Feb. 27, 1945. S. J. GORAN 2,370,458

CAST SQUIRREL CAGE ROTOR

Original Filed Sept. 14, 1942 2 Sheets-Sheet 1

Fig. 1.

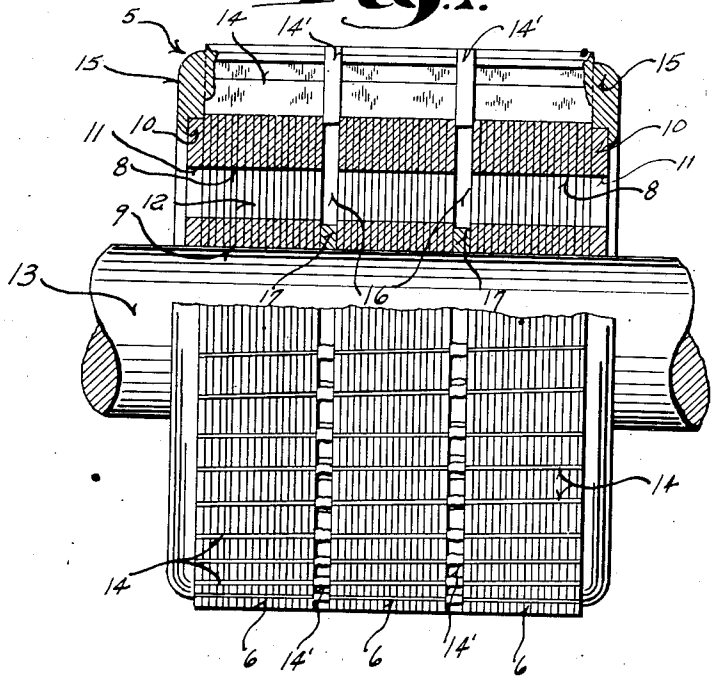
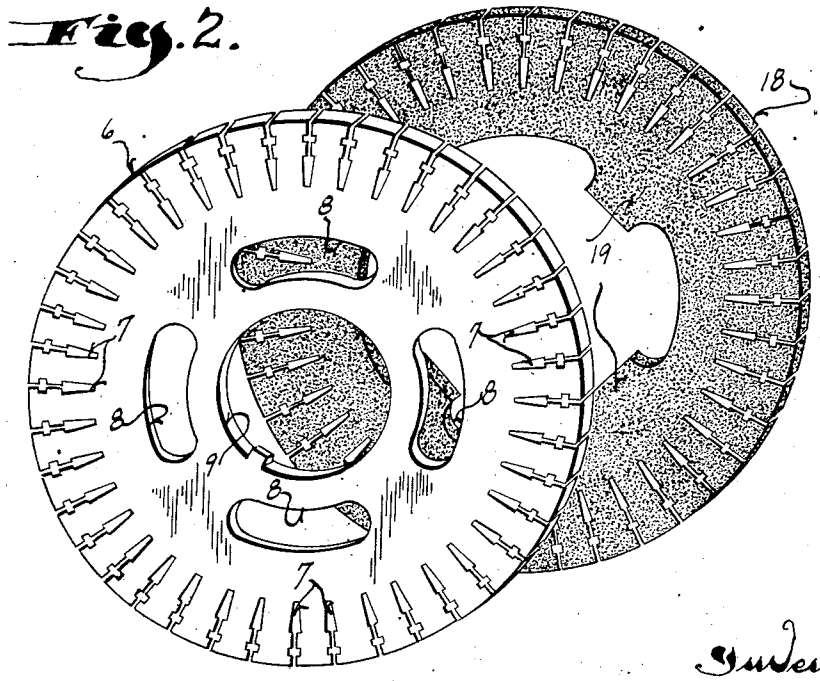


Fig. 2.



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Fig. 3.

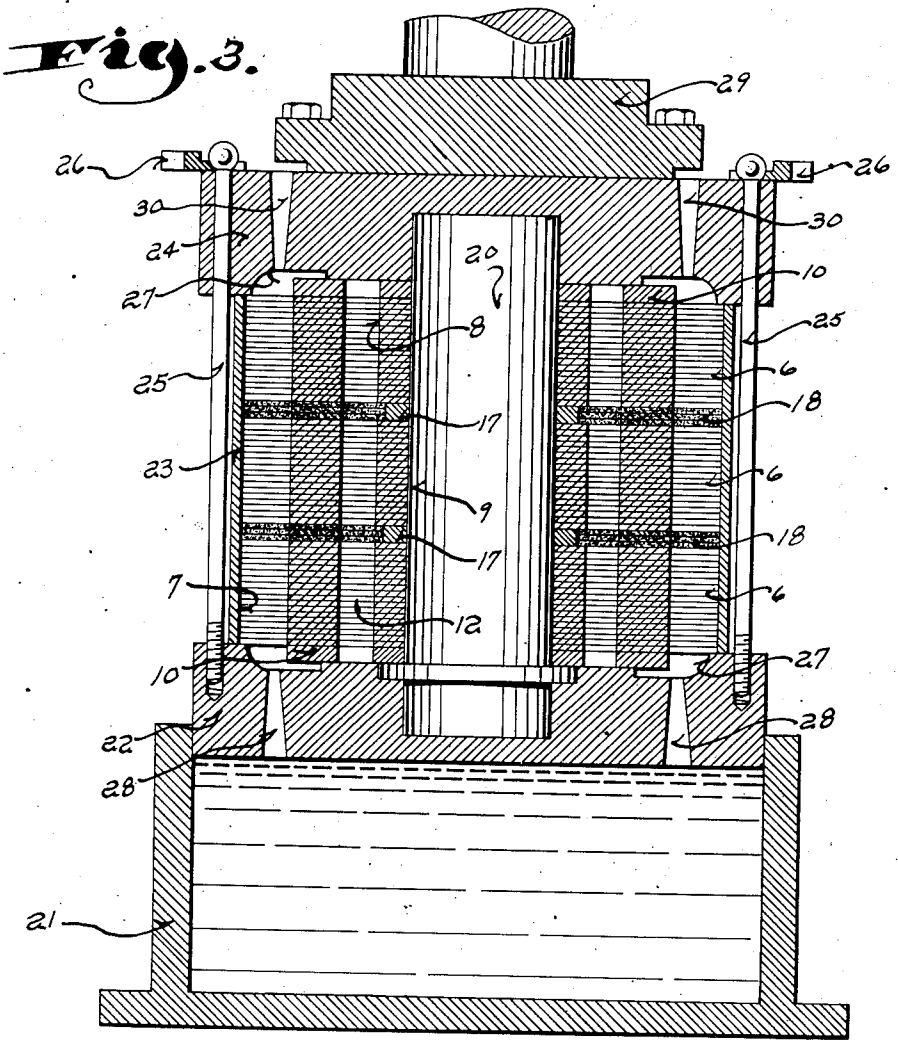


Fig. 4.

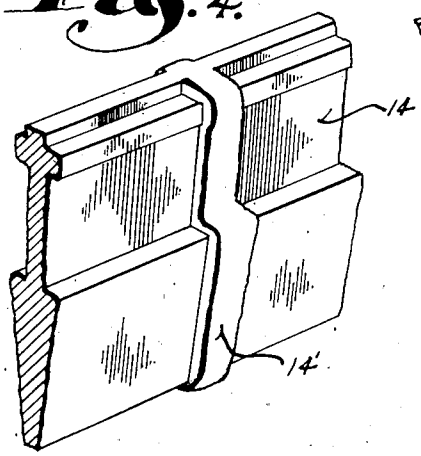
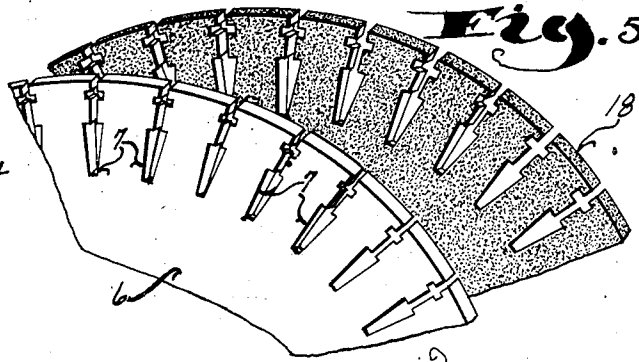


Fig. 5.



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UNITED STATES PATENT OFFICE

2,370,458

CAST SQUIRREL CAGE ROTOR

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Original application September 14, 1942, Serial No. 458,258. Divided and this application May 31, 1943, Serial No. 489,170

3 Claims. (Cl. 172—120)

This invention relates to electric motors and refers particularly to the construction of a squirrel cage rotor having cast conductor bars. It is a division of the co-pending application of Steven J. Goran, Serial No. 458,258, filed September 14, 1942.

To those skilled in the art, the necessity for providing ventilation for the rotor of a dynamo-electric machine to carry off the heat from the interior thereof is well understood. Many different schemes have been employed for this purpose, and as an illustration of past practice, reference may be had to Patent No. 2,176,871, issued to F. E. Harrell et al., October 24, 1939.

The present invention is likewise concerned chiefly with the provision of radial vents in the core of the rotor and has as its object the provision of a rotor of the squirrel cage type with cast conductor bars which is so designed and constructed that the desired radial vents are produced in an exceedingly simple and inexpensive manner.

More specifically it is an object of this invention to provide a squirrel cage rotor of the die cast type wherein radial ventilating openings are formed between adjacent groups of laminations held spaced apart by enlargements on the conductor bars produced during the casting of the rotor.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed in accordance with the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a view partially in side elevation and partially in longitudinal section through a die cast squirrel cage rotor embodying this invention;

Figure 2 is a perspective view of one of the laminations of the rotor and one of the temporary spacers used in the making of the rotor;

Figure 3 is a longitudinal sectional view through a rotor in position in a casting mold preparatory to having the conductor bars cast into the slots;

Figure 4 is a perspective view illustrating a section of the cast conductor bars to show the manner in which enlargements are formed thereon to space the groups of laminations; and

Figure 5 is a perspective view illustrating a portion of the lamination and spacer shown in Figure 2, but showing the slots of the spacer larger than those of the laminations to insure the rivet enlargements of the bars being of adequate size.

Referring now particularly to the accompanying drawings, in which like numerals indicate like parts, the numeral 5 designates generally the core of a squirrel cage rotor which, as is customary, consists of a stack of laminations 6 all punched by the same die to have conductor bar slots 7 in their outer peripheral portions and longitudinal vent forming openings 8 surrounding a central shaft receiving hole 9.

The laminations 6 are confined between end plates 10 of a diameter to extend approximately to the roots or inner end of the slots 7. These end plates 10 have circumferentially arranged openings 11 to align with the openings 8 of the laminations so that a plurality of longitudinal air passages 12 extending entirely through the core surround the shaft 13 upon which the core is mounted.

The entire structure is held together by conductor bars 14 which are die cast of aluminum or other suitable metal into the slots 7, the laminations being so arranged that the slots are slightly skewed around to give the conductor bars the desired angle across the surface of the rotor.

The ends of the conductor bars are integral with rings 15 which overhang the end plates 10 and thereby tie the entire structure together.

To this extent the present rotor follows conventional practice, but it is to be observed that in addition to the longitudinal passages 12 there are also radial vents or passageways 16 leading outwardly from the longitudinal passages 12 of the peripheral surface of the roto, and that these radial passages or vents lie between adjacent groups of laminations which are held spaced apart at the inside by spacer collars 17 of steel or other suitable metal and at the outside by integral enlargements 14' on the conductor bars.

In this manner an exceedingly simple and inexpensive construction is obtained for the provision of the desired radial air vents involves no costly or complicated spacing discs or their equivalent. The production of these desired radial vents is also accomplished in an exceedingly simple and inexpensive manner requiring no deviation from

accepted practice in the manufacture of the die cast squirrel cage rotors. The method employed forms the subject matter of the aforesaid parent application, Serial No. 458,258 and while the present invention is not concerned with the method, a brief description thereof will be helpful to an understanding of the structure concerned.

Hence, in the production of the rotor destroyable spacers 18 are punched on the same disc used to punch the laminations, and these spacers are interposed between the groups of laminations during the assembly of the laminations, and after the casting operation they are destroyed and removed.

The spacers are preferably of sheet material which may be readily decomposed. Cardboard is well suited for this purpose as it can be charred or carbonized by baking at temperatures which do not affect the cast conductor bars and when so decomposed can be easily removed by a blast of compressed air.

The use of cardboard or some such similar combustible material is desirable to this invention. It is this characteristic of the temporary spacers that enables the formation of the enlargements 14' which serve to hold the groups of laminations spaced. During the casting operation (illustrated in Figure 3) the hot molten metal coming in contact with the spacers burns away the portions thereof adjacent to the slots to form the enlargements 14' on each conductor bar.

Inasmuch as the spacers are preferably formed of cardboard or some such material which obviously does not have the same compressive strength as the metal laminations, the spacing collars 17 are used to prevent collapse of the spacers during the application of compression on the stack, and to accommodate the collars 17 the spacers have their central portions cut away as shown in Figure 2. The inwardly directed projections 19 on the spacers are of such size as to just contact the outer diameter of the collars 17.

With the complete stack of laminations and spacers properly assembled on a mandrel 20 the entire assembly is placed in a casting mold as shown in Figure 3. This mold is of conventional construction and includes a cylinder or well 21 in which a plunger 22 is reciprocally received. The plunger 22 provides the base for the assembled core laminations and is formed to receive the lower end of the mandrel 20.

It is to be observed that the base 22 closes the longitudinal passageways 12 at the bottom. Hence, molten metal cannot enter these passageways.

With the assembled laminations positioned on the base 22 a sheath 23 of sheet metal is applied around the cylindrical surface of the assembly to close the conductor bar slots 7; and then a cap 24 is positioned on the assembly which, like the base 22, is formed to accommodate the mandrel. Tie bolts 25 with quick acting latches 26 draw the cap and base together to compress the laminations and hold the same in intimate contact.

It is to be observed that both the cap 24 and the base 22 have annular grooves or channels 27 of a size and shape to form the cast rings 15 and that the base has ports 28 leading to its channel 27 through which the molten metal enters the same and consequently rises up into the conductor bar slots during the casting operation.

It is of course, understood that the assembly of the core structure in the mold as described takes place before the well or cylinder 21 has the molten metal poured into it, and that after the assembly is completed the cap which is attached to the plunger 29 of a hydraulic press is raised to lift the entire assembly out of the well and permit ladling of the molten metal into the well. Thereafter, the plunger 29 is caused to descend which forces the molten metal up into the slots and the channel 27 in the cap.

Air vents 30 in the cap preclude the entrapment of air and permit the metal to rise up into the slots.

As the molten metal rises up into the conductor bar slots it comes in contact with the spacers and burns away the adjacent portions thereof to form the enlargements 14' as previously described.

After the casting is complete and the metal is hardened sufficiently, the mold is opened and the core stripped off the mandrel. The entire unit is then baked in an oven or otherwise subjected to an elevated temperature to char or carbonize the spacers.

The desideratum of this invention can also be achieved with temporary spacers made of incombustible material. For instance, a material which is readily soluble in a suitable solvent but which is not affected by elevated temperatures could be used. In this case, the apertures in the spacer which align with the conductor bars slots would be somewhat larger than the slots 7 of the laminations as shown in Figure 5 to enable the molten metal to form the enlargements 14'.

Larger slots in the spacers also may be desirable where the spacers are made of combustible material, especially where there is any danger that the molten metal will not burn away enough of the spacer to form an adequate rivet enlargement 14'.

In the embodiment of the invention illustrated the laminations are provided with punched openings to form the longitudinal ventilating passages and the laminations are mounted directly on the rotor shaft. Obviously, the same result can be obtained by following the conventional practice of applying the rotor core, that is the stack of laminations, on a spider which in turn is mounted on the rotor shaft. This common expedient is illustrated in the aforesaid patent to Herrell et al.

From the foregoing description, taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art that this invention provides an exceedingly simple and inexpensive manner of making squirrel cage rotors of the type having die cast conductor bars.

What I claim as my invention is:

1. A squirrel cage rotor having cast conductor bars comprising: laminations having aligned conductor bar slots; integrally cast end rings and conductor bars, the conductor bars being embedded in the slots of the laminations and the end rings engaging the outermost laminations; and enlargements integral with the conductor bars and disposed between two groups of laminations for holding said groups spaced apart to provide radial ventilating ducts between said two groups of laminations and between adjacent conductor bars, said enlargements constituting the sole means for holding the peripheral portions of said groups of laminations spaced apart.

2. A squirrel cage rotor comprising: a stack of laminations having air passageways extending longitudinally therethrough, said laminations having aligned conductor bar slots in their peripheral portions; end rings between which the laminations are confined; conductor bars in said slots connecting said end rings; and enlarge-

ments integral with the conductor bars between two inner laminations holding said inner laminations spaced apart to provide radial air vents connected with the longitudinal ventilating passageways and opening to the cylindrical surface of the rotor.

3. A rotor for dynamoelectric machines, comprising: a laminated magnetic core having endwise spaced sections each comprising a group of laminations, all of the laminations having aligned conductor bar slots in their peripheral portions; end rings between which the laminated magnetic core is confined; conductor bars in said slots connecting the end rings; and enlargements integral with the conductor bars between said core sections for holding said core sections spaced apart to provide radial ventilating ducts between adjacent sections and adjacent conductor bars.

STEVEN J. GORAN.