PART II.

BOX AMPLIFIER MODEL MBA.

1. FUNCTIONS. This set is designed for use as an Amplifier for either spark or C.W. Signal. It can also be used as a self heterodyne for the reception of C.W. Signals without the use of a separate heterodyne set. It is intended for use with the existing Model "C" receiving instruments and it can be connected up to them in such a way that the amplifier may or may not be in use as required.

2. CONNECTIONS. Fig. 5 shows diagrammatically the method of connecting the amplifier box to the receiving circuit. From this figure it will be noted that one or two valves may be used and that an additional valve is provided which can be put into operation should the first valve be found faulty. Figures 6 and 7 are photographs of the set.

On the front of the instrument is situated a single-pole switch which is used for the purpose of cutting out certain sections of the high frequency transformer circuit to suit various ranges of LS value as follows:-

1st. stop of switch to be used for a range of waves from 210 to 450 metres (11 LS to 50 LS).

2nd. stop to be used from 450 to 1000 metres (50 LS to 256 LS).

3rd. stop to be used from 1000 to 2800 metres (256 LS to 2000 LS).

4th. stop to be used above 2800 metres (2000 LS).

3. THE ACTION OF THE CIRCUIT.

(a) For spark reception:- Referring to Fig. 5 it will be seen

be seen that when receiving spark signal, each train of waves in the secondary of the induction tuner of the receiving circuit gives rise to varying voltages applied to the grid of the first or amplifying valve. This high frequency variation of the grid filament voltage leads to corresponding high frequency variations of the current flowing into the anode of the valve. This current is obtained from the high tension battery which is shunted by a condenser and passes through the primary of the inter-valve transformer to the anode of the first valve. The changes of anode current through the primary windings of this transformer induce E.M.F's in the secondary windings. These induced E.M.F's are applied directly between the grid and filament of the second valve. The inter-valve transformer has an equal ratio of turns in the primary and secondary windings. The changes of potential applied to the grid of the second valves are accompanied by the corresponding changes of anode current in this valve. This current is also supplied by the high tension or anode battery.

This amplifying action between the two valves is accompanied by a rectifying action at the anode of each. The rectified currents from both valves pass through the telephones; consequently every train of oscillations in the receiving circuit is accompanied by a rise and fall in the telephone current, somewhat in the same way as when an ordinary crystal is being used but with the advantage that owing to the amplifying action of the valves the changes of the

telephone current are very much greater than when the crystal is in use.

A further amplifying effect is obtained by means of the actual coupling between the anode circuit of the second valve and the secondary coil of the induction tuner. The changes of the anode current of the second valve give rise to induced E.M.F's in the secondary coil of the receiving circuit. These E.M.F's may assist or oppose the current in the secondary circuit, depending upon the adjustment of the variometer coils. When the induced E.M.F's are slightly assisting the secondary currents the amplification obtained is largely increased. The way in which this increase is obtained is most easily seen by taking a numerical case. Suppose that to begin with the re-action coupling is zero and suppose that one unit of power is being expended in maintaining the high frequency oscillations in the secondary circuit. This power will give rise to certain changes in current through the telephones. Now consider the conditions when the re-action coupling is brought into operation. For the same high frequency changes of the current in the second valve the same power will be required in the secondary coil of the receiving circuit, but owing to the re-action a considerable proportion of this power is obtained from the second valve, for example, as much as 0.8 of the required power may be obtained in this way. Under these conditions the power required from the incoming signals is now only 0.2 unit instead of the whole 1 unit as in the case in which there is no re-action coupling, and consequently the set will be

about five times as sensitive with the re-action coupling.

It would appear at first sight that the sensitivity could be indefinitely increased by careful adjustment of the re-action coupling. This, however, cannot in practice be realised owing to the fact that when the sensitive point is being reached any small shock, as for example a slight atmospheric will cause the amplifier to produce continuous oscillations. In practice therefore when receiving spark signals the re-action coupling is adjusted so as to be as near as possible to the point at which the oscillations set in.

(b) For Reception of Continuous Waves. For the reception of continuous waves the re-action coupling is adjusted to a point just beyond the unstable position in which the amplifier sets up continuous oscillations in the secondary inductance of the receiving circuit. The wave of these oscillations depends upon the L.S. value of the secondary circuit and to receive incoming continuous wave signals by the heterodyne method in the usual way it is necessary to adjust the L.S. value of the secondary circuit so that the frequency of the incoming signals is just slightly different to the frequency of the oscillations which are being generated. The detecting action at the anodes of the valves then takes place practically as when receiving a spark signal, the only difference being that the heterodyne beats constitute a rise and fall of the voltage supplied between the grid and filament of the first valve instead of intermittent trains of oscillations.

The most sensitive condition for receiving continuous wave signals is when the re-action coupling is only just

sufficient to maintain the continuous oscillations. In practice, however, it is necessary to adjust the re-action coupling a little beyond this point in order to secure stability.

Under certain circumstances an increased sensitivity for the reception of spark signals is obtained when the valves are oscillating, but, as is always the case when receiving spark signals with a heterodyne oscillation, the note of the incoming signal is broken up and the gain of sensitivity is not infrequently more than compensated for by this loss.

The necessity for the fourway switch on the front of the instrument arises from the distribution of the stray capacity of the secondary winding. If the switch is not used it is found that the amplification on certain waves is greatly reduced, but by the proper use of the switch this difficulty is avoided. It is of use for the reception of both spark and continuous signals.

5. GENERAL INSTRUCTIONS FOR WORKING.

(i). Connect up as in the wiring diagram. Insert the valves.

(ii). Tune all circuits to the wave to be received in the usual way and adjust the re-action coupling coil to about its mid position.

(iii). Put transformer switch on the stop whose range includes the wavelength of the signals to be received.

(iv). Switch on the filament of both valves and gradually

increase the filament current until the maximum loudness of signals is obtained (the buzzer or wavetester used for these preliminary adjustments should preferably be placed at some distance from the receiving circuits).

(v). The re-action adjustment should be found which gives the largest signals but which at the same time does not cause the valves to produce continuous oscillations.

(vi). If it is desired to receive continuous wave signals the adjustments of the re-action coil should be just beyond the point at which the oscillations set in.

(vii). When actually receiving signals a final retuning of all the circuits should be made in the usual manner and at the same time the filament current should be finally re-adjusted so as to give the best results.

N.B. The filament currents should never be increased more than is necessary. The life of the valves decreases rapidly with the increase of the filament current.

(viii). Provision is made for receiving spark signals with one valve only. This gives a sensitivity which is about the same as a really good crystal. It is preferable from the point of view of selectivity always to use one valve only so long as the signals are of sufficient strength. In this connection it should be remembered that the effects of interference are much more accentuated if both the signal to be received and the interference are strongly amplified. It is therefore useless to attempt to reduce the effects of interference with a signal of moderate strength by amplifying both the signal and the interference. On the other hand if the

signal

signal is very much weakened by using very loose couplings the amplifier can be used effectively.

(ix). The coupling of the induction tuner should generally be very much looser when the amplifier (either one or two valves) is in use than when using a crystal. It is desirable to loosen off this coupling as far as possible especially when receiving continuous wave signals.

(x). When the amplifier is in use the crystal should be disconnected either by means of the crystal switch or by taking out the plug from the crystal holder.

(xi). A voltmeter is provided on the front of the box with two ranges viz:- 0 - 8 and 0 - 80 volts. The former range is for reading the filament voltage and the latter the voltage of the anode high tension battery. A push switch is fitted on the right hand side of the box and by pressing the button the anode battery voltage may be read. Normally, when the valves are switched on, the voltmeter should read the volts across the filament. The voltmeter is intended to give the operator an idea as to the condition of the batteries as well as the best filament voltages to use with a particular pair of valves.

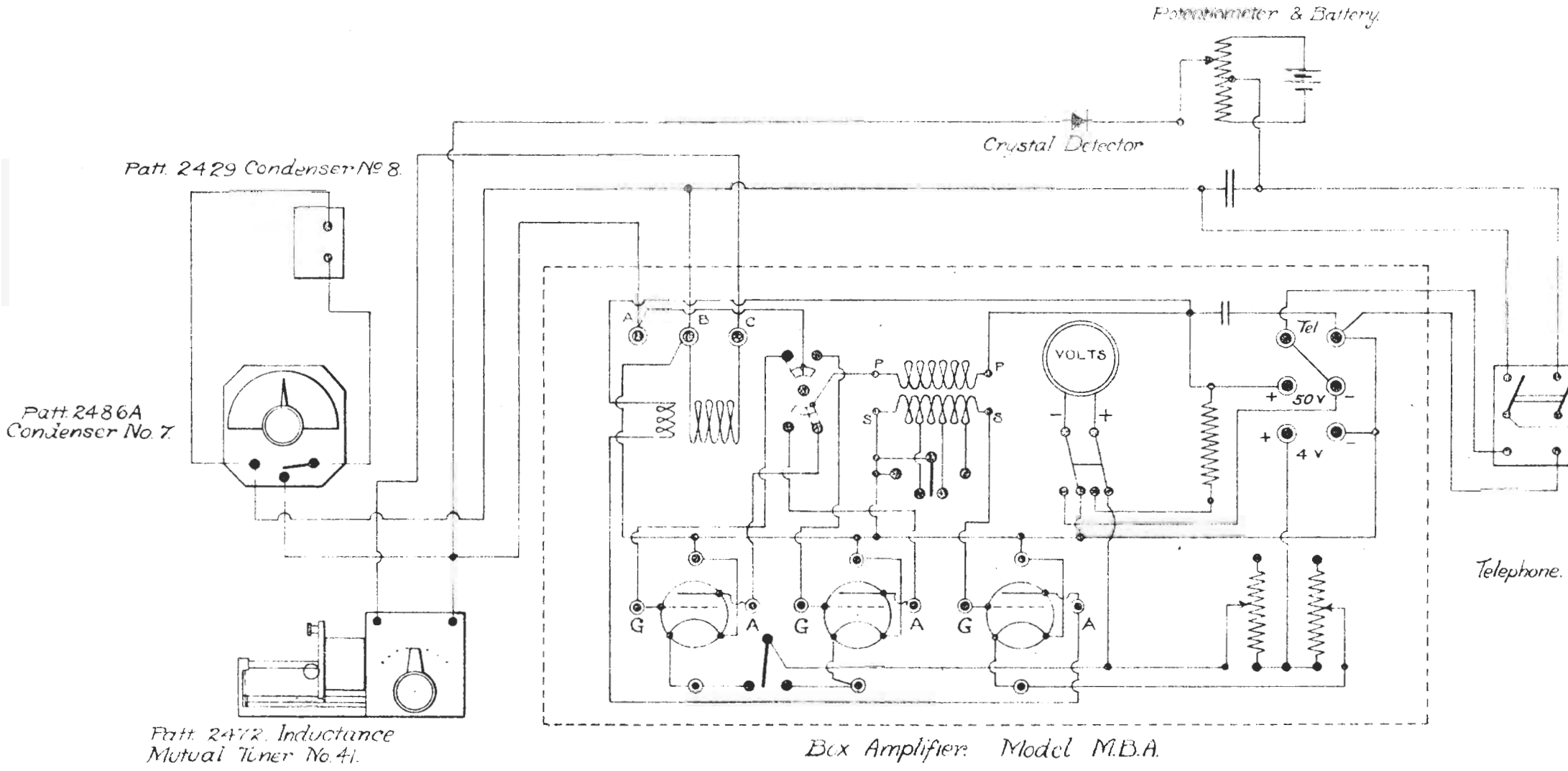
Potentiometer & Battery.
Crystal Detector
Patt. 2429 Condenser No 8.
Patt. 2486A
Condenser No. 7.
A
B
C
P
P
S
S
VOLTS
Tel
+
50 v
−
+
4 v
−
G
A
G
A
G
A
Telephone.
Patt. 2472. Inductance
Mutual Tuner No. 41.
Box Amplifier Model M.B.A.

FIG. 5.

SIGNAL SCHOOL PORTSMOUTH.

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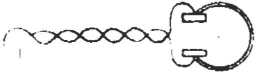
SKETCH Nº 8512D.



Patt 1549 Switch
C.O. unenclosed.

PHOTO. NO. 254.

Fig. 6.

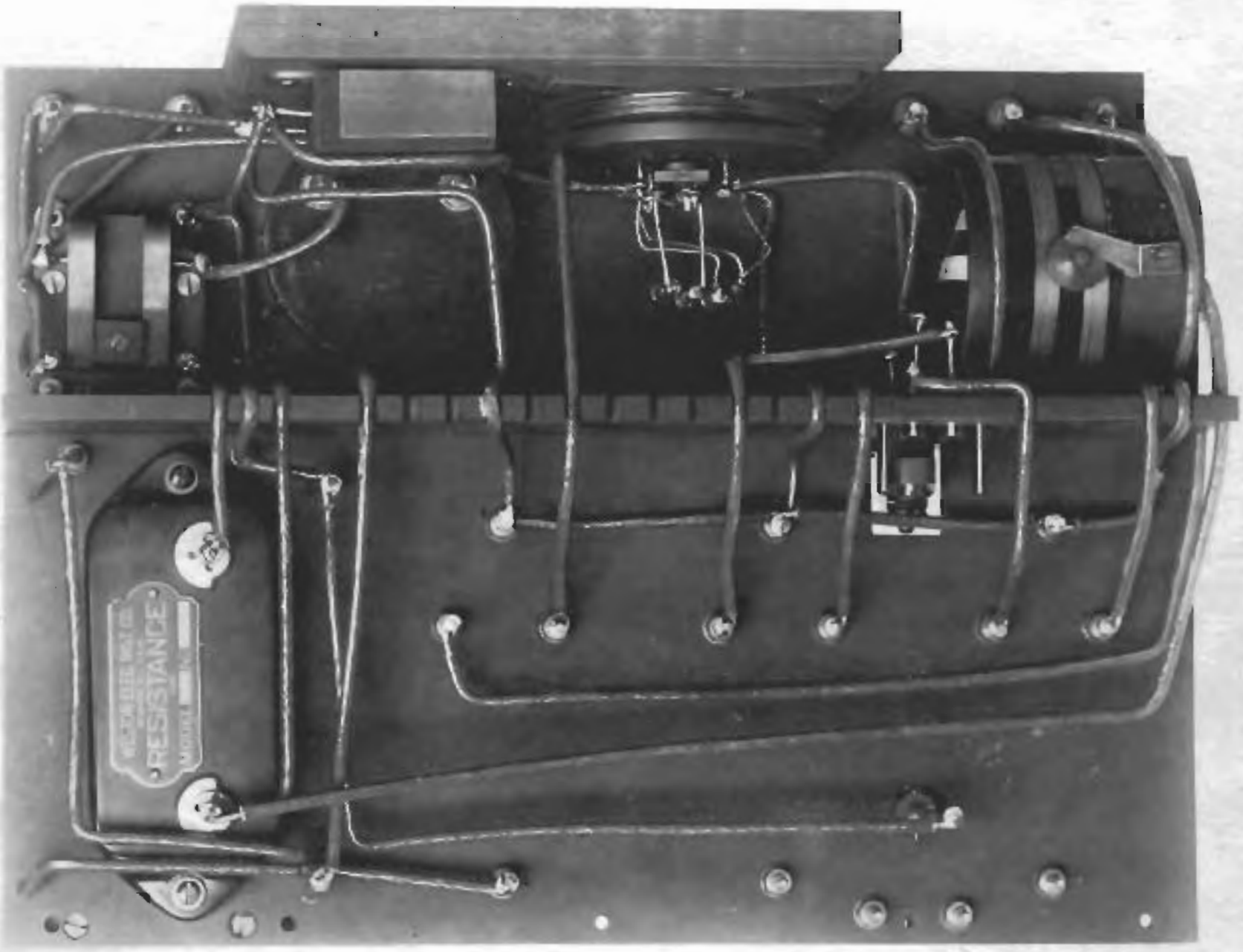


PHOTO. NO. 255.

Fig 7

PART III.

CIRCUIT FOR CHARGING FILAMENT BATTERY AND ESTABLISHMENT OF STORES.

1. CHARGING OF FILAMENT BATTERIES. It is of great importance that the filament batteries be kept fully charged in order that the full 4-volts should be available at the filament terminals. The minimum voltage required across the filaments of the valves is 3.6 volts for satisfactory working. It is therefore very important that the voltage fall in the leads from the battery to the receiver should be kept as small as possible. These leads should be of cable pattern 253 or of any suitable cable having a current capacity of not less than 5 amperes. They should be as short as possible and in any case the maximum length of wire should not exceed 30 feet i.e. the battery if placed outside the silent cabinet should not be more than 15-feet from the receiver. In order to allow some reserve of the battery volts fall on discharge, it is preferable that this length should be reduced if circumstances permit. The arrangement of the circuit for charging the batteries from the ships mains is shown in Fig. 8. A suitable charging rate is 2 amperes. As heat is developed in the lamps they should be fitted outside the silent cabinet.

2. STORES. The following is a list of W/T stores which will be supplied with Model MB or MBA receiving set. As experience is gained with these sets, however, the list is

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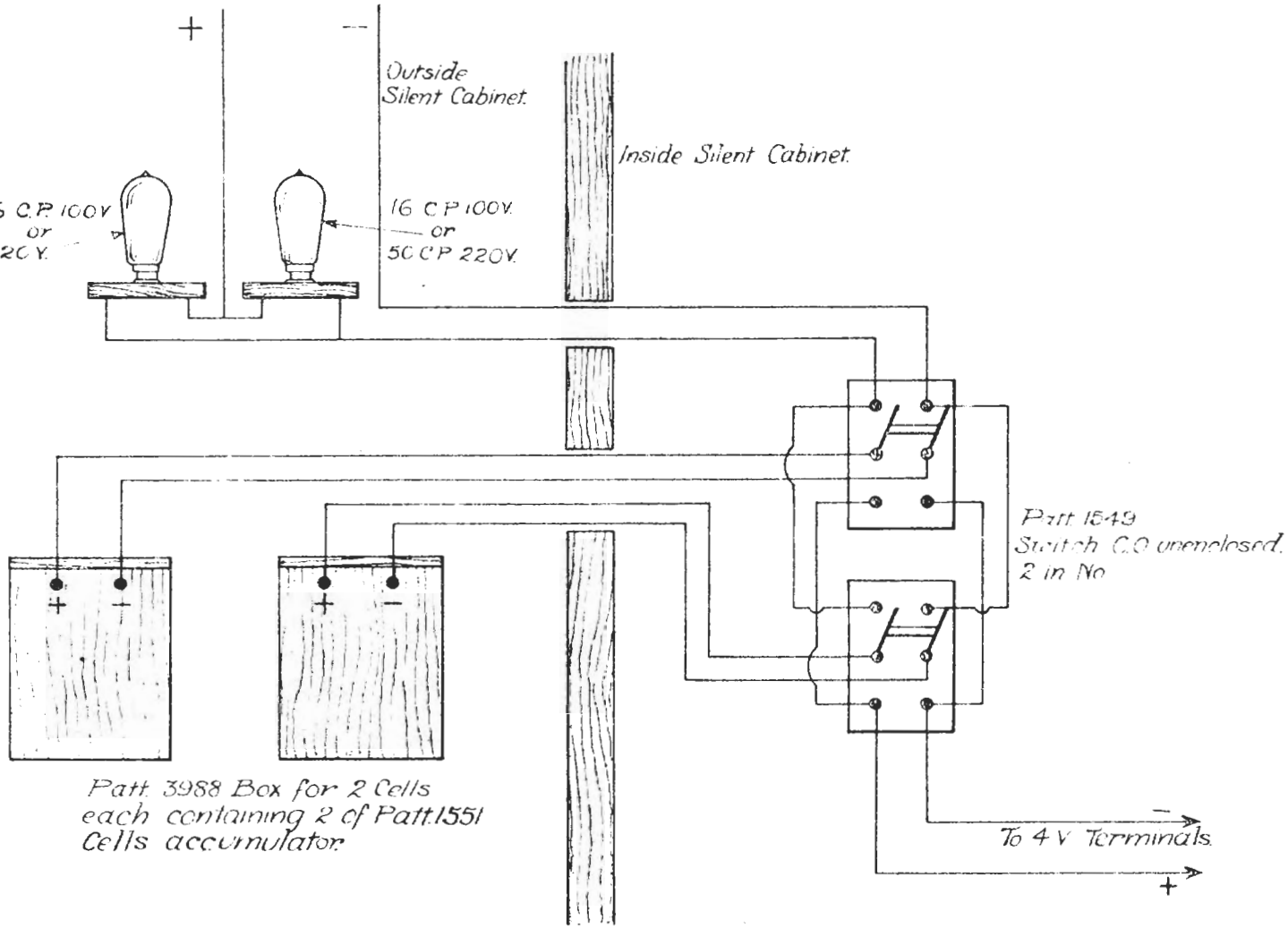

FIG. 8

SIGNAL SCHOOL PORTSMOUTH.

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SKETCH No 8512E.