THE

"EXPANSE" TYPES 103 AND 103A

TRIPLE

MAGNIFYING VALVE RECEIVER

General Description and Working Instructions

DESIGNED AND MANUFACTURED BY

AMALGAMATED WIRELESS (AUSTRALASIA) LTD.

"WIRELESS HOUSE."

CLARENCE STREET, SYDNEY, NEW SOUTH WALES

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Instructions for Operating the "Expanse" Type 103 Triple Magnifying Valve Receiver.

The "Expanse" Type 103 Triple Magnifying Valve Receiver is designed for the best possible efficiency when used on installations employing an aerial of dimensions suitable for transmission on the standard ship wave lengths of 300 and 600 metres. Its normal range of adjustment is 300 to 6000 metres, but this may be extended by using additional units, which can be supplied, if required; the receiver combination then is known as the Type 103a.

GENERAL DESCRIPTION.

Aerial Tuning Unit:—The internal connections of the Aerial Tuning Unit are shown diagramatically in figure 1. It consists of a variable Inductance and Condenser, both having suitable valves for tuning the aerial circuit over the full range of wave lengths of the receiver. When it is desired to increase the range of tuning of the aerial system, beyond 6000 metres, an extra Aerial Inductance Unit is supplied, and is joined in circuit between the terminals marked L. and M. (after removing the brass strap which normally connects the two).

A Static Choke is connected between the Aerial and Earth terminals. This provides a high inductive path to earth for any static charges which may accumulate on the Aerial.

An Expanse Type Universal Crystal Stand is fitted to the unit, and is connected up, in conjunction with a three-pole, two-way switch, so that by simple switching the Aerial Tuning Unit may be quickly converted into an Emergency Crystal Receiver.

The Valve Receiver Unit:—The complete wiring of the Valve Receiver Unit is shown diagramatically in figure 1. In order that the connections for receiving damped and undamped waves may be more readily traced, two diagrams showing the skeleton connection of the receiver as arranged for these receptions, are shown in figures 2 and 3. The disposition of the various Switches, Resistances, Terminals, etc., will be best familiarised by comparing the Receiver Unit itself with the diagram of connections. All the apparatus mounted on the Receiver is clearly named or marked in such a way as to at once indicate its function and use. The Receiver Tuning Condenser and all Switches are so designed that they may be entirely removed from the receiver for inspection without disturbing any internal connections. Special split screw drivers are supplied for removing the holding down screws. The range of wave lengths of the Receiver may be increased

beyond 6000 metres by connecting the extra Secondary Inductance Unit between terminals marked A. and B., after removing the strap connecting these terminals.

The Filament Lighting or Low Tension Batteries:—The batteries usually supplied each consist of a 6 volt 40 ampere hour accumulator set of the ordinary lead plate type, the cells being protected by a wooden case. One non-reversible plug and socket is supplied with each battery. The plugs should be similarly connected, one to each accumulator, and screwed in an accessible position for receiving the sockets. The sockets in turn should be wired, one to the 6 volt terminals on the Receiver, and the other to the terminals marked L.T., on the Charging Board, the polarity in each case coinciding with the polarity of the batteries. The electromotive force of the batteries should never be permitted to fall below 4.5 volts, and they should be charged daily until the plates gas freely, and the specific gravity has risen to 1.215. Evaporation of electrolyte should be compensated for by the addition of pure distilled water.

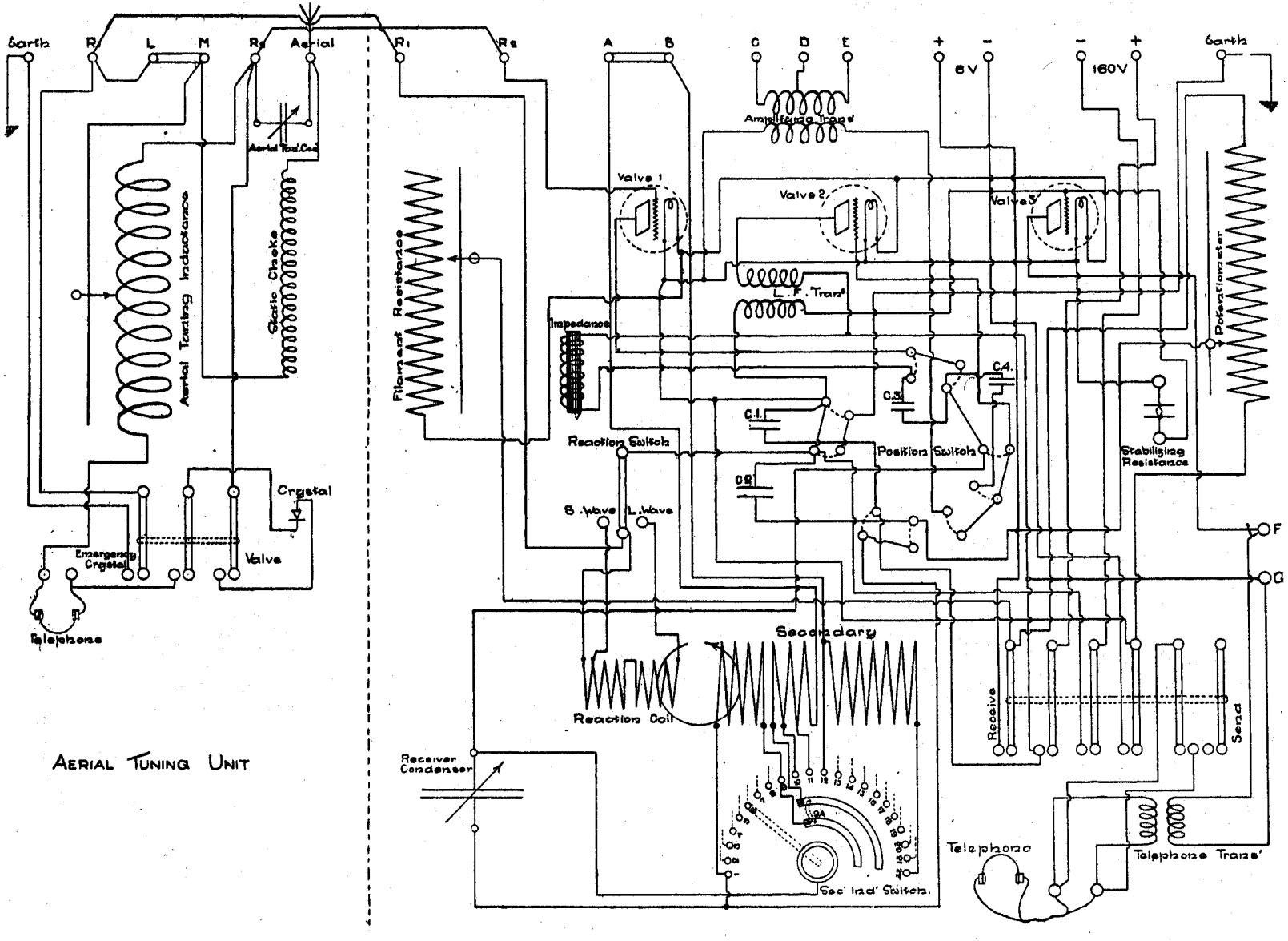
Plate or High Tension Battery:—This is an accumulator battery of novel design, consisting of 80 small cells mounted in a special acid proof container, provided with a movable cover, and suitably ventilated. The battery is subdivided into four sections, which are joined in parallel when the Multiple Control Switch on the front of the container is switched to the position marked "Mains." This enables the battery to be rapidly charged from a D.C. supply of any voltage between 50 and 110. Placing the Multiple Control Switch in the position marked "Valve," the four sections are joined in series, and the battery gives a total potential of 160 volts.

Two batteries are usually supplied, and they should be joined up parallel, and connected to the battery Charging Board, Mains and Receiver, as shown in figure 4.

Great care must be exercised in the maintenance of these batteries, and each must be given equal use. If necessary, both batteries may be charged and worked together. It is most important that the length of time of charging should be regulated to suit the voltage supply available. With 100 volt supply the charging time should not exceed 15 minutes; even when both batteries are charged simultaneously. If the supply of voltage is only 50, the time should be lengthened to approximately 45 minutes. With proper treatment, the more work the batteries are given, the greater will their capacity become, and they should be charged before and after each watch. If they are to be out of use for some days, they should be fully charged before and after the period, but it is not advisable that this period should be lengthy, unless energy is available for periodical charging. If the battery is to be idle for a lengthy period, and energy is not available for charging, the plates should be removed from the cells and dried. Before doing so, the battery should be fully charged, the electrolyte drawn off and replaced by pure distilled water, and the cells then slowly discharged, and finally short circuited. The plates may then be removed, dried, and stored. To reassemble the battery, replace the electrolyte in the cells, and insert the plates according to their polarity (positive, dark chocolate colour; negative, slate grey colour), and charge as usual.

One battery is sufficient to furnish the Valve Receiver with high tension energy for five hours' continuous working. As in the case of the low tension battery, distilled water should be added to compensate for evaporation of the electrolyte.

Charging Board.—The Charging Board carries the necessary apparatus for the control and distribution of the low tension and high tension energy. The Board is shown diagramatically in figure 4, from which the connections may be readily traced.



AERIAL TUNING UNIT

Figure 1.

Connecting Up.—The Aerial Tuning Unit and the Valve Receiver Unit should be connected as shown in figure 1, and the Filament Lighting Battery, High Tension Battery, and Battery Charging Board, joined to the Receiver, Power Mains, etc., as previously described. Great care must be exercised to ensure that the battery leads are correct with respect to polarities. Connect the telephones to their terminals on the Receiver. Insert a valve in each adaptor, so that the side pips, which are marked red and black, come into contact with the side springs of the adaptors, which are marked correspondingly. The tension on the springs of the Valve Adaptors must be sufficient to ensure a

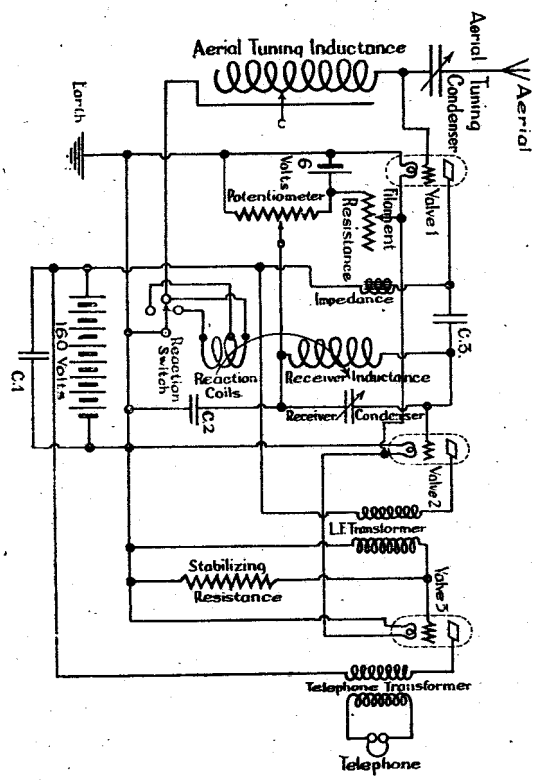


Figure 2.

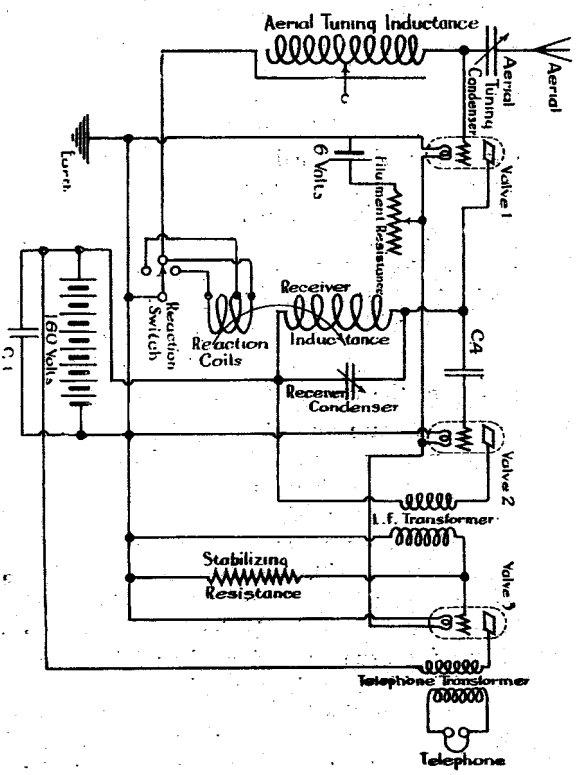


Figure 3.

perfect contact, and the contacts must be periodically cleaned. The batteries must be in good condition, and capable of supplying energy at their respective pressures.

OPERATION.

Damped Waves:—For the reception of damped waves, the position switch mounted on top of the receiver is placed in the position marked "Damped." The "Send-Receive" switch is, of course, placed in the "Receive" position, and is only switched over to "Send"

during transmission or when the receiver is out of service. One High Tension Battery should be switched on, and one Lighting Battery plugged through to the receiver. Place the "Emergency Crystal-Valve" switch, on the Aerial Tuning Unit, in the position marked "Valve."

The adjustment for any desired wave length, within the range of the Receiver, may be pre-determined from the Calibration Chart supplied, and with a little practice a corresponding adjustment for the Aerial Tuning Inductance and Condenser for any given aerial may be roughly determined, final adjustments being made with passing signals. It is advisable when receiving wave lengths less than 2500 metres to place the Reaction Switch in the position marked "Short Waves," and adjust the Reaction Coupling for the best results. On longer wave lengths, the Reaction Switch may be placed in its central position, thus rendering the reaction coils inoperative and eliminating the need for coupling adjustment, or it may be placed in the position marked "Long Waves," when the coupling will probably require very careful adjustment.

Maximum efficiency is obtained by keeping the condenser values as low as possible. Great selectivity in reception is possible with this Receiver, and by careful adjustment of the Aerial and Receiver circuits, undesired signals may be almost eliminated. Whilst making the foregoing adjustment, the brilliancy of the valve filaments should be varied by means of the Filament Resistance until the best position is found.

Undamped Waves:—For the reception of undamped waves, leave the Receiver as arranged for damped waves, with the exception of the Position Switch, which should be placed in the position marked "Undamped." Adjust the Receiving Condenser and Secondary Inductance Switch for the desired wave length, as indicated on the calibration chart. The Receiver, when so adjusted, will operate on the beat system, and in order to create the beats it is necessary for the Receiver oscillating circuit and Aerial circuit to be slightly out of resonance with respect to each other; the difference in tuning of the two determining the pitch of the note heard in the telephone receivers. The beats are, of course, necessary, in order that the reception of the continuous waves may be audible. The received energy in the Aerial system will be at a maximum when the Aerial circuit is in resonance with the incoming waves, and in order to set up beats, the Receiver oscillating circuit must have a slightly different adjustment from that indicated for the given wave lengths on the calibration chart for undamped signals.

Many continuous wave transmitting stations continuously excite their aerials and signal by varying the wave lengths of the radiated energy. The wave radiated during transmission of a signal is the one to which the Receiving Instruments should be adjusted, the other wave being known as the compensating or balancing wave.

The difference between the length of these two waves is, as a rule, not very great. with the result that both are audible to the Receiver at the same time, but by careful tuning the compensating wave may be almost or entirely eliminated. In practice, the best method is to adjust the Receiver so that the signalling wave is lowered in pitch to such an extent that the compensating wave disappears. If it is found that the proper wave has been eliminated, and the compensating wave is audible, the signals will, of course, be reversed, but by lowering the tone of the compensating wave the signalling wave will reappear. The best method is to set the Receiver adjustment as indicated by the calibration chart, and vary the Aerial Tuning Inductance and Aerial Tuning Condenser and Coupling until signals are heard, and then readjust the three and the Grid Potentiometer until the signals attain maximum strength. During the foregoing adjustment, it will be noticed

that when the Aerial and Receiver oscillating circuits become closely resonant, signals will become audible in the telephones. Also a loud crackling sound will be heard when the

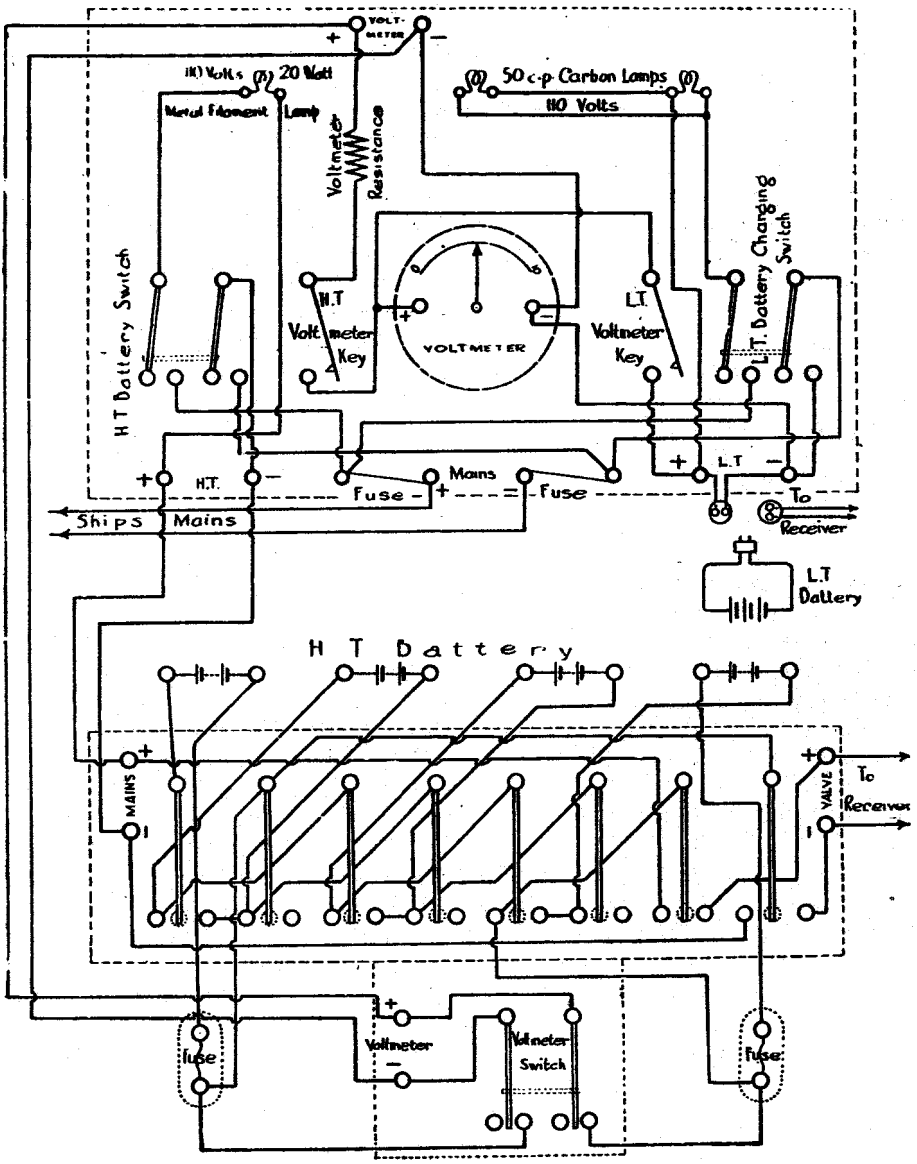


Figure 4.

Aerial Tuning Inductance slider is quickly moved. When this condition obtains, the turning of the Coupling handle towards and away from its zero position will give rise to

a peculiar thud in the telephone receivers, which indicates that the circuits are producing beats, and are in proper adjustment in relation to each other for continuous wave reception. These effects should be sought for by setting the Receiver oscillating circuit to the pre-determined wave length, and adjusting the Aerial Tuning Inductance and Aerial Tuning Condenser. It is also possible to receive damped waves with the Receiver connected as above, but, except with a very critical adjustment of coupling, the note will be "hissy."

External Amplification:—To amplify signals from an external receiver or other source, connect the telephone leads of the external set to the terminals D.E. or C.E., provided on the ebonite top, and place the Position Switch in the position marked "External." The terminals C., D. and E. are connected to three points on the primary winding of a small transformer, the resistance of the winding between the terminals C. and E. being 3000 ohms, and between D. and E. 150 ohms. Current operated receivers, such as the Magnetic Detector Multiple Tuner combination, with which low resistance telephones are used, should be connected across terminals D. and E., while a crystal or other Receiver, which is potentially operated and normally requires high resistance telephones, should be connected across C. and E. No. 1 valve is not necessary for external amplification, and it may be removed from its socket, thus conserving a certain amount of filament battery current. The filament resistance should be adjusted to give the best possible magnification.

FAULTS.

Crackling Noise in Telephones Apparently Not Due to Static Discharges in the Acrial.—This is probably the most common fault, and is usually due to an intermittent contact. The best method for locating the fault is to first disconnect the Aerial and the earth leads from the Valve Receiver Unit. This will prevent any induced effects from local electrical machinery reaching the Receiver. If the noise is still present, examine the Valve Adaptor Spring Contacts, Valve Terminals, and all Switch Springs for intermittent or dirty contact. Generally speaking, the "Position," "Send Receive," "Secondary Inductance," and "Charging" Switches maintain positive contact with their studs, and should not be removed more than is absolutely necessary. If it becomes necessary to clean the contacts of these Switches, care must be taken not to disturb the lateral adjustment of the springs, but a little extra tension may be given to them by carefully bending them down. Bad commutation of an electrical fan or other instrument operating in the vicinity of the Receiver will immediately give rise to undesired noises, which are, of course, magnified by the Receiver.

All terminal connections on the Receiver and Batteries must be kept scrupulously clean, in order that the connections will be absolutely positive.

Failure of High Tension Battery Current:—The presence of high tension pressure at the terminals on the Receiver can be roughly ascertained by touching the finger and thumb across the terminals. The same test may be applied across the plate and filament of each valve socket. Should the potential not be felt, the fault must lie between the Receiver and the High Tension Battery. A bad contact in the "Send-Receive" Switch will most probably be the trouble. Should the pressure be felt on the sockets when the Position Switch is in the position marked "Damped," and not when in the position marked "Undamped," or vice versa, the fault will most probably lie in the Switch. It should be carefully disassembled and cleaned.

Open Circuit in High Tension Battery:—If the fault still exists after examining the Multiple Control Switch and Fuses on the battery box, remove the lid and test each of the four sections with the voltmeter, or by placing the fingers across the poles. A probable fault is the breakage of a container. The broken container should be removed, and also the electrolyte from the bottom of the box by means of a suction hydrometer. Fit a new container in the box, and replace the lead plates and glass separator, so that the polarity of the plates, as indicated by their colour, is the same as before. Fill the tube with Sulphuric Acid (specific gravity, 1.200), to the required height, being careful not to spill acid outside the tube.

Failure of High Tension Battery to Retain Charge:—This is probably due to sediment collecting in the bottom of the tubes to such an extent as to short circuit the plates. This sediment should be periodically removed, the same acid being replaced in the tube. The High Tension Battery, when not in use, should retain a charge for at least 12 hours. Failure to do this is generally due to leakage between the cells. The best remedy is to remove the containers from the box and thoroughly dry the inside of the box, and the outside of the tubes.

GENERAL.

As a rule, new Valves do not appear as sensitive as Valves which have been in use for some time. It is, therefore, advisable when inserting new Valves to place them in sockets two and three, leaving a used Valve in the first socket. Generally the more use a Valve is given, the more sensitive it becomes. Certain Valves work much better in some sockets of the Receiver than in others, and their position may be best determined by transposing the Valves from socket to socket during the passage of working signals. If at any time the supply of Valves for the Receiver becomes limited and only two are available, these may be used in the second and third sockets, the Receiver being used for amplifying the signals from the Aerial Tuning Emergency Crystal or other Receiver. As an alternative to this, the Valves may be placed in the first and second sockets and the telephones connected between the Grid and Filament contacts of the third valve socket: the Receiver being employed as usual. If only one Valve is available, it may be placed in the first socket, while the telephones are connected between the Grid and Filament contacts of the second socket. Fairly good results shoud be obtained in the foregoing temporary arrangements. In the event of the supply of Valves becoming totally exhausted, the Aerial Tuning Unit may be used as an Emergency Crystal Receiver, the telephones being transferred as indicated in the wiring diagram, Figure 1. The tuner is sealed at top and bottom, and these seals must not be broken except by persons qualified to remedy internal faults.