

A.J.

REPORT ON A VISIT TO NORMANDY.

The purpose of the visit was to investigate the interference experienced by Type 281 equipments in the Eastern Task Force and to obtain details of the performance of the A.J. unit against interference.

Throughout the whole period considerable interference to the Type 281 equipment was experienced in H.M.S. BELFAST. There were a number of interfering signals of different strengths and carrier frequencies. Reports from other ships showed that the interference was general.

Much of the interference was directly attributable to the cross-channel V.H/F scheme, the speech being audible by phones in the low level receiver output. The interference at other times, with one exception, consisted of a pure modulation of 50 kc/s-300 kc/s which would be obtained if two unmodulated P/T carrier waves were accepted by the receiver. The one unknown modulation was a unity mark: space pulse interference of repetition frequency 2 kc/s. A film has been taken of the C.R.T. picture under different interfering conditions, and sketches of the interference are given in the drawing on page. 47.

With the beam switch running a double trace effect appeared under interference conditions, owing to the difference in strength of the interference received by the two beams. The complexity of the picture was considerably reduced by switching off the beam switch and also the I.F.F. Even with these off, weak interference imposed considerable strain on the operator and frequently strength of jamming was such that operation was impossible in the absence of the A.J. unit; as only three ships are fitted with this, the effect of the interference is very serious.

The A.J. unit successfully removed all interfering signals encountered during the visit, with slight deterioration in performance, and returned the picture to normal. The removal was so complete that operators could not detect cessation of the interference and so there was a tendency to work with the unit always in circuit. Prior to the visit one period of interference was reported when the filter did not effect complete removal, but did ease operation. Slight re-adjustment of receiver gain is generally necessary when the unit is put in circuit but no retuning of the receiver is required in the absence of interference. Retuning is not recommended in the presence of interference owing to the continually changing character of the latter - and on cessation the receiver may be out of tune. The removal of jamming by the unit is shown in the films taken; there is slight ground wave paralysis with the unit in circuit, and the cause of this is being investigated.

There is little evidence of enemy jamming of Type 281 in the Eastern Task Force. The interference from the cross-channel V.H/F scheme is very serious and can be considerably minimised by the fitting of more A.J. boxes. Some improvement may be obtained by a thorough overhaul of the Type 281 equipments.

INTERFERENCE TO TYPE 281 IN EASTERN TASK FORCE

(BEAM SWITCH OFF)



R/T.



UNMODULATED C.W.



300 Kc/s M. C.W.



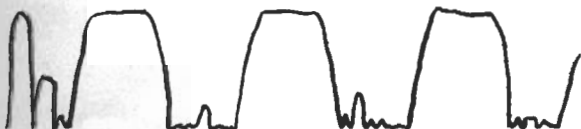
40 Kc/s SINE WAVE



20 Kc/s. HALF SINE WAVE.



2 Kc/s. MODULATED
AT 40 Kc/s.



2 Kc/s. PULSE.

TYPE 281

In the two and half years Type 281 has been at sea, it has seen already, a number of changes. To list the more important we have had control unit 20CX replaced by control unit 20D, alteration to Type 281B the single masted version, fitting of Type 241 and later Type 243, fitting of P.P.I's and Skiatrons. In addition to these changes we have had a number of minor modifications to make the set more reliable, the list of A.F.O.s covering this is quite long.

Modifications are not introduced by the A.S.E. just for fun, but only when they are considered either absolutely necessary or will definitely lead to improvement of operational efficiency. A number of further modifications will be introduced shortly and it is thought that Radar Officers responsible for maintaining Type 281 may be interested to know what they are in for.

PRE-AMPLIFIER M 81

This is hardly a new modification as a number of these are already at sea. C.A.F.O. 837/44 gives details of fitting these. Pre-amplifier M 81 is only suitable for use with 281B but it is hoped to produce a modified version suitable for Type 281.

TRANSMITTER BLOCKER FOR SUPPRESSING NOISE FROM NT 86 VALVES

Pre-amplifier M 81 should give an increased noise ratio of about 6 dB. Reports from sea and trials ashore have however been disappointing. Investigations have revealed that these poor results were due to no fault in the pre-amplifier but to an unexpected trouble in Type 281B itself. Certain NT 86 transmitting valves act as noise generators. This noise reaches the receiver via the diode switch. This reduces the efficiency of the Type 281B and is particularly apparent when a pre-amplifier is fitted. As a temporary measure an A.F.O. is being issued explaining how to test NT 86s in order to exclude those that would act as noise generators. A new unit is being designed to prevent any noise reaching the receiver from the transmitter.

PERFORMANCE METER.

Performance Meter with Types 281 and 281B is referred to in Appendix F of the handbook. On trials this Performance Meter was unsatisfactory, as the test model, being vertically polarised, picked up RF from the feeders rather than from the transmitter. A new aerial has been designed and should be produced shortly. The Performance Meter should greatly assist in ensuring that Type 281B is kept in the maximum state of efficiency and should lead to more satisfactory Height Finding.

TYPE 941 INTERROGATOR.

A new Interrogator rack has been designed which includes as well as Type 243 - the present interrogator - Type 941 a new interrogator suitable for Aircraft Direction and giving a display on the Skiatron. With this interrogator, Mixer Design 7, will be supplied which, with its increased numbers of outputs will provide adequately for the full number of remote displays contemplated. It should be noted that this mixer does not provide for sync. distribution. The sync. available for the 281 receiver is not sufficient to feed the number of remote displays, and sync. distribution will in future be made from the transmitting office.

REMOTE SCAN FOR HEIGHT FINDING - OUTFIT JJ1.

The R scan, that is to say, the A scan which shows on a long delay cathode ray tube only when the aeriels are on a selected bearing, has been designed for use in the Radar Display Room or Height Filtering Position to enable Echo amplitudes to be obtained without stopping the aeriels. This is required for Height Finding with Type 281 and is referred to in C.A.F.O. 1367 as Panel L44. Actually this panel will be the same as Panel L43 referred to in the next section and the term L44 is therefore dead.

REMOTE SCAN FOR INTERROGATION - OUTFIT JH2

Except for associated equipment, this is the same as outfit JJ1 above. The unit is referred to as L43 in C.A.F.O. 1367. It has application to sets other than Type 281.

LONG RANGE P.P.I.s.

With the Pre-Amplifier M81 the range of first detection of high flying aircraft is often appreciably greater than 100 miles. A slightly modified P.P.I. is being designed which displays targets between 100 and 200 miles. The centre of the P.P.I. will extend to 100 miles and the outer 100 mile ring to 200 miles. It is possible that the unit may be designed for ranges of 50 miles to 150 miles instead of 100 miles to 200 miles.

LONG RANGE "A" SCAN.

Now that the bearing tube is no longer required for Gunnery purposes a modification is being introduced to convert the present bearing tube to a warning "A" scan for ranges 0 to 160 miles.

VIDEO FILTER UNIT.

In order to reduce the likelihood of this set being interfered with by jamming from enemy or other transmissions, a video filter unit is being produced which will be fitted in the Receiving Office. There will be certain associated modifications to the Receivers P13 and P23.

SWEPT GAIN

In order to reduce clutter, a swept gain unit similar to that fitted for Type 277 is being designed. This will also require small modifications to the Receiver.

REMOVAL OF A PORTION OF PANEL L11.

It is clear to anyone familiar with the Type 281 Receiving Office that there is no room to incorporate all the modifications referred to above in the existing office. Either the present Receiving Office must be enlarged or something not now required must be removed.

When Type 281 was designed it was a "maid of all work" providing not only warning but also gunnery facilities. Type 281 is not now required for Gunnery purposes and the range and bearing transmission units can be removed. In addition the whole of the accurate ranging equipment can be removed. Unfortunately R.B.L.11 (right) contains not only the ranging equipment but also the power pack for the warning and bearing tubes. Unit R for this equipment must therefore be retained.

It is proposed to produce a new rack which will consist of R.B.L.11 (left), and is the receiver and its power pack, the warning tube, and the bearing tube (modified to be a long range warning tube). Below this various new units such as the Performance Motor, Video Filter Unit and Swept Gain Unit and also Unit R. of the old R.B.L.11 (right) will be fitted. This will be mounted to the right of the aerial control table and will leave space for 2 P.P.I.'s to be mounted side-by-side above the control table. This alteration should greatly simplify the office lay-out and reduce maintenance problems.

AZICATORS.

In order to simplify Height Finding with Type 277, a modified P.P.I. known as a P.P.I. (Azicator) is being developed. This consists of a standard P.P.I. modified to incorporate a bearing cursor which is driven by the Type 277 Control Table. The Azicator gives a normal P.P.I. display from Type 281 and is placed so that the Type 277 Aerial Training Operator can hold a target in Azimuth while the acrials are elevated for Height Finding. The Type 281 P.P.I. (277 AZ) will be sited near the Type 277 control table, preferably above the Type 277 P.P.I. if headroom permits.

OTHER MODIFICATIONS.

Other modifications pending are :-

- (i) Improved ventilation of the Transmitting Office
- (ii) A small modification to the Diode Switch Supply Unit
- (iii) A modification to the matching unit which has been giving insulation trouble.

TYPE 281B.M.

This is Type 281B modified for continuous aerial rotation. It involves the fitting of a new aerial pedestal and a new control table. The new control table contains a P.P.I. so that only one P.P.I. instead of two will be mounted on top of the control table in this case.

CONCLUSION .

The modifications listed above are quite formidable but it is hoped that when they have been carried out, Type 281 will, operationally, be a much more satisfactory set. No action should be taken on the basis of this article as the necessary instructions will be issued by A.F.O. or C.B. in due course. The statement above summarises what is planned at the moment, but alterations may occur before the proposals reach their final form.

In particular it should be noted that only a limited number of remote displays can be fed from existing mixer units and therefore a number of the modifications referred to cannot be carried out until Type 941, with its Mixer Design 7, is installed.

600 SERIESPROGRESS OF DEVELOPMENT

Development was started towards the end of 1942 of a medium power H/F M/F transmitter, a medium power H/F transmitter and a low power H/F transmitter.

The H/F transmitters were to cover a range of 1.5 - 30 mc/s; the M/F transmitter a range of 200 - 500 kc/s. The output power of the medium power transmitters was to be 400 watts and that of the low power transmitters 50 watts.

It was the intention that the H/F M/F medium power transmitter should be the main set in Fleet Destroyers, the H/F medium power transmitter the main set in Light Craft other than Fleet Destroyers, and the H/F low power transmitter as a general purpose, power operated, short range H/F set.

In the summer of 1943 the question was raised whether the low power transmitter could be modified to perform the function and take the place of all variants of the Type 60. This meant the introduction of an M/F range and arrangements for battery operation in an emergency.

The frequency range of 200 - 500 kc/s was agreed to and development started on a low power M/F transmitter.

The problem of providing alternative battery operation was not so simple. It was agreed that the emergency equipment should take the form of a motor alternator producing 230 volt single phase 50 cycle A.C. so that the set would normally operate from the 230 volt A.C. mains, and only when this supply failed would the battery be employed. With a view to preventing any increase in size and weight of batteries, the existing 220 ampere-hour batteries provided in the battery operated versions of Type 60 had to be employed; at the same time the period during which the set had to operate in the emergency condition was not to be reduced. However, as the output of the Type 60 in the R/T condition is, say, 7 watts, while that of the low power set is 50 watts, it was not found possible to provide either R/T or true M.C.W. during emergency operation owing to increased consumption. In emergency C.W. is provided on both H/F and M/F, I.C.W. is provided instead of M.C.W., but R/T could not be provided without a considerable alteration which would have caused an unacceptable delay in the development of the sets. The problem of providing R/T on reduced power in the emergency condition is under investigation, but the first sets to reach the Fleet will not be provided with this facility.

It had originally been stated that an H/F frequency coverage of 1.5 - 30 mc/s was required. To effect this it had been planned to develop 2 transmitter units, one to cover 1.5 - 18 mc/s the other 18 - 30 mc/s. The upper limit was later reduced to 24 mc/s and it was then found possible to build one unit to cover the whole band from 1.5 - 24 mc/s.

In early 1944 it was decided that while the M/F transmitter in the U.T.R. of Cruisers and above must be of 2 kW. output, an output of 400 watts was acceptable in the case of the M/F transmitter in the L.T.R. A medium power M/F transmitter, Type 604, thus came into being.

This meant utilising the M/F side of the medium power H/F M/F transmitter, Type 605. But as Type 605 had been developed for Destroyers where the trunk length is short and the aerial roof comparatively small, it became necessary to develop an external aerial

switch unit and series condenser to allow Type 604 to work into a Capital ship's trunk and aerial roof.

When development of these transmitters commenced, it was decided that as the medium power sets were not intended for ships larger than Destroyers, the power supply of the whole series should be 230 volt A.C. 50 cycle single phase. When the low power set is fitted in a ship with C.W.S. power supplies, it should operate from one phase of the 230 volt supply. The decision to fit the medium power sets in ships with C.W.S. power supply meant that the power cabinets had to be modified. This is being done by modifying the power cabinet to operate from either 230 volt A.C. single phase or 3 phase. Change-over of links at time of installation will effect the alteration of one to the other. The medium power transmitter can thus be supplied either from A.C. machines producing 230 volt A.C. single phase; from the C.W.S. supply via the 20 kVA 400/230 volt transformers now fitted in C.W.S. ships; or, in the case of the older C.W.S. ships, via a 400/230 volt transformer which will be specially provided. The first medium power transmitters to reach the Fleet will operate from 230 volt single phase but later all cabinets supplied will be capable of operation from either single or 3 phase.

The transmitters now under development are shown in Table 'A' on Page 11 of the June Bulletin. In the column headed 'Power Supply and Load' against Type 603, 604 and 605 should be added 'or 230 volt A.C. single/three phase 50 cycles.'

High speed had not originally been stated as a requirement but when the decision was made that the medium power sets should be fitted in ships larger than destroyers, this facility became a requirement. Sets capable of high speed working up to 200 w.p.m. will reach the fleet at the same time as the single/three phase power cabinet.

TECHNICAL FEATURES

System of Construction

(a) The transmitters have been built up on the unit principle; that is to say, a standard range of units has been developed covering high and low power rectifiers, modulators and radio frequency panels. For example, the H/F and M/F units in the low power set are employed as the driver units in the medium power sets.

(b) The particular advantage of this scheme lies in the standardisation of units, and that the more technically intricate units (which may be expected to be more prone to minor breakdowns than those of more straight-forward design) are common to each transmitter, and thus inter-changeable.

(c) Each of the smaller units is fitted on ball-bearing runners which gives instant accessibility for servicing at sea and easy removal where detailed examination or interchange of units is required.

(d) The larger units, while not fitted on ball-bearing runners are easily removed from the front of the cabinet after disconnection of terminals.

(e) In the case of the medium power transmitters, the modulator, modulator amplifier and rectifier units have been grouped together to form the power cabinet which is common to Types 603, 604 and 605. The H/F transmitter, H/F amplifier, H/F aerial matching and tuning units, together with aerial switching facilities have been grouped together and form the H/F cabinet which is common to Types 603 and 605. The M/F transmitter, M/F amplifier and M/F tuner units are grouped together and form the M/F cabinet which is common to Types 604 and 605.

(f) In the case of the low power sets the H/F transmitter, H/F aerial tuner, rectifier, and modulator units are contained in one cabinet with the control panel to form Type 601. The Type 602E cabinet contains the same units as the Type 601 with the addition of the M/F transmitter unit and controls for the emergency machine.

Aerial Switching Arrangements.

(a) An aerial switching unit is mounted separately from the low power sets. The aerial outlet from the H/F tuning unit is connected by a short cable to the aerial switch unit; similar cable connects the M/F transmitter to the aerial switch unit in the case of Type 602E. An 8" trunk is used with the low power sets; the trunk can be connected to either side, the back or the top of the aerial switch unit. The following facilities are provided in the aerial switch unit which is used with both Types 601 and 602E:-

Earth.
Receiver.
Isolate.
H/F D/F (Earth through resistance)
H/F
M/F (Type 602E only)

By a system of links in the aerial switch unit, it is possible, in emergency, to connect the transmitter to any trunk associated with a Type 600 Series transmitter in the same office by means of a flexible coaxial cable, and for any low power transmitter or medium power H/F transmitter of the Type 600 Series, in the same office, to be connected via the aerial switch unit to the 8" trunk. An auxiliary switch in the aerial switching unit operates the interlock and the indicator circuits of the transmitter.

(b) The aerial switch unit in Types 603 and 605 is mounted in the H/F cabinet. An 8" trunk is used with Type 603. An 18" and an 8" trunk are used with Type 605. The trunks can be connected to either side, the back or the top of the H/F cabinet. In the case of type 603 the Main Aerial Switch in the aerial switch unit provides the following facilities:-

Low Power. (L.P.A. or emergency)
Isolate.
Receiver.
H/F D/F (earth through resistance)
Earth.
H/F.

By a system of links in the aerial unit, it is possible, in emergency, to connect any low power transmitter or medium power H/F transmitter of the Type 600 Series in the same office by means of a flexible coaxial cable to the 8" trunk and for Type 603 to be connected to any trunk associated with a Type 600 Series transmitter in the same office. It is also possible to employ a Type 601 or 602E as a low power attachment to Type 603. In the case of Type 605, both the Main and Auxiliary Aerial Switches are used providing the following facilities:-

Main Aerial Switch.

Isolate.
Low Power (L.P.A. or emergency)
Isolate.
M/F via 18" trunk,
H/F D/F (earth resistance).
Earth.
H/F via 18" trunk.

Auxiliary Aerial Switch

H/F via 8" trunk.
Isolate.
Isolate.
Isolate.
Isolate.
Earth.
Isolate.

A send/receive relay in the M/F transmitter allows a receiver to be connected via the 18" trunk to the main roof aerial. By a system of links in the aerial switch unit it is possible, in emergency to connect a low power transmitter or medium power H/F transmitter of the Type 600 Series, in the same office, by means of a flexible coaxial cable to either the 8" or 18" trunk of Type 605, and for the H/F side of the Type 605 to be connected to any trunk associated with a Type 600 Series transmitter in the same office. If the 8" trunk is dispensed with, a Type 601 or 602E can be used as a low power attachment to Type 605. An auxiliary switch in the aerial switch unit operates the inter lock and indicator circuits of the transmitters.

(c) The aerial switch unit in Type 604 is mounted separately from the transmitter. An 18" trunk is used and the following facilities are provided:-

- Main M/F series condenser OUT.
- Main M/F series condenser IN
- Low Power (L.P.A. or emergency) series condenser OUT
- Low Power (L.P.A. or emergency) series condenser IN
- Isolate.
- Earth.
- H/F D/F (earth through resistance)

It is possible, in emergency, to connect any low power transmitter or medium power H/F transmitter of the Type 600 Series in the same office by means of a flexible coaxial cable, to the 18" trunk via the aerial switch unit with the series condenser either IN or OUT. A low power set of the Type 600 Series may be used as a low power attachment to Type 604. A send/receive relay in the set allows a receiver to be connected to the main roof aerial.

Cable Entry

The cable entry is by means of flexible cables from junction boxes fitted externally to the transmitter, through gland plates in the rear of the cabinets to terminal strips.

Ventilation

Internal ventilation is provided for the low power sets through louvres fitted at the back and sides. Forced ventilation is provided for the medium power sets by means of a blower in each cabinet.

Mounting

All cabinets are resilient mounted. Where ample head room is available, the approximate overall height from the deck to the top of the cabinets, allowing approximately 10" from the deck to the level of electrical equipment in Types 602E, 603, 604 and 605, will be as follows:-

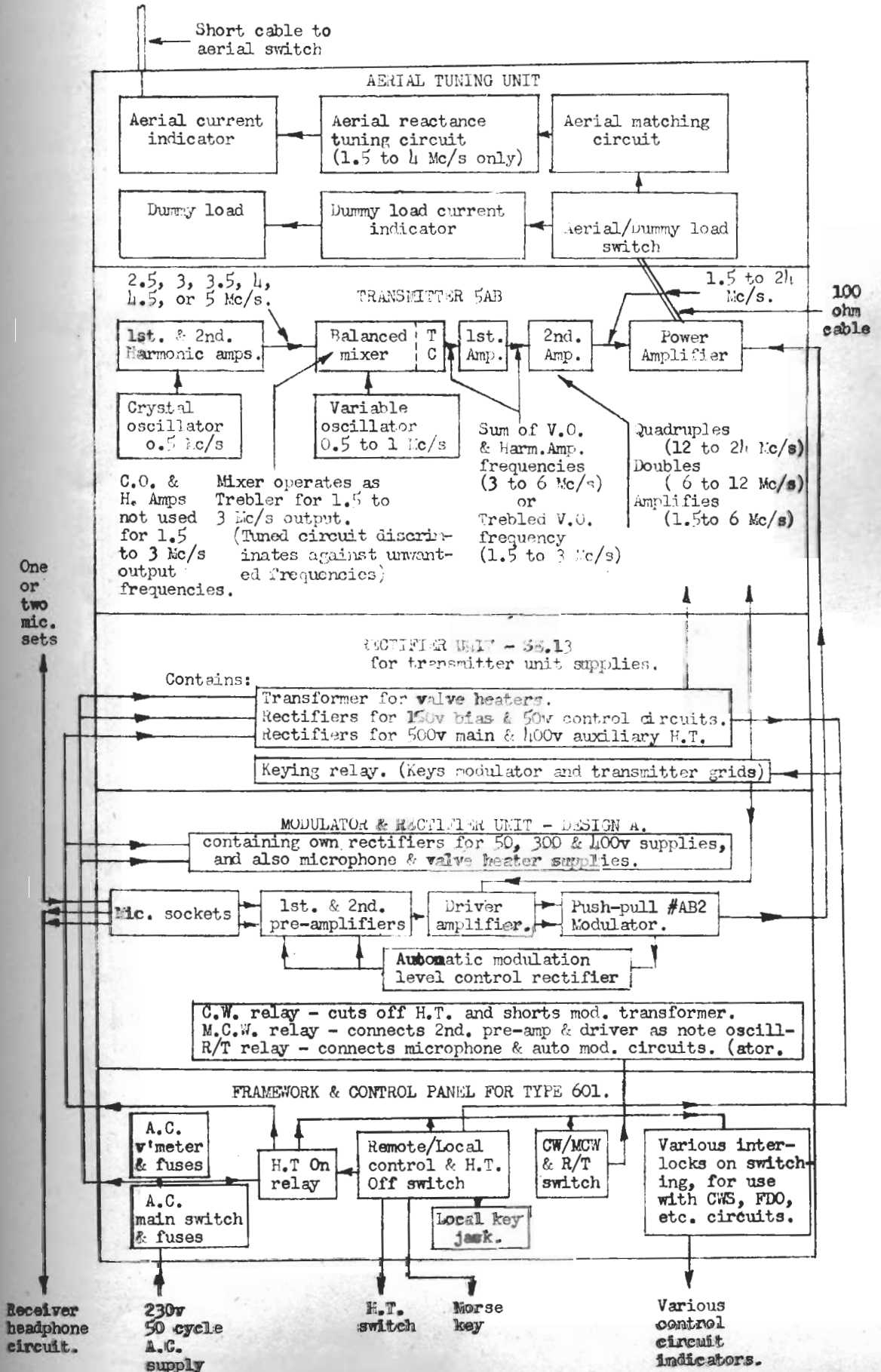
Types 603, 604 and 605	6' 9"
Type 602E	6' 3"
Type 601 (including support)	..	6' 0"

Where adequate headroom is not available, arrangements have been made to fit resilient mounts to Types 603, 604 and 605, in such a manner that the overall height from the deck to the top of the cabinets is 6' 1" allowing no more than 2" from the deck to the level of electrical equipment.

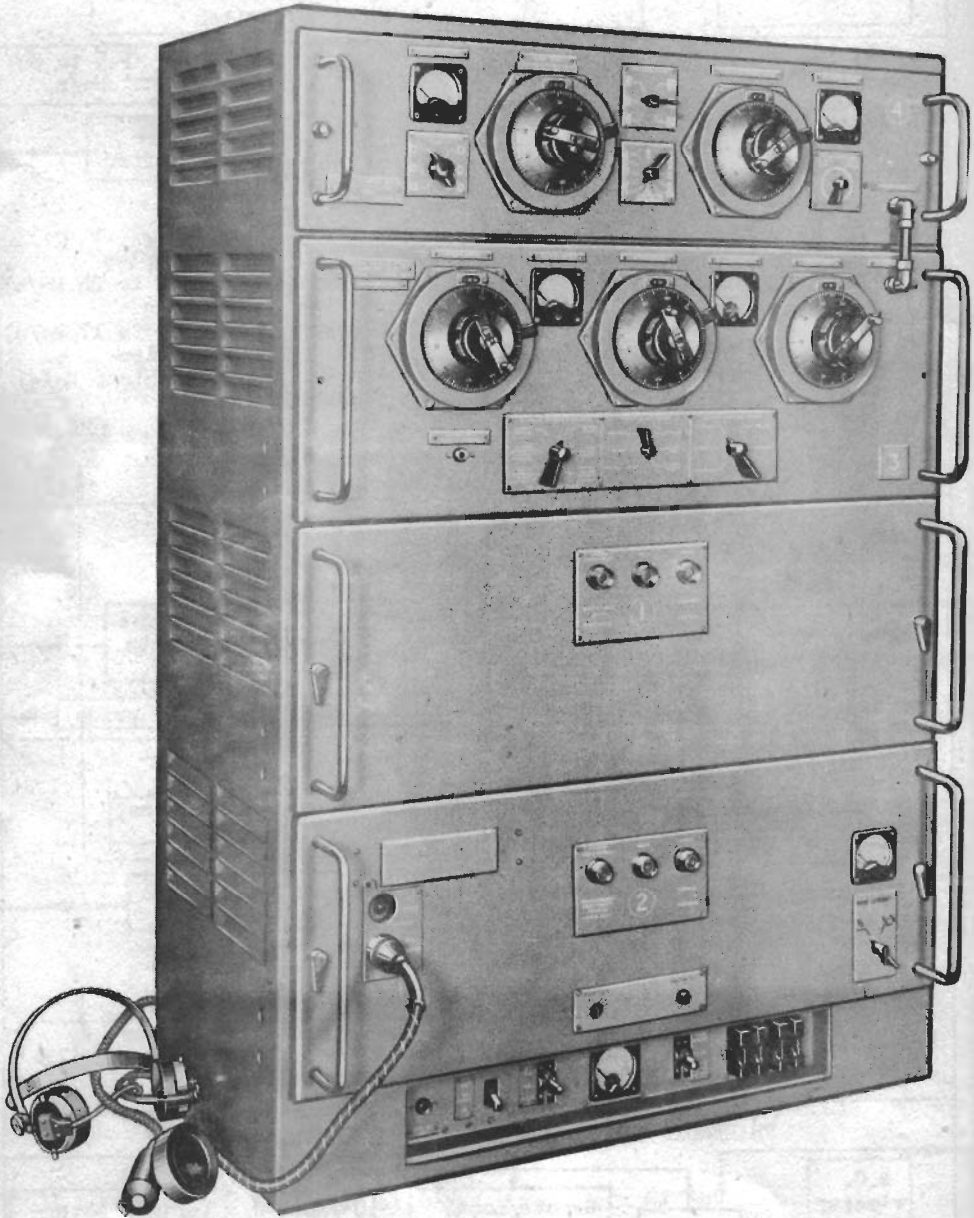
Size of Cabinets

The cabinets have been constructed so that they will pass through a 2' 6" square or 2' 0" x 4' 6" hatch with 2" radius corners. In the particular case of a Flotilla leader, where a 602E is fitted in the Second Office, a collapsible rack has been provided to allow passage through a hatch of 2' 6" diameter.

TRANSMITTER TYPE 601 - SIMPLIFIED SECTIONAL DIAGRAM.



TYPE 601



Siting of Cabinets.

All units are fully serviceable from the front so that except for space for ventilation, cable entry and trunks where applicable, the transmitters can virtually be sited with back and sides against bulkheads. The cabinets of the medium power transmitters can be separated if necessary, in order to facilitate installation.

Servicing.

Units have been designed as far as possible to ensure easy servicing. As previously stated the majority of units can be withdrawn from the front, some on ball-bearing runners without any disconnecting of leads, others after disconnection of leads. Certain of the units are inter-changeable between transmitters. Patching cords are provided so that power can be brought to a unit which has been withdrawn from its cabinet.

Safety Arrangements.

"Safe to transmit" boards are fitted in the aerial switch units which prevent the aerial switch being put to any of the transmit positions. Gate switches are fitted to all easily withdrawable units, i.e. those provided with ball-bearing runners, and to all hinged doors.

Power Consumption and Output.

The maximum power consumption of the transmitters is as follows :-

601 and 602E	-	350 watts on C.W. 500 watts on R/T and M.C.W. (Mains operation only).
603, 604, and 605	-	2 kW on C.W. 3.5 kW on M.C.W. and R/T.

The rated power output of C.W., M.C.W. and R/T of the medium power sets is 400 watts; that of the low power sets is 50 watts. Facility for the reduction of power output to 150 watts is provided with the medium power sets; reduction of power is not provided with the low power sets.

Modulation.

Anode modulation is employed in all transmitters which, compared with suppressor grid modulation allows :-

- (i) Full rated output on R/T and M.C.W., against one quarter to one third.
- (ii) 100 per cent peak modulation against 80 per cent, with normal distortion.
- (iii) Better quality speech.

Automatic modulation control is provided by means of which the peak modulation is kept between 80 and 100 per cent for all normal variations of speech level.

R/T frequency range.

The R/T frequency range is 200 - 4000 c.p.s. providing speech of excellent intelligibility

M.C.W. Frequency.

A screwdriver adjustment through the front panel allows tuning of the M.C.W. note between 800 and 1200 c.p.s.

Keying

Grid keying is provided, normally at hand speed. High speed facilities up to 200 w.p.m. will ultimately be provided on the 400 watt sets.

Microphones

Either single or double pressel carbon microphones can be employed, and facilities exist for using microphones of any other input at 600 ohms level, e.g. moving coil microphones.

Control arrangements.

Basic control arrangements provided are as follows:-

- (i) 1 wire for switching on H/T.
- (ii) 1 wire for keying.
- (iii) 1 cable for microphone and headset.

In addition, facilities exist for interlock and lamp indicating circuits, together with remote control of modulation, to allow these sets to be used with C.C.S., C.W.S. and Aircraft Direction Control Systems.

Frequency Stability and Wavemetering.

Partial crystal control is employed in all H/F transmitters between 3 and 24 mc/s. Control in the band 1.5 - 3.0 mc/s is by Master Oscillator. No wavemeter is required as the Master Oscillator may be recalibrated on site against the crystal oscillator.

In the M/F transmitter, master control is provided and facilities are provided for connection to a wavemeter G.N.

Reduction of Harmonic Radiation.

Circuit arrangements have been so designed to obtain the greatest possible reduction of harmonic output without loss of fundamental carrier power or additional controls.

Aerial Characteristics.

In the case of the H/F transmitters an endeavour has been made to provide aerial tuning facilities to cover a very wide range of aerial impedance, the object being to allow the transmitter to load fully into any combination of trunks and aerials to be found in ships over the whole frequency range.

"Quick Starting".

To ensure that the low power transmitters are instantly ready to operate arrangements have been made for the filaments to be kept continuously alight while at sea, so that as soon as the H/T is switched on the set is at once ready to transmit. In the case of Types 603, 604, and 605, the filaments can be switched on remotely, the H.T. coming on automatically 20 seconds later. When "quick starting" is necessary with the medium power sets it is permissible for the H.T. to remain on without operation of the transmitter for an extended period.

SIMPLIFIED SECTIONAL DIAGRAM.

A simplified sectional diagram of transmitter Type 601 and a photograph of a laboratory model of this transmitter are shown on pages 55 and 56.