROVEMENTS IN HAND.

Tube Selection

Reference to this will be found in C.A.F.O. 2586/44.

Improved Focus Coil.

An improved type of focus coil has been developed and will be incorporated in models now being fitted. Similar coils are being made under separate contract for retrospective fitting for sets already fitted. This improvement will result in a sharper focus and a clearer cut picture with higher apparent contrast.

Increased E.H.T.

An additional power pack has been designed, which fits on top of the existing power rack, and the output of which is wired in series with the output of the 10 kV pack, so that a total of 14 kV is obtained at the anode of the skiatron tube. The effect of this is to intensify the picture and improve the focus, again with an increased apparent contrast.

New Lamp Box.

A new design of lamp box has been produced, which gives about 3 times the intensity of light on the viewing screen. The effect of this greatly increased level of illumination in contrast is not clear, but some improvement is probable. Increased illumination does mean that ambient lighting level can be somewhat higher.

Easier Optical Setting-Up.

A new tube carriage has been designed and will be fitted retrospectively. It incorporates screw adjustments for optical centreing and focusing and will probably result in better optical focus being obtained by relatively inexpert staff when changing a tube in a hurry.

Improved Viewing Screen

Experiments are going ahead on a new type of plastic viewing screen material. This is thought to be as good, if not better, than flashed opal glass, and it may ultimately be possible to engrave (or photo-etch) the spiders-web straight onto this material, and possible to plot on its top surface. Thus, the number of surfaces in the viewing screen could be reduced to the minimum, with a resulting better contrast. Work on this, however, is still proceeding.

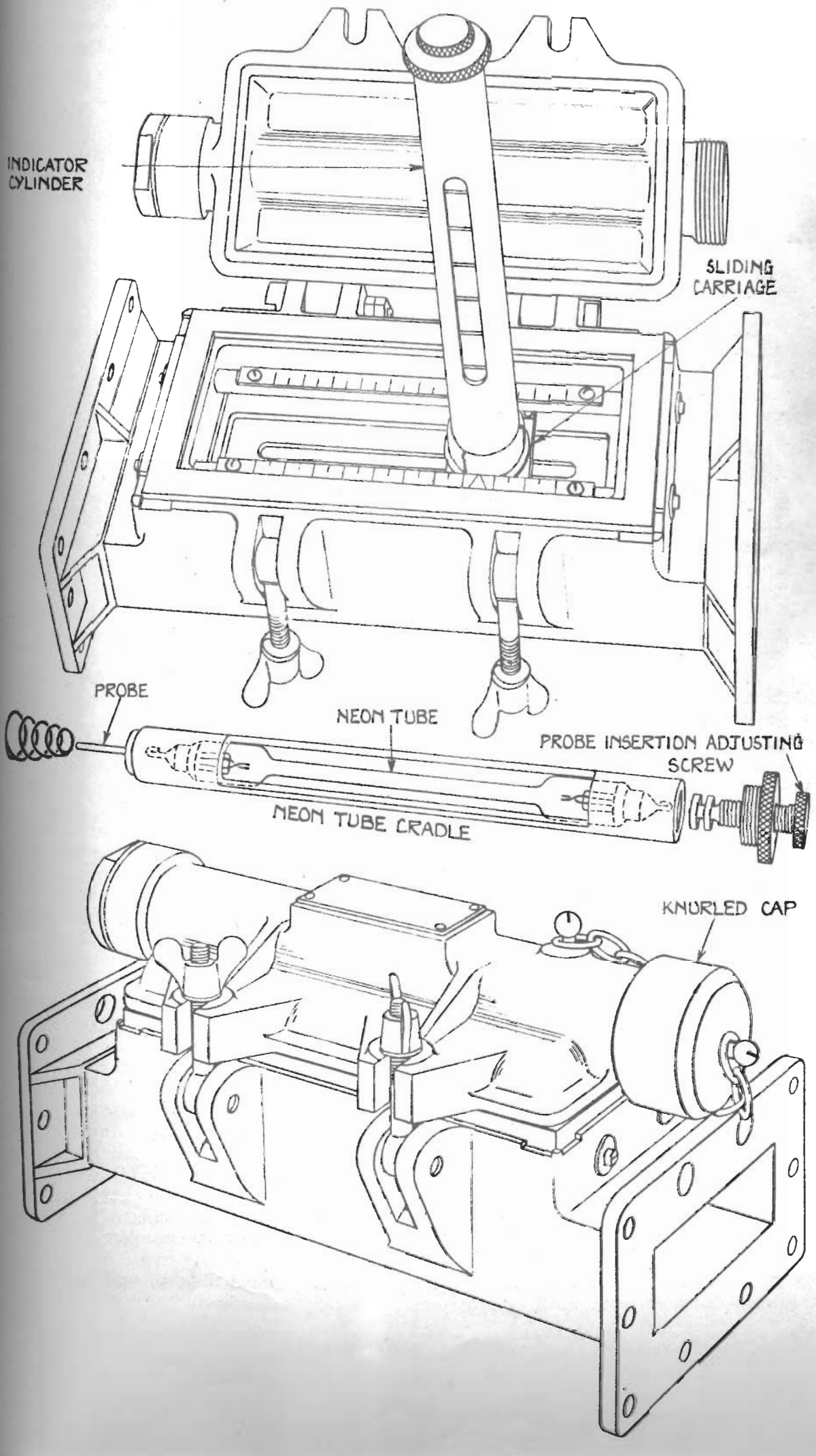
Type 281 - increased p.r.f.

In addition to the foregoing modifications to the Skiatron, Type 281 (and variations) is being modified to work at 100 pulses/sec. instead of the 50 hitherto used. Thus, twice the number of paints are achieved per second, and the skiatron picture becomes more intense without defocussing, so producing again, a higher apparent contrast.

Miscellaneous

A number of other improvements are also in hand, to simplify operation e.g. electrical centreing. Also a modification to protect the tube from burning should the sync. pulse to the equipment fail, has been issued as a C.A.F.O. (No. 25/45).

DESIGN I. PATT. 56807



It will be seen that the objects of the above modifications are, in the main, to improve the contrast and focus, and there should be no doubt that with all these points taking effect, the performance of the Skiatron working from Type 281 will be very satisfactory in operation.

As regards the bad effects of stains due to permanent echoes, there is little that can yet be done directly; however, means are being provided in the ventilation arrangements to heat up the skiatron tube screen when it is required to "wash" the screen. Under these conditions, P.E.s will disappear comparatively quickly.

Complete sets of components and units for the improvements listed above, will be packed together and sent to ships with instructions on how to fit and operate.

"Bubbly" ships will be the first to get these improvements but it is hoped to make them general as soon as possible.

P.P.I. NEWS

DELAYED-START P.P.I. USING RANGING OUTFITS RTA, RTB, ETC.

It is sometimes desirable to examine a distant echo or group of echoes on a fairly short-range display, in order to bring out details of the shape and number of the echo or echoes, as for example when looking at a group of islands or a formation of aircraft. An easy way of doing so is to trigger the P.P.I. from the strobe pulse of a Ranging Outfit. The P.P.I. display will then be delayed relative to the Radar sync. pulse by an amount equivalent to the range at which the strobe is set, and an echo at, say, 80,000 yards can be examined on a 15,000 yard display. The facility is thus rather similar to that provided by the fast time-base on Panel L13/17. The range of an echo on the delayed display will be its range shown on the display plus the range at which the triggering strobe is set. The picture will of course be distorted in azimuth, the distortion being greatest nearest the centre of the display, but correct bearings can still be found by bisecting echo arcs. This arrangement was suggested in the last Radar Bulletin. The greatest difficulty in the use of this scheme will probably be found to lie in setting the strobe at the right range to bring any desired echo on to the screen. If the Strobe Input modification already described has been carried out on the P.P.I. in question, the difficulty can be overcome as follows : First, with the P.P.I. being triggered by the Radar sync. pulse and operating on long range, feed the strobe into the Strobe Input plug so as to paint a ring of variable radius on the screen. Run the strobe out until the ring is a few thousand yards short of the appropriate echo. Then trigger the P.P.I. from the strobe (without altering the range of the latter), and set the P.P.I. to Range A. The desired echo will now appear on the delayed display, and can be identified from its bearing. If a suitable change-over switch is used, this operation of setting the correct delay can be very quickly carried out. In one position the switch should feed the Radar sync. pulse to the P.P.I. sync. input and the strobe to the strobe input plug, while in the other position the Radar sync. pulse should be cut off from the P.P.I. and the strobe fed to the sync. input on the latter.

This modification will prove most useful if combined with the one giving an 8000 yard scan with open centre, already described.

COMING SHORTLY - SENSITIVITY CONTROL FOR "BRIDGE" P.P.I's.

The Sensitivity Control Unit is a small box containing a switch and potentiometer, mounted close to the "bridge" P.P.I. When the switch is pressed, all echoes less than an amount determined by the setting of the potentiometer (for example - 10 times noise) disappear, while the remainder continue to paint with full intensity. At the same time a red light shows to remind the Observer that he is now working with reduced sensitivity.

By depressing the switch during every other rotation of the aerial a picture is obtained with two levels of "afterglow" - a strong afterglow corresponding to the larger echoes (those painting with each rotation of the aerial) and a weaker afterglow corresponding to the smaller echoes (those painting every other rotation).

This gives the picture the appearance of a contour map with layer shading. The extra information so obtained will need to be interpreted with considerable caution, but it is expected that it will be of some definite help to the Observer.

By adjusting this "reduced" level of sensitivity it is possible to "pin-point" on the P.P.I. individual landmarks which would otherwise be lost in the echoes from the surrounding land. Adjusting the Receiver Gain Control produces something of the same effect, but it is not nearly so positive a method of doing this, because the Sensitivity Control biasses weak signals off without any reduction in gain for stronger ones.

"TALK DOWN"

Since the weather is not the least of the many factors controlling the operational aspect of naval aircraft, any device which enables the pilot to find his way back to base under conditions of low visibility is of great importance, for not only does it increase the morale of pilots, but it widens the scope of offensive operations.

It is not unnatural therefore, that the problems involved in providing such devices have been constantly under review during the war. In most systems which have made their appearance it has been necessary to fit certain equipment in the aircraft, thus limiting the facility to aircraft in which the addition of extra weight is not a vital factor. Although may fighter aircraft are equipped with receivers for use with various beacon systems enabling them to "home" to their carrier or base, there is at the present moment no adequate system for use at sea by which a fighter plane may be directed, or manoeuvre itself, into a suitable position for "landing on".

It was, therefore, with an eye to covering the needs of all types of aircraft and of the single seater fighter in particular, that attention became focussed on the possibilities of "Talk Down", a natural extension of the well known principles of fighter direction.

The successful control of aircraft returning to ship base in bad visibility to actual "touch down" on the deck is in the ultimate an operation requiring the co-ordination of four distinct phases of control, as follows :-

(a) Homing to the vicinity of the carrier.

(b) Allocation of waiting positions within easy range clear of other aircraft and of the area astern where approach is made for landing on.

(c) Selection of identifiable aircraft; direction to stern clear of others en route, and the final vector towards the stern on the same course as the carrier.

(d) Correction of approach to stern of ship until sighting allows the D.L.C.O. to give "batting" directions to "land" on.

It is intended in this article, only to discuss the equipment needed and the problems involved in (d) above.

A Radar equipment mounted in such a manner as to be able to scan the area of approach will enable a Control Officer to appreciate on the P.P.I. the aircraft which has been vectored to the position necessary for a controlled approach.

Once identified the aircraft is directed to make the approach and provided the equipment is capable of a really close minimum range the aircraft is under continuous observation to within a short distance of the end of the flight deck.

With an experienced Control Officer passing the necessary alterations of course over the R/T and an adjustment of height on the part of the pilot by means of the Radio Altimeter with reference to range, it is possible to bring the approaching plane to a position where it becomes visible to the D.L.C.O. and which is suitable for the final "landing on".

From this it will be realised that much of the responsibility for a successful "Blind Approach" lies with an officer who is a specialist.

As a result of tests carried out by H.M.S. Vindex, using a standard A.S.V. Mark XI mounted at the starboard after end of the flight deck it was felt that the A.S.V. XI would prove a suitable basis for an interim equipment. A modified version known as Type 961 will shortly become available.

This equipment will have a range of from 3 to 4 miles against a single seater fighter and will be provided with a P.P.I. presentation and a "B" scope. A high speed of aerial rotation (40 r.p.m.) in conjunction with the "B" scope will readily enable any deviation from course to be quickly detected. The minimum range will be of the order of 200 - 400 yards.