Feb. 9, 1943. E. KRIEBEL 2,310,444

DRY-TYPE RECTIFIER

Filed Sept. 10, 1940 3 Sheets-Sheet 1

Fig. 1.

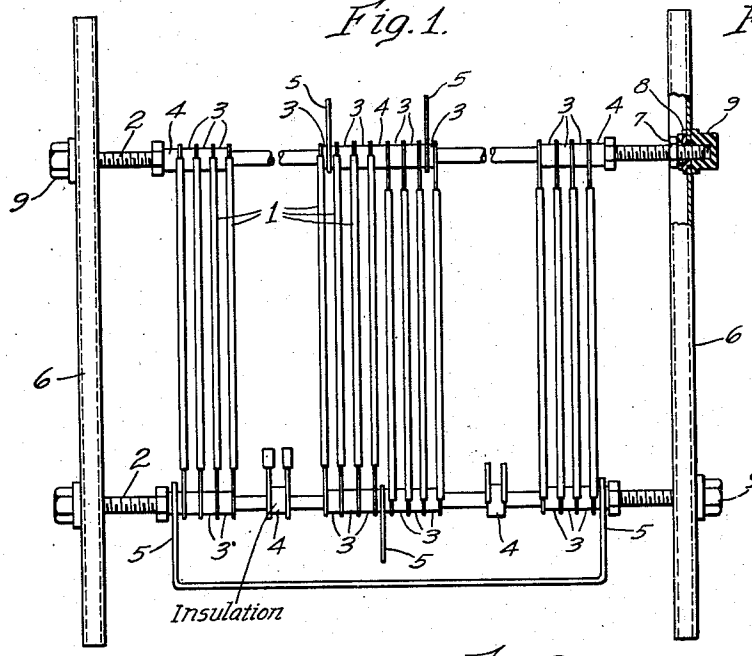


Fig. 2.

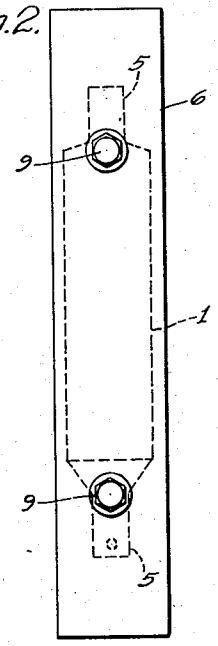
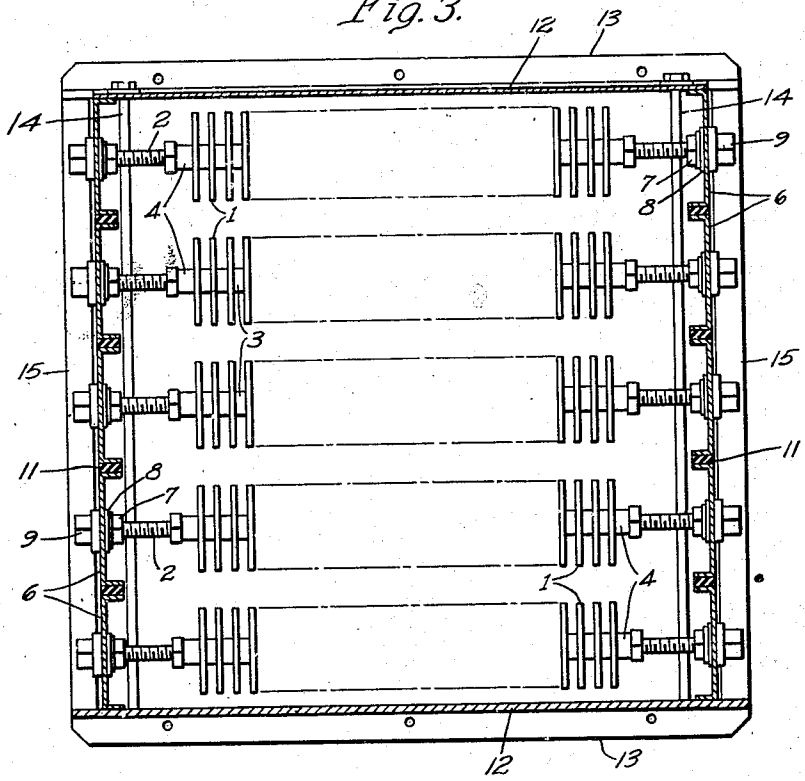


Fig. 3.



WITNESSES:

C. J. Weller.

Wm. C. Groome

INVENTOR

Ernst Kriebel.

BY

F. W. Lyle.

ATTORNEY

Feb. 9, 1943. E. KRIEBEL 2,310,444

DRY-TYPE RECTIFIER

Filed Sept. 10, 1940 3 Sheets-Sheet 2

Fig. 4.

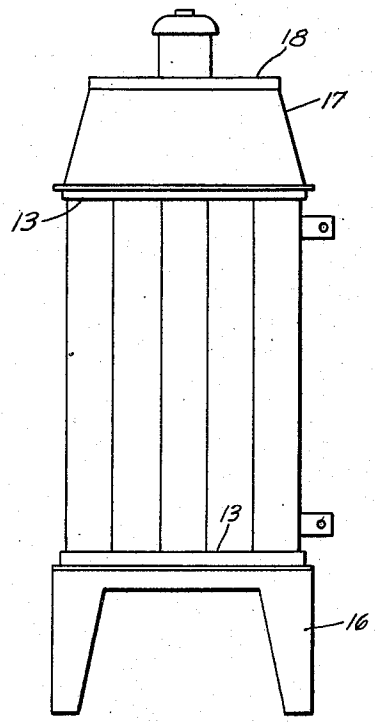


Fig. 5.

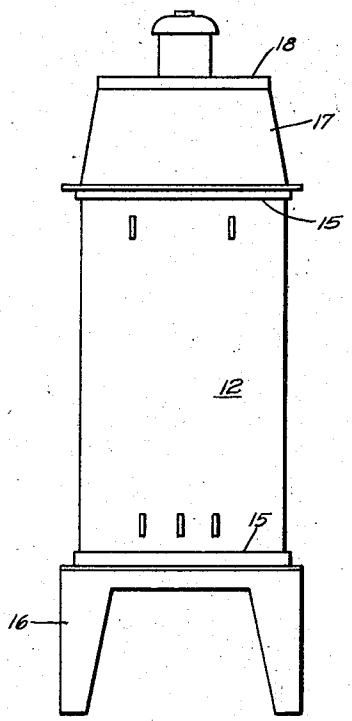
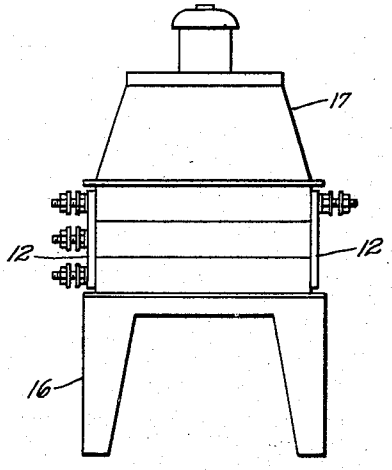


Fig. 6.



WITNESSES:

E. J. Weller.

Wm. E. Groome

INVENTOR

Ernst Kriebel.

BY

F. W. Lyle

ATTORNEY

Feb. 9, 1943. E. KRIEBEL 2,310,444

DRY-TYPE RECTIFIER

Filed Sept. 10, 1940 3 Sheets-Sheet 3

Fig. 7.

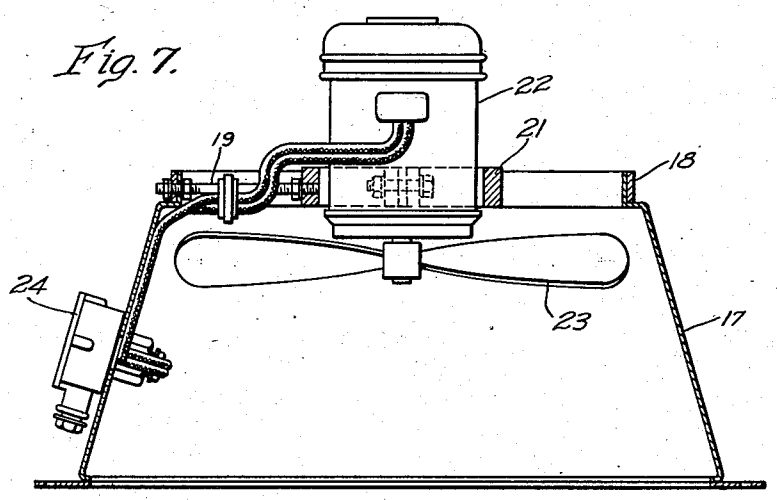
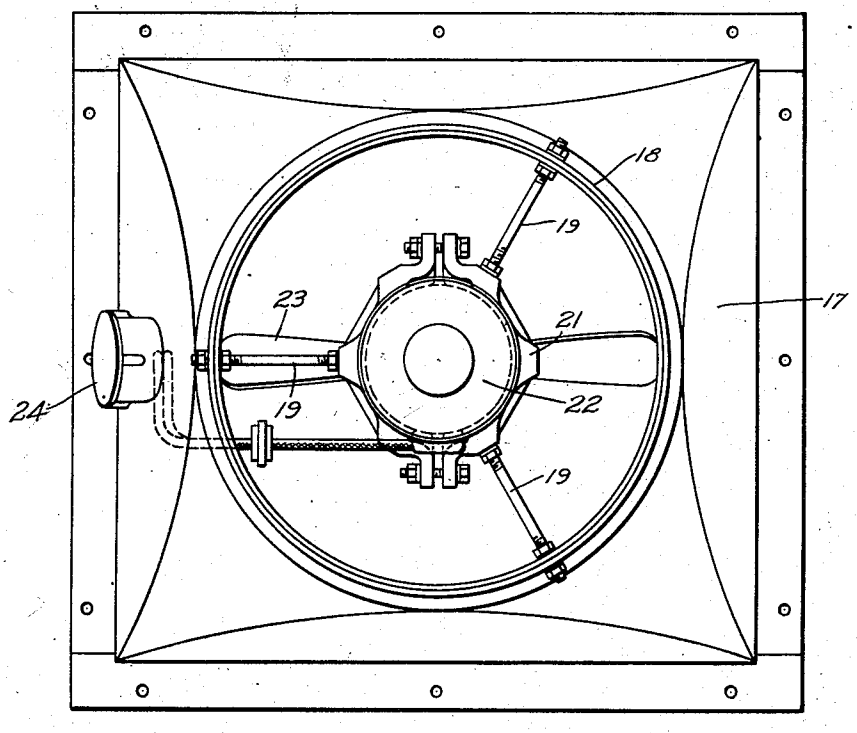


Fig. 8.



WITNESSES:

C. J. Weller.

Wm. C. Groome

INVENTOR

Ernst Kriebel.

BY

F. W. Lyle.

ATTORNEY

Patented Feb. 9, 1943

2,310,444

UNITED STATES PATENT OFFICE

2,310,444

DRY-TYPE RECTIFIER

Ernst Kriebel, Berlin-Spandau, Germany, assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application September 10, 1940, Serial No. 356,126
In Germany March 14, 1939

4 Claims. (Cl. 175—366)

My invention relates to contact rectifiers, and in particular to methods and structures for assembling contact rectifier units for commercial operation.

It is standard practice in the contact rectifier art, such, for example, as selenium rectifiers or copper oxide rectifiers, to manufacture the rectifiers from units comprising discs or plates of a standard size, and then to connect the requisite number of such discs or plates in series and parallel with each other electrically to provide the required output voltage and current.

My invention relates to arrangements for economizing the amount of material required for housing such assemblages of unit rectifiers, and to the economizing of time and effort in designing and assembling the housings for different numbers of such rectifier units to suit different voltage and current rating requirements.

In accordance with my invention, a plurality of rectifier unit discs or plates are assembled and maintained in spaced relation to each other by means of through-bolts provided with proper separating washers. This general manner of assembly is illustrated in Fig. 1 of the drawings. Such an assemblage of rectifier units on a pair of through-bolts then is manufactured and assembled as a unitary group in the factory; and when rectifiers of different current ratings are ordered, it is necessary to assemble such number of these unitary groups as will properly supply the required current without overheating. It is desirable to enclose the assemblage of such groups in a housing, particularly because in many cases forced drafts of air provided by blowers are employed to ventilate the assemblage.

It has been customary in the prior art to design separate housings for each order to accommodate the necessary number of unitary groups, but I have discovered that by the method about to be described, it is possible to avoid the necessity of separately designing housings to suit each current rating; but that instead, by modifying the method of assembling the rectifier units into groups, it is possible to avoid the necessity for constructing separate housings. In short, the unitary groups are of such form that they can be attached to one another to form the required enclosing housing.

It is, accordingly, one object of my invention to provide a way of assembling contact rectifier units in unitary groups which may readily and economically be assembled in commercial structures.

Another object of my invention is to provide a way of assembling such unitary groups as are referred to in the preceding paragraph into housing structures suitable for commercial use, in which the housing structure is built up largely from the standard auxiliary fittings used in assembling the standard unitary groups.

With the foregoing principles in mind, my invention will be readily understood from reading the following specification, in which:

Figure 1 illustrates a side and Fig. 2 an end view of an assemblage of unit rectifier discs or plates to form one of the above-mentioned unitary groups;

Fig. 3 shows a top view of an assemblage of unitary groups of the type shown in Figs. 1 and 2, together with certain auxiliary fittings to form a complete housing structure;

Fig. 4 shows a side view and Fig. 5 another side view at right angles to Fig. 4 of an assemblage of unitary groups of the type illustrated in Figs. 1 and 2, together with a supporting base and a top-cover therefor in which the unitary groups are disposed in a vertical position;

Fig. 6 shows an assemblage of similar unitary groups, supporting base and top-cover, but with the unitary groups in a horizontal position;

Fig. 7 is a view, partly in cross-section, illustrating the structure of the top-cover shown more generally in Figs. 4, 5 and 6; and

Fig. 8 is a plan view of the top cover shown in Fig. 7.

Referring specifically to Figs. 1 and 2, unitary rectifier plates, which may be of the general shape illustrated in dotted lines in Fig. 2 are supported in spaced relation upon a pair of through-bolts 2 which may be of steel covered with an insulating coating and which pass, respectively, through two holes in the plates 1. Instead of the shape illustrated in Fig. 2, the unit rectifiers may each comprise a circular washer, a plurality of such washers being supported on a single through-bolt of the type just described, such assemblies being well known in the art. While the herein described method of assembly is obviously applicable to dry-type rectifiers in general, the plates 1 may, for example, be formed by oxidizing copper plates and thereafter removing said oxide in the vicinity of the hole at one end. The surface of the remaining oxide may then be coated with tin, cadmium or the like by metal spraying. A method of forming copper oxide rectifiers is claimed and described in Grondahl Patent No. 1,640,335. Alternatively, the rectifier plates may, to give another example, be formed of aluminum which has been coated,

except for a space immediately adjacent the hole at one end, with selenium, and the selenium thereafter coated with cadmium or some other suitable metal by a metal spraying process; such selenium rectifiers are themselves well known in the art.

Each such unit plate as has just been described constitutes a unit rectifier, capable of withstanding a definite and well known voltage, and having a current capacity substantially proportional to the area of the plate. As is disclosed in the above-mentioned Grondahl patent, a sufficient number of such unit rectifiers may be assembled in series to form the well known Graetz bridge connection capable of withstanding the line voltage imposed upon the rectifier. To do this, a sub-group of adjacent plates are positioned with the holes from which the oxide has been removed on, let us say, the upper through-bolt, the plates being separated from each other by metallic washers 3 so that the mother copper (or aluminum in the case of the selenium rectifier) of the different plates of the sub-group are electrically connected. Then a second sub-group, equal in number, is assembled with the holes in which the oxide has not been removed on the above-mentioned through-bolt, the oxidized surfaces of this sub-group accordingly being interconnected also with each other by metallic washers, but the two sub-groups are insulated from each other by an insulating spacer 4. Such a pair of sub-groups is illustrated in Fig. 1. The other through-bolt is then threaded through the other hole in each sub-group of plates, metal washers being employed to interconnect the plates on the through-bolt except that an insulating spacer 4 is inserted on the lower through-bolt at the midpoint of each of the aforesaid sub-groups. In the case of selenium rectifiers, the aluminum plate occupies the same position in each sub-group as the mother copper has just been described as doing in the case of copper oxide rectifiers; and the metal coating on the outside of the selenium occupies the same position as the copper oxide has just been described as doing in the sub-groups. To furnish leads for connection to external circuits, terminal tabs 5 may be welded to the metal washers, one terminal tab for each end of each sub-group. The aforesaid Grondahl patent describes substantially the foregoing way of assembling unit rectifier plates or discs to constitute a unitary group on a through-bolt.

The desired number of sub-groups having been assembled on a pair of through-bolts, the latter are united at their respective ends by a pair of channel-irons 6, the ends of the through-bolts passing through holes in the channel-irons, and being clamped thereto by a nut 7 and washer 8 threaded onto the through-bolt and bearing against the bottom of the channel, and by a nut 9 threaded onto the outer end of the through-bolt. Such an assemblage thus constitutes a unitary rectifier group.

Any desired number of such unitary groups as are shown in Figs. 1 and 2 may be assembled together as illustrated in Fig. 3, that is to say, a plurality of groups are placed side by side. If desired, gas-tight gaskets 11 may be sandwiched between them. A pair of plates 12 is positioned against the free edges of the outer pairs of channels to wholly or partially cover the sides of the box-like space occupied by the rectifier units. A pair of angle-irons 13 bored to receive a pair of through-bolts 14 is then clamped against the lower ends of the channels, as shown in Fig. 3. A similar pair of channels is similarly clamped against the upper ends of the channels. A second pair of angle-irons 15 may be riveted to the above-mentioned angle-irons at both the top and the bottom of the assembly. Terminals of any well known type in the art for connecting external circuits to the terminal tabs 5 of the rectifier group may pass through appropriate openings in the side walls 12.

While such assemblies as are shown in Fig. 3 may be used with natural ventilation, and may or may not be provided with any desired type of top-cover, it is frequently desirable to provide for forced ventilation of these rectifier assemblages by blowing air or other gases through them. This is illustrated in Figs. 4 and 5 in which such a rectifier assemblage as is shown in Fig. 3 is supported on a base 16 which may be formed in any suitable way, such, for example, as by riveting four pieces of angle iron to form a square having supporting legs at each corner. The top of the unit is provided with a top cover 17 shown in more detail in Figs. 7 and 8. The cover rests on the angle irons 13, 15, forming a rim about the upper end of the rectifier groups, and may be riveted thereto or fastened thereto by means of bolts and nuts.

As is shown in more detail in Figs. 7 and 8, the cover may be a distorted frustum of a cone having a vertical rim 18 around its upper edge. Passing through holes in this rim may be three support-bolts 19 clamped in said holes by nuts threaded thereon. The inner ends of these bolts are clamped to a supporting frame 21 which, in turn, embraces an electric motor 22, from the lower end of which its shaft supports a set of fan blades 23. Electric supply wires lead to the motor from a conduit box 24 of standard design supported on the walls of the cover.

Rotation of the motor obviously draws a current of air through the open center of the base up through the space within the enclosure which is occupied by the rectifier plates and out of the central hole in the cover, thereby providing for efficient dissipation of heat from the rectifier plates. It will be recognized that a given base and a given cover may serve for assemblages of rectifier units, regardless of the vertical length of the channels, thereby making it possible to employ the same auxiliary fittings for a considerable number of different sizes of rectifier-unit assemblies.

I claim as my invention:

1. A dry type rectifier assembly structure comprising a plurality of individual rectifier units fastened on a through-bolt, a pair of end plates fastened respectively to the opposite ends of said through-bolt to constitute a unitary rectifier group, a plurality of said groups assembled so that their end plates are contiguous to each other and form two walls of a quadrilateral enclosure, and a pair of side walls supported in contiguity with the lateral edges of said end plates to form the other side walls of said enclosure.

2. A dry type rectifier assembly structure comprising a plurality of individual rectifier units fastened on a through-bolt, a pair of channel members fastened respectively to the opposite ends of said through-bolt to constitute a unitary rectifier group, a plurality of said groups assembled so that their channel members are adjacent each other and form two walls of a quadrilateral enclosure, and a pair of side walls supported in contiguity with the lateral edges of said channel

members to form the other side walls of said enclosure.

3. A dry type rectifier assembly structure comprising a plurality of individual rectifier units fastened on a pair of through-bolts, a pair of channel plates interconnecting the opposite ends of said pair of through-bolts to constitute a unitary rectifier group, a plurality of said groups assembled so that their channel members are adjacent each other and form two walls of a quadrilateral enclosure, and a pair of side walls supported in contiguity with the lateral edges of said channel members to form the other side walls of said enclosure.

4. A dry type rectifier assembly structure comprising a plurality of individual rectifier units fastened on a pair of through-bolts, a pair of channel plates interconnecting the opposite ends of said pair of through-bolts to constitute a unitary rectifier group, a plurality of said groups assembled so that their channel members are adjacent each other and form two walls of a quadrilateral enclosure, a pair of side walls supported in contiguity with the lateral edges of said channel members to form the other side walls of said enclosure, the adjacent ends of said channel members being alined with each other, an apertured base member supporting the alined lower ends of said channel members, and an apertured top-cover provided with a blower resting upon the other alined ends of said channel members.

ERNST KRIEBEL.