April 11, 1939. M. A. SAVAGE 2,154,217

METHOD OF FABRICATING HOLLOW PADS

Original Filed June 24, 1936

Fig. 1.

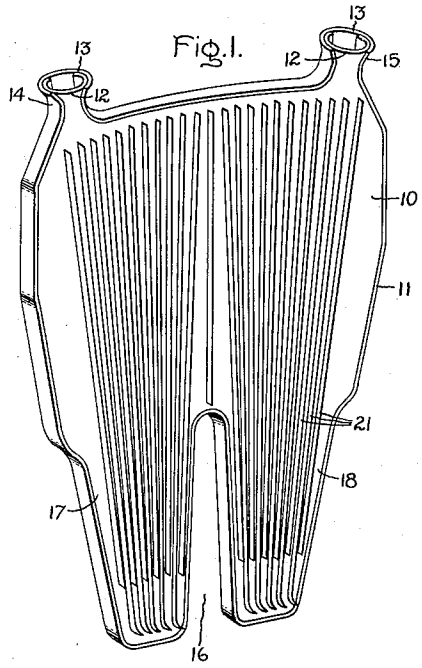


Fig. 7.

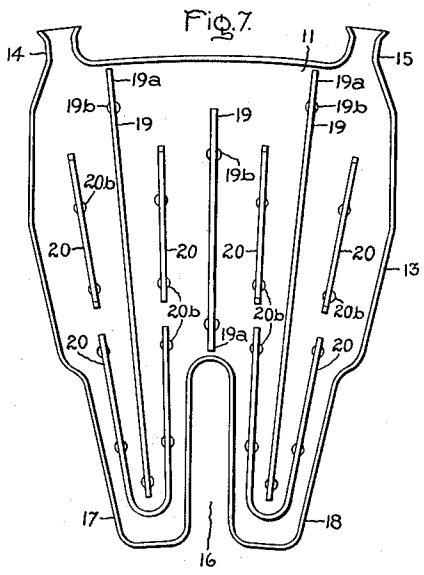


Fig. 2.

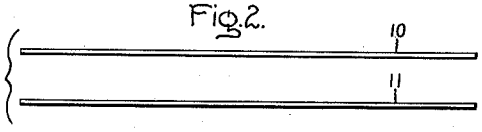


Fig. 3.

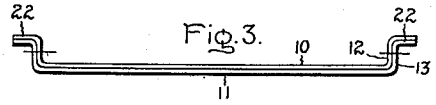


Fig. 4.

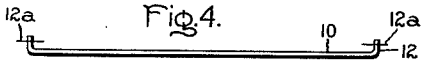


Fig. 5.

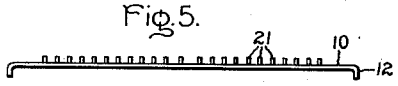


Fig. 8.

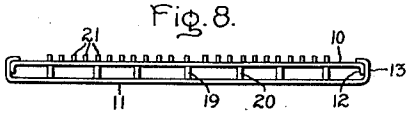
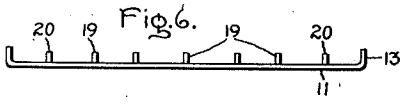


Fig. 6.



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2,154,217

METHOD OF FABRICATING HOLLOW PADS

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Original application June 24, 1936, Serial No. 86,966. Divided and this application April 8, 1937, Serial No. 135,751

7 Claims. (Cl. 29—157.3)

My invention relates to cooling pads which are primarily adapted for insertion between bundles of laminations in dynamo-electric machine core structures for removing heat therefrom. These cooling pads have substantially parallel flat face portions which make contact with the bundles of laminations and transfer the heat from the laminations to a cooling fluid circulated through the pad.

In my application, Serial No. 86,966, filed June 24, 1936, for "Cooling pad" I have described and claimed a cooling pad of improved construction. The present application is a division thereof and covers the method of fabrication described therein.

For an understanding of my invention reference may be had to the following description taken with the accompanying drawing in which Fig. 1 is a perspective view of a pad made in accordance with my invention and embodying the structural features thereof; and Figs. 2 to 7 inclusive, are views illustrating the structure of the pad shown in Fig. 1, as well as the procedure by means of which this pad is fabricated.

The hollow cooling pad shown in the drawing forms the subject matter of my above referred to application. It has two substantially parallel faces formed by the body portions of two sheets 10 and 11, the edges of which have been turned up to form flanges 12 and 13. These flanges are turned toward one another to space apart the body portions of the sheets and are integrally attached to one another throughout their lengths to form the edge walls of the pad, as well as the side walls of two flared nipples 14 and 15 formed by projections arranged one within the other and extending from the edge of the pad. The configuration of the pad and the location of the nipples will depend on the use to which the pad is put. In the construction illustrated, the lower portion of the pad is divided by a slot 16, which forms finger-like portions 17 and 18 opposite the side from which the nipples project. This slot 16 is made to accommodate windings located in the slots of laminations forming the core structure of a dynamo-electric machine and between which laminations the pad is located.

Metal strips 19 of substantially the same width as the width of the flanges of the sheets 10 and 11 are attached to the inner surfaces of the body portions of the sheets 10 and 11. As shown in Fig. 7, these strips are laterally spaced from one another with the outer strips 19 spaced from the ends of the portions 17 and 18, and with the intermediate strip 19 spaced from the wall between the nipples 14 and 15 to form a sinuous passageway which extends between the openings in the pad provided by the nipples. The ends 19a of these strips are slightly spaced from the adjacent flanges of the sheet 11 to slidably receive the flanges of the sheet 10. In the resulting pad construction the strips 19 are thus spaced from one another and alternately form opposite flanged portions of the sheets 10 and 11 to form the sinuous passageway referred to. Additional strips 20, having the same width as the strips 19, are also attached to the inner surfaces of the body portions of the sheets 10 and 11 and extend along the central portion of the passageway formed by the strips 19. The ends of these additional strips are spaced from one another at points opposite the central portions of the strips 19 to provide for a pressure equalization of the cooling fluid flowing on opposite sides of these strips through the passageway defined by strips 19. Strips 19 and 20 serve to reinforce the pad against the compressive force exerted on its face portions in the assembled core structure of a dynamo-electric machine. These strips also act as baffles by means of which the cooling fluid is directed in a predetermined path which brings it into intimate contact with the total surface portion of the cooling pad.

For some applications one of the external faces of the pad may be provided with cooling fins 21 attached thereto in any desired arrangement such as illustrated in Fig. 1.

The method of fabricating this cooling pad is as follows:

Two metallic sheets 10 and 11 are placed one upon the other in a press by means of which their edge portions 12 and 13 are simultaneously turned up to form pans which closely fit one within the other, as shown in Fig. 3. The excess metal 22 at the rim of these pans is simultaneously removed from the turned up portions of the sheets to form flanges of substantially uniform width. The inner pan formed of sheet 10 is then separated from the outer pan formed by sheet 11. Additional metal, above the line 12a in Fig. 4, is removed from its turned up edge portion 12, to facilitate the assembly of these sheets with their flanges turned toward and overlapping one another to form the hollow portion of the pad.

The sheets are then preferably cleaned by immersing them in hot water, a cleaning solution, or a pickling bath, to remove oil and dirt therefrom, and the surfaces of the sheets where they

are to be attached to one another and to the strips 19, 20 and 21 are preferably roughened by suitable means such as steel grit directed thereon through the agency of an air blast. Strips 19 and 20 are then attached by welding them at intervals, as indicated at 19b and 20b, to the inner surface of the body portion of sheet 11, as shown in Fig. 6. Strips 21 are then attached, preferably by welding, to the outer surface of the body portion of the sheet 10, as shown in Fig. 5. The turned up edges of the sheets 10 and 11 and their surface areas, as well as the surface areas of the strips 19, 20 and 21, are then coated with a brazing material such as copper, which may be applied thereto as a molten metal spray. The parts are then assembled as shown in Fig. 8 with the edge of sheet 11 turned over the body portion of sheet 10 and the projections constituting the nipples 14 and 15 formed around one another thus bring the edge portions of the sheets in close contact with one another. The assembly is then placed in a brazing furnace with the assembly resting on the outside surface of the body portion of the sheet 11. Any suitable arrangement for applying a pressure to the assembly may be placed in engagement with the fins 21.

The brazing operation is preferably performed in a hydrogen furnace to effect that species of brazing known as "hydrogen brazing". In the presence of an atmosphere of hydrogen the copper brazing material readily flows into the crevices of the assembled parts and unites them one to the other in a manner closely approaching the condition of a welded union. The pad after the brazing operation is an integral structure in which all the parts are firmly attached one to another through their contacting areas by the hydrogen brazing operation.

The nipples 14 and 15 are flared to facilitate the attachment therein of metallic conduits, the ends of which can be soldered to the nipples by puddling the solder in the annular space provided by their flared portions. I prefer to perform this soldering operation by using a silver solder, melted by the flame of a welding torch in the presence of a fluxing material.

The metal of the pad structure may be of any suitable kind, but I prefer to use for the sheets 10 and 11 and the strips 19 and 20, a copper nickel alloy known to the trade as "Monel" metal. I use this material because of its resistance to corrosion as well as its high electrical resistance which prevents undue heating due to eddy current losses in the pad when used as part of the core structure of a dynamo-electric machine. The fins 21 may be made of a low carbon steel or any other suitable material. These fins are provided to space the pad from an adjacent bundle of laminations and form passageways for the circulation of cooling gas between the pad and the bundle of laminations. These fins 21 may or may not form part of the pad structure. When used they also serve to conduct heat from the bundle of laminations placed in contact therewith to the pad and to the cooling fluid circulated in the pad.

It is, of course, apparent that variations may be made in the structure of the pad, as well as in the procedure by means of which the pad is fabricated without departing from my invention. For example, the parts may be attached to one another by welding. Furthermore, the flanged edge portions of the sheets need not necessarily overlap one another, and may be provided with rims for facilitating certain welding operations. It is also apparent that the strips 19, 20 and 21 are not necessarily attached throughout their lengths to the sheets 10 and 11, although such construction strengthens the pad and facilitates the transfer of heat through the strips 21 to the body portion of the plate to which they are attached.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of making a hollow pad which comprises superimposing two metal sheets one upon the other, simultaneously turning up the edge portions of said sheets to form pans which closely fit one within the other, removing excess metal from the turned up portions of said pans to form flanges of uniform width, separating, reversing and assembling said pans with their hollow portions forming the hollow portion of the pad, and integrally uniting the turned up portions of said pans.

2. The method of making a hollow pad which comprises superimposing two metal sheets one upon the other, simultaneously turning up the edge portions of said sheets to form pans which closely fit one within the other, simultaneously removing excess metal from the turned up portions of said pans to form flanges of uniform width, separating, reversing and fitting the pans one within the other with their hollow portions forming the hollow portion of the pad, and integrally uniting the turned up portions of said pans.

3. The method of making a hollow pad which comprises superimposing two metal sheets one upon the other, simultaneously turning up the edge portions of said sheets to form pans which closely fit one within the other, simultaneously removing excess metal from the turned up portions of said nested pans to form flanges of uniform width, separating the inner pan from the outer pan, attaching spaced metal strips of substantially the same width as said flanges to the inner body surface of one of said pans, reversing and fitting said pans one within the other with their hollow portions enclosing said strips and forming the hollow portion of the pad, and uniting said pans and said strips into an integral structure.

4. The method of making a hollow pad which comprises superimposing two metal sheets one upon the other, simultaneously turning up the edge portions of said sheets to form pans which closely fit one within the other, simultaneously removing excess metal from the turned up portions of said nested pans to form flanges of uniform width, separating the inner pan from the outer pan, attaching to the inner surface of one of said pans metal strips spaced from one another and alternately from opposite edge walls of said pan to form a sinuous passageway which occupies substantially all of the hollow portion of said pan, reversing and fitting said pans one within the other with their hollow portions enclosing said strips and forming the hollow portion of the pad, and uniting said pans and said strips into an integral structure.

5. The method of making a hollow pad which comprises superimposing two metal sheets one upon the other, simultaneously turning up the edge portions of said sheets to form pans which closely fit one within the other, simultaneously removing excess metal from the turned up portion of said nested pans to form flanges of uniform width, separating the inner pan from the outer pan and removing additional metal from

its flanged edge portion, attaching to the inner surface of one of said pans metal strips of substantially the same width as said flanges and spaced from one another and alternately from opposite edge walls of said pan to form a sinuous passageway which occupies substantially all of the hollow portion of said pan, applying a brazing material to said pans at said strips and at their turned up edges, fitting said pans one within the other with their hollow portions enclosing said strips and forming the hollow portion of the pad, and uniting said pans and said strips into an integral structure by heating them to the melting temperature of said brazing material.

6. The method of making a hollow pad which comprises superimposing two metal sheets one upon the other, simultaneously turning up the edge portions of said sheets to form pans which closely fit one within the other, simultaneously removing excess metal from the turned up portions of said nested pans to form flanges of uniform width, separating the inner pan from the outer pan and removing additional metal from its flanged edge portion, welding at intervals to the inner surface of one of said pans a plurality of metal strips of substantially the same width as said flanges and spaced from one another and alternately from opposite edge walls of said pan to form a sinous passageway which occupies substantially all the hollow portion of said pan, applying a brazing material to said pans at said strips and at their turned up edge portions, fitting said pans one within the other with their hollow portions enclosing said strips and forming the hollow portion of the pad, and uniting said pans and said strips into an integral structure by heating them to the melting temperature of said brazing material.

7. The method of making a hollow pad which comprises superimposing two metal sheets one upon the other, simultaneously turning up the edge portions of said sheets to form pans which closely fit one within the other, simultaneously removing excess metal from the turned up portions of said nested pans to form flanges of substantially uniform width, separating the inner pan from the outer pan and removing additional metal from its flanged edge portion, cleaning the surfaces of said pans, roughening the surfaces of said pans and of metal strips to be attached thereto at their surfaces of contact when assembled, welding at intervals to the inner surface of one of said pans a group of said metal strips spaced from one another and alternately from opposite edge walls of said pan to form a sinuous passageway which occupies substantially all the hollow portion of said pan, welding at intervals to the outer surface of the other of said pans a group of said metal strips in spaced relationship relative to one another, spraying a coating of copper on said strips, on the surfaces of said pans where said strips are attached and on the flanged edge portions of said pans, fitting said pans one within the other with their hollow portions forming the hollow portion of the pad, placing said pans and strips in a brazing oven with the strips on said pans extending in an upward direction and integrally uniting said strips and said pans by melting said copper coating in said furnace in an atmosphere of hydrogen.

MARION A. SAVAGE.