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R. E. UPTGRAFF, JR

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TRANSFORMER HOUSING CONSTRUCTION

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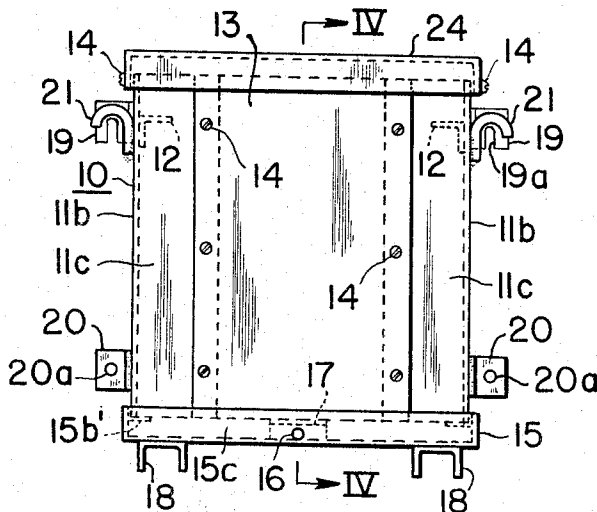


Fig. 1

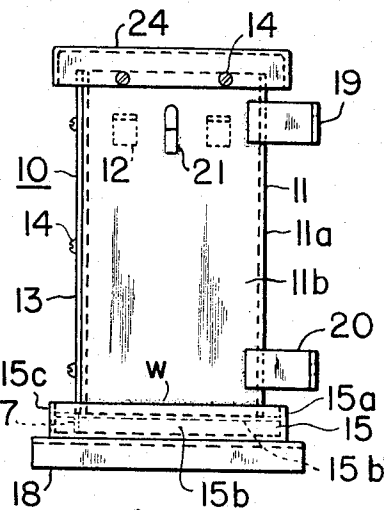


Fig. 2

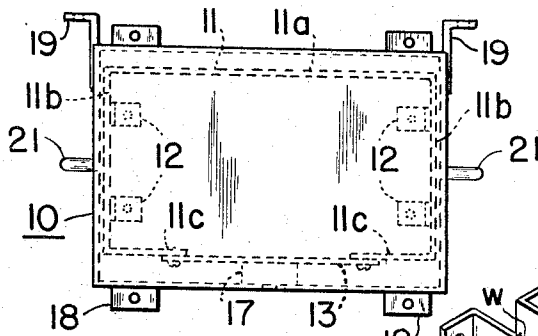


Fig. 3

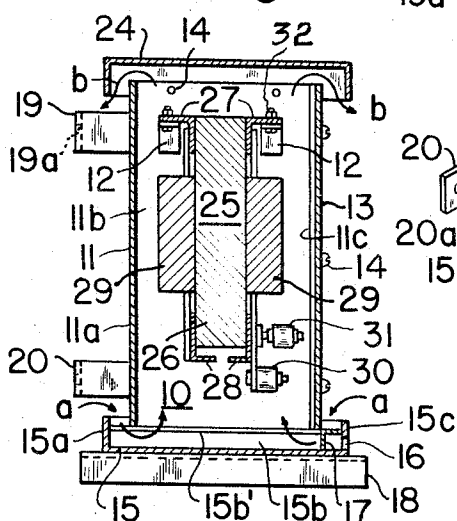


Fig. 4

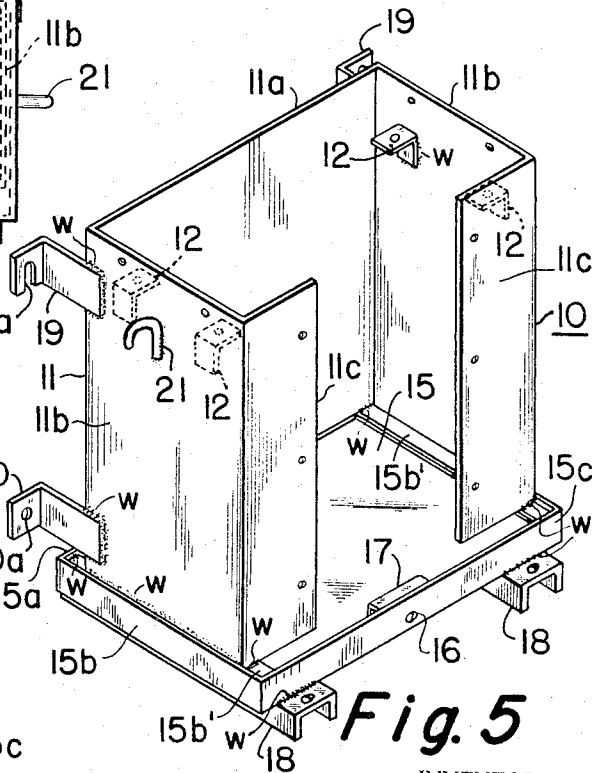


Fig. 5

INVENTOR,
Roy E. Uptegraff, Jr.

BY *Green, McCallister & Miller*

HIS ATTORNEYS

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TRANSFORMER HOUSING CONSTRUCTION

Roy E. Uptegraff, Jr., Scottsdale, Pa., assignor to R. E. Uptegraff Manufacturing Company, Scottsdale, Pa., a corporation of Pennsylvania

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13 Claims. (Cl. 336-59)

This invention relates to electric transformers and particularly, to dry type distribution transformers such as used in stepping-down voltage for commercial, industrial, and plant utilizations. Usually transformers of this type have a rating range of about 15 through 167 kva., at about 15,000 volts or less. This invention relates particularly to an improved distribution transformer housing construction which employs atmospheric gases or air for cooling a transformer carried or positioned therein and which may be used for either an indoor or an outdoor installation as required.

Previous to my present invention, it has been customary to employ a housing having grillwork which permits air circulation through the transformer windings to maintain such windings at a suitable operating temperature. That is, in order to provide for introduction of cooling air upwardly from the bottom portion of a transformer unit, it has been customary to provide its housing with a bottom closure grill and its upper portion with a top or side grill or the like for exhausting warmed air which has been passed upwardly through the electrical windings. The transformer, itself, including its windings and core as well as its terminal panels are all mounted within the housing. Although transformers for commercial utilizations are normally mounted indoors, I have found that they may pick-up moisture from fumes in the air and are also subject to direct water pick-up due to plant washing-down operations. Outdoor transformers are, of course, subject to moisture pick-up from rain, snow, etc.

I have found that there is a fire and safety hazard in connection with the present construction of such transformers. When a transformer is overloaded or fails for any reason, molten metal and other incandescent material may drop downwardly through the bottom grillwork. Since these transformers are not normally placed in a vault or provided with protective enclosures, such as fences or walls, they have heretofore presented a hazard to both persons and property. In a plant, waste, packing and other inflammable material may be stored beneath the transformer which is mounted on a wall or ceiling to save space, thus causing a fire hazard. Also, it is possible to poke or stick a sharp rod or other similar metal object through the grillwork, thus giving rise to the danger of a short circuit or of the electrocution of plant personnel.

There is a problem involved in providing a housing structure which will enable necessary air movement into, through and out of the transformer in an efficient manner and, at the same time, will ensure against damage to the transformer by accidentally or otherwise engaging it or its electrical connections with a sharp, grill-penetrating rod or similar object, and will avoid the danger from a drain-off of molten metal. There is also a need for providing a construction which will enable the drain-off of liquid, including atmospheric precipitation, that tends to corrode the transformer housing or build-up to such an extent as to damage the transformer windings by shutting off flow of cooling air at the bottom.

It has thus been an object of my invention to devise a new and improved form of distribution transformer which will solve the problem involved and provide a practical and efficient unit from the standpoint of air circulation;

Another object of my invention has been to devise a transformer housing construction which is closed-off in

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a foolproof manner from the standpoint of tampering or the introduction of a foreign object and which will, at the same time, provide for moisture drainage and an efficient cooling movement of air;

5 A further object of my invention has been to provide a transformer enclosure, housing or casing which will eliminate fire hazards, particularly from the standpoint of downflow of molten material or metal therefrom;

10 A still further object of my invention has been to devise a transformer housing which will provide a downward inflow of cooling air into the bottom portion thereof and a downward outflow of warmed air through an upper end portion thereof;

15 These and other objects of my invention will appear to those skilled in the art from the illustrated embodiment and the claims.

In the drawings,

FIGURE 1 is a front and view in elevation of a transformer constructed in accordance with my invention;

20 FIGURE 2 is a side view in elevation on the same scale as and of the transformer unit of FIGURE 1;

FIGURE 3 is a top plan view on the scale of and of the transformer construction of FIGURES 1 and 2;

25 FIGURE 4 is a sectional view in elevation on the scale of and taken along the line IV-IV of FIGURE 1; and

FIGURE 5 is an isometric view in elevation on the scale of FIGURES 1 to 4, inclusive, further illustrating the construction of the housing of the illustrated embodiment, with its top cap or lid and its front face plate or cover member removed.

In the illustrated embodiment shown in FIGURES 1 to 5, 10 represents a complete enclosure, housing or casing assembly which may employ a unitary or one-piece vertical upright wall part or enclosure member 11 to define a transformer-receiving chamber. As shown particularly in FIGURE 5, the member 11 is formed as an upright, rectangular enclosure having a vertical back closure wall or side 11a, a pair of opposed, slightly more narrow, vertical side closure walls 11b, and a pair of vertical front wall tabs, panel portions or transversely spaced-apart flange walls 11c. The front flange walls 11c define an open maintenance spacing therebetween at the front of a transformer core and winding unit 25 to enable its ready electrical connecting and servicing. As shown particularly in FIGURES 1 and 2, a front vertical closure wall or plate member 13 is adapted to abut or rest upon the flanges 11c and to be removably-secured thereto, as by self-tapping metal screws 14. As 50 illustrated particularly in FIGURES 3 and 5, opposed pairs of angle pieces or mounting brackets 12 are secured by one of their tab or foot portions to the inside of the side closure walls 11b adjacent to and in a spaced relation below an open top end portion of the upright enclosure 11. The mounting brackets 12 of each side-mounted pair have a transversely spaced-apart relation with each other and are adapted to receive angle-shaped brackets 27 that project outwardly from the top end portion of a metal core 26 of the transformer 25 to suspend the latter within the transformer chamber defined by the enclosure 11.

A bottom tray 15 is mounted or positioned in a downwardly-spaced relation with the bottom open end portion of the upright enclosure 11 and has a substantially planar bottom closure wall circumscribed by an upwardly-projecting rim flange. A pair of opposed side flange portions 15b of the rim flange are shown extending upwardly along and in abutment with the side walls 11b and as being secured thereto along the joints therebetween by weld or brazing metal w. The rim flange of the tray 15 also has a pair of opposed back and front flange portions 15a and 15c that are shown as extending upwardly along and in an

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outwardly-spaced relation with the upright enclosure 11 to define a pair of opposite air inlet passageway (see arrows *a*) to the transformer chamber. If desired, side support strip members or pieces 15b' may be secured within the tray 15, as by spot weld metal *w*, between flange portions 15a and 15c and along flange portions 15b to provide an additional support mounting for the upright enclosure 11 with respect to the tray 15. As shown particularly in FIGURES 2, 4, and 5, the side-mounted pieces or members 15b' have a downwardly-offset position below the top edge of the rim flange of the tray 15, such that the upright enclosure 11 extends therebelow and there-within.

It will be noted further that the width of the enclosure side walls 11b is considerably less than the spacing between the back and front flange portions 15a and 15c, and that the back enclosure wall 11a and front wall flanges 11c are mounted in an open, substantially equal, space-defining relation between such front and back flange portions. When the front closure cover 13 is in position on the wall flanges 11c, it will thus be apparent that longitudinal air entry passageways are provided at the front and back sides of the housing assembly 10.

To provide for drainage of moisture, a drain hole, port or open outlet portion 16 is shown in FIGURE 5 as provided at a mid-point along the front flange portion 15c. As disclosed particularly in FIGURE 4, the port or outlet portion 16 is open to the level of the top planar surface of the bottom closure wall of the tray 15. To baffle the emergence of incandescent material and to positively prevent the introduction of a rod or other sharp object substantially horizontally or otherwise through the drain hole or outlet portion 16, I have provided a protective, shielding, closure piece or member 17 of angle-shape which is weld-secured between the flange portion 15c and the bottom closure wall to define an open-end box chamber that is closed from above and from the back and that extends on either side beyond the outlet portion 16. As a result, even an angling-in of a metal rod cannot be accomplished through the outlet portion 16. However, moisture or water collected in the tray 15 can enter through at least one of the opposed open ends of the closure member or piece 17 to pass out through outlet portion 16. Although the portion 16 may have a back mounting in flange portion 15a, its front mounting in the flange portion 15c facilitates cleaning-out of the passageway defined by the member 17. The member 17 also serves as a baffle or outflow blocking means for incandescent material.

The upright closure 11 underlaps the rim flange of the tray 15 and although cooling air can enter therebetween at the front and back portions of the assembly, it is difficult, if not impossible, to insert a sharp object, such as a rod, substantially horizontally into the transformer chamber or up into the transformer windings and connections to cause damage. The tray 15 is shown secured on a pair of front and back extending, spaced-apart, side-extending channels 18 to reinforce it and to provide a base mounting therefor. It will be noted that the channel members 18 extend beyond the front and back ends of the tray 15 and are provided with holes through their web portions for receiving bolts, suspension rods or the like when the transformer is to be mounted. The channels 18 serve to either fasten the unit to a floor, deck or platform or to accommodate suspending rods that project downwardly from a ceiling or overhead support.

For further facilitating mounting of the transformer housing 10, I have also shown a pair of upwardly-positioned, backwardly-extending, angle-shaped, hanger-like, mounting brackets 19 which are secured, as by weld metal *w*, outside on the side walls 11b adjacent the upper open end of the upright enclosure 11 to project backwardly therefrom. Each bracket 19 has a downwardly open slot 19a in its mounting tab, so that the housing 10 may be slid downwardly, for example, on a pair of wall bolts to

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position it while other final securing means is utilized. In this connection, I have also shown a pair of lower mounting brackets 20 of angle-shape that are secured, as by weld metal *w*, outside on the side walls 11b, adjacent the bottom open end portion of the upright enclosure 11 to project backwardly therefrom. Each of the lower brackets 20 is shown provided with a bolt or stud-receiving mounting hole 20a therein. To facilitate handling a transformer unit of my construction, I have provided a pair of hook-like inverted J-shaped lifting lugs or elements 21 which may be of steel rod construction and which project from the side walls 11b substantially centrally thereof adjacent their upper end portions. However, it will be apparent that any suitable type of lifting brackets may be employed, as desired.

As particularly illustrated in FIGURES 1 to 4, inclusive, the top of the housing assembly 10 is provided with a lid or cap member 24 having a top closure wall surrounded by a rim flange. The rim flange of the lid 24 projects along and downwardly to overlap the top open end portion of the upright enclosure 11. Also, like the bottom member or tray 15, the lid 24 has a greater front to back extent than the width of the side walls 11b, so as to define longitudinally-extending front and back warm air outlet passageways. Like the tray 15, the rim flange of the lid 24 has opposed side flange portions that are positioned in a close abutting relation with the side walls 11b; it also has opposed front and back flange portions that are spaced outwardly from the back closure wall 11a and the front flanges 11c and their front closure member 13 to define opposed, longitudinally-extending air outlet passageways, see arrows *b*. The lid 24 is shown removably-secured, as by self-tapping metal screws 14 (see particularly FIGURE 2) that extends through its pair of side flange portions into the side walls 11b of the enclosure.

In FIGURE 4, I have somewhat diagrammatically shown transformer 25 that has the usual laminated core 26 and primary and secondary windings or coils represented by 29. The pair of mounting brackets 27 may be secured, as by rivets or bolts to the core 26 to project outwardly therefrom and support or suspend the transformer between the opposite pairs of inside mounting brackets 12 of the housing assembly 10. A pair of angle pieces 28 whose flanges project inwardly towards each other may be secured in a similar manner at the lower end of the core 26 to support a pair of terminal panels or boards 30 and 31. Electrical leads or wire cables to the transformer 25 may be entered through the housing assembly 10, in the usual manner, as through openings made, where convenient, by the person installing the transformer or through openings provided by the manufacturer in the form of knock-out tabs in, for example, one of the side walls 11b. Insulating layers between the wire layers of the coils 29 (not shown) may be corrugated or provided with conventional vertical spaces to define vertically-extending passageways that are open at their ends to receive entering cooling air *a*, and pass it upwardly therealong and out of the container or housing as warmed air *b*.

It will be noted that the suspension mounting of the transformer 25 gives it a certain flexibility or resiliency and enables the lower end portion thereof to be spaced upwardly with respect to the tray 15 and downwardly with respect to the lid 24 to define a lower inlet air chamber and an upper air outlet chamber. Such mounting of the transformer 25 gives it further protection from the standpoint of an attempt to tamper with it from the top or bottom ends of the enclosure 11. It will be noted, see arrows *a*, that the inflow of air into the housing 10 follows a downward, horizontal and upward path, and that the outflow of air, see arrows *b*, follows an upward, horizontal and downward path. By providing a spaced solid bottom wall closure member or tray 15, I eliminate the conventional bottom grillwork and its disadvantageous features and, at the same time, provide opposed substan-

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tially full-width back and front entry passageways for the cooling air *a* into the bottom or inlet chamber of the housing 10. In a like manner, by providing a spaced solid top wall closure or lid 24, I eliminate any need for conventional top grillwork and its disadvantageous features. The overlapping of the flanges of the top and bottom covers for the housing, assures protection of the transformer 25 from the standpoint of tampering therewith by introducing a rod or other metal object therein. In addition, the tray 15 serves to collect and solidify any molten metal which may drop from the transformer due to overheating, failure, etc., so that there is no danger of fire. Full water or liquid drain-off is assured by the use of the outlet drain hole or port portion 16 which, itself, is provided with the protective shield 17 to prevent tampering with the transformer 25 by the introduction of a rod or the like. The suspension mounting of the transformer 25 may, if desired, be supplemented by resilient vibration-absorbing means, as of rubber material.

Although I have not found it to be necessary, the member 15 may have a slight inclination in the direction of the drain outlet portion 16 and the lid 24 may also have a slight inclination for drain-off purposes. The housing 10 is shown of metal construction but may be of any suitable non-inflammable material. In the latter event, cement or heat may be used for joint members that are shown secured by weld metal *w*.

Although I have illustrated a particular embodiment of my invention for the purposes of illustration, it will be apparent to those skilled in the art that various modifications and changes may be made in the illustrated construction without departing from the spirit and scope of the invention.

I claim:

1. An improved dry transformer housing construction which comprises, an upright wall enclosure defining a transformer positioning chamber therein and having open top and bottom end portions, a tray having a bottom closure wall in a spaced relation below the open bottom end portion of said upright enclosure and having a rim flange extending upwardly from said bottom closure wall along and about said upright enclosure to define opposed vertical air inlet passageways therebetween in such a manner as to prevent the introduction of a rod or the like substantially horizontally within the transformer chamber, means securing said tray in its defined positioning with respect to said upright enclosure, a lid having a top closure wall in a spaced relation above the open top end portion of said upright enclosure and having a rim flange extending downwardly from top closure wall along and about said upright enclosure to define opposed vertical air outlet passageways therebetween in such a manner as to prevent the introduction of a rod or the like substantially horizontally within the transformer chamber, and means securing said lid in its defined positioning with respect to said upright enclosure.

2. An improved transformer housing construction as defined in claim 1 wherein, said tray has an outlet portion through its said rim flange for draining-off liquid collected therein, and means cooperates with said outlet portion to prevent the introduction of a rod or the like substantially horizontally within the transformer chamber through said outlet portion and to baffle outflow of incandescent material.

3. An improved transformer housing construction as defined in claim 1 wherein, said rim flange of said tray has opposed flange portions in an abutting relation against opposed wall portions of said upright enclosure, and said first-mentioned means extends along joints between said opposed flange portions and the opposed wall portions of said upright enclosure.

4. An improved transformer housing construction as defined in claim 1 wherein, said rim flange of said tray has a pair of opposed flange portions in a horizontally-outwardly-spaced relation with respect to said upright

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enclosure for defining the air entry passageways, and said rim flange of said tray has a second pair of opposed flange portions that are secured by said first-mentioned means in an abutting relation with respect to said upright enclosures.

5. An improved transformer housing construction as defined in claim 1 wherein, said rim flange of said tray has a pair of opposed front and back flange portions in an outwardly-spaced relation with respect to said upright closure for defining the air entry passageways, an outlet portion extends through one of said pair of opposed flange portions from said bottom closure wall for draining-off liquid collected in said tray, and an angle-shaped member is secured between said one flange portion and said bottom closure wall to define an outlet flow passageway longitudinally of said one flange portion in back of said outlet portion to prevent the introduction of a rod or the like substantially horizontally within said transformer chamber.

6. An improved transformer housing construction as defined in claim 1 wherein, said lid has a pair of opposed flange portions in an abutting relation with a pair of opposed wall portions of said upright enclosure, and said second-mentioned means cooperates with said pair of opposed flange portions and the opposed wall portions for removably-securing said lid with respect to the top open end portion of said upright enclosure.

7. An improved transformer housing construction as defined in claim 1 wherein, said lid has a pair of opposed flange portions in an abutting relation with a pair of opposed wall portions of said upright enclosure, said second-mentioned means cooperates with said pair of opposed flange portions and the pair of opposed wall portions for removably-securing said lid with respect to the top open end portion of said upright enclosure, said lid has a second pair of opposed flange portions that project downwardly in an outwardly-spaced relation with respect to a second pair of opposed wall portions of said upright enclosure to define said air outlet passageways.

8. An improved transformer housing construction as defined in claim 1 wherein, said upright enclosure on a front side thereof has a pair of flange wall portions extending upwardly in a spaced-apart relation with each other to define a front opening to the transformer chamber, a closure plate is adapted to be positioned on said pair of flange wall portions for closing-off the opening defined therebetween, and means is provided for removably-securing said closure plate in position on said pair of flange wall portions.

9. An improved transformer housing construction as defined in claim 1 wherein, said upright enclosure is a unitary metal member shaped in the form of a rectangle and having a back closure wall, a pair of connected side closure walls and a connected pair of front flange wall portions in a spaced-apart relation with each other to define a front opening to the transformer chamber; a front closure plate member is adapted to be positioned on said pair of front flange wall portions to close-off the opening therebetween, and said air entry passageways are defined by opposed front and back flange portions of said rim flange of said tray with said back closure wall and said front closure plate member.

10. An improved transformer housing construction as defined in claim 1 wherein, opposed pairs of mounting brackets are secured within said upright enclosure adjacent and in a downwardly-spaced relation with respect to the top open end portion of said upright enclosure for suspending a transformer within the transformer positioning chamber in such a manner as to define a lower air entry chamber with said tray and an upper air exit chamber with said lid at top and bottom end portions of the transformer.

11. An improved transformer housing construction as defined in claim 1 wherein, said upright enclosure has vertical wall portions defining a back closure wall, op-

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posed side closure walls and a pair of vertical front flange walls connected to said side walls in a transversely spaced-apart relation with each other to define a maintenance opening therebetween; a vertical closure member is removably-positioned to close-off the front portion of said upright enclosure in an abutting relation with said pair of front flange walls, said rim flange of said tray has a pair of side flange portions in abutment against and secured by said first-mentioned means to said side walls of said upright enclosure, said rim flange of said tray also has front and back flange portions in an outwardly-spaced relation with respect to said back closure wall and said vertical closure member to define the air inlet passageways therewith, said rim flange of said lid has a pair of side flange portions in abutment against said opposed side walls of said upright enclosure and secured thereto by said second-mentioned means, said rim flange of said lid also has front and back flange portions in an outwardly-spaced relation with respect to said back closure wall and said vertical closure member to define the air outlet passageways, said front flange portion of said tray having an outlet portion therethrough extending from said bottom closure wall thereof for draining-off liquid from said tray, and means is positioned within said tray in an inwardly-spaced relation with said outlet portion to prevent the insertion of a rod or the like substantially horizontally along said bottom closure wall thereof and has at least one endwise opening for passing liquid collected in said tray through said outlet portion.

12. An improved transformer housing construction as defined in claim 11 wherein, a pair of mounting brackets are secured on the outside of and project backwardly from said side closure walls adjacent the open top end portion of said upright enclosure for suspension-mounting said

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upright enclosure, a pair of mounting brackets are secured on the outside of and project backwardly from said side closure walls adjacent the bottom open end portion of said upright enclosure for securing said enclosure in a mounted position, a pair of hook-like hanger elements are secured substantially centrally on the outside of said side closure walls adjacent the open top end portion of said upright enclosure to project outwardly therefrom for hanging said enclosure, and pairs of mounting brackets are secured on inner sides of said side closure walls adjacent to and in a downwardly-spaced relation with respect to the top open end portion of said upright enclosure for suspension mounting a transformer within the transformer chamber.

13. An improved transformer construction utilizing a housing construction as defined in claim 11 wherein, mounting brackets are secured within said upright enclosure adjacent the open top end portion thereof, a transformer having a core and electrical windings is positioned in said transformer chamber and has outwardly-projecting brackets at an upper end thereof resting on said mounting brackets, and said transformer has a vertical extent and said mounting brackets have a vertical positioning to define a lower air inlet chamber between the bottom end of said transformer and said bottom closure wall of said tray and to define an upper air outlet chamber between the top end of said transformer and said top closure wall of said lid.

No references cited.

LARAMIE E. ASKIN, *Primary Examiner*.

A. T. GRIMLEY, *Assistant Examiner*.