CARBON PILE REGULATORS

"NEWTON" TYPE

With the rapid development in the early years of the War, of Radio and Radar equipment requiring a power supply with a stable voltage, there arose the need for an automatic voltage regulator with a rapid response and high sensitivity which at the same time would be compact and reasonably robust; this was met by the Carbon Pile Regulator. This regulator is not new in principle; it has been used in connection with train lighting for many years, but recent developments in design have greatly enhanced its performance.

HOW THEY WORK.

The Carbon Pile Regulators at present most widely used in the Navy are of the "Newton" type and, although all carbon pile regulators are similar in principle, it is with the "Newton" regulator that this description deals.

These regulators consist essentially of a variable resistance in the form of one or more stacks or piles of carbon washers connected in series with the field winding of the controlled generator or alternator. The resistance between the ends of the pile occurs chiefly as contact resistance between the surfaces of the washers and varies between wide limits inversely as the pressure exerted upon them. The washers are contained in porcelain tubes closed at the outer end by carbon tipped screws and surrounded by a metal housing with a large cooling surface or cooling fins. A star shaped leaf spring connected either directly or through pressure balancing levers if there is more than one pile, to a carbon tipped plunger which rests upon the inner end of each pile, compresses the washers. A soft iron armature is attached to the inner side of the spring and moves in the gap of a pot type electromagnet; when the magnet coil is not energised the washers are fully compressed and the pile resistance is at its very minimum, but when the magnet is energised the force exerted on the armature opposes that of the spring and tends to decompress the washers; the less the pressure upon the washers, the greater is the resistance between the ends of the pile. The regulator is so designed that when the output of the generator or alternator is applied to the magnet coil circuit, the two forces balance at a predetermined voltage; a rise in voltage produces an increase in pile resistance with resulting decreases in field current and thus tends to oppose the change of voltage; if a fall in voltage occurs a similar, but converse action takes place. The full range of pile resistance requires only a very small movement of the armature and can be obtained with a change of about 4 per cent of the controlled voltage i.e. the regulator will maintain the voltage constant within ± 2%.

For Naval Radio and Radar these regulators are mostly used with A.C. Supply Outfits; the alternator output is connected through a trimming resistance and pre-set "ballast" resistance to a selenium rectifier, all of which are components of the regulator assembly; the output of the rectifier, usually smoothed by an 8 mfd. condenser, is used to energise the magnet. Changes in controlled voltage arising from variation of air and regulator temperature are compensated partly by proper choice of ballast resistance and partly by arranging the star-shaped spring to rest upon a dished bi-metallic ring; this ring flattens with rise of temperature and reduces the spring pressure to offset the reduced magnetic pull due to heating of the magnet coil.

A slow drift of voltage of about 1% of the controlled value may occur with changing temperature. Two copper rings surround the core of the magnet at the gap end and damp the moving system by reason of eddy currents induced when the magnetic flux changes.

CHOICE OF REGULATOR.

Four factors influence the choice of a carbon pile regulator for a particular machine: (a) power to be dissipated, (b) voltage across the piles, (c) permissible minimum resistance, (d) necessary maximum resistance. There are three sizes of the "Newton" type regulator now in service, having four piles, two piles and one pile and able to dissipate respectively 250, 125 and 30 watts. An "exploded" view of the 250 watt type mechanism is shown.

It is a disadvantage of the carbon pile regulator that the resistance cannot be reduced to zero. There is always a residual resistance of a value depending on the number of washers and the connections of the piles which, in turn, are determined by the maximum resistance required. The maximum resistance can be made very high if the pressure on the piles is light, but in practice there is a limiting minimum pressure below which the regulator is sensitive to vibration and is susceptible to destructive arcing between the washers. The practicable ratio of maximum to minimum resistance usually lies between 30 and 40. Further, the voltage across the piles must be limited to a value such that the voltage between adjacent washers does not appreciably exceed 0·6 volt.

USE OF DIVERTER.

When an alternator requires a field current less than that obtainable with the maximum resistance of a standard regulator in circuit, it is often possible to obtain satisfactory control by shunting the field winding with a fixed resistance referred to as a "diverter". For convenient use in such cases a 300 ohm resistance is fitted in Pattern W.1698 Regulator and connected so that when the terminal marked "COM-" is joined to the negative pole of the supply, the diverter is in circuit. The proper use of the diverter is most important. The A.C. Outfit handbooks indicate whether it should be in circuit; for general guidance it is never used with 110 volts D.C. machines, but is mostly used with 220 volts D.C. machines having an alternator field resistance greater than 200 ohms: it must not be used with machines having a lower field resistance than 140 ohms; if it is, the regulator will be overloaded and rapidly destroyed. If, on the other hand, the diverter is not in circuit with the machines requiring it, the regulator will operate with loosely packed washers, will tend to be unstable and will have a short life.

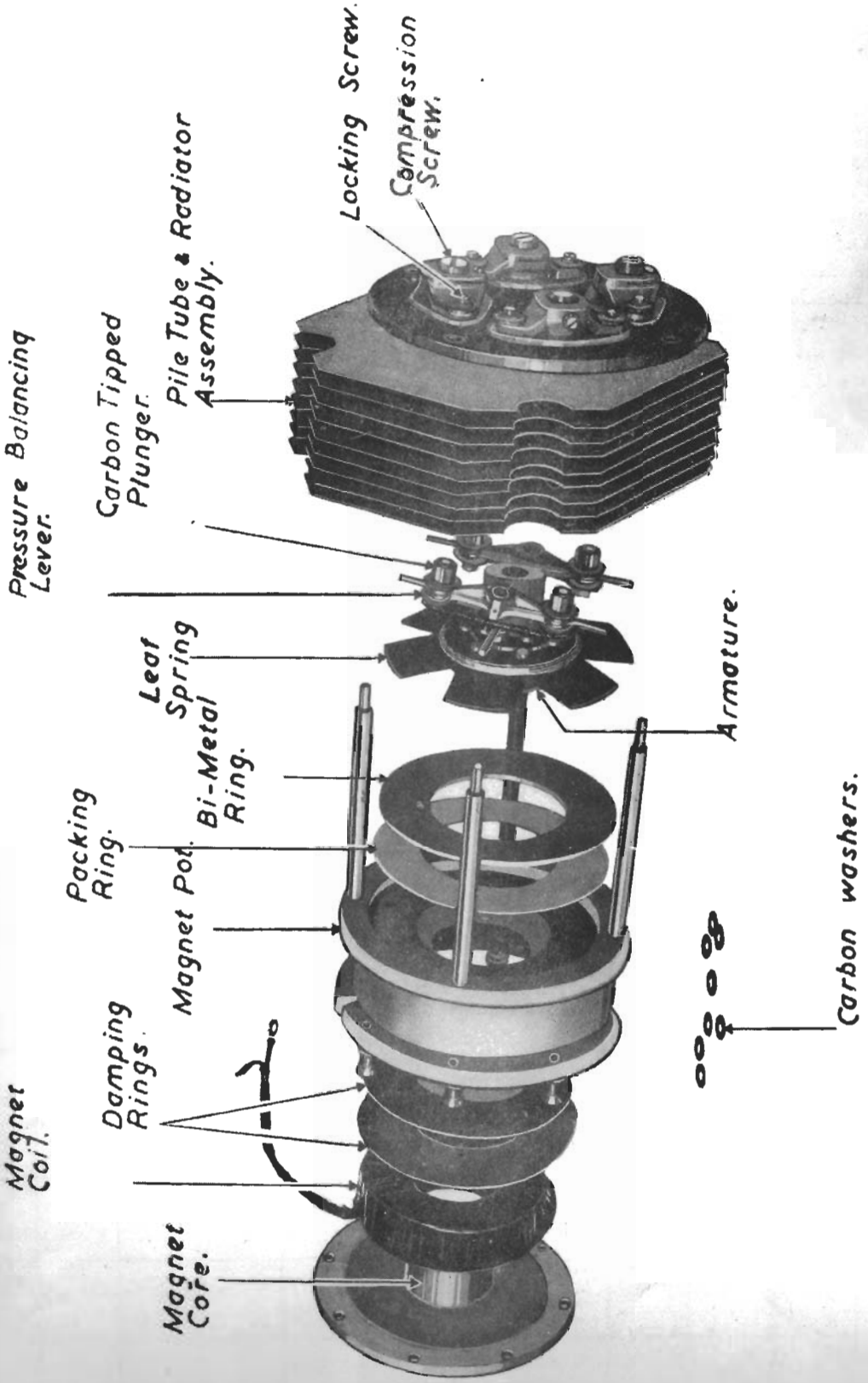
ADJUSTMENTS.

All these carbon pile regulators have three pre-set adjustments (i) Compression Screws, (ii) Ballast resistance, (iii) Magnet Coil, and the larger sizes have a fourth, the Armature Stop. The settings of the last three should not be altered unless the regulator has been dismantled or some major change made; it is a golden rule to leave them alone. The Compression Screws do require adjustment from time to time and proper attention to them will result in long and satisfactory regulator life.

TO CURE HUNTING.

When a regulator has been in service (or even in storage) for some time, the piles shrink slightly and instability or "hunting" may result, causing rapid fluctuation of voltage. Besides making safe operation of equipment impossible, hunting causes serious arcing between the washers and if allowed to persist will quickly destroy the

CARBON PILE REGULATOR.
("NEWTON TYPE")
Exploded view.



TYPICAL CONNECTIONS OF CARBON PILE REGULATOR

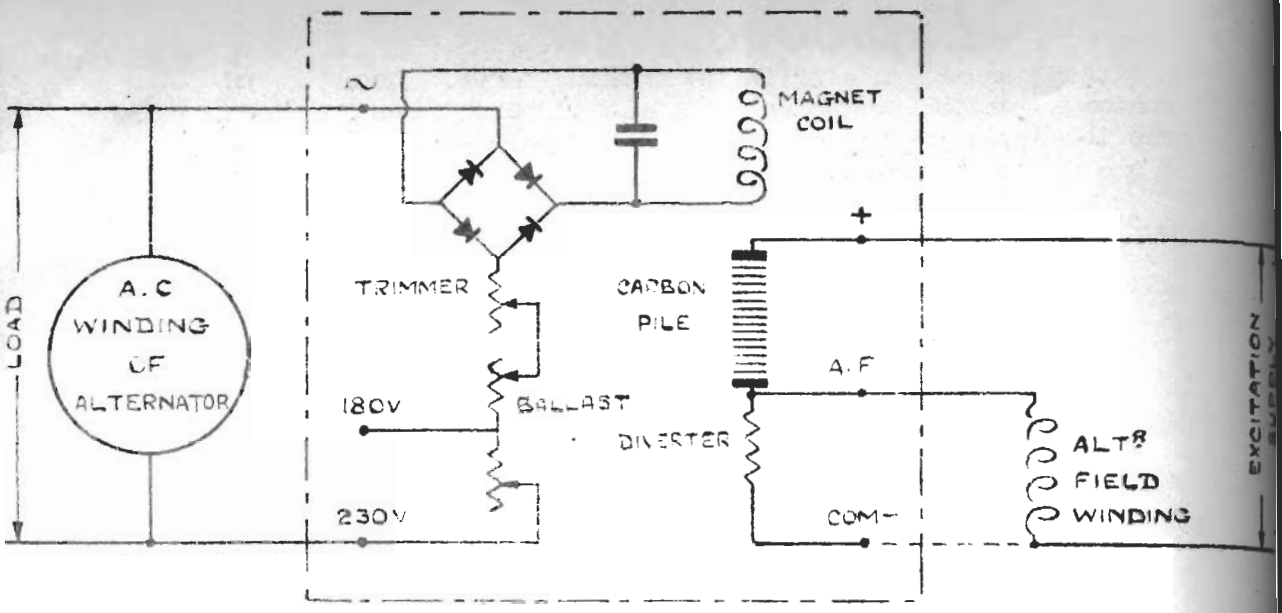


FIG. 1.

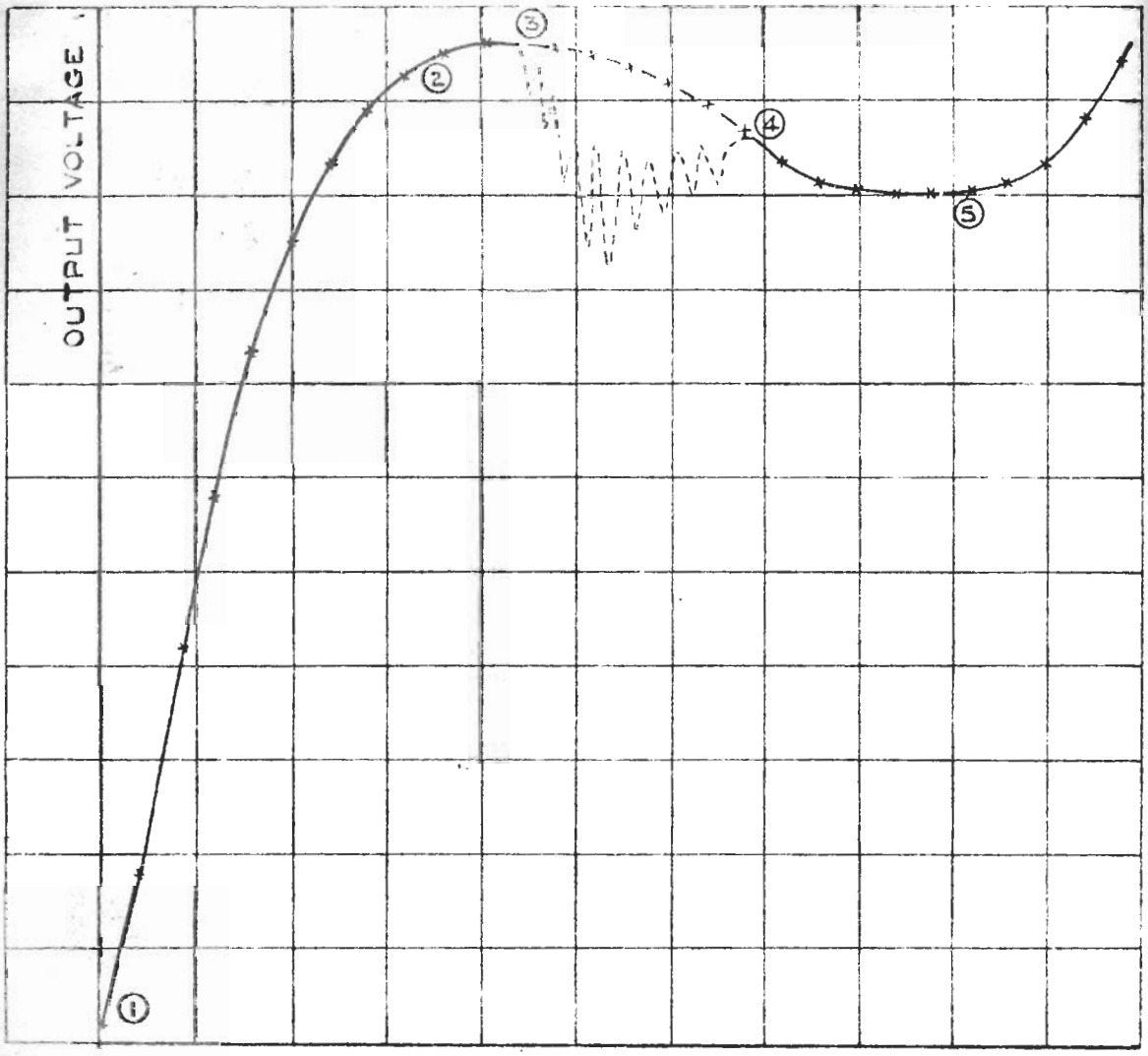


FIG. 2

contact surfaces. At the first signs of hunting, the regulator should be adjusted; it is quickly and easily done. With the 125 and 250 watt sizes, open the front panel, mark the position of each compression screw with a pencil and slacken the locking screw. Run the motor alternator unloaded, and using an insulated screwdriver, screw in each compression screw in turn, one eighth of a turn at a time. Usually after one or two movements of the screws the regulator will become stable. Watch the A.C. voltmeter and continue turning one eighth of a turn at a time until the voltage just begins to rise; then turn back each screw one eighth of a turn and lock. Check that the regulator is controlling satisfactorily by throwing load on and off; if it does not, unscrew each screw a little further.

A similar procedure applies to the 30 watt regulators. Take off the cover, slacken the locking screw, run the alternator unloaded and very slowly screw in the compression screw until hunting stops. Mark the position of the screw with a pencil and then give it a further quarter of a turn. Tighten the locking screw and check operation.

Make these adjustments quickly - don't let a regulator hunt for more than a few seconds.

The reason for the above procedure can be seen from Fig. 2; this shows how the voltage varies if the compression screws are first screwed right out until they only just make contact with the piles, and are then screwed slowly home. From (1) to (2) the washers are very loose and the regulator is not controlling automatically, but is simply acting as a varying series resistance; the armature is held away from the magnet gap by the spring and the compression plungers are hard down on the ends of the pile tubes. The voltage rises as the screws enter and beyond (2) is at maximum because the armature has not yet been drawn towards the magnet gap and the washers are now fully compressed. Further movement of the screws pushes the armature into the gap and at (3) the regulator takes control; the armature is now "floating" in the gap, but the regulator is very unstable and violent hunting occurs, diminishing towards point (4). If the screws are tightened well beyond this point, the piles again approach full compression since the armature is forced against the armature stop, so that the regulator loses control and the voltage rises towards maximum. The most satisfactory regulating position is in the vicinity of point (5) and this is the approximate position obtained by the adjusting procedure described.

REPLACING WASHERS.

After a long period of service, or if hunting has been allowed to persist, the carbon washers will soften and disintegrate and it will be impossible to obtain stable operation. Replacement washers packed in glass phials are available for all regulators. When fitting new washers make sure that they are of the right type, that all fragments are cleared out of the pile tubes and that all the washers in a phial are inserted in each tube; handle the washers as little as possible and never with dirty or greasy hands; they are best fitted by sliding on to a piece of wire to facilitate insertion into the pile tube. When replacing washers examine the condition of the carbon tipped plungers and compression screws and if they are pitted or burnt, replace them. To fit new plungers the pile tube and cooler assembly must be carefully removed. After replacing washers insert the compression screws and screw up finger tight; then use a screwdriver, moving them one eighth of a turn at a time and keeping them in step, until the regulator begins to control and there are signs of hunting. Finally adjust the screws as already described.

DON'T TOUCH THE CORE!

Don't alter the core setting of a regulator unless it is absolutely essential; that is, unless, having fitted new washers and adjusted the compression screws, it will not control stably or at the correct voltage and you have no spare regulator. If you have to change the setting, first carefully mark its position - any satisfactory operating position will be very close to the original setting; screwing in the coil lowers the voltage at which the regulator controls and vice versa.

ARMATURE STOP

The armature stop, which is a screw passing down the centre of the coil of the pot magnet, can be readily adjusted though, again, this will only be necessary if it has been moved or loosened. With the alternator running unloaded turn the trimmer resistance knob to the minimum voltage position, screw in the stop until the voltage begins to rise; then unscrew one quarter turn and lock.

DANGER !

It is an inherent feature of most automatic regulators that if the controlled supply is disconnected, the regulator resistance is reduced to its minimum value. This is a source of danger for if the magnet of a carbon pile regulator is accidentally de-energised, the piles will be compressed and the alternator voltage will rise to a high value. This may happen through failure of a rectifier, or the burning out of resistances or of the coil itself, but a more common cause on the larger regulators is the partial short-circuiting of the coil due to failure of the electrolytic smoothing condenser. It is probable that in future, this condenser will be replaced by an external paper dielectric type; in the meantime it may, if desired, be disconnected when regulators are used with 500 cycles equipments (not on 50 cycles) without adversely affecting operation, though if this is done an adjustment of the preset ballast resistance (right hand portion only) will be necessary to give the correct voltage. The terminals of the condenser are used as connectors for two leads and if the condenser is disconnected, each pair must be joined and taped. To protect against failure from any cause, an over-voltage relay (Patt. 56271) has been introduced and will shortly be available; over voltage relays are also being fitted in recent Power Boards.

REMEMBER !

(i) That the carbon pile regulator, whilst reasonably robust is an instrument and needs to be treated as such. Boards in which it is fitted should always be resiliently mounted; freedom from vibration and unnecessary shock should be the rule.

(ii) There are practically no moving parts to get out of order. Those needing replacement are the carbon washers, and, sometimes, the plungers and compression screws. With proper replacement of these parts, the regulator is as good as new.

MICROPHONES

The problem of the technical and electrical details of microphones is closely allied to control systems to ensure the successful operation of a ship's W/T and R/T control system. Where all transmitters are capable of operation via a control circuit exchange, it is essential that all forms of microphone assemblies shall have identical technical and electrical characteristics.

It is not intended to give detailed advantages or disadvantages of the different types of microphones, e.g. carbon, electro magnetic, moving coil, etc. It can be stated, however, that the carbon type of microphones has been adopted for general use in H.M. ships for the following primary reasons:-

(a) Robustness, i.e. will stand considerable ill usage, thereby giving added reliability.

(b) It does not require a microphone amplifier between the microphone and the modulator units of the various transmitters.

The rapid growth of R/T for ship to air and ship to ship communication, together with the use of certain American and R.A.F. types of transmitters, has necessitated the use in ships of different types of microphone. Although of the carbon variety, these microphones differ in electrical circuit details, and this prevents their use in a common control system.

This fact is apparent in the case of the modern Fleet Destroyer, where at present three separate control systems are being fitted. These are:-

KCK (for main W/T equipment)
KCU (for 2 types TBS)
Control circuit for Type 86M.

This undesirable state of affairs has mainly arisen due to the fact that the rate of fitting of additional transmitting equipment for R/T communication outstripped the development, design and production necessary to modify the transmitters for operation via a CCX.

Up to date the following first steps have been authorised by A.F.O. in order to achieve a partial standardisation in the use of the P.O. Type 184B micro telephone hand set and the Admiralty Pattern W6703 microphone and telephone head set assembly.

(a) Modification to 4T transmitter. This is applicable to all the Type 60 series. This transmitter previously operated with a differential type carbon microphone, viz. Admiralty Patt. 5756.

(b) The introduction of W/T and R/T control outfits KCH to KCP for non C.W.S. ships.

(c) Modifications to the C.W.S. control circuits for Types 57DR/DMR and the conversion of Type 60D to 60DR for C.W.S. ships. The Type 57DR/DMR previously employed Admiralty Pattern 1359 moving coil type microphone.

Types 86M (except in Destroyers and below) 87M and 89M, fitted primarily as fighter direction transmitters, all operate with the same types of microphone mentioned above.

Type 86M in Destroyers and below employs the standard Air Ministry type of electro magnetic microphone supplied with the set, but it has recently been decided that the necessary modifications to the transceiver in these ships should be made to allow operation with the P.O. Type 184B and the Admiralty Pattern W.6703 is in Cruisers and above.

To attain final microphone standardisation, work is now proceeding to:

(a) Connect all transmitters fitted in a ship to a combined W/T and R/T control circuit exchange, which then allows the use of a common type of microphone.

(b) Develop a standard micro telephone hand set suitable for working with such a control system.

(c) Develop a microphone and telephone head set assembly with the same technical and electrical characteristics as (b) but more suitable than the present Admiralty Pattern W.6703 microphone and telephone head set assembly for the use of personnel employed on fighter direction and similar functions.

One specific requirement of (b) and (c) above peculiar to their employment in ships is "internal security". This implies the prevention of transmission of noise or conversations taking place in the same compartment. Lip microphones have proved efficient in this respect but have been unfavourably reported upon after trials in the Fleet on the grounds of discomfort, especially in tropical climates, and hygiene.

Throat microphones have also been tried with a view to meeting the "internal security" requirement, but were discarded owing to the poor intelligibility of the resulting R/T transmissions.

It will be seen from the foregoing that, although apparently at first sight a simple matter, the standardisation of microphones where several types of transmitters are in use, is in fact a major problem and, together with providing the "internal security" requirement, entails considerable research and development to produce the most suitable type of microphone assemblies.

CONSOL

"Consol " is a long range navigational system sometimes referred to as "Sonne", and used by the Germans since 1943.

Since its first detection in this country later in the same year, it has been used extensively by coastal command and later by the Royal Navy giving consistently good results meriting the system to be classed as a most satisfactory aid to navigation.

"Sonne" is an M/F W/T beacon producing lines whereon a continuous note is heard. These lines are radii which are boundaries of sectors of alternate dot and dash signals. The pattern rotates in azimuth at the rate of one sector per minute for the angular displacement of one sector.

This sweep period is followed by a one minute continuous omni-directional transmission and then the lobe pattern reappears and the cycle recommences.

By counting the dots and dashes heard at any point and using a suitable key the signal can be interpreted as a great circle bearing from the transmitter. Special consol charts on the gnomonic production are provided for the direct plotting of bearings, together with border printings of the appropriate keys of beacons covering the area.

This system is produced from a shore installation of three 350 feet aerials in line evenly spaced at a distance of the order of three times the wave length of the transmission. Frequencies used have been between two fifty and five hundred kc/s.

Greatest accuracy is secured along the normal lines when a miscount of one or two signals will make only a fraction of a degree error. Towards the edge of the pattern the accuracy falls off until a miscount of one or two signals can make more than a degree error.

It must be appreciated that an ambiguity exists in that there is no direct indication that the vessel is situated in a particular sector. The width of sectors is of the order of 10° in the centre of the pattern, widening to about 20° at the sides of the pattern. Other means, such as D.R. or D/F, must be employed to identify the sector in which the vessel is situated.

In general, the average accuracy of bearings by day is approximately one degree and by night two degrees. Erratic results may be secured at dusk and dawn.

Counter measures may be taken which makes the system unreliable.

Experimental stations are in the course of erection in U.K. for further research by the Air Ministry.

V. H/F AERIAL OUTFIT FEEDERS

It might appear inconsistent to use feeder cables of different impedances in V.H/F aerial outfits ARU (aerial outfit for Fleet and Light Fleet Carriers and Fighter Direction ships) and AFH (aerial outfit for all other types of ships except submarines) to connect the same transmitter (Type 87M/86M) to the same aerial unit (Type 3 dipole). The explanation is this:-

The best impedance for this feeder is 70 ohms. At present there is no low loss 70 ohm. cable and so in aircraft carriers (except escort carriers) and figther direction ships, Uniradio 8 (Pattern 13808), a low loss large diameter cable with an impedance of 100 ohms is used in conjunction with Uniradio 31 (Pattern 13831) where a flexible lead is required. The use of 100 ohm cable increases the losses due to mismatch, but this is more than compensated by the reduction in attenuation.

In escort carriers where cable runs are difficult, and in capital ships and cruisers where it is considered that the V.H/F equipment can sacrifice a small measure of efficiency, Uniradio 2 (Pattern 13802) is used in conjunction with Uniradio 1 (Pattern 13801) for flexible connections. The impedance of both these latter cables is 70 ohms and they are of small diameter.

A.S.E. is at present trying to produce a low loss 70 ohms feeder cable of small diameter. When this is achieved, this cable will be used as the V.H/F aerial feeder in all types of ships.

H.M.S. MERCURY

H.M. Signal School, so long a part of the Royal Navy Barracks in Portsmouth, was moved from there after the blitz on Portsmouth, to Leydene House, East Meon, the property of the Countess Peel and was commissioned as H.M.S. "Mercury" in August 1941. Leydene House commands a very wide view of the surrounding country, being situated on high ground approximately 740 feet above sea level and constituting the third highest point in Hampshire. To the south-westward, ships in the Solent, about 17 miles distant are clearly visible in normal weather.

The main building is a modern house, completed in 1922, and houses the officers' quarters, administrative offices, certain classrooms, and the Wren cooks, stewards, etc. Two principal camps have been built to house 920 ratings and provide 60 odd classrooms. The full numbers of ratings are victualled daily and the number of officers under instruction varies from 50 to 110.

All No.2 rate courses are carried out here, and in addition all Portsmouth 3's. These courses have been very large for the last six months, the W/T classes averaging about 65 per course.

The introduction of the Radio Mechanic W/T Branch produced a very large additional requirement and a new Camp consisting of 30 huts is now practically completed. It consists of 15 technical rooms and workshops and the remainder lecture rooms.

H.M.S. Mercury

REFITS - SIGNAL OFFICER'S DUTY

The following elementary notes are written with a view to assisting the officer who becomes ship's signal officer and is faced, probably for the first time, with the duty of ensuring that appropriate signal items are inserted in the "Defect" list and "Alterations and Additions" list.

PURPOSE OF A REFIT.

The purpose of a refit is to make good the ship's Defects and particularly those affecting fighting and sea going effeciency.

COMPLETION OF THE DEFECT LIST.

Defects are graded by their importance into lists, the instructions for which are on the form and the Engineer Officer is the king of these lists.

Your job will be to advise him of appropriate items to insert in these lists.

The Defect List is the method whereby you remedy all defective wiring (such as power supply or control cables), defective transmitting trunks and feeder cables, insecure structure etc. If in doubt consult the E.O.

DEFECTIVE RADIO EQUIPMENT.

Practically all items of actual radio equipment are "Sea Stores" and, if damaged or defective, are not dealt with by the Defect List but by demanding new ones and returning the old via the Naval Stores.

DEFECTING SEA STORES.

Your job will be to see that the Naval Stores have full particulars for completing their Notes (Form S.331) for returning and drawing a new article.

ALTERATIONS AND ADDITIONS.

Alterations and Additions are alterations to existing equipment or new items of equipment to be added; they are authorised for the ship from time to time by the Admiralty generally by means of A.F.O.'s or C.A.F.O's.

A AND A REGULATIONS.

The A and A regulations are laid down in a C.A.F.O. the appropriate one in force at this date (May, 1945) being C.A.F.O. 793/43. You should read it.

Lists of "proposed" As and As are forwarded from time to time, in accordance with the current orders, for scrutiny at the Admiralty for approval for your individual ship. Opportunity is often taken at the Admiralty to insert any items approved since your list was forwarded from the ship.

Admiralty decisions on these items are published in the A.F.O. "A" series and the items concerned are then transferred to the "Approved" list of A and A's for your ship.

It may well be that through a change of policy or the work not being considered justified the item is "Deferred" or even "Cancelled" for your ship.

Deferred means the item is left dormant in the list and nothing will happen until deferred is altered either to "Approved" when it will be put on the "Approved" list or it is "Cancelled" when it will be removed entirely from the A and A lists.

A and A items may well be authorised for a new ship at such a late date in her construction that the builders cannot do the work before the completion date. You must not be surprised therefore on joining a ship for her first commission to find some outstanding A and A items. You can find out these items from the Warship Electrical Superintendent in charge of building your ship.

YOUR A AND A LIST DUTIES.

Your job will be to ensure that the Captain's Secretary (the king of this list) inserts all the signal items in his "Proposed" list of A and A's as they are authorised.

GOING TO REFIT.

News comes that you are to refit and the "Approved" lists are sent immediately to the F.O.I.C. of the repair base or A.S. of the dockyard concerned.

For the purposes of the refit the F.O.I.C. or A.S. is an all powerful Dictator.

DUTIES ON ARRIVAL AT THE REFITTING PORT.

You should lose no time in getting to know, and on the best of terms with, his Prime Minister who in your case is the Electrical Repair Overseer at a repair base or the Electrical Departmental Foreman at a Dockyard.

Also, on arrival you (or the senior W/T rating) should contact the local P.W/T.O. to discuss the defects and A and A items. Even if there are none, the P.W/T.O. should still be contacted because he may have up-to-date knowledge of some new equipment about which the ship has not yet received information.

REFIT CONFERENCE.

Shortly after your arrival at the refitting port the F.O.I.C. or A.S. concerned will call a Refit Conference which will be attended by all the principal departmental authorities of the yard concerned with the refit and to which the ship is invited.

The Defect lists will first be dealt with and the length of the refit decided.

Then such items from the A and A lists as can be completed within the time and with the labour available will be selected for completion.

This selection which is left by the Admiralty entirely to the F.O.I.C. or A.S. requires a Solomon as there are invariably many classification A* and A items that have to be left undone.

The F.O.I.C. or A.S. is guided in his decisions by the Classification of the item awarded by the Admiralty and also of course by anything the Captain and ship's officers have to say on the subject. They probably bring a list ready in order of preference.

REFIT CONFERENCE DUTIES.

This is where you should have come in. Make sure to draw your Captain's attention to all your important items before he goes to the conference.

You will also observe from C.A.F.O. 793/43 that "Proposed" items may be put forward for completion so don't forget to include them when bringing items to the notice of the Captain.

If you don't fully understand the item or its application at sea, consult the P.W/T.O. who is there for that purpose or ring up the Admiralty Signal Establishment (Haslemere 1080) and ask for "A3", the installation application officer.

It is important that the senior W/T rating should not proceed on leave until decisions are reached on what items are to be undertaken by the refitting authorities, which items - if any - will require ship's staff assistance, the work of the refit planned, and the defects taken in hand.

Remember it is no use complaining to the Admiralty about the F.O.I.C's decisions on items that are not being done, if the F.O.I.C. has omitted an item to which great importance is attached, it is the fault of the ship's officers for not indicating the items of lesser importance that might have been omitted to provide the necessary labour for the item of great importance.

DUTIES OF SHIP'S STAFF DURING THE REFITTING PERIOD.

The refitting authorities are in no way responsible for maintaining W/T equipment already fitted in the ship, and this will not be tested by the firm or Dockyard on completion of the refit unless work has been undertaken on it. It is up to the ship's staff to maintain existing W/T equipment during the refitting period.

DUTIES ON COMPLETION OF REFIT.

When the ship's Programme of Completion is drawn up, the Signal Officer should insist on adequate time for testing and tuning of all new apparatus. The P.W/T.O. will advise on the time required for tests.

THE PW/TO

(BY A P.W/T.O.)

Although many of the following remarks apply only to ports at which work is carried out by private yards, some are applicable in all cases.

A.F.O. 993/44 states that duties of a P.W/T.O. generally but it is hoped that the following will be informative to those officers detailed for Communication duties in a ship, and, may be passed on to others, particularly to Commanding Officers of Minor War Vessels who may from time to time visit Signal School for courses, or who can be advised by communication officers.

The particular interest of a P.W/T.O. is in Emergency Repairs as distinct from New Construction, which A.S.E. looks out for, and there are many differences in the problems which arise. Ships may be taken in hand under three main headings: Damage from Enemy Action, Modernisation for Service in Eastern Waters or Defects which must be made good to continue the duties upon which the ship is engaged. I have never known of a ship coming in only for W/T Repairs, on a large scale. From this it will be seen that such work that is undertaken is dependent upon other defects which have to be taken in hand. Hence such W/T work which will be undertaken must be fitted into the time allowed to put right other defects. Amongst the factors to be taken into consideration are the following :-

The natural desire of the ship to be in action again as soon as possible, the desire of all concerned that the ship goes to sea equipped with the most up-to-date apparatus, and as many modifications carried out as possible. That these may be accomplished depends upon time available and, in some places in particular, the labour available. In this connection there is a great shortage of skilled electricians, and much dilution has to be accepted. This adds considerably to the difficulties of the hard worked Electrical Overseer and adversely affects the amount of work which can be undertaken.

When a ship is taken in hand there is usually a Conference at which representatives of the Firm, officers of the ship and the technical advisers of the Flag Officer are present. Some preliminary work has been done and most of the answers are usually cut and dried. In cases of doubt it is usual for the technical officer and Emergency Repair Overseer to examine the particular defect or A and A and decide whether it can be undertaken or not. A tentative date of completion is arrived at and, in the case of W/T, much will depend upon stores being available.

The position of the P.W/T.O. is not always enviable. He functions purely in an advisory capacity although called upon to give decisions which are not always laid down in specifications.

The Electrical Repair Overseer is responsible for getting the work done but he has many things to contend with, including Radar, Fire Control and other commitments besides W/T. The P.W/T.O. keeps him informed of latest developments, information received from A.S.E. A.F.O's and C.A.F.O's and generally oils the wheels and he passes such information on to the Firm's representatives.

The P.W/T.O. may know from his experience that such is the case and can only inform his Flag Officer. At subsequent conferences this information is aired, when a new completion date is fixed or the Firm gingered up. In the meantime the work goes along, the Overseers ask for enlightenment on certain points, complain that stores have not arrived etc. The P.W/T.O. reports progress to A.S.E. shakes R.E.A. regarding stores and diplomatically placates ships officers about jobs which cannot be undertaken.

From my previous remarks it would appear that much of the W/T work is dependent upon time available.

At the completion of the refit the trials period always seems to depend upon other considerations. It is gratifying that Their Lordships have pointed out in A.F.O. 6185/44 that time for W/T trials should be allowed for. Although specifications state that W/T sets should be handed over for test in working order, it is most unusual for this happy state of affairs to happen and much time must be spent by the P.W/T.O. and dockyard staff finding the inevitable cross wires before testing can take place.

In this matter of testing and tuning it is of great assistance if the Ship's staff co-operate in every way possible. It may be that there is a danger of telegraphist ratings losing their full sense of responsibility for the technical side of their work, but this tendency must be checked. It is obvious that they should take every opportunity to become familiar with the sets they have to operate and should therefore be present whenever tests are being carried out. The introduction of the Radio Mechanic branch in no way lessens the importance of this. If breakdowns occur after a ship has left its refitting port it may well be due to failure on the part of the Ship's staff to have become familiar with apparatus which had then been fitted or modified. Not the least reprehensible feature of such events is the possibility that a P.W/T.O. called in later to assist will have an unfair impression of his colleague in his mind.

With regard to small craft where no W/T A and A's are taking place, it appears to be the idea that the P.W/T.O. will be responsible for the maintenance and well being of the W/T. Telegraphists are sent on leave, or, if on board, used as postmen etc. The result is that when about to go to sea urgent requests are made for P.W/T.O's assistance. Attention to A.F.O. 6185/44, para. 2 and 3, should obviate this.

The P.W/T.O. receives many enquiries regarding stores. It does not appear to be generally known that large stocks of W/T stores are not available at certain ports. Demands for replenishments must be forwarded to Storing Yards or to Haslemere. Although this is not meant to be a "Pity the poor P.W/T.O." article, from past experience I have appended a list of DON'TS which, if more generally known, would help the P.W/T.O. and make for greater efficiency.

(Editor's Note : The Editor fully appreciates the difficulties existent in wartime when a ship comes into a yard for a refit. It is often the only chance that the telegraphist ratings get of going on leave, and to a certain extent getting extra instruction such as courses.

It is obvious however, that all telegraphist ratings should take every opportunity to become familiar with the sets they have to operate, and it is hoped as many as possible are always present when major tests are being carried out.

Introduction of Radio Mechanics (W/T) who are already being drafted to ships will undoubtedly relieve the P.W/T.O. of a great deal of work on these occasions. The amount they are able to do will naturally increase as they become more experienced, and fuller training facilities exist).

D O N ' T S.

DON'T Neglect to ask the P.W/T.O. for advice before conference on defects and A and A's.

DON'T Expect a large maintenance staff to descend on to your ship. Maintenance is the ship's responsibility and the P.W/T.O. staff is very small.

DON'T Expect a new A and A to be taken in hand when refit is nearly finished.

DON'T Expect the P.W/T.O. to get jobs done for which there is no Admiralty authority. This applies to any projected schemes which you have heard about in your most recent course.

DON'T Send all your senior ratings on leave together so that there is no responsible rating on board whilst work is proceeding.

DON'T Forget that making aerials is a ship's staff commitment.

DON'T Apply for examination of Telegraphist ratings when only a few days are left before the ship leaves. Examinations require preparation.

DON'T Imagine that P.W/T.O. is a stores officer. Remember at most places there is a N.S.O. and R.E.A.

DON'T Think a Type 86M or TBS etc. can be produced out of the bag. Allocations are made by Admiralty.

DON'T Expect the answer to any query straight away, there are more varieties of W/T sets than 57.

DON'T Expect the P.W/T.O. to visit you every day. You are not the only ship in port. He has many other commitments but you are not forgotten. Your completion date is always on his mind.

DON'T Forget to allow time for trials and tests at completion of refit.

DON'T Forget that it is Admiralty policy to take on board W/T sets allocated but not fitted. You will have to find room because they may be fitted at your next port of call.

DON'T Dismantle all your aerials and scrap them without being sure you have spare aerial wire on board.

TYPES 686M AND 687.

Type 686 is a U.H.F. transportable transmitter-receiver for intercommunication between certain landing craft, working on spot frequencies between 300 and 312 mc/s. The set was designed for operation by unskilled personnel. The time required for installation is from 15 to 30 minutes. The communication range is from 2 to 10 miles according to the height of the aerials. Either R/T or M.C.W. can be used.

As a result of operational experience it was decided to carry out certain modifications and also provide a portable version of this set. The modified version is known as Type 686M and the portable as Type 687.

The main modifications are as follows :-

(a) The incorporation of an external vernier tuning device (for the transmitter) to facilitate netting when several stations are involved. This has required some minor re-arrangement of the transmit/receive panel.

(b) The incorporation of a miniature loudspeaker and facility for the employment of a high level output, which can be used either for local reception or relaying of received signals. This has involved considerable re-arrangement of components in the power compartment and a new chassis.

Type 687 is electrically similar to Type 686M, but its size and weight have been considerably reduced, and it is fully tropical. The chief differences are :-

(a) Two spot frequencies only are provided instead of three, but any two of the former five can be preset. Altering the preset frequencies requires the use of Test Set Pattern 54455 and can be done only at base. A reversible and exchangeable tally plate on the transmitter and receiver tuning shows to which pair of the five channels the set can be pre-set.

(b) No Morse Key for M.C.W. is provided.

The power supply consists of a 12v. unspillable accumulator. Two accumulators are supplied with each outfit.

A lightweight telescopic dipole aerial is used with 4 mast sections to give a maximum aerial height of 15 ft. A directive array is also provided if increased range is required.

The transmitter-receiver and aerial are capable of withstanding immersion in water for a short period.

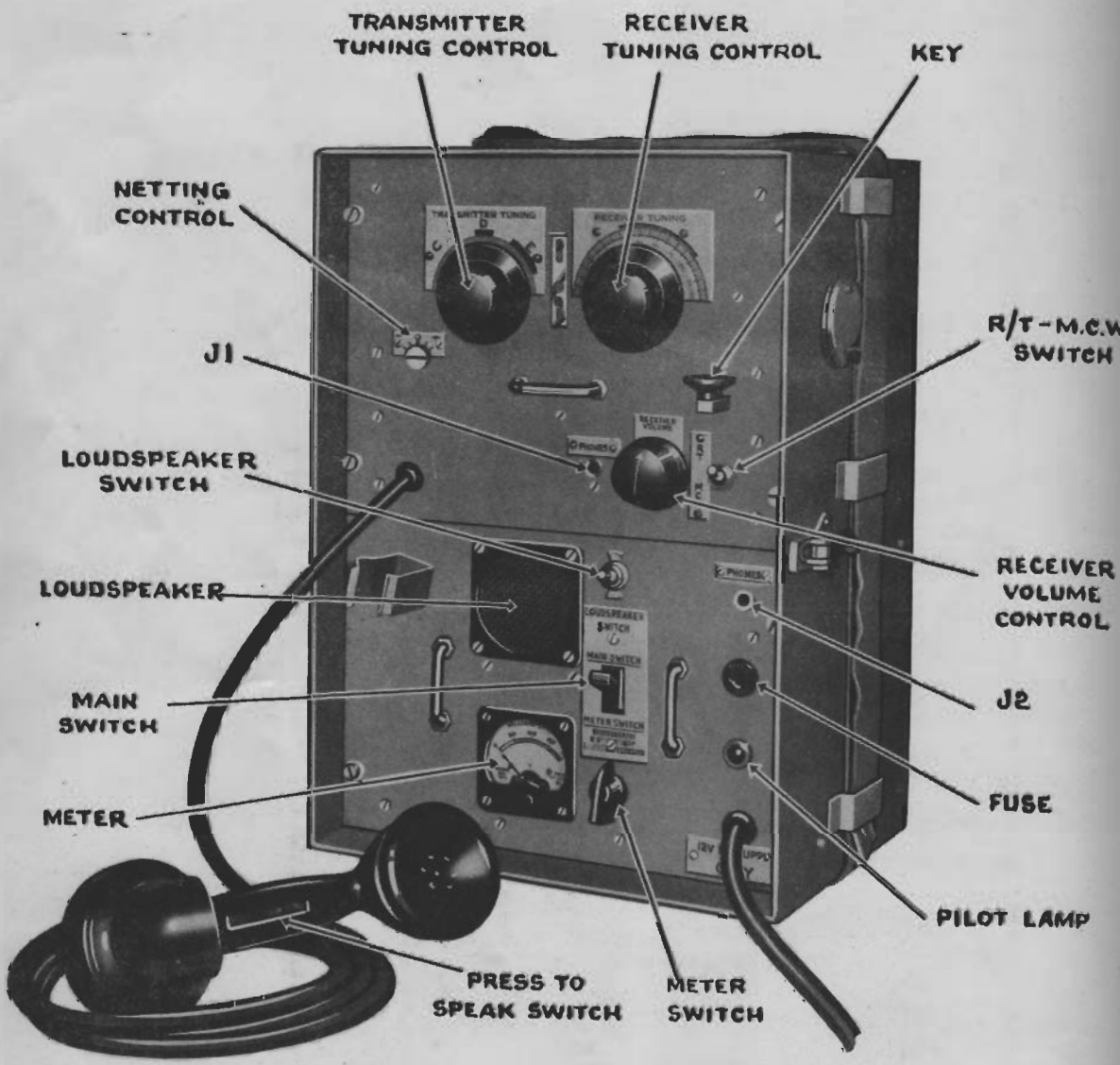
The equipment is divided into three loads, viz., transmitter-receiver 23 lbs. battery 37 lbs. aerial gear 10 lbs. approximately.

The first Type 686M sets were issued early in April, 1945, and it is expected Type 687 will be ready about June or July, 1945.

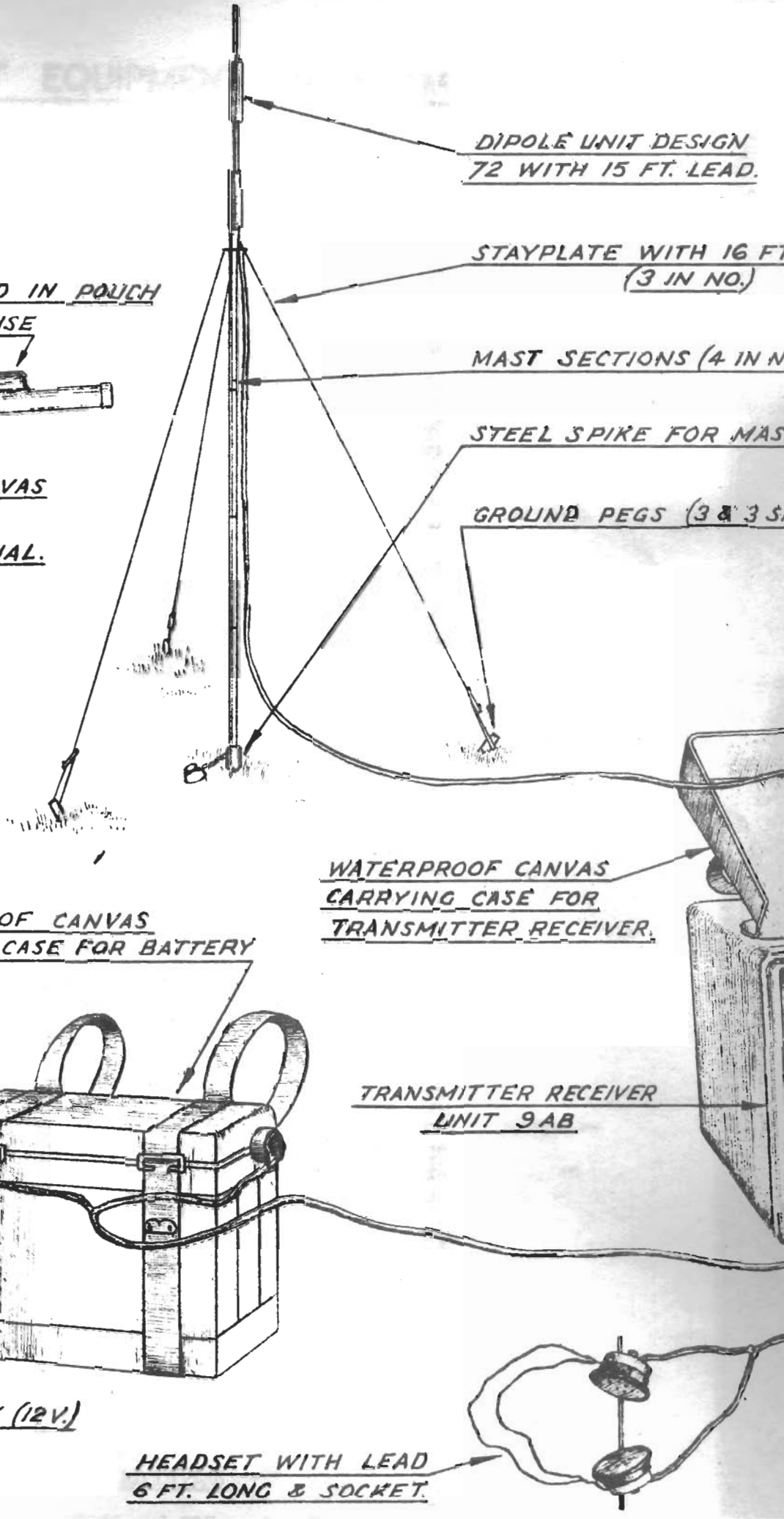
C.A.F.O. 28/45 gives certain preliminary information.

TYPE 686M

TRANSMIT RECEIVER UNIT 7AW



COMPLETE EQUIPMENT



T COMPRISING TYPE 687.

T. STAYS.

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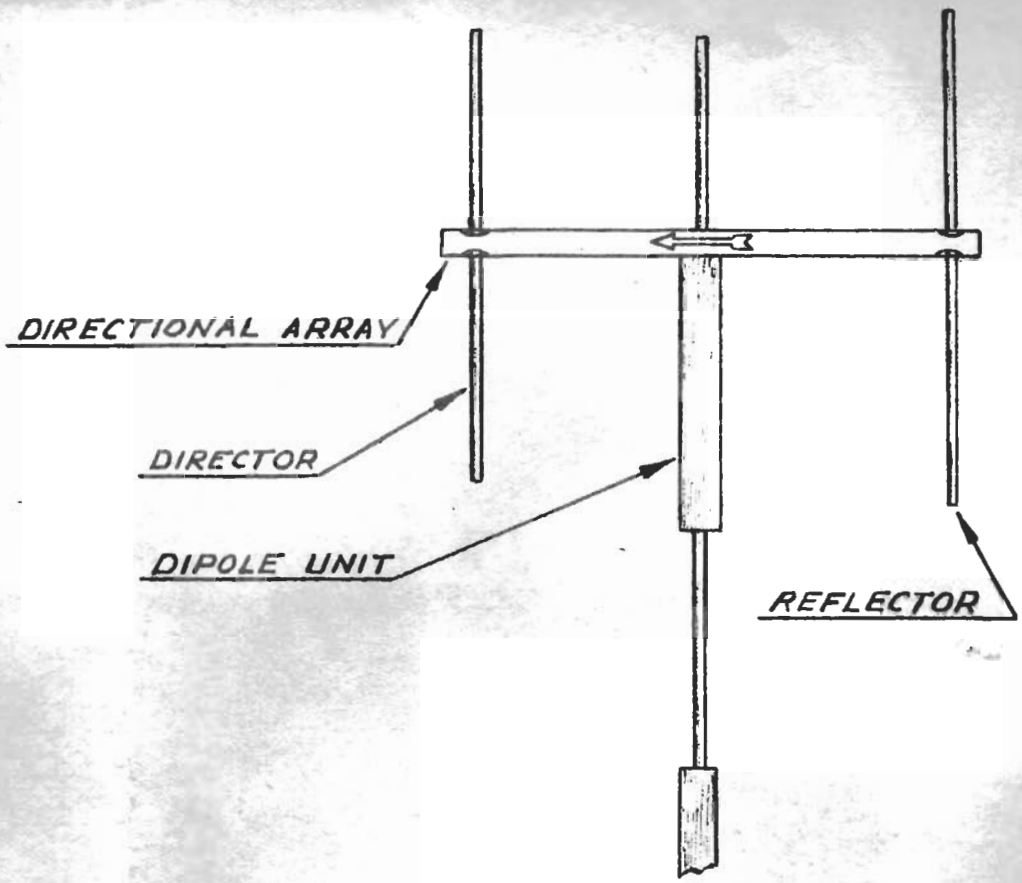

DIPOLE UNIT FITTED WITH ARRAY.