Sept. 5, 1939. K. BRENKERT 2,171,643

TRANSFORMER RECTIFIER ASSEMBLY

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FIG. 1

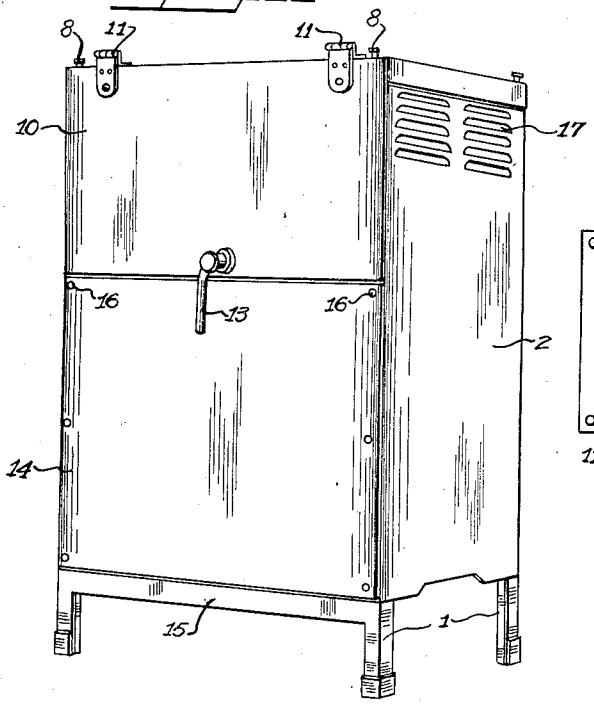


FIG. 2

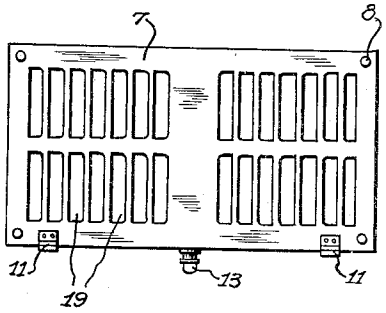


FIG. 4

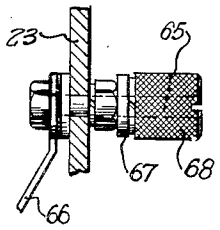


FIG. 3

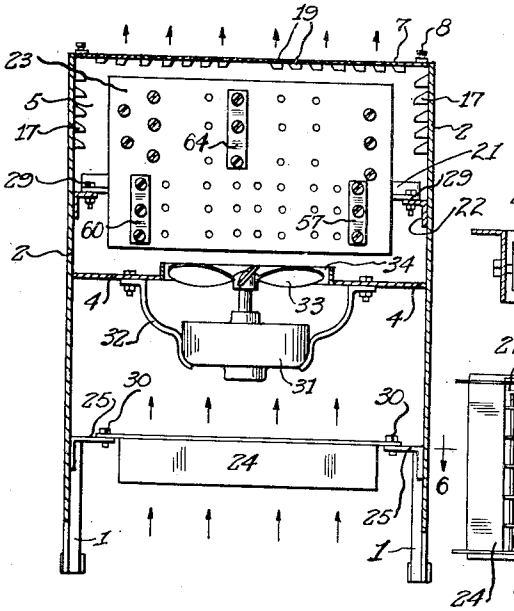


FIG. 6

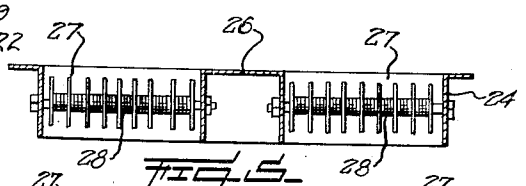
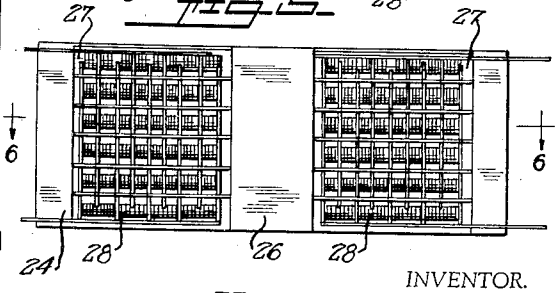


FIG. 5



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FIG. 7

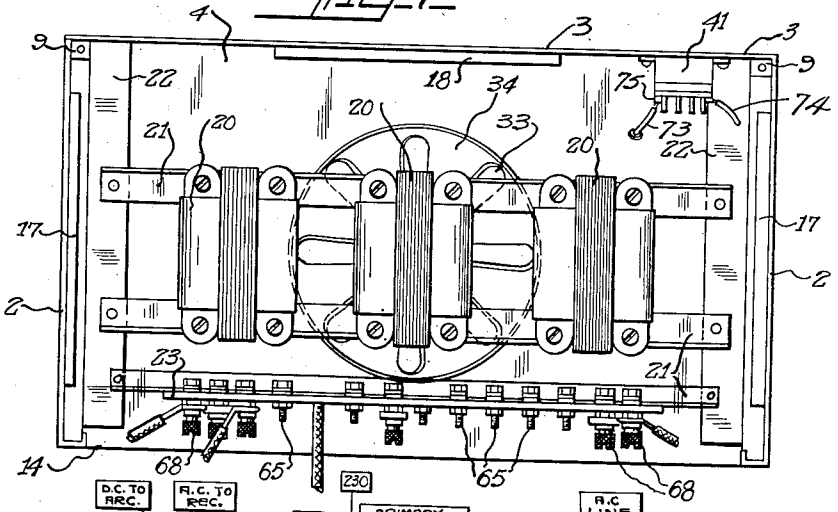


FIG. 8

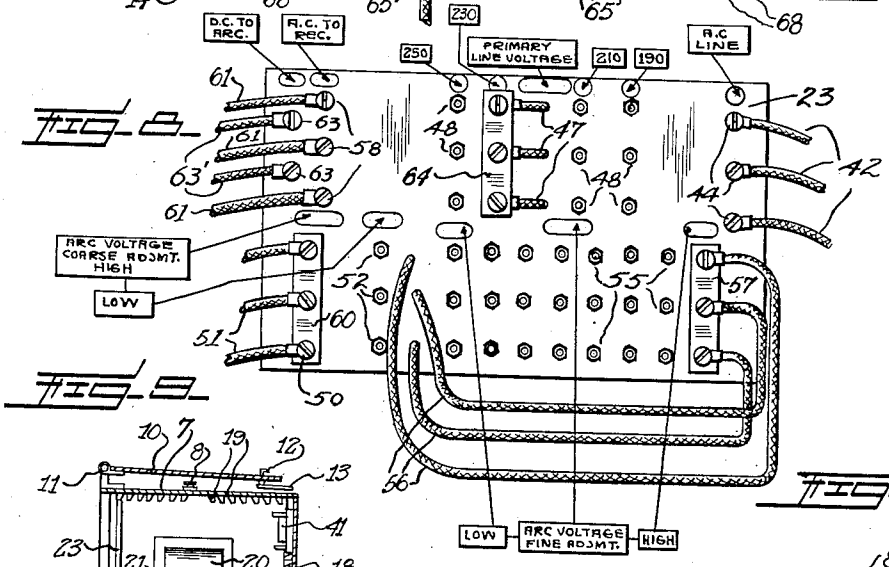


FIG. 9

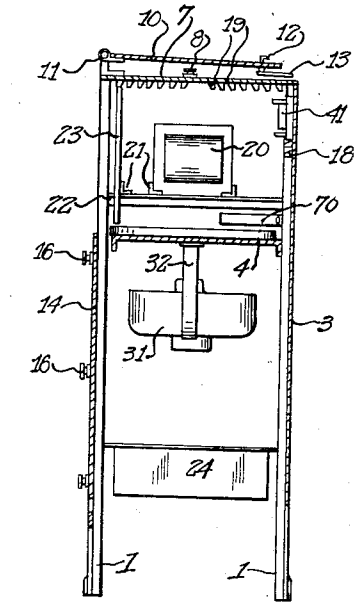


FIG. 10

FIG. 11

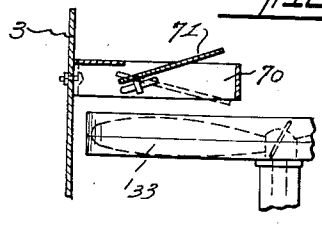
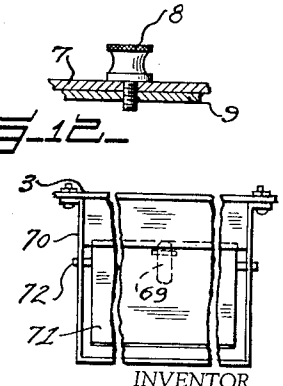


FIG. 12



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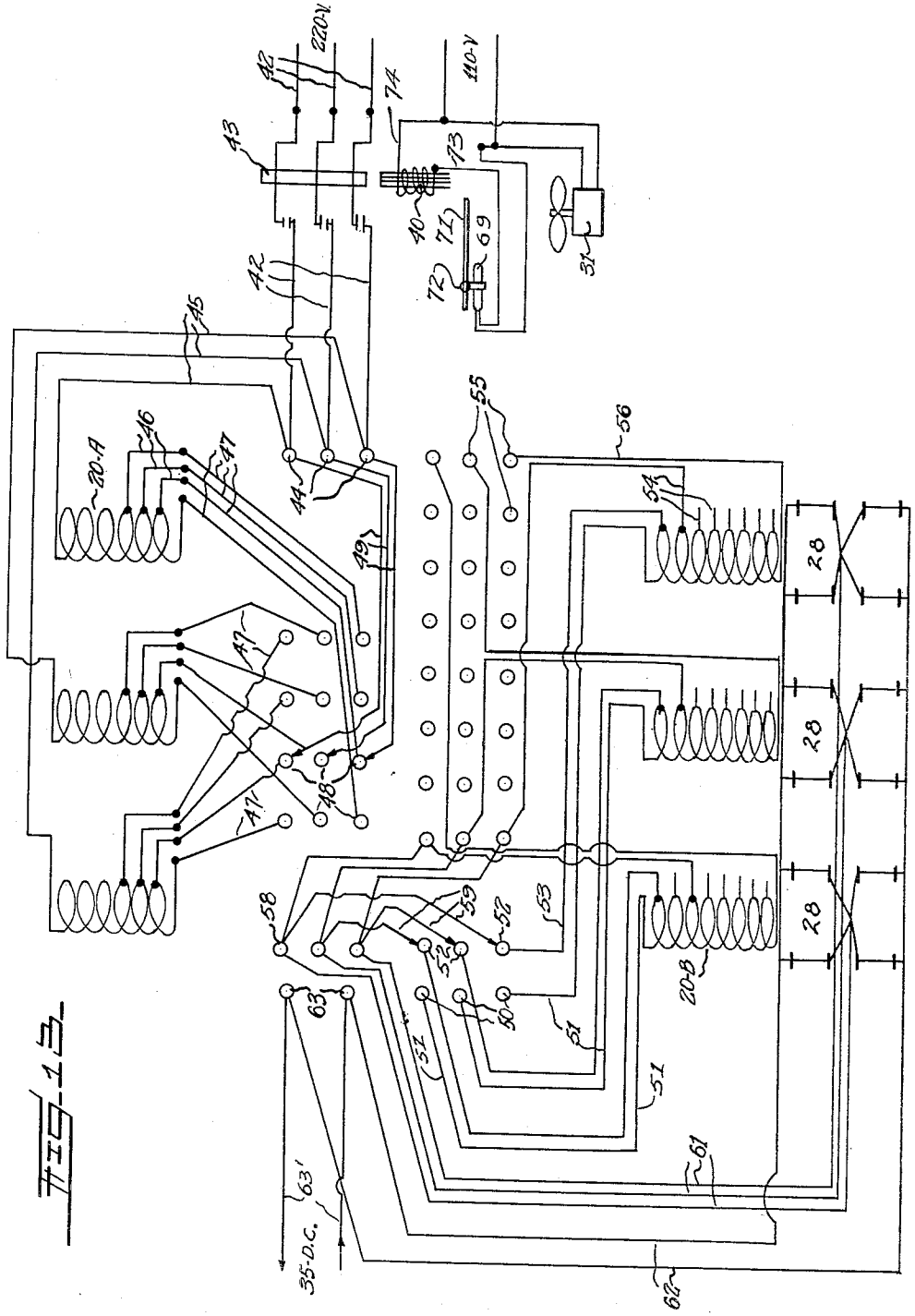


FIG. 13

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2,171,643

UNITED STATES PATENT OFFICE

2,171,643

TRANSFORMER-RECTIFIER ASSEMBLY

Karl Brenkert, Detroit, Mich., assignor to Brenkert Light Projection Company, Detroit, Mich., a corporation of Michigan

Application July 25, 1938, Serial No. 221,096

11 Claims. (Cl. 175—363)

The present invention pertains to a novel transformer-rectifier assembly of the dry-disk type designed particularly for use in connection with projection arc lamps.

In these devices it is desirable that the transformer and panel be mounted above the rectifier unit. It is also desirable to cool the dry-disk rectifier unit by suction created by an electric fan mounted between the rectifier unit and transformer and also cooling the transformer by forced air.

It is also necessary to have frequent and easy access to the panel for regulation of the several circuits. In prior devices, such access is obtained by opening or removing the front door of the cabinet containing both units, and in practice the door is frequently left open longer than is actually necessary. When this is done, the fan pulls air through the door and across the top of the rectifier unit rather than vertically through the latter, with the result that the rectifier unit becomes overheated and damaged or burnt out, especially if it is of the dry-disk type.

One of the objects of the invention is to remedy this situation by permitting access to the panel without necessarily exposing the fan and rectifier unit directly to the atmosphere. This is accomplished by providing separate doors or lids for the two compartments of the cabinet containing the two units. The rectifier compartment is covered by a lid bolted in place, while the transformer unit or panel is covered by a door preferably hinged at its upper edge. Thus, the panel is reached by lifting the hinged door and without disturbing the lid of the rectifier compartment. In fact, some effort is required in removing the bolts of this lid, so that the lid is not likely to be removed unless actually necessary. It will be understood that the lid, when in place, compels the air intake of the fan to pass upward through the rectifier and to cool the rectifier.

With regard to protection of the rectifier against overheating, another object of the invention is to provide a current control switch that holds the rectifying circuit open until the fan has reached the proper speed to insure a strong draft of air through the rectifying elements.

Still another object of the invention is to provide a unit construction whereby either the transformer unit or the rectifier unit may readily be detached and removed both mechanically and electrically.

The invention is fully disclosed by way of example in the following description and in the accompanying drawings in which:

Figure 1 is a perspective view of the device fully closed;

Figure 2 is a top plan view;

Figure 3 is a front elevation with the lids removed and partly in section;

Figure 4 is a detail section showing a typical binding post on the panel;

Figure 5 is a plan view of the rectifier unit;

Figure 6 is a section on the line 6—6, of Figure 5;

Figure 7 is a top plan view with the top cover plate removed, showing the transformer unit;

Figure 8 is a detail elevation of the panel, illustrating the connection of conductors thereto;

Figure 9 is a vertical cross section showing the door of the transformer compartment open;

Figure 10 is a detail section showing one of the fasteners of the lid of the rectifier compartment;

Figures 11 and 12 are detail views showing the control switch for the rectifier unit, and

Figure 13 is a wiring diagram.

Reference to these views will now be made by use of like characters which are employed to designate corresponding parts throughout.

The construction of the cabinet is best illustrated in Figures 1, 3, and 9. The frame of the cabinet comprises four legs, 1, of channel or angle iron to which are secured side walls 2 and a rear wall 3. A horizontal plate 4 is supported in the cabinet to divide the interior thereof into an upper transformer compartment 5 and a lower rectifier compartment 6.

The top of the cabinet is closed by a plate 7 detachably held by a number of headed and knurled bolts 8 adapted to screw into the overturned upper ends 9 of the legs 1. To the forward edge of the member 7 is hinged a door 10 adapted to extend downward as far as the plate 4, as may be seen in Figures 1 and 9. The hinges 11 on which the door is carried permit the door to be thrown back on the top 7, as is shown in Figure 9. The free edge of the door carries a latch 12 and operating handle 13.

Another door or lid is provided for the rectifier compartment and is in the form of a panel 14 of such size as to extend across the forward legs 1 and from the plate 4 downward to a stretcher 15 connecting the forward legs. The lid is secured by bolts 16 of the character illustrated in Figure 10 and screwed into the forward legs 1.

In the transformer compartment 5, the end walls 2 are formed with louvers 17, the rear wall 3 with louvers 18, and the top plate 7 with louvers 19.

In the upper compartment 5 is a group of transformers 20 fastened on rails 21 which, in turn, rest on brackets 22 on the end walls 2. In front of the transformers is a vertical electrical panel 23 supported in any suitable manner, for example, on one of the rails, as shown in Figure 9.

In the rectifier compartment, a flanged box-like structure 24 is suspended from brackets 25 on the end walls 2. The member 24 has an open top and bottom and a transverse filler 26 forming two chambers 27, as shown in Figure 6. Each

chamber 27 contains a copper oxide rectifier assembly 28 of the washer type.

The rails 21 are fastened to the brackets 22 by bolts and nuts 29. Similarly, the flange of the member 24 is fastened to the brackets 25 by bolts and nuts 30. Thus, the transformer and panel assembly and the rectifier assembly may readily be removed separately as a unit after disconnecting the electrical conductors, as will presently be described.

A fan motor casing 31 is suspended from plate 4 by straps 32. The fan 33 driven by the motor is received in a flanged opening 34 in the plate 4. The fan draws air by suction through the rectifiers 28, as indicated by the arrows in Figure 3. This is the preferred method of cooling with a fan since it furnishes a more even distribution of air through the rectifier than a stream forced by the fan.

The discharge of the fan, although somewhat warmed by the rectifier, is suitable for cooling the transformers since the latter are less sensitive to heat than the rectifier.

In the use of the apparatus, frequent changes of the electrical connections to the panel 23 are necessary. Access to the panel is obtained by swinging the door 10 back on the top member 7, as shown in Figure 9. At the same time, the lid 14 remains closed against the rectifier compartment 6, and there is no interference with the stream of air pulled through the rectifiers in the manner described.

This action is to be distinguished from that of prior devices having a single door for both the panel and rectifier compartments. When such a door is opened, the fan draws air across the top but not through the rectifier. If the door is left open for too long a time, as frequently happens, the rectifier is damaged or burnt out. In the present construction, the rectifier compartment door 14 is readily removable when necessary, but with some effort in releasing the bolts 16, and under such circumstances the lid 14 is not likely to be removed negligently.

With reference to the wiring diagram, Figure 12, the fan motor 31 is in the same circuit with the electromagnet 40 of a relay 41 mounted on the rear wall 3 of the cabinet. Current at 110 volts is applied to this circuit.

The three leads 42 of a three-phase or a delta circuit are connected to the relay, the latter being operated by the armature 43 associated with the magnet 40. The conductors 42 extend from the relay to a group of posts 44 on the panel 23. These posts are connected by conductors 45 respectively to one end of each of the primary windings 20A of the transformers 20. Each primary has several taps 46 connected by conductors 47 to a series terminals 48 on the panel 23. Conductors 49 are extended from the three selected terminals 48 to the terminals 44 to complete the primary circuits.

The panel carries a group of three terminals 50 joined by conductors 51 to one end of each of the secondary windings 20B for a rough high adjustment of the arc voltage. Adjacent thereto is a similar group of terminals 52 joined by conductors 53 to intermediate points on the secondary windings for a rough low adjustment of the arc voltage. The groups 50 and 52 are so labeled, as illustrated in Figure 8.

Each of the secondary windings is also tapped at 54 to a number of terminals 55 arranged in vertical groups of three on the panel 23. The conductors from the taps 54 are designated by the numeral 56 in Figure 8. Their free ends are attached to an insulating plate 57 facilitating connection to any one of the groups of terminals 55, which give a fine adjustment of arc voltage, increasing from left to right, as shown by the labelling in Figure 8.

The last named groups are connected to three terminals 58 from which extend conductors 59 adapted for connection through an insulating block 60 to either of the groups 50 or 52.

The terminals 58 are connected by conductors 61 to the rectifier to deliver alternating current thereto. The output lines 62 from the rectifiers are connected to terminals 63 on the panel, and these in turn are connected to the arc by conductors 63', as shown in Figure 12.

The free ends of the conductors 47 are also carried on an insulating block 64 for connection to the selected group of terminals 48, as described in connection with members 57 and 60.

Individual conductors are connected to the terminals by the means shown in Figure 6. Here the terminal is a threaded member designated generally by the numeral 65. At the rear of the panel 23, a conductor 66 is clamped to the terminal. The conductor to be connected at the face of the panel has its bare end 67 hooked on the terminal and clamped thereon by a knurled nut 67. A similar clamping means is used for fastening the insulating blocks 57, 60 and 64 with the free conductors carried thereby.

The 110-volt circuit to the relay magnet 40 is preferably controlled by a mercury switch 69 in series with the magnet winding and in parallel with the line. To support the switch, a frame structure 70 is fastened to a suitable part of the cabinet, such as the back wall 3, as shown in Figures 11 and 12, and the switch is carried by means of a blade 71 which, in turn, is journalled in the frame by trunnions 72. The switch is normally open when the fan is not operating, and the blade 71 is disposed in the air stream of the fan. When the fan reaches the proper speed for cooling the rectifiers, the blade 71 is blown to a tilted position, as shown in Figure 11, whereby the circuit to the magnet 40 is closed through the switch 69.

The conductors connected to the ends of the magnet 40 of the relay are indicated by the numerals 73 and 74 in Figures 7 and 13. They are detachably connected by conventional binding posts 75.

It will be seen that, throughout the electrical apparatus, there is no soldering of conductors. All the variable connections, including the in-put lines 42, the out-put lines 63', and the connections to the primary and secondary windings of the transformers, as well as the 110-volt circuit to the relay, are made by means of detachable binding posts. All the posts are on the panel 23, with the exception of the posts 75 and the other conventional binding posts on the relay. Thus, in changing the connections at the panel for adjustment of the current values in various parts of the system, it is not necessary to break any soldered or other permanent connections.

Although a specific embodiment of the invention has been illustrated and described, it will be understood that various alterations in the details of construction may be made without departing from the scope of the invention, as indicated by the appended claims.

What I claim is:

1. In a transformer-rectifier assembly of the

dry-disk type, a cabinet divided horizontally into two compartments, a transformer and a panel in the upper compartment, a rectifier in the lower compartment, a fan between the rectifier and transformer and adapted to draw air upwardly through the rectifier and discharge it into the transformer compartment, a door for the upper compartment and adapted to expose said panel, and a detachable lid for the lower compartment.

2. In a transformer-rectifier assembly of the dry-disk type, a cabinet divided horizontally into two compartments, a transformer and a panel in the upper compartment, a rectifier in the lower compartment, a fan between the rectifier and transformer and adapted to draw air upwardly through the rectifier and discharge it into the transformer compartment, a top piece on said cabinet, a door hinged to the forward edge of said piece and adapted to cover the front of the upper compartment, and a detachable lid for the lower compartment.

3. In a transformer-rectifier assembly of the dry-disk type, a cabinet divided horizontally into two compartments, a transformer and a panel in the upper compartment, a rectifier in the lower compartment, a fan between the rectifier and transformer and adapted to draw air upwardly through the rectifier and discharge it into the transformer compartment, a top piece on said cabinet, a door hinged to the forward edge of said piece and adapted to cover the front of the upper compartment, and adapted to be thrown back on said top piece, and a detachable lid for the lower compartment.

4. In a transformer-rectifier assembly of the dry-disk type, a cabinet divided horizontally into two compartments, a transformer and a panel in the upper compartment, a rectifier in the lower compartment, a fan between the rectifier and transformer and adapted to draw air upwardly through the rectifier and discharge it into the transformer compartment, a door for the upper compartment and adapted to expose said panel, and a detachable lid bolted on said cabinet and covering the lower compartment.

5. In a transformer-rectifier assembly of the dry-disk type, a cabinet divided horizontally into two compartments, a transformer and a panel in the upper compartment, a rectifier in the lower compartment, a fan between the rectifier and transformer and adapted to draw air upwardly through the rectifier and discharge it into the transformer compartment, a top piece detachably mounted on said cabinet, a door hinged to the forward edge of said piece, and adapted to cover the front of said upper compartment, whereby said top piece and door may be removed together to expose two sides of the upper compartment, and a detachable lid for said lower compartment.

6. In a transformer-rectifier assembly of the dry-disk type, a cabinet divided horizontally into two compartments, a transformer and a panel in the upper compartment, a rectifier in the lower compartment, a fan between the rectifier and transformer and adapted to draw air upwardly through the rectifier and discharge it into the transformer compartment, a door for the upper compartment and adapted to expose said panel, and a detachable lid for the lower compartment, said panel, transformer and rectifier being detachably supported in said cabinet, and said transformer and panel being detachably mounted as a unit in said cabinet, whereby the rectifier and the transformer-panel unit can be removed separately from each other.

7. In a transformer-rectifier assembly of the dry-disk type, a cabinet divided horizontally into two compartments, a transformer and a panel in the upper compartment, a rectifier in the lower compartment, a fan between the rectifier and transformer and adapted to draw air upwardly through the rectifier and discharge it into the transformer compartment, a door for the upper compartment and adapted to expose said panel, and a detachable lid for the lower compartment, current in-put lines detachably connected to said panel, conductors detachably fastened to said panel and interconnecting said lines, transformer and rectifier, whereby the various circuits may be altered by detachments of said conductors from said panel.

8. In a transformer-rectifier assembly of the dry-disk type, a cabinet divided into two compartments, a transformer and a panel in one compartment, a rectifier in the other compartment, an electric fan adapted to deliver air to said rectifier and transformer, in-put lines connected to said transformer, an electro-magnetic relay in said lines, an independent circuit including the magnet of said relay, a switch governing said magnet, and means tending normally to open said switch, said means being in the air stream of said fan and adapted to be actuated by a given strength of air current against its normal tendency and to close said switch.

9. In a transformer-rectifier assembly of the dry-disk type, a cabinet divded into two compartments, a transformer and a panel in one compartment, a rectifier in the other compartment, an electric fan adapted to deliver air to said rectifier and transformer, in-put lines connected to said transformer, an electro-magnetic relay in said lines, an independent circuit including the magnet of said relay, a liquid switch governing said magnet, a blade pivotally mounted in the air stream of said fan and carrying said switch, said blade being positioned to open said switch by its own weight and to close said switch when acted upon by a given strength of air current from said fan.

10. In a transformer-rectifier assembly of the dry-disk type, a cabinet divided horizontally into two compartments, a transformer and a panel in one of said compartments, a rectifier in the other compartment, a fan between the rectifier and transformer and adapted to draw air upwardly through one of said compartments and discharge it into the other compartment, a door for the compartment containing the transformer and panel and adapted to expose said panel, and a detachable lid for the other compartment.

11. In a transformer-rectifier assembly of the dry-disk type, a cabinet divided horizontally into two compartments, a transformer and a panel in one of said compartments, a rectifier in the other compartment, a fan between the rectifier and transformer and adapted to draw air upwardly through one of said compartments and discharge it into the other compartment, a door for the compartment containing the transformer and panel and adapted to exposed said panel, and a substantially air-tight detachable lid for the other compartment.

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