

UNITED STATES PATENT OFFICE

DONALD G. ACKERLY, OF EDGEWOOD, PENNSYLVANIA, ASSIGNOR TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

APPARATUS FOR RECTIFYING ALTERNATING CURRENTS

Application filed February 19, 1931. Serial No. 516,996.

My invention relates to apparatus for rectifying alternating current, and particularly to rectifying apparatus of the type comprising asymmetric units, each consisting of a metal member having a layer of a compound of the metal formed thereon.

In rectifying apparatus of the type described, the current density at which the units may be operated depends upon the temperature attained by the units due to the heat generated by the power loss in the units. One object of my invention is to provide a novel assembly of the units and arrangement of parts whereby the heat generated in the units due to the power loss may be dissipated rapidly, thus permitting the units to be operated at higher current densities than would otherwise be possible.

I will describe one form of apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawings, Fig. 1 is a top plan view of rectifying apparatus embodying my invention. Fig. 2 is an enlarged sectional view taken on the line II—II of Fig. 1.

Referring to the drawings, the rectifying apparatus in the form here shown comprises a plurality of similar full wave rectifiers, each designated in its entirety by the reference character 1, and each consisting of a stack of asymmetric units 2. These asymmetric units may be of any suitable type, and as here shown, each comprises a flat disc 3 of metal, such as copper, having a coating 4 of a compound of the metal, such as cuprous oxide formed thereon. Asymmetric units of the type described exhibit the characteristic of offering a higher resistance to current which tends to flow from the copper to the oxide than to current tending to flow in the opposite direction through the unit. The units of each rectifier are assembled on a suitable rod or bolt 5, which passes through suitable openings in the units, and which is insulated from the units by a sleeve 6 of suitable insulating material such as fiber. Adjacent the coating 4 of cuprous oxide of each unit is placed a thin layer 7 of an impressionable electrical conducting material, such as lead foil, and

interposed at suitable intervals in each rectifier are fins 8, the diameter of which is considerably larger than the diameter of the units 2. Each fin 8 is made up of some material which readily conducts heat, such for example, as copper.

Each rectifier is divided into four sections 9, 10, 11 and 12 respectively, each of which sections constitutes one leg of the rectifier. As here shown, each section comprises six units in series, the units of each of the sections 9 and 10 being assembled with the coated side down, so that these sections will offer the lowest resistance to current tending to flow upwardly through the sections, and the units of each of the sections 11 and 12 being assembled with the coated side up, so that these sections will offer the lowest resistance to current tending to flow downwardly through the sections. It should be understood, however, that this particular arrangement is chosen merely for convenience in illustrating my invention, and not by way of limitation, the number and arrangement of washers in each section being determined by the manner in which the rectifier is to be utilized.

As shown in the drawings, the rectifiers are arranged in concentric circular rows and are connected together both electrically and mechanically by means of annular plates 13 which are perforated to fit over the bolts 5 and tubing 6. These plates also serve as baffles to direct the flow of air past the rectifiers as will be explained hereinafter. The plates 13 are assembled onto the bolts while the units are being stacked, and any desired number may be employed. As here shown, a plate 13 is located at each end of the rectifiers, and at the junctions of the sections, thus providing a convenient means for electrically connecting the corresponding sections of all of the rectifiers in multiple.

The rectifier stacks are each clamped together by means of nuts 14 and 15, which are screwed onto the upper and lower ends, respectively, of the bolts 5. An insulating washer 16 is interposed between each nut and the adjacent plate 13 to insulate the bolts from the plate. A saucer shaped spring

washer 17 is also interposed between each of the nuts 14 or 15 and the associated insulating washer 16 to maintain a uniform pressure on the stacks when the nuts are tightened. It will be noted that the nuts 15 are

provided with integral legs, thus permitting a free circulation of air under the apparatus.

A vertical shaft 18 is rotatably mounted at the center of the apparatus in suitable bearings 30, 30 supported by two of the stacks as illustrated in Fig. 1, and fixed to the shaft are two fan blades 19 and 20 which are located in the openings in the upper and lower plates 13, respectively. These blades are so arranged that when the shaft 18 is rotated air will be drawn in past all the rectifiers in directions which are controlled by the baffle plates 13, and forced outwardly through the openings in the upper and lower plates, as indicated by the arrows. The shaft 18 may be rotated in any suitable manner. As here shown, it is connected with an electric motor 21.

The electrical connections to the apparatus may be made by means of terminals 29 which are fastened to the large annular discs 13. A transformer 22 is shown with its secondary 23 connected with the alternating current terminals of the apparatus, and a pair of wires 25 and 26 are shown connected to the direct current terminals. The polarity of the wires 25 and 26 is indicated by the plus and minus signs. Alternating current may be supplied to the primary 27 of transformer 22 from any suitable source not shown in the drawings.

The operation of the apparatus as a whole is as follows: When motor 21 is energized, the shaft 18 is rotated, and air is then drawn inwardly past all of the units, by the fans 19 and 20, and is forced outwardly through the openings in the upper and lower units, as described hereinbefore, the direction of the air flow being controlled by the baffle plates 13. The air drawn in from the outside will have a higher temperature when it passes the inner circle of rectifiers than it had in passing the outer circle, but since the area of the air passages between the rectifiers of the inner circle is smaller, the velocity of the air will be higher, so that more air will come in contact with the radiating surfaces. It will be apparent, therefore, that substantially uniform cooling of all of the rectifiers will take place. Due to the large radiating surfaces provided by the baffle plate and by the fins, the heat will be conducted away from the units at a very rapid rate, and it follows that with rectifying apparatus constructed in accordance with my invention, the units may be operated at very high current densities.

Although I have herein shown and described only one form of rectifying apparatus embodying my invention, it is understood that various changes and modifications may

be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. Apparatus for rectifying alternating currents comprising a plurality of stacks of asymmetric units, a plurality of baffle plates each assembled into all of said stacks in such manner that all of said stacks are connected together by said plates, said plates being provided with aligned apertures about which said stacks are arranged, and means for drawing air inwardly past all of said stacks and forcing it outwardly through certain ones of said apertures in such manner that substantially uniform cooling at a rapid rate of all parts of all of said stacks is effected.

2. Apparatus for rectifying alternating currents comprising a plurality of stacks of asymmetric units, a plurality of baffle plates each assembled into all of said stacks in such manner that all of said stacks are connected together both electrically and mechanically by said plates, said plates being provided with aligned apertures about which said stacks are arranged, and means for drawing air inwardly past all of said stacks and forcing it outwardly through certain ones of said apertures in such manner that substantially uniform cooling at a rapid rate of all parts of all of said stacks is effected.

3. Apparatus for rectifying alternating currents comprising a plurality of stacks of asymmetric units, a plurality of annular baffle plates each assembled into all of said stacks in such manner that said stacks are connected together both electrically and mechanically by said plates, said stacks being arranged in circular rows about the openings in said annular baffle plates, and means for drawing air inwardly past all of said stacks and forcing it outwardly through the apertures in the two end baffle plates, the spacing between said stacks being such that the velocity of the air is higher when it passes the inner stacks than it is when it passes the outer stacks.

4. Apparatus for rectifying alternating currents comprising a plurality of stacks of asymmetric units, a plurality of annular baffle plates each assembled into all of said stacks in such manner that said stacks are connected together both electrically and mechanically by said plates, said stacks being arranged in circular rows about the openings in said annular baffle plates, and two fans one located in the aperture in each of the two end baffle plates, said fans being so arranged that when said fans are operated air is drawn inwardly from all sides of the apparatus and is forced outwardly through the apertures in which said fans are located.

5. Apparatus for rectifying alternating currents comprising a plurality of stacks of

asymmetric units, a plurality of baffle plates each assembled into all of said stacks in such manner that said stacks are connected together both electrically and mechanically by
5 said plates, said plates being provided with aligned apertures, a rotatable shaft extending through said apertures, a pair of fan blades fixed to said shaft and located in the apertures in the upper and lower plates, respectively, said blades being so arranged that
10 when said shaft is rotated air is drawn inwardly past said stacks and is forced outwardly through the apertures in which said fan blades are located, and means for rotating
15 said shaft.

6. Apparatus for rectifying alternating currents comprising a plurality of stacks of asymmetric units, said stacks being arranged in concentric circular rows, a plurality of
20 annular baffle plates assembled into all of said stacks, a rotatable shaft extending through the openings in said annular plates, two fan blades attached to said shaft and one located in the opening in each of the two
25 end plates, said fan blades being arranged to force air outwardly through the associated opening, and means for rotating said shaft.

In testimony whereof I affix my signature.

DONALD G. ACKERLY.

30

35

40

45

50

55

60

65