Sept. 4, 1928. 1,683,389

F. J. KAEHNI ET AL

TRANSFORMER

Filed June 8, 1922 2 Sheets-Sheet 1

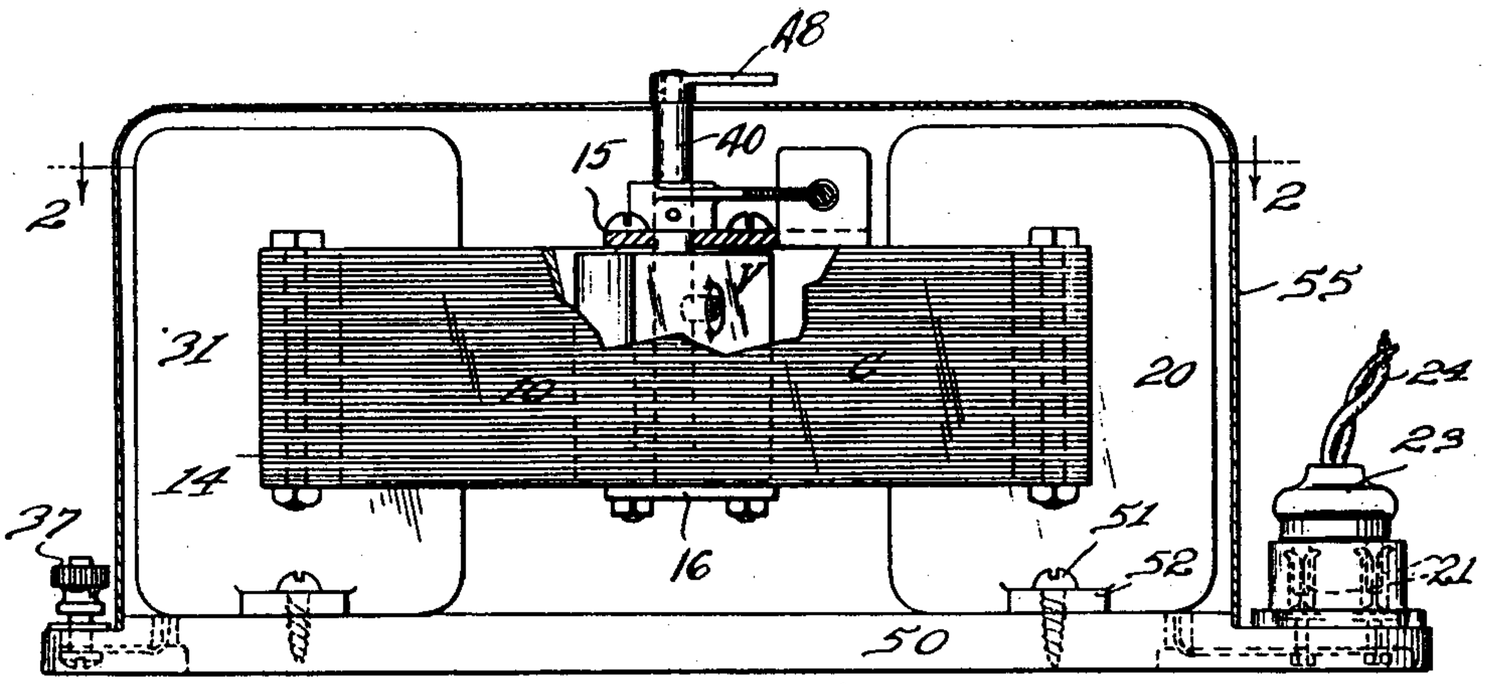

FIG.-1

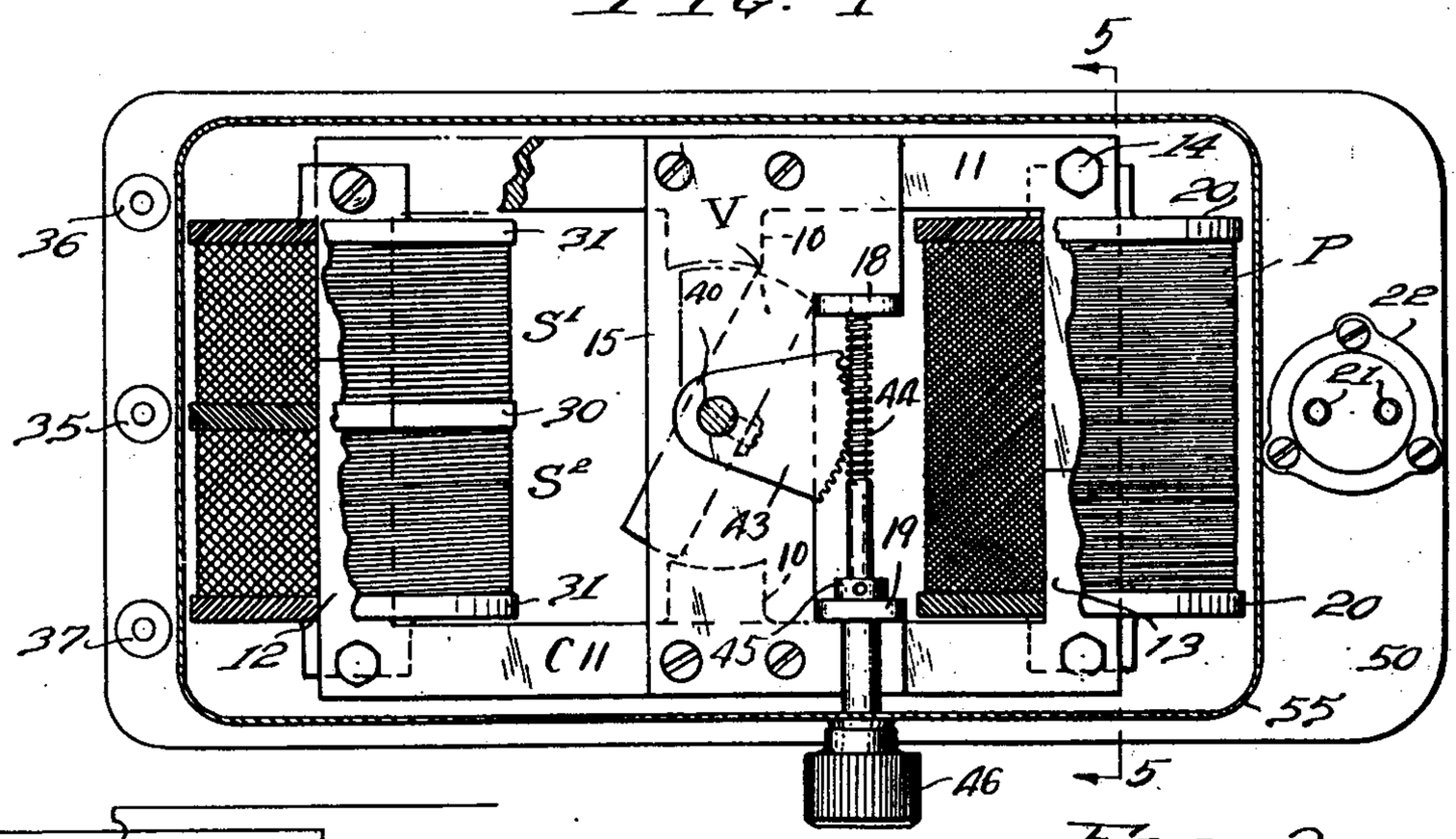

FIG.-2

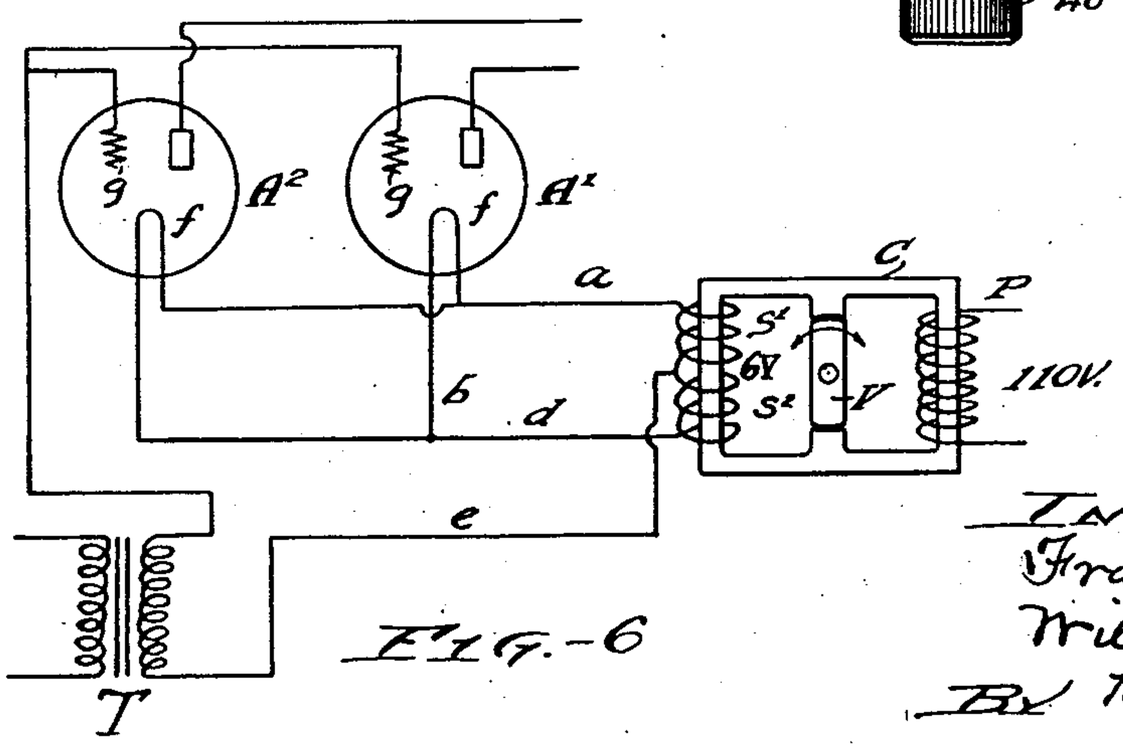

FIG.-6

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TRANSFORMER

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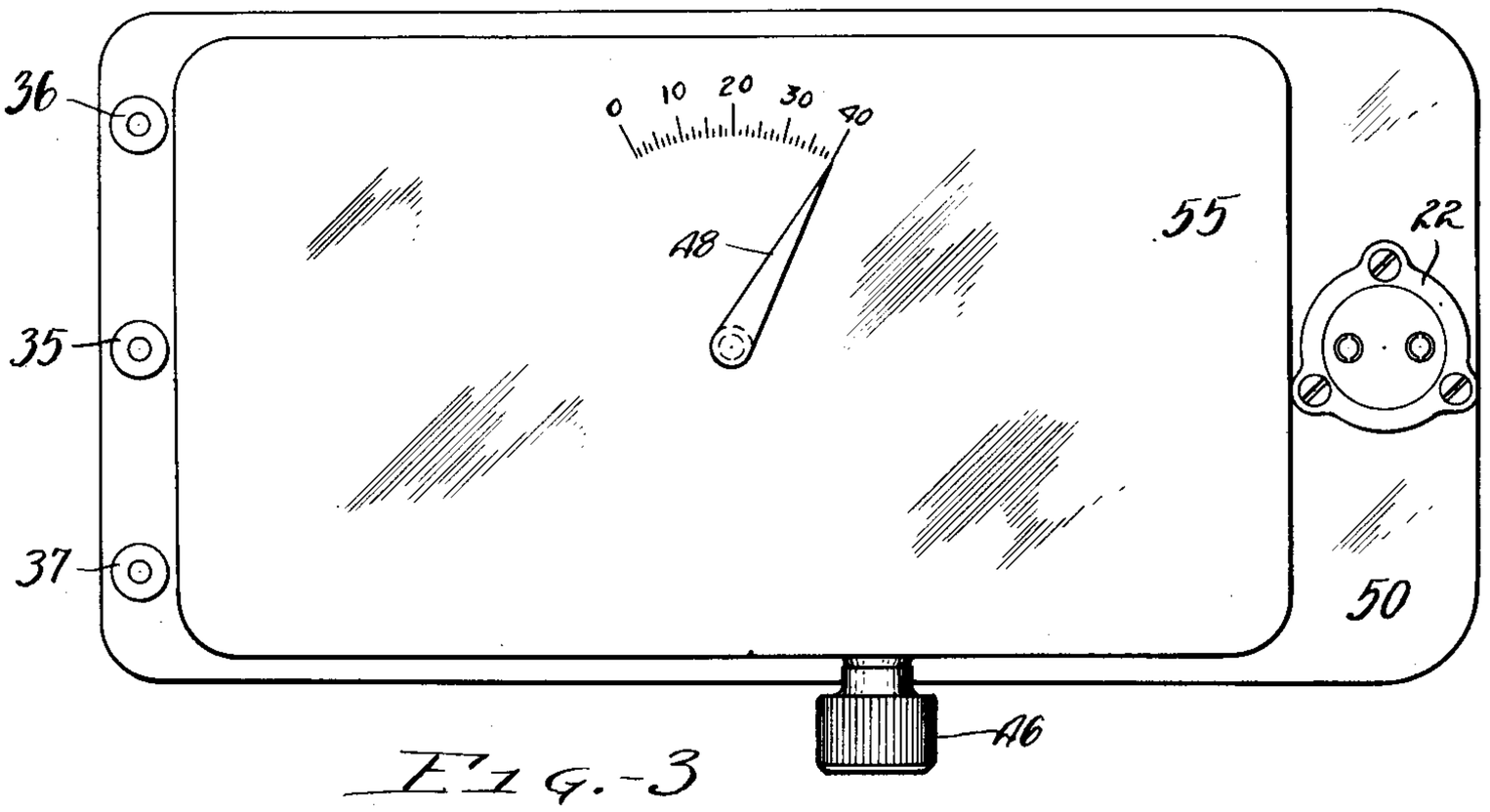

FIG.-3

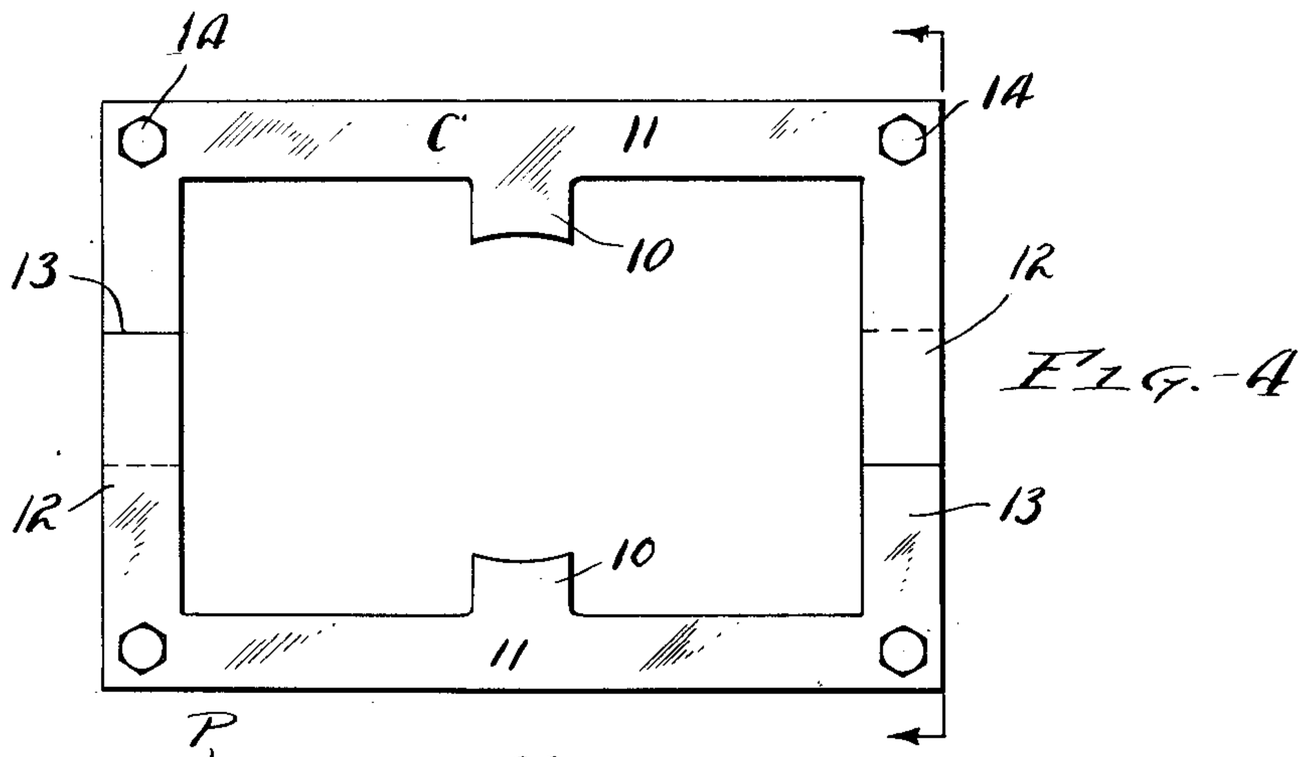

FIG.-4

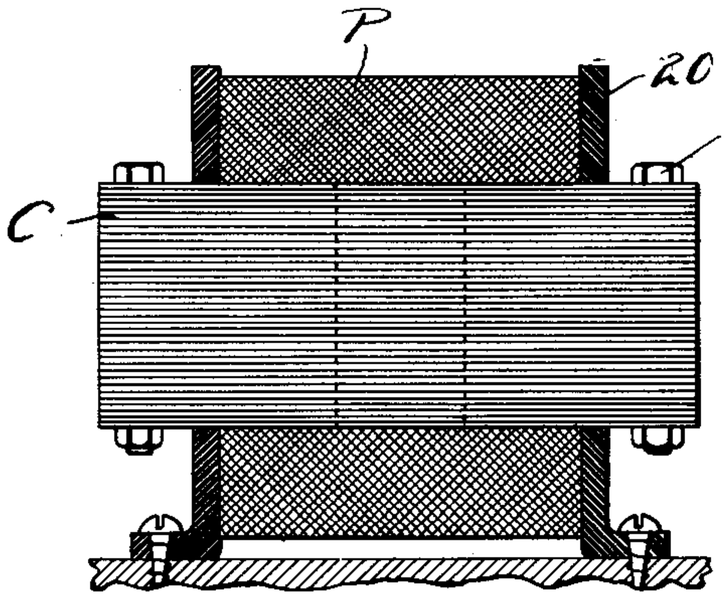

FIG.-5

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UNITED STATES PATENT OFFICE.

FRANK J. KAEHNI AND WILLIAM L. KAEHNI, OF CLEVELAND, OHIO.

TRANSFORMER.

Application filed June 8, 1922. Serial No. 566,807.

The object of this invention is to provide in a very simple form a variable voltage transformer, whereby with a definite voltage input any desired voltage output, within the limits of the device, may be obtained. Our invention is especially well adapted for use in heating the filaments of audions used in radio transmission or reception, taking the place of the usual "A" battery used for this purpose. When so employed the transformer may, for instance, be wound with the primary designed for 110 volts and connected to a plug socket or to a flexible cord having a plug for attachment to an ordinary light socket, while the secondary may be wound to give a maximum of 6 volts.

We accomplish the control of the voltage by means of a variable magnetic shunt, which is one of the features of our invention. For radio work it is important to neutralize the cycle hum of the alternating current input, and to accomplish this we prefer to place the entire secondary in series with the filament of the audion, but take a tap from the center of the secondary and connect it with the grid, so that the alternating current through the filament will not influence the voltage on the grid. The two paths of equal resistance from the grid line to the opposite ends of the filament give the same stabilizing effect as if the circuit were connected to the central point of the filament.

Our invention is hereinafter more fully described in connection with the accompanying drawings, and its essential characteristics are summarized in the claims.

In the drawings, Fig. 1 is a sectional side elevation of our transformer embodied in a simple form; Fig. 2 is a sectional plan thereof; Fig. 3 is a transformer with the casing in place; Fig. 4 is a plan of the built-up transformer core; Fig. 5 is a cross section through the primary of the transformer as indicated by the line 5—5, Fig. 2. Fig. 6 is a diagram illustrating the use of the transformer in radio work.

The magnetic core of our transformer comprises a closed circuit member C preferably rectangular. This member is laminated and may be conveniently made of approximately U-shaped sheet metal stampings, each having an intermediate portion 11 and end legs 12 and 13. The end leg 12 is preferably longer than the leg 13 so that identical stampings may be used to make the complete annulus, the ends of the legs overlapping, as illustrated in Fig. 4. Suitable non-magnetic bolts 14 may pass through the corners of the core to lock the laminations together and the two sides of the core member may be held by suitable cross plates 15 and 16 of non-magnetic material secured thereto.

Around one end member of the core bar is the primary winding P which is preferably a single coil mounted between suitable heads 20. The secondary windings S^1 and S^2 are placed about the other end member. These windings may be separated by a non-magnetic plate 30 located between them, and there are preferably end heads 31 at the two outer ends.

Between the primary and secondary windings we extend the core inwardly to make two pole pieces 10, and between these pieces we mount on an intermediate pivot a variably positioned block V of magnetic material. The outer ends of the block and the inner faces of the pole pieces are curved concentrically of the pivot of the block so that the block may stand close to the pole pieces as a magnetic continuation between them, as shown in Fig. 6, or it may be swung to one side, as shown in Fig. 2.

When the variator block is aligning with the pole pieces it forms an effective magnetic shunt for the lines of force from the primary so that comparatively few of such lines pass through the secondary winding and practically no current is delivered by the secondary. If, however, the variator block be shifted on its pivot, the magnetic path is interrupted and a larger portion of the lines of force pass through the secondary, depending on the extent of shifting. When the ends of the block are carried well beyond the pole pieces the magnetic path is practically entirely interrupted, and in such case the full voltage strength is obtained from the secondary.

To pivotally mount the variator block as described, we find it convenient to secure it to a central shaft 40 which may be mounted in the plates 15 and 16 secured to the core. Suitable means are employed for turning the shaft 40. To enable it to be gradually turned, and also held in any adjusted position against the magnetic pull of the core, we may employ the worm construction shown in Fig. 2. There 43 indicates a suitable worm segment rigid on the shaft 40, while 44 is a worm shaft meshing therewith and mounted in ears 18 and 19 of the plate 15. A suitable collar 45

holds the worm shaft against shifting, and a knob 46 on the forward end of the shaft provides means for rotating it.

We have shown the ends of the primary winding as connected to terminals 21 in a suitable socket 22 adapted to receive pins of a plug 23 on a flexible cord 24. The inner ends of the two secondary coils are shown as connected together and also connected to a binding post 35, while the outer ends of the respective coils are connected with binding posts 36 and 37, as shown in Fig. 2, though other terminal arrangements may be made if desired.

The structure may be mounted on a suitable base indicated at 50, and may be readily secured thereto, for instance, by screws 51 which pass through ears 52 on the heads 20 and 31. The socket and binding posts may also be carried by this base, though other mounting may be used if desired.

It is desirable to encase the transformer mechanism described and to that end we may provide a suitable housing of inverted cup-shape indicated at 55, which is shown as extending freely over the coils and core and resting at its lower edge on the base, being positioned by a shoulder thereon. The operating shaft 40 may extend through this casing and be provided above the casing with a pointer 48 co-operating with graduations on the casing.

Our transformer has a variety of uses but by way of illustration, we have shown in Fig. 6 its employment in heating the filaments of audion bulbs of which two are indicated at A^1 and A^2. The two filaments are shown as connected in parallel with the complete secondary S^1 and S^2 by lines *a* and *d* which lead from the binding posts 36 and 37. A line *e* from the binding post 35 at the center of the secondary leads to the grids *g* and may pass intermediately through the secondary of the usual amplifying transformer T.

With the construction described, if a cord from an ordinary electric light circuit be connected to the socket 22, giving an alternating current of 110 volts to the primary, the secondary may supply, for instance, 6 volts to the filament or a less amount, according to the position of the variator V.

It should be noted that the variation in voltage is effected by infinitesimal increments or decrements, which has a decided advantage in fineness of regulation over a step by step transformer. By dividing the secondary into two equal parts as explained, the cycle hum which comes from the alternating current reversals is neutralized. Accordingly, our device is well adapted to take the place, not only of the usual "A" battery in radio work, but also of the filament rheostats.

We claim:—

1. In a transformer, the combination of a closed magnetic core in substantially rectangular form, a primary winding associated with one leg of the core, a secondary winding associated with the opposite leg, inwardly projecting pole pieces carried by the remaining legs of the core, a shaft located midway between the pole pieces, a shunt block of magnetic material carried by the shaft and having curved surfaces complementary to said pole pieces, the width of the block being substantially equal to the width of the pole pieces, means associated with the core for supporting said shaft and for holding it in adjusted position, said means permitting rotation of the shunt block but preventing axial and lateral movement thereof.

2. In a transformer, the combination of a base, a primary winding and a double secondary winding supported by the base, a closed circuit magnetic core extending through said windings and having inwardly projecting pole pieces between the windings, a bracket member carried by the core, a shaft supported in the base and bracket, a shunt block of magnetic material carried by the shaft between said pole pieces and having curved faces complementary to the pole pieces, a transverse shaft carried by the bracket, a worm screw and segment between the two shafts for positioning and holding the block in varying angular relationship to the pole pieces, and terminals mounted on the base outside of the casing, there being two such terminals for the primary and three for the secondary windings.

In testimony whereof, we hereunto affix our signatures.

FRANK J. KAEHNI.
WILLIAM L. KAEHNI.