Feb. 28, 1939. R. S. EDWARDS 2,148,449

TRANSFORMER CONSTRUCTION

Filed Aug. 20, 1937 2 Sheets-Sheet 1

Fig. 1

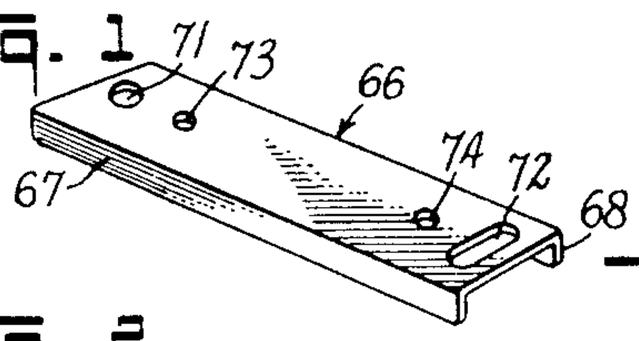


Fig. 2.

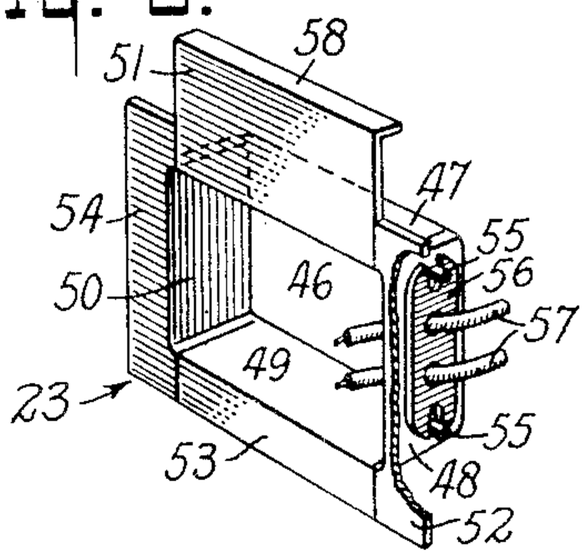


Fig. 6.

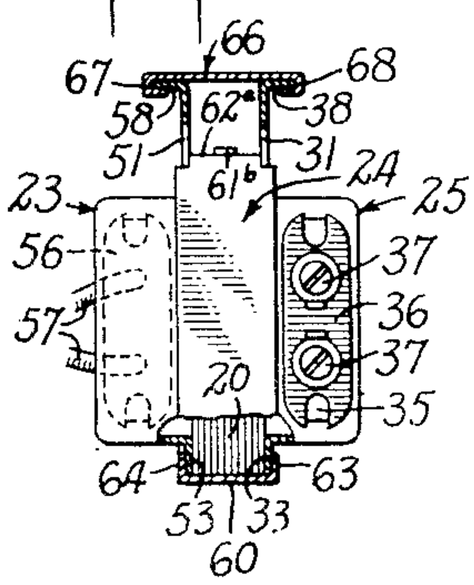


Fig. 7.

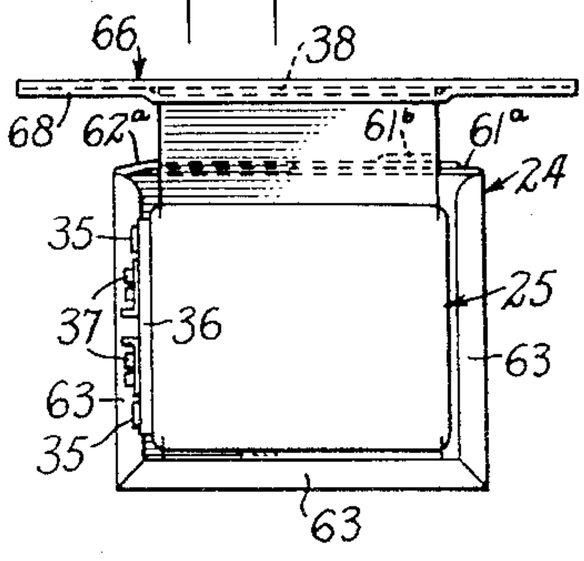
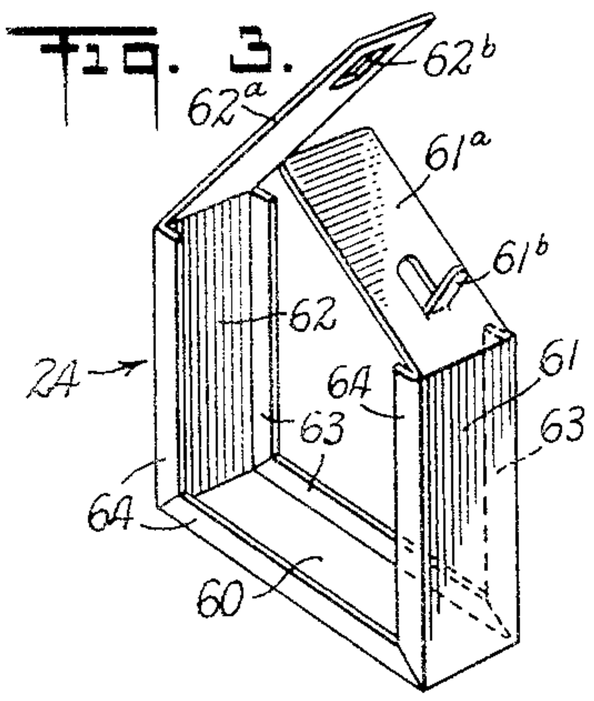


Fig. 3.



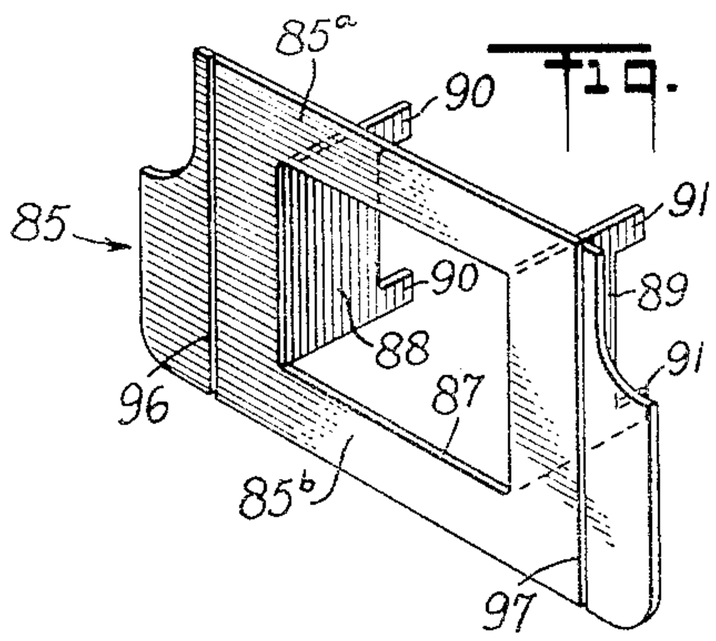


Fig. 8.

Fig. 4.

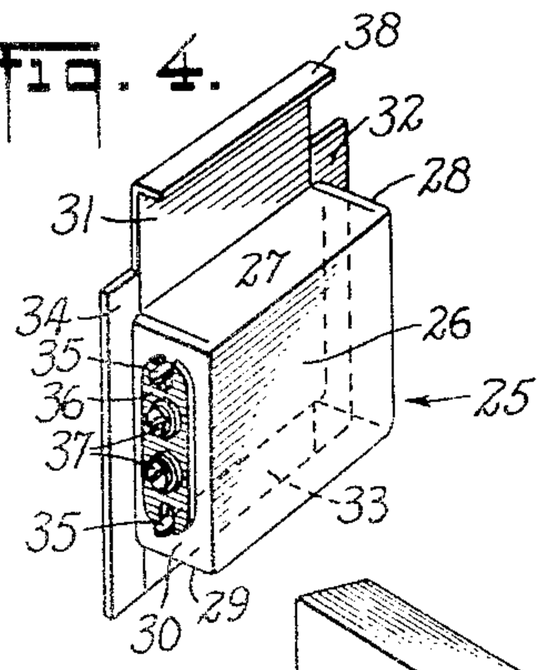


Fig. 9.

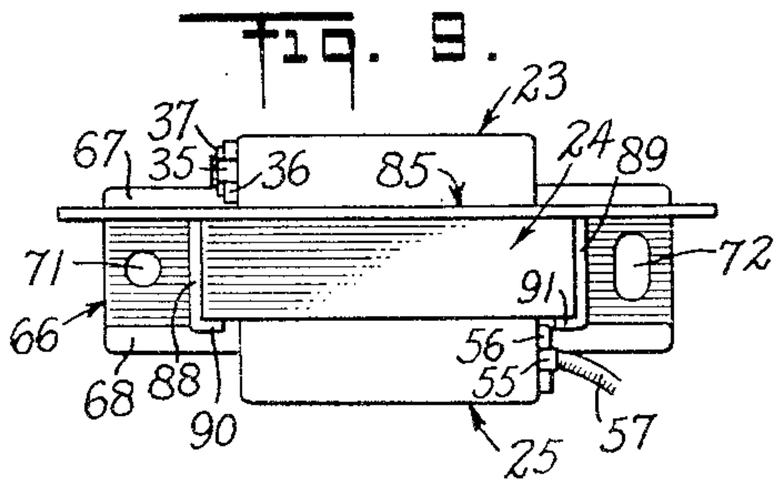
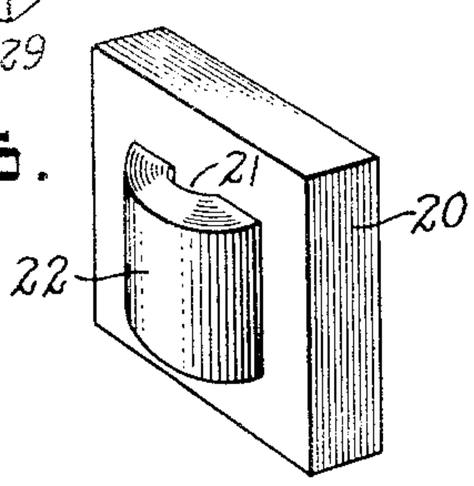


Fig. 5.



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TRANSFORMER CONSTRUCTION

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Fig. 10.

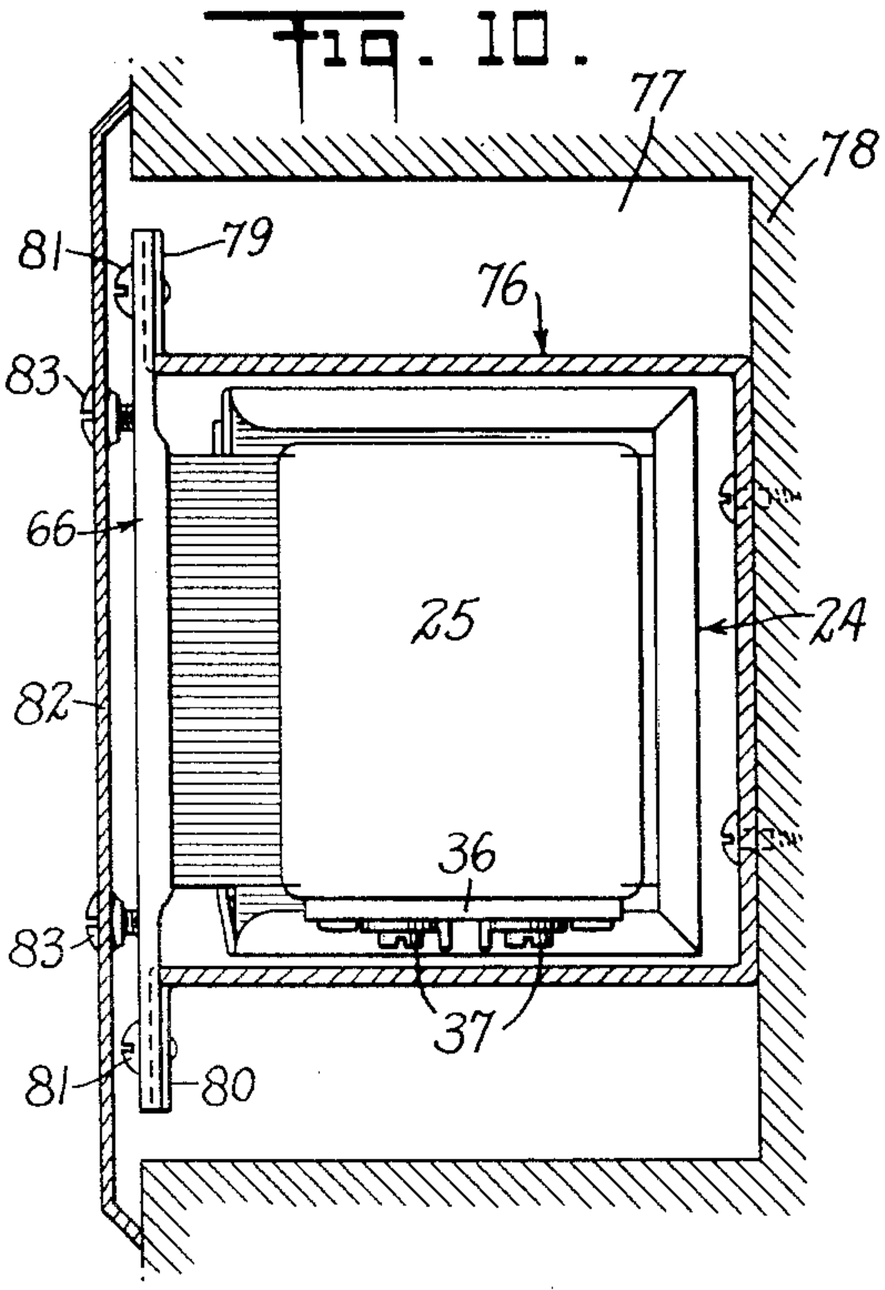


Fig. 11.

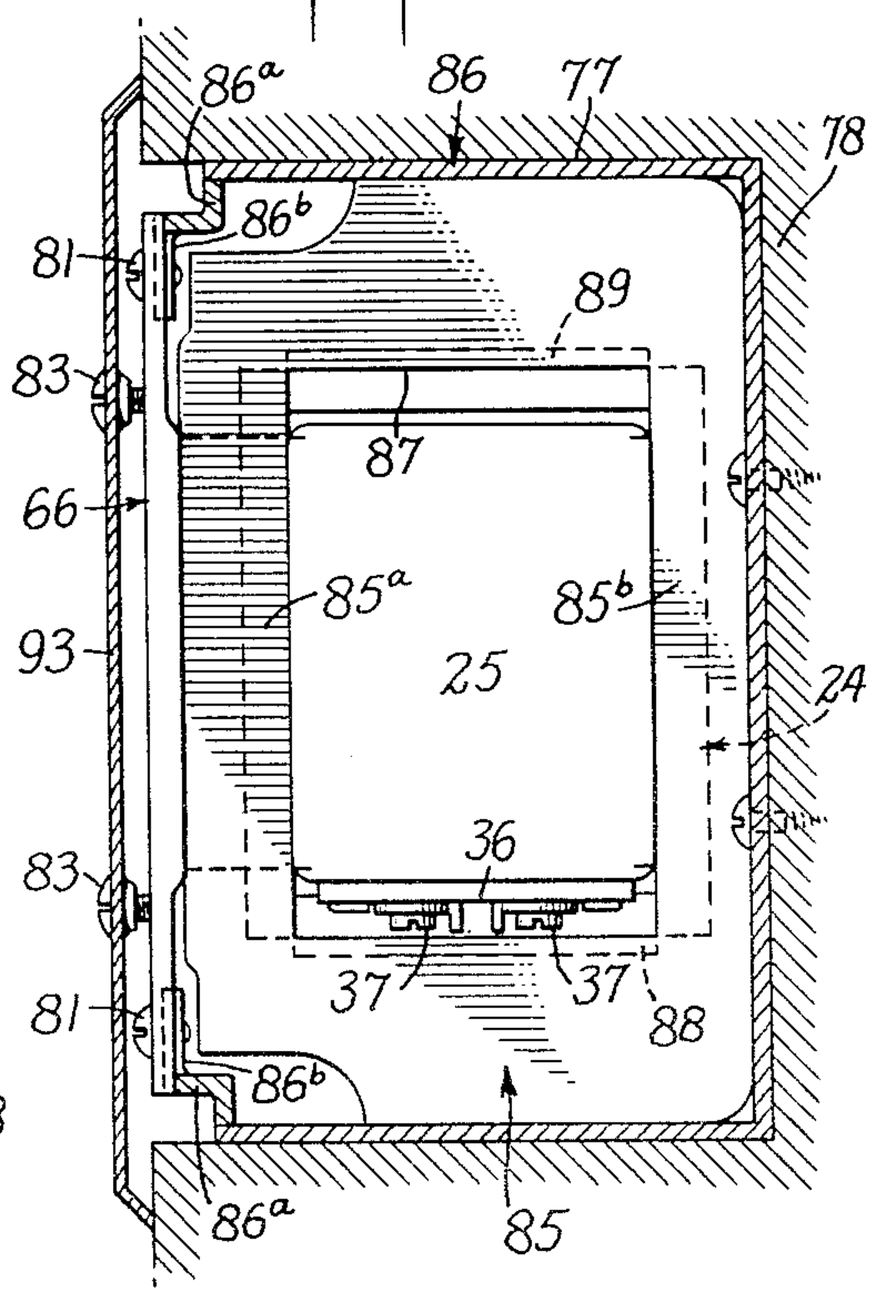
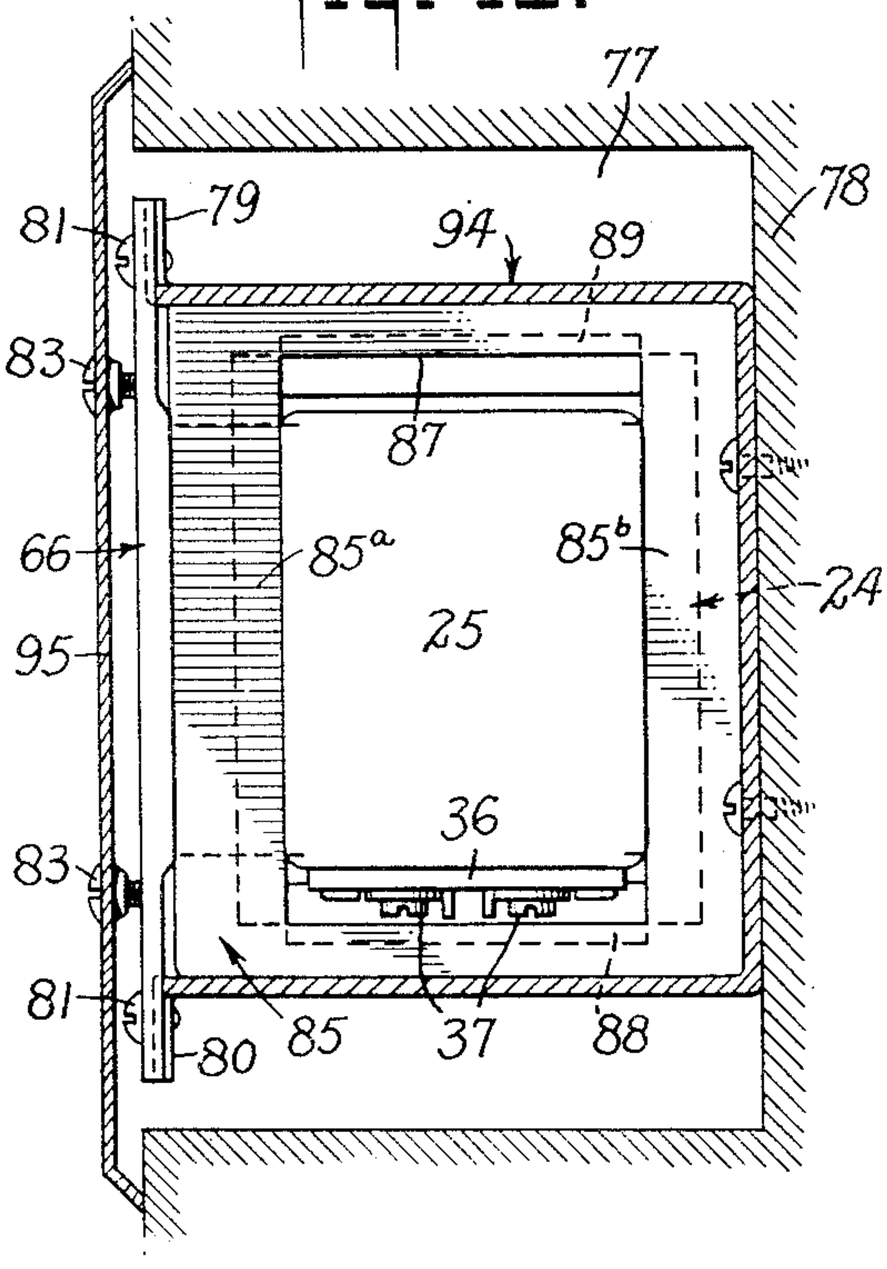


Fig. 12.



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UNITED STATES PATENT OFFICE

2,148,449

TRANSFORMER CONSTRUCTION

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Application August 20, 1937, Serial No. 160,032

13 Claims. (Cl. 175—361)

This invention relates to transformer construction and installation.

One of the objects of this invention is in general to provide an improved transformer construction and installation, particularly of the low voltage type of transformer, such as is employed in obtaining a lower voltage from the usual type of household circuit usually of about 110 volts. Another object is to provide an apparatus of the above-mentioned character in which manufacture and installation will be facilitated and certain desirable practical advantages dependably achieved. Another object is to provide a transformer construction particularly of the kind intended to be mounted in a so-called wall or outlet box that will be of improved manufacture and construction, compact, and, where installed in a box to form a barrier, saving in space without impairment of dependable barrier action. Another object is to provide an apparatus of the just mentioned kind that will be simpler and less expensive to construct as to its individual or component parts and also to assemble. Another object is to provide a transformer construction of the above-mentioned character that will be of generally universal applicability to outlet or analogous boxes used in certain kinds of present-day wiring systems. Another object is to provide a transformer construction which can be in a simple, inexpensive and thoroughly practical manner adapted to meet various conditions of practical application. Another object is to provide a transformer construction and installation that will be well adapted to meet the hard and varying conditions of practical use. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings in which is shown a preferred one of the various possible embodiments of the invention,

Figures 1, 2, 3, 4 and 5 are, respectively, perspective views of certain of the component parts of the transformer construction, ready for assembly, and showing a mounting member in Figure 1, an end casing section in Figure 2, a central casing section in Figure 3, an end casing section in Figure 4, and a transformer per se in Figure 5;

Figure 6 is an end elevation of the assembled construction; and

Figure 7 is a side elevation as seen from the right in Figure 6;

Figure 8 is a perspective view of a barrier member relatable to the transformer construction;

Figure 9 is a bottom plan view as the construction would be seen from the bottom in Figure 7 but with the barrier member of Figure 8 assembled thereto;

Figure 10 is a vertical sectional view through one type of wall box showing one form of installation;

Figure 11 is a similar view of an installation related to another type of box; and

Figure 12 is a similar view showing the transformer construction installed to meet still a different practical condition.

Similar reference characters refer to similar parts throughout the several views in the drawings.

Referring first to Figure 5 of the drawings I have there shown a transformer per se comprising a core **20** preferably laminated and illustratively of the shell type and having therefore core windows and a central core leg **21** about which the high voltage and low voltage windings, generally indicated at **22**, extend; for purposes of illustration the transformer may be considered to be for the purpose of reducing 110 volts, the voltage of its high voltage winding, to a lower voltage, say 15 volts, such as is employed for operating relays, bells, buzzers, and the like. This transformer **20—22** is preferably encased in a casing preferably made of sheet metal and illustratively and preferably, though not by way of limitation so far as certain features of my invention are concerned, made up of several parts or sections. The casing parts or sections may, for example, comprise three sections shown in perspective at **23**, **24** and **25**, respectively, in Figures 2, 3 and 4.

Considering first one end section, namely section **25** of Figure 4, it is constructed to be inexpensively stamped or formed as in press operations, as is true of the remaining sheet metal parts of the construction. It comprises a box-like portion open at one end, and made up of a wall **26** from which extend at right angles wing-like portions to provide side walls **27**, **28**, **29** and **30**, respectively, flanged as at **31**, **32**, **33** and **34**, thus virtually to provide a continuous peripheral flange about the open end of the casing section that extends in a plane spaced from but parallel to the plane of the end wall or face **26** and which falls within an area and configuration substantially to match the area and con-

figuration of one lateral face of the core 20. Accordingly, the casing section 25 may be laid against a lateral face (that one toward the observer viewing Figure 5) of the core 20, the edges of the peripheral flange portions, at least on three sides, being in substantial alinement with the edges of the laminations of the core 20; thereby the projecting portions of the windings 22 become closed over and encased.

The side wall 30 (Figure 4) has mounted upon it, as by ears 35, 35, a block of insulating material 36, such as fiber, the latter carrying suitable conductor-connecting devices, illustratively in the form of binding screws 37, 37, to which the external low voltage circuit conductors may be connected and, of course, prior to assembling the casing section 25 to the transformer 20—22, these connecting devices, which are insulated from the casing by the block 36 are internally of the casing connected in any suitable manner to the low voltage lead wires (not shown) extending from the low voltage coil of the windings 22.

The flange 31 extends upwardly to a substantial extent so that it projects upwardly beyond the upper face of the core 20 (Figure 5) whence it is bent over at right angles to form a securing flange 38 for purposes later described.

A substantially identical end casing section is provided for the opposite face of the core 20 and that is the casing section 23 of Figure 2. Thereby, also, the advantage of using the same tools in making up both casing sections is achieved. Thus, referring to Figure 2, casing section 23 has a face or end wall 46 from which extend, substantially at right angles, wing-like extensions to form side walls 47, 48, 49 and 50, preferably butt-jointed as in the casing section 25 and which at their free edges are bent to form flanges 51, 52, 53 and 54, respectively, adapted to abut against the opposite face of transformer 20 with the free edges of at least three of them alined with the edges of the core 20, thus encasing the windings that project to the opposite side of the core.

One of the vertical side walls, preferably wall 48 (Figure 2) has secured thereto, as by ears 55, 55, a block 56 of insulating material, such as fiber, for insulatingly passing through the side wall the insulated lead wires 57, 57 which, prior to assembling the casing section 23 to the transformer 20—22, are connected to the terminals of the high voltage coil of the windings 22, leaving appropriate lengths of the lead wire extending outwardly from the casing section for ultimate connection to the conductors of the high voltage circuit with which the transformer is to be related.

Flange 51 (Figure 2) is extended upwardly to a substantial extent, like the flange 31 of the casing section 25 of Figure 4, whence it is bent over at right angles to provide a flange 58.

With the two casing sections 23 and 25 thus related to the transformer 20—22, the central casing section 24 is put in place to complete the casing and to hold all of the parts together. Referring to Figure 3, the casing section 24 will be seen to be a sheet metal stamping of a generally U-shape, having a bottom wall 60 from which upstand side walls 61—62 at right angles thereto, these three wall portions having flanges 63, 64, the parts being so proportioned that the transformer 20—22, with the casing sections 23, 24 related thereto may now be slipped as it were into the U-shaped central casing section 24 and snugly received peripherally, at least on three sides of the assemblage, between the flanges 63—64. The latter may be operated upon to cause them to securely clamp the parts interposed between them together, as is better shown in the lower portion of Figure 6; in the latter view, it is clearly shown how the flanges 53 and 33 and the interposed transformer core 20 are held and clamped together by the flanges 63, 64, that action preferably also aiding to clamp the laminations of the core 20 securely together.

Referring back to Figure 3, the side wall portions 61, 62 have upward extensions 61a and 62a, respectively, which, when the assembly has proceeded as far as above described, are folded or bent downwardly into overlapping relationship in between the upstanding flanges 31 and 51 between which they snugly fit, and are secured in place in any suitable manner. Preferably, one of these extensions, like extension 61a, has cut or stamped out of it an upstanding tongue 61b adjacent its connection with the side wall portion 61 and the other one, like extension 62a, has an aperture 62b cut in it so that when the latter member is brought downwardly on top of the member 61a, the tongue 61b may be brought through the aperture 62b and after being put under appropriate tension, as by pulling, is then bent downwardly against the upper face of the extension 62a to hold the members 61a and 62a against separation and in snug overlapping relationship to the upper edge face of the core 20, all as appears from Figures 6 and 7.

I then provide a mounting member, better shown in perspective in Figure 1, generally indicated by the reference character 66; it is preferably made of sheet metal, has two spaced downwardly extending flanges 67, 68 spaced apart by a distance sufficient to snugly receive therebetween the flanges 38 and 58, as shown in Figure 6, whereupon the flanges 67 and 68 are bent over and under the flanges 58 and 38, respectively, thereby and preferably to achieve certain actions; among the latter is a slight drawing together of the flanges 31 and 51 so as to hold them dependably against separation and thus to hold the upper horizontal portions of the casing sections 23 and 25, across which portions of the flanges 63 and 64 in the illustrative embodiment do not extend, together and to supplement the above-described clamping action of the flanges 63 and 64 in holding the parts together. Also, the underturned flanges 67, 68 tightly secure the mounting member 66 in place and, these flanges being turned under throughout their entire length, as appears better in Figure 7, hold the transformer construction nicely centered with respect to the member 66 and also reinfofce and strengthen the latter throughout its entire length, such reinforcement being also contributed to by the angular relationship of the flanges 51—58 and 31—38, as better appears in Figure 6.

The mounting member 66 (Figure 1) is of sufficient length to provide for holes 71, 72 adjacent its ends spaced apart by preferably the standard distance of the screw holes provided in the lugs, ears or flanges of standard types of outlet, wall, or switch boxes, or the like, and to provide also threaded holes 73, 74 spaced apart by the standard spacing of the holes in cover plates used to close over such boxes.

Accordingly, when it is desired to mount the transformer construction as it appears in Figures 6 and 7, in a wall box of a size to accommodate just the transformer, such as a switch box 76, shown in Figure 10, mounted in a recess 77 in a wall 78, the high voltage and low voltage sides

of the transformer are connected to their respectie circuit conductors and the construction inserted into the box, as shown in Figure 10; the extreme ends of the mounting member 66 come to rest upon the threaded lugs 79—80 of the box 76 with the holes or slots 71, 72 in substantial registry with the threaded screw holes in these lugs, whence suitable screws 81, 81 are used to secure the structure in place.

Usually in such standard forms of wall boxes, space is limited but by positioning the terminal connectors 37, 37 and the lead wires 57 at or on the diagonally opposed narrow vertical side walls 48 and 30 (see Figures 6 and 9), there is least interference with and no encroachment upon the opposed end walls of the box 76 through the knockouts in which the conductor or conduits are usually brought. Also, the diagonal relationship insures maximum spacing apart, with the transformer structure interposed therebetween, of the high voltage and low voltage conductors within the box but external of the transformer structure itself. A cover plate 82 (Figure 10) of standard shape or dimension may then be used to close over the entire installation by screws 83, 83 which are threaded into the holes 73, 74 (Figure 1) of the mounting member 66.

However, there are numerous instances where it is necessary or desired to positively segregate or separate the interior of the box into a high voltage side or compartment and a low voltage side or compartment, and this requirement must be met even though the interior dimensions of the boxes met with in practice vary. This need is fulfilled by associating with the transformer construction of Figures 6 and 7 a barrier plate generally indicated in Figure 8 at 85. This plate is preferably dimensioned or outlined, as shown in Figure 8, to be snugly received within and virtually snugly to contact the three walls of that type of wall box, indicated in Figure 11 at 86, which has the largest cross-section of the various types of boxes met with in practice. The box 86 of Figure 11, shown mounted in a recess 77 in the wall 78, is intended to represent such a box and the barrier plate 85 will be seen from Figure 11 to snugly fit into the interior of the box crosswise, usually centrally thereof, and thus, in coaction with the transformer construction itself, positively to sub-divide the box 86, as above noted.

Recurring to Figure 8, the barrier plate 85 is preferably a sheet metal stamping and has a substantially central opening 87 whose vertical dimension, as viewed in Figure 8, just permits the laterally projecting casing section 25 (Figures 6 and 7) to pass therethrough and whose horizontal dimension just matches the horizontal dimension of the central casing section 24, as seen in Figure 7 or 3. Along the vertical edges of the aperture 87, certain of the sheet material that would otherwise close the aperture 87 is bent at right angles to the plane of the barrier plate 85 and rearwardly thereof to form two parallel rearwardly extending arms 88, 89 (Figure 8) whose dimension in a rearward direction substantially matches the thickness of the central casing section 24 as the latter is seen in Figure 6. At appropriate points at the rear edges of the members or arm-like extensions 88, 89, the latter have extending therefrom and integrally formed therewith ears 90—90 and 91—91.

Accordingly, when an installation has to be made like that above-mentioned in connection with Figure 11, the transformer structure of Figures 6 and 7 has related to it the barrier plate 85 and this is achieved preferably in the following way:—The barrier plate 85, with the rearwardly extending arms 88, 89 and held in the position shown in Figure 8, is moved flatwise with respect to the structure, as shown in Figure 7, or in a direction toward the left, as viewed in Figure 6, so that the casing section 25 passes through the opening 87 in the plate 85 until the upper and lower marginal portions 85ᵃ and 85ᵇ of the plate 85 come to rest flatwise against the central casing section 24, the extensions 88, 89 passing, respectively, to the left and right of the central casing section 24 which, because of the above-described dimensioning and spacing of the parts, becomes snugly received between the parts 88, 89 and leaves the ears 90, 90 and 91, 91 projecting beyond the central casing section 24, whence they may be bent over against the latter, as is shown in the bottom view of Figure 9, from which clearly appears the arrangement whereby the central casing section 24 becomes clamped between the marginal portions 85ᵃ, 85ᵇ of the plate 85 and the ears 90, 90 and 91, 91. These marginal portions 85ᵃ, 85ᵇ also prevent relative vertical displacement between the barrier plate 85 and the transformer casing section 25 of the latter is snugly received between the contiguous edges thereof while relative horizontal displacement is prevented because the central casing section 24 is snugly received between the rearwardly extending arms 88, 89 of the barrier plate. In assembling the latter to the casing, the just described relative proportioning of the parts also insures that the connecting devices 37, 37 and insulating block 36 (Figure 7) are safely by-passed inasmuch as the arm 88 of the plate 85 moves, in course of assembly, along the plane of the left-hand edge of the central casing section 24 which, as is seen in Figure 7, is displaced from the connecting devices and their mounting.

The resultant construction, when inserted into the box 86 which is usually of two parts, having an upper peripheral frame member 86ᵃ related to its periphery and provided with a suitable number of pairs of opposed lugs 86ᵇ, 86ᵇ with threaded holes therein of the same standard spacing mentioned in connection with the lugs 79 and 80 of Figure 10, brings the barrier plate 85 into a snug fit crosswise of the box 86 and brings the projecting ends of the mounting member 66 onto the opposed lugs 86ᵇ, 86ᵇ with the holes or slots 71, 72 therein in registry with the threaded holes in the spaced lugs, whence screws 81 are used to secure the construction in place in the box, it being noted that, as is better shown in Figure 11, the marginal portion 85ᵃ above-mentioned of the barrier plate 85 fits closely along the under face of the member 66 and that the barrier plate 85 in coaction with the transformer casing structure itself thus dependably divides off the interior of the box 86 into a high voltage compartment in which the high voltage leads 57 and related circuit conductors or apparatus are accommodated and a low voltage compartment in which the diagonally opposed connecting devices 37, 37 are exposed and contained for connection with the low voltage circuit conductors or apparatus contained in the low voltage compartment. The diagonal disposition of the high voltage and low voltage terminals or conductors, as already above described, also makes for absence of encroachment upon the spaces of the respective high voltage and low voltage compartments, a feature of practical advantage where in one or both of these com-

partments other apparatus might be mounted or positioned, such as a bell, buzzer, relay, switch, outlet plug receptacle, or the like.

The installation of Figure 11 may be completed by the standard cover plate 93 secured in position by screws 83, 83 threaded into the threaded holes 73, 74 of the transformer mounting member 66 and into corresponding holes of such high voltage or low voltage devices as may be in the respective compartments to either side of the transformer structure and barrier.

In Figure 12 is illustrated another type or shape of wall box, indicated at 94; this box 94 is of smaller cross-sectional dimension than the box 86 of Figure 11 and may be of larger cross-section than the box 76 of Figure 10. Box 94 may have threaded ears or lugs 79 and 80 having threaded holes therein spaced apart by the same standard distance as those of the lugs 79—80 of Figure 10 or of the lugs 86^b, 36^b of Figure 11. To these lugs the mounting plate 66 is secured as by the screws 81, 81 and the standard cover plate 95 with standard spacing of holes for the screws 83, 83, threaded into the holes 73, 74 of the mounting member 66, may complete the installation. The box 94 may, like the box 86, be of the gang type and may have to be subdivided into high voltage and low voltage compartments. In such case, the barrier plate 85 of Figures 8 and 9 is scored, marked or weakened along the lines 96, 97, the latter lines being so positioned that when the marginal portions of the barrier plate 85 are bent, cut, broken off, or severed, or otherwise operated upon along the lines 96 and 97, the projected area of the barrier plate 85 is reduced to substantially match the cross-sectional interior of the box 94 of Figure 12 with which it thus interfits when the structure is related thereto as will now be clear and with results and advantages which will also now be clear in view of what has already been set forth above.

Thus, it will be seen that there has been provided in this invention a transformer construction and installation in which the various objects hereinbefore noted, together with many thoroughly practical advantages, are successfully achieved. It will be seen that the construction is of a thoroughly practical nature, well adapted to meet the peculiarly varying conditions of practical use, inexpensive in construction and thoroughly dependable and durable.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:—

1. In apparatus of the character described, in combination, a wall box having at its opposed upper ends flange-like means having threaded holes, a transformer construction comprising a sheet metal casing receivable into said box but of smaller cross-section than the interior of the latter and having secured thereto mounting means adapted to rest against said opposed flange-like means and to be secured thereto by screws threaded into said threaded openings, said casing comprising a main casing section and at least one end casing section projecting from said main section and of lesser dimensions than the latter, the plane of said mounting means being spaced from a side wall portion of said end section, a barrier plate of an expanse sufficient to fit the cross-sectional interior of said box and having an aperture dimensioned to receive therethrough said end casing section and thereby to rest against said main casing section, said barrier plate having a portion extending along said side of said end section and in the space between said side and said mounting means, and means securing said barrier plate to said casing.

2. An apparatus as claimed in claim 1 in which said plate-securing means comprise holding means between which and said barrier plate a portion of said casing is clamped.

3. An apparatus as claimed in claim 1 in which said plate-securing means comprises spaced arm-like extension means on said plate spaced sufficiently to by-pass said main casing section, said extension means being bent over against the latter.

4. An apparatus as claimed in claim 1 in which said securing means comprises a pair of extension means on said barrier plate formed out of at least a portion of the metal cut and bent away to form said aperture therein, said extension means extending into coacting relation with said main casing section, and means for fastening said extension means and said casing together.

5. An apparatus as claimed in claim 1 in which said aperture in said barrier plate has one dimension substantially matching one dimension of said end casing section and the other dimension being greater than said one dimension and substantially matching a dimension of said main casing section, whereby said end casing section is received through said aperture and two marginal portions of said barrier plate along opposite sides of said aperture rest against said main casing section, the said barrier plate having extensions from the opposed edges of said aperture that are of greater dimension to receive therebetween said central casing section.

6. In apparatus of the character described, in combination, a transformer comprising a sheet metal casing having a main casing portion and an end casing portion of lesser projected area than said main casing portion, a plate having an aperture therein of a size sufficient to pass said plate over said end casing portion but not large enough to permit said main casing portion to pass therethrough, said plate having extension means thereon extending laterally of said main casing section, and means coacting with said extension means and said casing for holding the latter assembled to said plate and with said end casing portion extending into said aperture.

7. In apparatus of the character described, in combination, a transformer comprising a sheet metal casing having a main casing portion and an end casing portion of lesser projected area than said main casing portion, said casing having therein a transformer core and windings therefor, and means for making connection to at least certain of said windings and including insulating means and conductive means carried by said casing but positioned and dimensioned to fall within a portion of the space that is defined by the difference in the projected areas of said two casing portions.

8. In apparatus of the character described, in combination, a transformer construction comprising a casing having a central casing portion and two end casing portions extending therefrom on opposite sides thereof and each of a lesser projected area than said main casing portion, said casing having therein a core and windings,

terminal connections for certain of said windings positioned to one side of said casing portion and dimensioned to fall within a portion of the space that is defined by the difference in the projected area of said main casing portion and the projected area of the end casing portion on that side of said main portion, and terminal connecting means for another portion of said windings positioned on the other side of said main casing portion and dimensioned and positioned to fall within a portion of the space defined by the difference in the projected area of said main casing portion and the projected area of the end casing portion on said other side of said main portion.

9. A sheet metal plate for interconnection with a transformer that has a casing comprising at least two portions one of which is of greater projected area than the other and the said other being an extension of the former, said plate having an aperture through which said lesser casing portion may pass but not said greater casing portion, and having securing means integrally formed therewith and of an extent to receive therebetween said greater casing portion.

10. A sheet metal plate for interconnection with a transformer that has a casing comprising at least two portions one of which is of greater projected area than the other and the said other being an extension of the former, said plate having an aperture through which said lesser casing portion may pass but not said greater casing portion, and having securing means integrally formed therewith and of an extent to extend alongside of and beyond said greater portion and bendable over against the latter.

11. A transformer construction comprising a core with windings thereon and a three-sectioned casing therefor comprising two box-like end sections having peripheral-flanges respectively resting against and in edgewise alinement with said core, and a central substantially U-shaped section for enveloping three side faces of said core and having flanges taking over the peripheral flanges on three sides of said two end sections, the flanges on the remaining side of said two end sections being extended and the arm-like parts of said U-shaped central section having extensions bent into overlapping relationship against the remaining edge face of said core and between said extended flanges, and means whereby said transformer may be mounted by way of said extended flanges.

12. A construction as claimed in claim 11 in which said mounting means comprises a sheet metal mounting member spaced from said remaining edge face of said core and having said overlapping bent extensions thereunder, and means for securing said mounting member to both of said extended flanges.

13. In apparatus of the character described, in combination, a transformer comprising a casing having a main casing portion and an end casing portion of lesser projected area than said main casing portion, a plate having an aperture therein of a dimension in one direction commensurate with the spacing between two opposed side walls of said end casing portion and hence sufficient to pass said end casing portion therethrough and a dimension in the other direction greater than the spacing between the other opposed side walls of said end casing portion thereby to cause said aperture, when said lesser casing portion is received therethrough and said plate rests against said main casing portion, to have included within its projected area at least a portion of the difference in the projected areas of said two casing portions, and terminal connecting means carried by said casing and positioned within the aforesaid portion of the difference between said two projected areas, whereby said apertured plate takes over not only said lesser casing portion but also said terminal connecting means.

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