Supplement to The Wireless & Electrical Trader, March 10, 1945

"TRADER" SERVICE SHEET 713

PHILIPS DC to AC "ROUND TYPE" CONVERTER UNITS

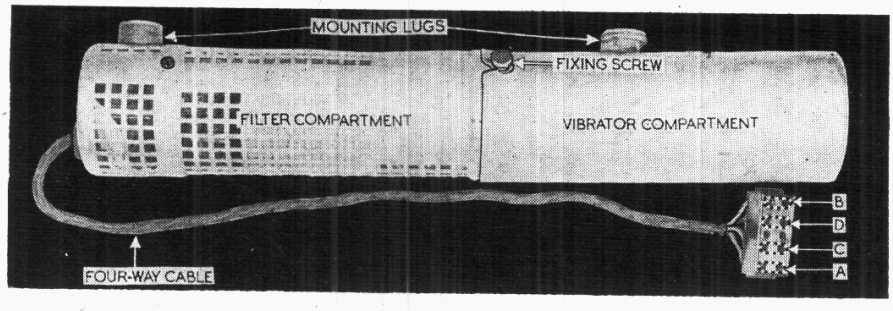
ALTOGETHER there are six different types of Philips DC-AC mains converter : the square type (code No. 28.891.460) and five tubular or "Round" types. When fitted to an AC receiver properly adapted for them, they enable it to operate from DC mains.

The square type was covered in our *Service Sheet* 594, and four of the round types are covered in this *Service Sheet*. These are the two 1937 models 7860C (for 110-145 V DC mains only) and 7861C (for 200-245 V DC mains only); and the two 1938 models 7880C (for 110-145 V DC mains only) and 7881C (for 200-245 V DC mains only).

The type number of the latest model (1939), which is suitable for DC mains of 110-145 V and 200-245 V, is 7882C, but this model is *not* covered in this *Service Sheet*.

This *Service Sheet* was prepared from a 7881C unit. Receivers on which these units are used are listed as "Receivers Involved" under "General Notes."

Original price, all models, 25*s.*, *later increased to* 27*s.* 6*d.*



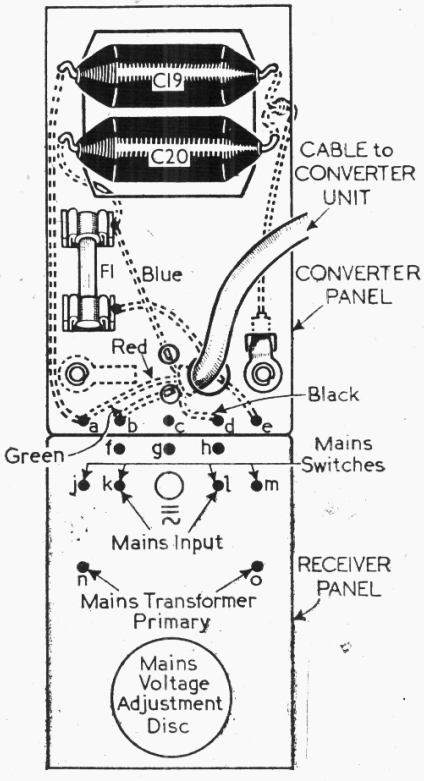


Fig. 2. Sketch showing the converter connecting panel (above) and receiver panel (below) as used in the 1937 models. Connecting pins are lettered **a** to **o**.

CIRCUIT DESCRIPTION

The four converter units covered by this *Service Sheet* can be broadly divided into two groups : 1937 and 1938 models; and in each group there is a low voltage mains and high voltage mains type. It will be convenient to refer to the low voltage range as 100 V, and to the high voltage range as 200 V; the actual voltage ranges are given in the introduction.

The principal difference between the 1937 and 1938 groups is in the method of connecting them to the receiver, and although there are small differences in each of the four units themselves, these may be neglected for the present.

CONVERTER CIRCUIT

On the assumption that the converter unit is the same in all models, it will be logical first to consider that alone, and explain later the differences in the four models. The converter circuit is shown in Fig. 1, where the DC input is applied to the left-hand end and an AC output is available from the right-hand end.

Commencing at input lead **A**, a DC current flows via the filter circuit coils **L1, L3, L5,** then through the ballast resistor **R1,** vibrator connecting socket **5,** vibrator energising coil **L11,** reed contact **p,** socket **2** and via **L6, L4** and **L2** back to the mains lead **B.**

As a result of the flow of current through **L11,** the vibrator armature is attracted to the magnet, and contacts **r** and **t** close. Current from the DC mains therefore flows via socket **1,** contact **r,** socket **3,** filter coils **L8, L10,** output lead **D,** mains transformer primary (in the receiver, connected between **C** and **D**), coils **L9, L7,** socket **6,** contact **t** and socket **2.**

At the same time, contact **p** has opened owing to the movement of the reed, so that the armature swings back again; its momentum carries it past its "rest" position, from which it started, so that as contacts **r** and **t** open, contacts **q** and **s** close. Current flowing in at socket **1** now flows via contact **q,** socket **6,** coils **L7, L9** and output lead **C** to the receiver; that is, in the opposite direction; and so on via **D, L10, L8,** socket **3,** contact **s** and socket **2.** Contact **p,** of course, has closed

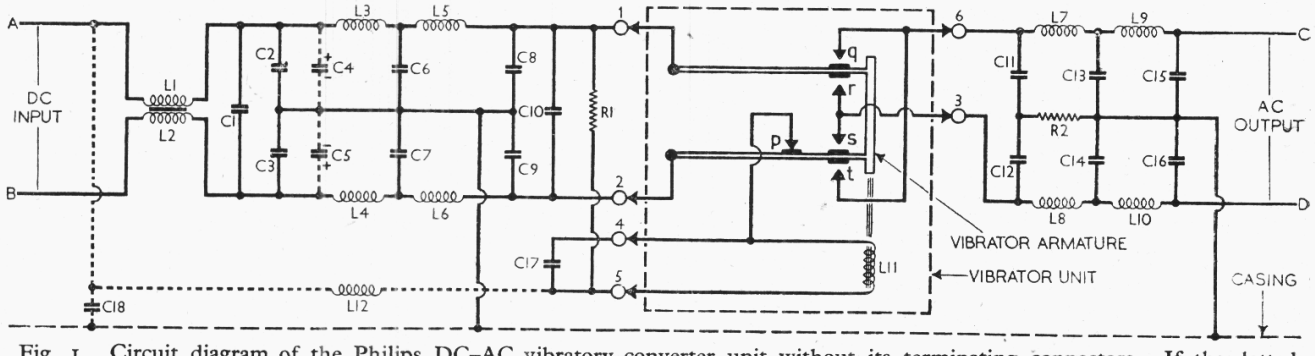


Fig. 1. Circuit diagram of the Philips DC–AC vibratory converter unit without its terminating connectors. If the dotted connections are omitted, it is correct for either of the 200 V models. The vibrator is shown at rest, and its contacts are lettered **p, q, r, s, t.** Its connecting sockets are numbered 1 to **6.** The casing is not connected to the receiver chassis. **L12** is iron-cored.

again, so the whole cycle is repeated so long as the DC mains supply is maintained. The reed and armature assembly and the electrical constants of the vibrator circuit are tuned to resonate at a suitable frequency, and the output from **C** and **D** is approximately that of AC mains.

The input filter circuit **C1, C2, C3** (with two further capacitors **C19, C20** mounted on the receiver) **L3, L4, C6, C7, L5, L6, C8, C9, C10** prevents interference from the vibrator from entering the mains, while the output filter **C11, C12, L7, L8, C13, C14, L9, L10, C15, C16** prevents it from entering the receiver.

The small differences referred to earlier between the four types concern the components **C4, C5, L12** and **C18** which are shown with broken line connections in Fig. 1, and the values of some components. These are explained under "General Notes."

TERMINATIONS

Quite different methods are employed for the connections betwen the converter and the receiver in the 1937 and 1938 models, although the method used in each year is the same in high and low voltage types.

For consideration of their terminations, therefore, the two groups must be distinctly divided and treated separately; if they are studied together, confusion, particularly in the pin lettering used later, will be inevitable.

1937 Models 7860C and 7861C

Fig. 2 is a sketch of the connecting panels as seen from the rear of an AC receiver fitted with a 1937 converter. The upper panel is attached to the converter cable, and carries the input and output connections to the converter. The lower panel is attached to the receiver and carries all the mains input, mains switches' and mains transformer primary connections. There is no connection between the two panels, except that provided by the mains connector, which is the connecting plug on the receiver end of the mains lead. The makers call it the "Safety Contact."

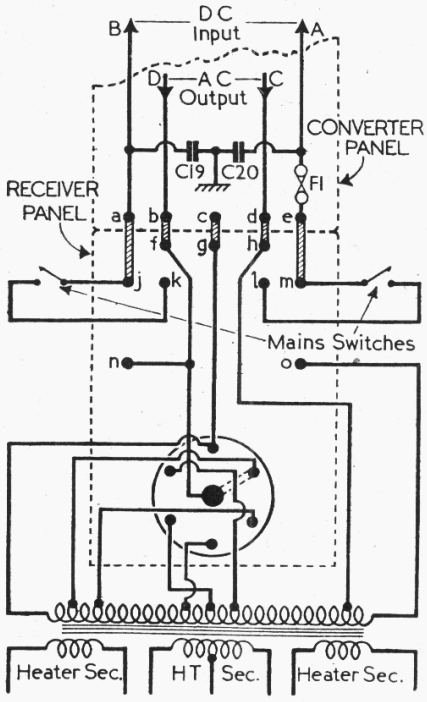
C19, C20 and the mains input fuse **F1** are mounted on the upper panel, and the four leads from the cable are shown in the sketch dotted (behind the panel) going to their various terminals. There are five pins in a row on this panel, lettered **a** to **e;** on the lower panel are nine more pins, lettered **f** to **o,** in three rows.

The mains connector, or "Safety Contact," is a rectangular plastic reversible block containing five connecting links, two long ones and three shorter ones, and an eccentrically disposed locating pin. It also carries two "links" to which the pair of leads from the mains are soldered, and which always contact pins **k** and **l** on the lower panel.

This block has on its rear face the signs = and ~ to indicate DC and AC mains respectively, that for which the set is adjusted being the upper one. When the AC sign is uppermost, the locating pin, which engages in the hole seen in Fig. 2 between pins **k** and **l,** is above the horizontal centre line of the block, and the top edge of the block is about level with the row of pins **f, g, h,** but it does not overlap the junction of the two panels. The set is then adjusted for AC mains operation.

To insert the converter unit, to operate the receiver from DC mains, all that is necessary is to reverse the position of the block : that is to say, withdraw it from the panel and turn it through 180 degrees. The DC sign will now be uppermost, and if the locating pin is in its hole correctly, the upper edge of the block will now just cover the row of pins **a, b, c, d, e** on the upper panel.

When the block is correctly positioned and pressed home, the panel pins engage in the links in the block and effect all the necessary switching from AC to DC or *vice versa*. The diagram in Fig. 3a shows in a physical sense the electrical circuit of the panel when adjusted for DC mains, the links being indicated by shaded loops joining the appropriate panel pins. The converter leads are indicated by the same letters **A, B** and **C, D** as they are in the circuit diagram in Fig. 1.



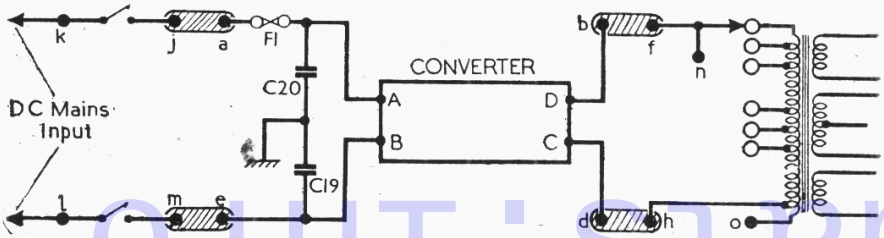
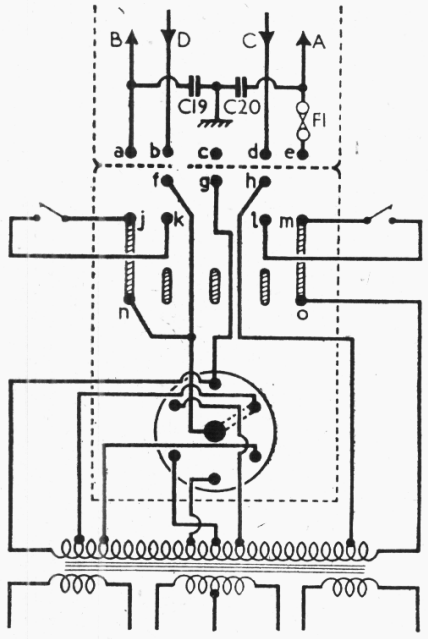
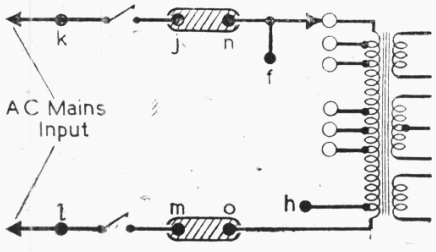


Fig. 3a (above) shows the complete electrical circuit of the 1937 panels when adjusted for DC operation. Shaded loops connecting certain pins represent link connections in the mains connector. The DC mains are connected to pins **k** and **l.** Fig. 3b (lower diagram) gives the circuit diagram.



Figs. 4a (above) and 4b (below), showing how the electrical circuit in Figs. 3a and 3b is modified for AC mains input (at pins **k** and **l**) by reversing the mains connector.



In Fig. 3b the diagram of the whole system is shown in the normal manner as it applies to Fig. 3a.

Fig. 4a shows Fig. 3a with the block reversed to operate from AC mains. Below it again in Fig. 4b is the circuit diagram of the whole system when adjusted for AC operation.

1938 Models 7880C and 7881C

Fig. 5 is a sketch of connecting panel as seen from the rear of an AC receiver fitted with a 1938 converter. There is only a single panel, but it is used in conjunction with two connectors : one from the mains, which the makers call the "Safety Contact," and one from the converter. **C19, C20** and the mains input fuse **F1** are mounted on the panel, and there are fourteen pins lettered **a** to **o.**

The mains connector, or "Safety Contact," is a rectangular plastic moulding screwed to a non-reversible metal backplate, which holds it on to the back cover of the receiver. The moulded block is

Supplement to The Wireless & Electrical Trader, March 10, 1945

reversible and is marked on its rear face with the signs = and ~ to indicate DC and AC mains respectively, that which is applicable being visible through a circular hole in the metal back-plate.

All that is necessary to change this block over from AC to DC mains operation, or *vice versa*, is to slacken the eccentrically disposed screw near the centre on the front face of the block (though some blocks have two screws) and turn the block through 180 degrees. Locating studs on the rear face will then engage in holes in the metal plate, and the correct sign will register with the circular hole. The mains lead itself passes through a clamp on the back-plate, and its length must be adjusted.

For DC operation, the second connector, that attached to the converter cable, is pressed home on to the two top rows of pins **a, b, c, d** and **e, f, g, h.** For AC operation this connector must be withdrawn from the pins and left hanging.

Fig. 6a shows in a physical sense the electrical circuit of the panel when adjusted for DC operation, the links in the two connectors being indicated by shaded loops joining the appropriate panel pins. The converter leads, which are soldered directly to their links, are indicated by the same letters **A, B** and **C, D** as they are in the circuit diagram in Fig. 1.

In Fig 6b the circuit diagram for the whole system is drawn in the normal manner as applied to Fig. 6a.

Fig. 7a shows Fig. 6a with the converter connector removed and the "Safety Contact" reversed to operate from AC mains. Below it again in Fig. 7b is the circuit diagram of the whole system when adjusted for AC operation.

Like the four converter leads, the pair of leads from the mains are soldered to the two short links which cantact pins **n** and **o.**

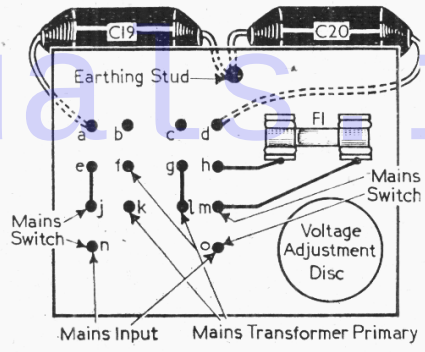


Fig. 5. Sketch showing the connecting panel on the receiver for use with the 1938 converter units. The connecting pins are lettered **a** to **o**, and the functions of some of them are indicated.

DISMANTLING THE UNIT

Dismounting.—The unit is held to the roof of its receiver cabinet by two brackets into which the two rubber-cushioned lugs on the casing slide. If the two fixing screws on the casing are slackened, the two sections of the unit can be pulled apart, and the lugs slide out of the brackets at the same time. In the 1937 models, two fixing screws must also be removed to release the connecting panel.

Dismantling.—If the two sections are the same way round when they are pulled apart as they are in our illustrations, the operator's right hand will hold the vibrator, and the left hand the filter assembly. The pins connecting the vibrator with the six sockets shown in Fig. 8 will project from the vibrator unit.

Extracting Filter.—To obtain access to the filter, remove two short 6 BA screws from the cap at the lead end, and slide the cap down the lead. The internal assembly may now be withdrawn from the other end, so that the rest of the casing follows the cap down the lead.

When replacing, see that the fixing screw holes in the casing register with those in the filter frame. The cap should be replaced with its fixing lug at the top; the three vibrator sockets 1, 2, 3 (arranged in a straight line) should also be at the top.

Extracting Vibrator.—The makers did not intend that this should be done by the dealer, and it is a difficult operation. It is more difficult still to replace it satisfactorily.

First the disc carrying the connecting pins must be eased out of the metal case; it is held by crimps in the case. Behind the disc is a circular rubber block carrying two retaining nipples which fit into two holes in the disc. Flexible leads from the vibrator pass through the rubber block to the disc.

Next ease out the rubber block from the case; with it will emerge the vibrator, inside a second metal cover which has two rubber bands round it. The rim of this cover fits closely into a ridge near the periphery of the rubber block.

The vibrator is slung resiliently on five fine coil springs which are held to the metal cover by looped retaining pins. If these pins are withdrawn, the cover may be removed, revealing the vibrator unit.

When replacing, the simplest way to refit the suspension springs is to thread a wire through each of the two holes at the closed end of the cover and tie their ends to the two springs at the top of the vibrator. The vibrator can then be drawn into the cover and the retaining pins slipped through the spring loops while the wires hold them.

At the open end of the cover it is a simple matter to hold the springs in position with pliers while inserting the retaining pins, but it should be noted that here *two* springs are used on one side, and it should be seen that these are at the *top* when reassembled; that is, on the same side as pins 1, 2, 3 on the disc.

When the disc is finally replaced, care should be taken that the rubber band round its edge is properly in position. Some difficulty will be experienced in getting the rubber nipples on the block to come through the holes in the disc.

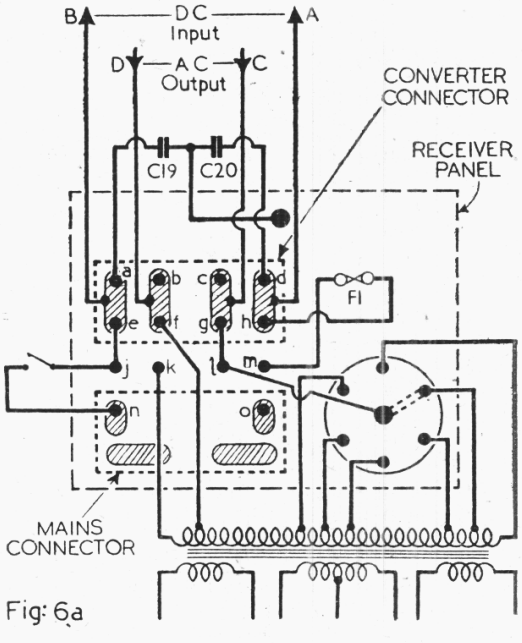


Fig: 6a

Fig. 6a (left) shows the electrical connections of the panel in Fig. 5 when the mains connector is adjusted to the DC position and the converter connector is in position above it. DC input is to pins **n** and **o.** Below in Fig. 6b is the equivalent circuit diagram. Fig. 7a (right) shows the rearrangement of connections when the mains connector is reversed for AC operation, and the converter connector is withdrawn. Fig. 7b shows the circuit diagram.

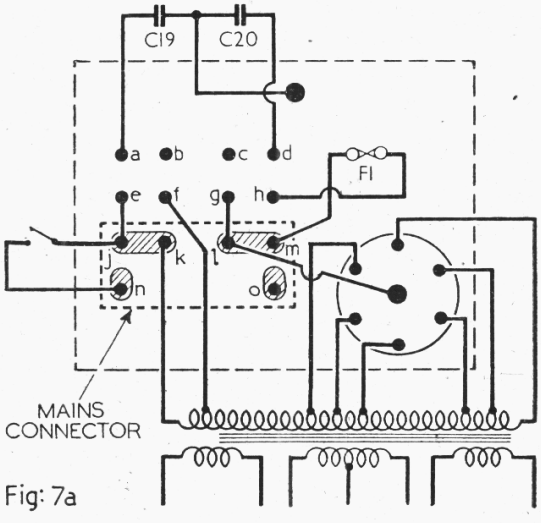


Fig: 7a

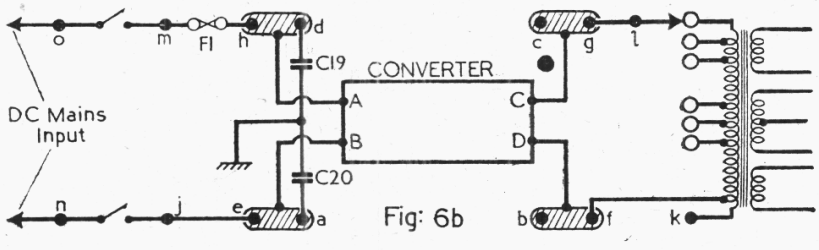


Fig: 6b

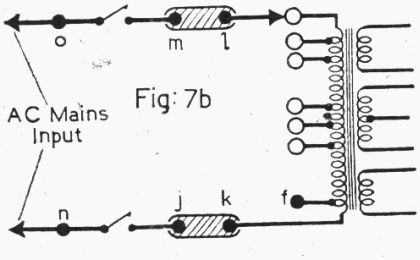
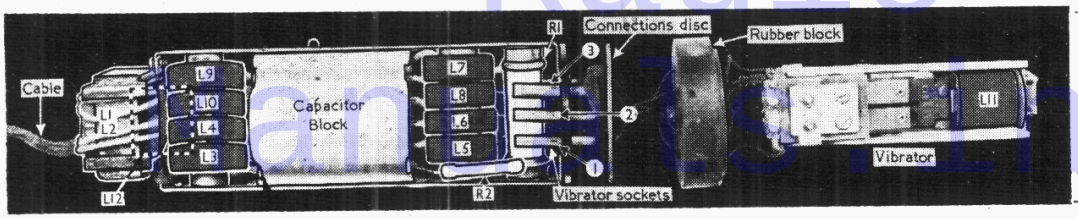


Fig: 7b



Internal view of the converter unit, after removal of the casings, showing the filter coils and vibrator. **L12** appears only in 100V models.

COMPONENTS AND VALUES

	RESISTORS	Values (ohms)
R1	Vibrator coil ballast ...	1,800† / 2,200‡
R2	Filter resistor ...	50

† 100 V models. ‡ 200 V models.

CAPACITORS
All values quoted are in μF

C1	0·2	C11	0·02
C2	0·1	C12	0·02
C3	0·1	C13	0·1
C4*	8·0	C14	0·1
C5*	8·0	C15	0·1
C6	0·1	C16	0·1
C7	0·1	C17	0·2† / 0·05‡
C8	0·1		
C9	0·1	C18	0·1
C10	0·4	C19	0.02
		C20	0·02

† 100 V models. ‡ 200 V models. * Electrolytic.

COILS
Approximate DC resistance values in ohms

L1	0·9	L7	0·9
L2	0·9	L8	0·9
L3	1·2	L9	1·2
L4	1·2	L10	1·2
L5	0·9	L11	700·0† / 2,500·0‡
L6	0·9	L12†	

†100 V models only. ‡ 200 V models only.

GENERAL NOTES

Features Common to All Four Types.—The external appearance is seen in the illustration in columns 1 and 2 overleaf. The tubular metal case is in two major portions : that containing the filter circuits, from the outer end of which the cable emerges; and that which contains the vibrator. This latter slips over a short neck on the former and is held in position by two kurled fixing screws.

The internal appearance, as seen when the casings are removed, is shown in the illustration at the top of this page, where an inner metal shroud has been removed to reveal the vibrator itself. When comparing an actual unit with this illustration, the cable should be on the left, the vibrator on the right, the three vibrator sockets in a straight line (Nos. 1, 2, 3 in this *Service Sheet*) should be on top, as shown, and the soldered seal on the capacitor block should be at the bottom.

Capacitor Block.—The internal connections of the capacitor block are shown in the diagram in Fig. 8. The unit is a circular drum, with twelve connecting studs at one end and nine (or ten in 100 V models) at the other.

Several studs on one end are internally connected with studs at the other end, so the two ends are drawn in the same diagram, showing the connections between the two ends and the capacitors inside the unit. In order to identify one end from the other, certain features of the converter facing the two ends are shown.

Note when using this diagram that the seal in the metal cover is at the *bottom* of the drum in each case, as indicated in the diagram. Six stud positions are in the upper half of each end, and six in the lower half.

Divergencies.—So far as the converter unit itself is concerned, the 7861C and 7881C (200 V types) are for all practical purposes identical, although their connecting devices are very different. The principal differences between these and the 7860C and 7880C (100 V moleds) are in the inclusion of **L12** and **C18,** and some different component values, all of which are indicated in the component tables.

One difference that occurs between the two 100 V types is that the junction of **L12, C18** goes to the junction of **L3, L5, C6** in the 7880C, but to the **A** end of **L1** in the 7860C.

There is also an alternative arrangement of the 1937 converter panel. Although it does not entail any difference in the circuit, the physical disposition of the wiring is different.

In our particular sample, the black lead from the converter cable went to **C15** on the capacitor block, and the green lead went to **C16,** but we have shown it in Fig. 8 the same way round as do the makers in their manual.

Fuse F1.—The fuse is rated at 1 A.

Capacitors C4, C5.—These are two 8 μF electrolytics which do not form part of the converter unit as a rule. They are supplied specially in cases where vibrator interference is exceptionally bad.

When necessary, they are mounted on a small bracket attached to the lead end of the converter unit, leads being brought out externally to them through a hole in the casing.

Vibrators.—Both 100 V converters employ a Philips type 7930 vibrator, and both 200 V types employ a 7931. The makers say that repairs to them are not a worthwhile proposition, and they should be replaced complete, although we understand at present that replacements are unobtainable.

Wiring Note.—Should the wiring of the converter unit be disturbed for any reason, such as repairs, it is highly important that it should be replaced exactly as it was originally.

Receivers Involved.—Receivers in which the 7860C or 7861C converters are used are as follows :
Philips 691U, 698U, 699U, 701AX, 702U, 747AX, 785AX, 787AX.
Mullard MUS7, MUS8.

The following receivers are fitted with 7880C or 7881C converters :
Philips 555U, 597U, 650U, 660U, 753U.
Mullard MUS15, MUS17, MUS18, MUS20, MUS24.

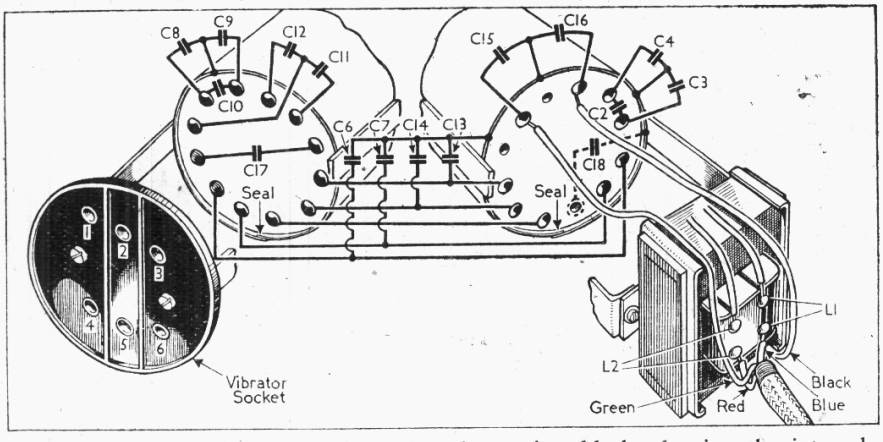


Fig. 8. End views of the drum-shaped capacitor block, showing the internal connections, several of which go to the case. The vibrator socket numbers are shown in one end-view, the connecting studs of **L1, L2** and the cable lead-colours at the other.

Warning.—Although the mains transformer primary winding on each of the foregoing receivers is tapped for 100 V and 200 V ranges, and the voltage adjustment disc is appropriately marked, the associated converter is suitable only for one range or the other. These receivers, therefore, may be used on both ranges on AC mains, but only on one range on DC mains.

Radiograms using these converters take their motor leads directly to the mains input circuit, so that where universal motors are used they may be operated from AC or DC mains of 100 V or 200 V ranges, but when a change of mains is effected the motor voltage adjustment must be suitably set.

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