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E. W. PETERSEN

2,012,021

METHOD OF FORMING ROTORS

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Fig. 1.

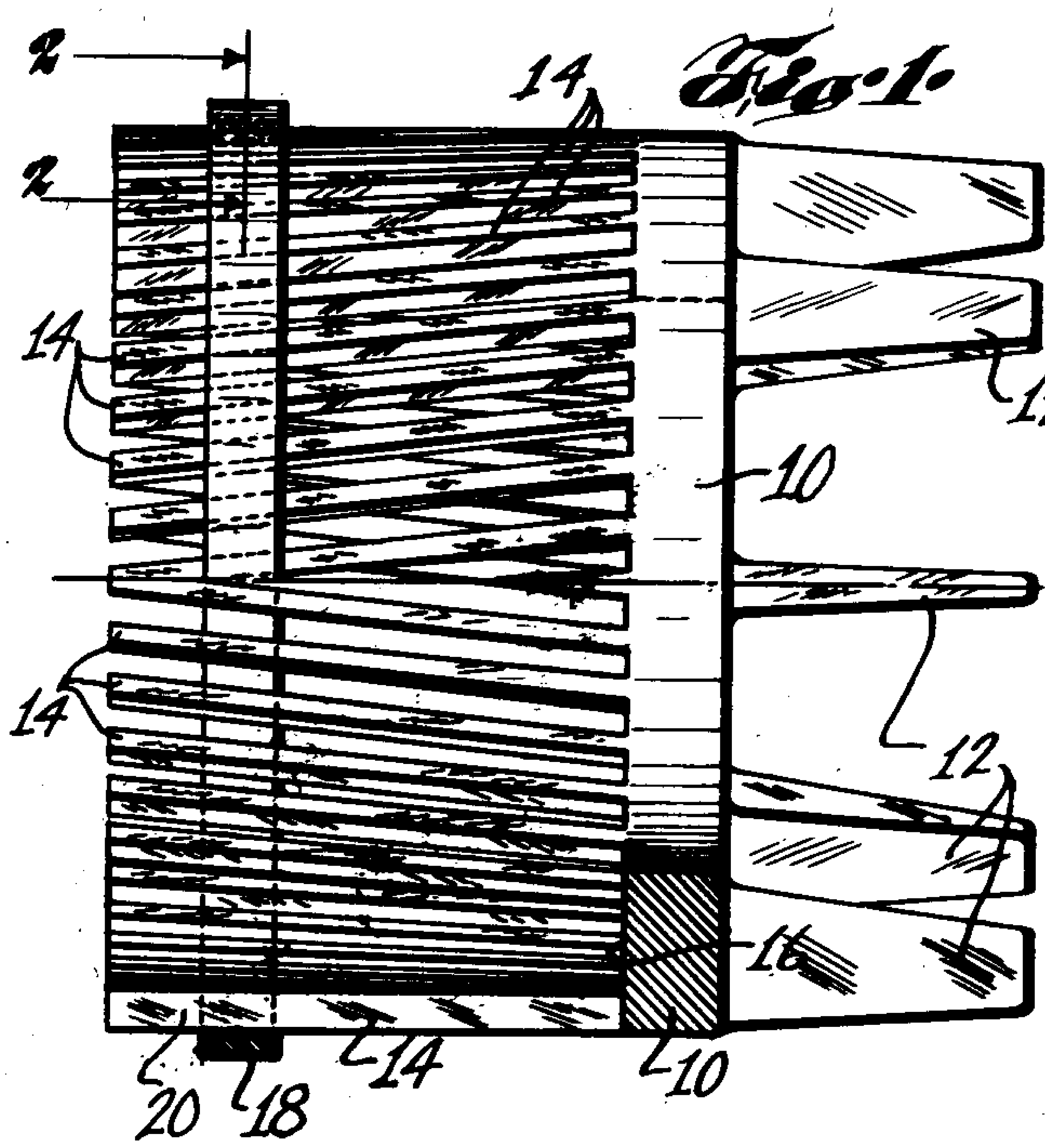


Fig. 2.

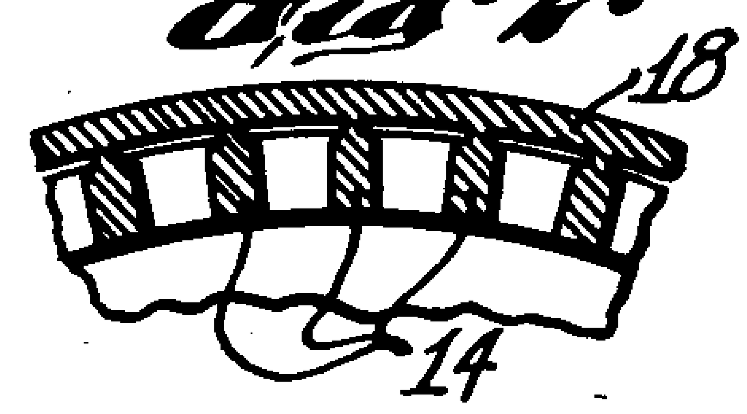


Fig. 4.

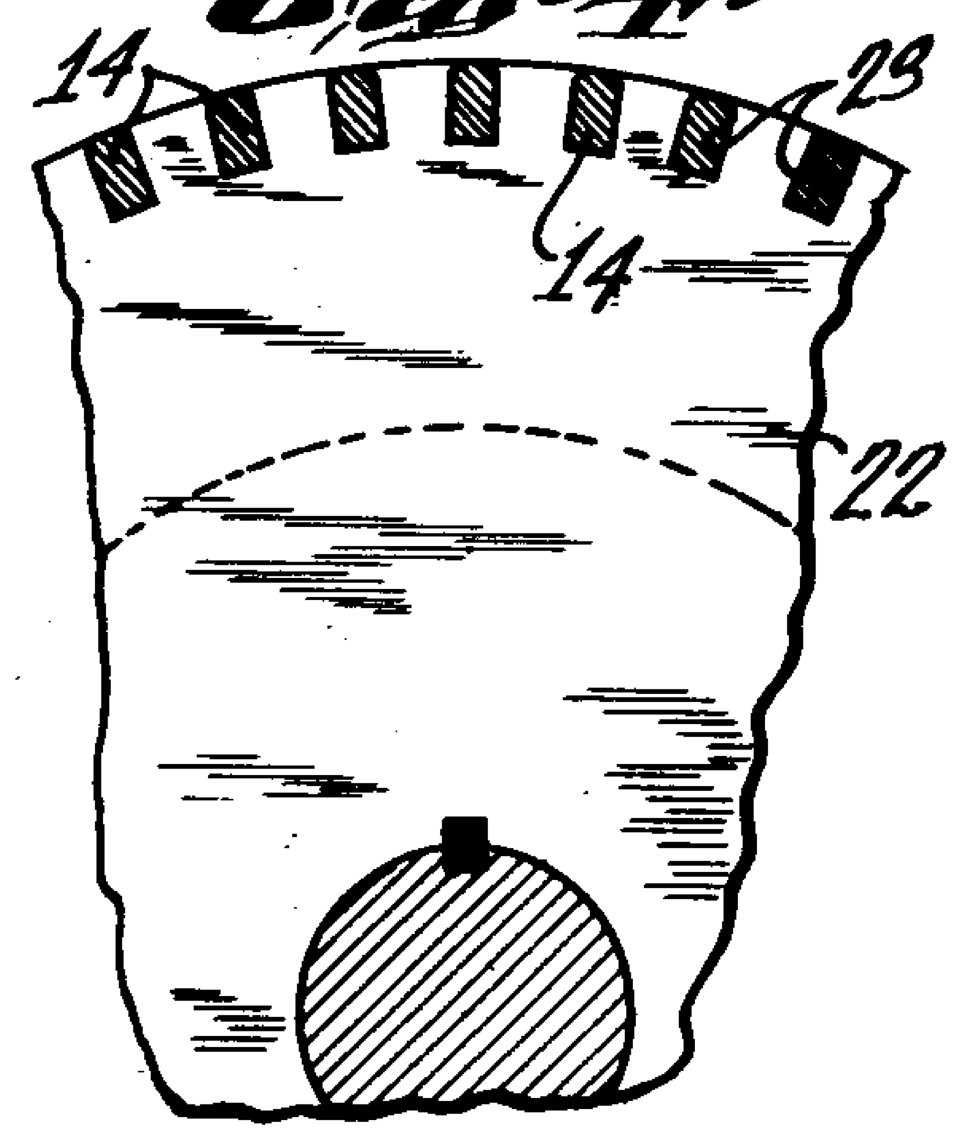
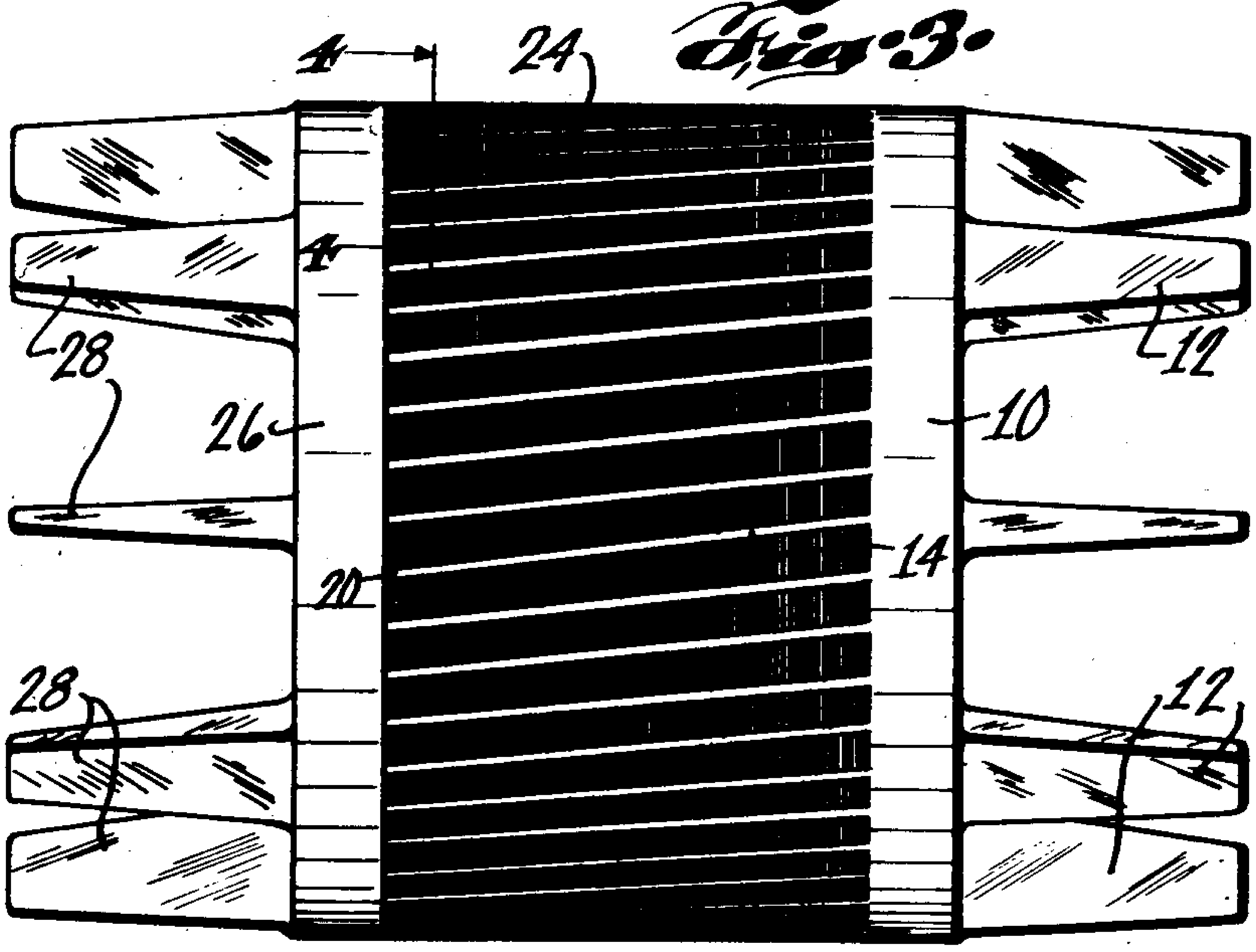


Fig. 3.



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METHOD OF FORMING ROTORS

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7 Claims. (Cl. 22—203)

This invention relates to improvements in rotors for dynamo-electric machines, and more particularly to an improved rotor, and method for die casting and assembling rotors for induction machines.

It has been common practice heretofore, to form induction machine rotors by assembling the core laminations, bolting or riveting them together with the slots properly aligned, and casting the rotor bars within the slots, as by placing the assembled core in a die casting mold. An evident disadvantage in so casting the bars in place, is that any defects in the cast bars cannot readily be detected. Furthermore, when the bars are cast in place, stresses are set up in the bars, as a result of shrinkage of the casting metal in cooling, which tends to cause internal cleavage lines, voids, or even rupture of the bars, after the rotor is placed in service. It is, therefore, an object of this invention to provide an improved method of forming an induction machine rotor which will eliminate the above noted objections incident to the older methods.

Another object of the invention is to provide a rotor which is substantially free from defects, such as blow holes and the like, and abnormal tensional stresses likely to result in failure of the rotor in service.

A further object of the invention is attained in a method of forming rotors of the type noted, wherein any defects in the rotor bars may be visually discovered before the rotor is completed, thus allowing any defective rotor bar assembly to be remelted with a minimum of expense.

Further objects and advantages will appear from the following description of one example of the practice incident to the invention, and from the appended drawing, in which:

Fig. 1 is a longitudinal elevation, partly in section, of a preferred form of winding structure of the rotor; Fig. 2 is a fragmentary section taken along line 2—2 in Fig. 1; Fig. 3 is a longitudinal elevation of a preferred form of a completed rotor, and Fig. 4 is a fragmentary section taken along line 4—4 in Fig. 3.

Proceeding now to a description of the invention, by numerals of reference, 10 is a rotor end ring, preferably formed by die casting from any suitable metal such as an aluminum or zinc alloy. Formed integrally wtih the end ring 10, and projecting from one end face thereof, are a series of spaced projections 12 which act as fan blades for cooling the machine when in operation. Rotor bars 14, formed integrally with the internal face portion 16 of the end ring, and at an angle to the axis of the rotor most effective in preventing a humming motor noise, are held in place by a ring band 18 which is conveniently cast integrally with the bars near their free ends 20, but which may, if desired, consist of a separate band of metal. Rotor laminations, such as punchings 22, have their slots 23 left partly open so that they may be slipped over the bars 14 and under the ring 18, in assembly. It will be noted from Fig. 2, that the ring 18 is displaced from the outer circumferential surface of the bars a sufficient distance to allow the laminations to be assembled on the bars. The laminations are assembled on the structure 10—14—18 in the required number to form the laminated core 24, the punchings then being compressed in a clamp, press or similar device (not shown), which retains the members in compression for succeeding operations.

The structure consisting of parts 10, 14 and 18, together with the laminations under compression, is inserted in a mold suitable for pressure casting. An end ring 26, which may include integral fan blades 28, is now die cast to the ends 20 of the rotor bars, which, in the process, become fused into the metal of the ring 26. When the cast metal has cooled, and set in its final form, the clamp compressing the core laminations may be removed, and likewise, the ring band 18. The rotor is then key seated as by milling, and turned to form a completed structure such as illustrated in Fig. 3. It will be noted that the only substantial stress to which the rotor bars are subject, is imparted substantially upon completion of the rotor, being due to the release of the compressed punchings which, in expansion, place a tension stress in the bars. The bars are, however, by this time, fully frozen and entirely able to withstand this tension. Furthermore, it has been found that the present method of assembling the laminations, by placing them over the preformed bars, positions each more accurately than does the more usual key seat punched in the bore.

It will have appeared that in the older prevailing method according to which the bars are cast in place in the channels therefor, the greater part of each bar is invisible and hence not subject to inspection; further, that any substantial internal defect, in any one of the rotor bars, renders the finished rotor unserviceable. In distinction the present method of manufacture and order of assembly of the parts, permits all faces of the end ring 10, as well as all faces of the individual bars 14 to be subject to inspection, thus greatly reducing the hazard of hidden blow holes or faults. If, by chance, any of such defects appear, they are detected prior to further assembly operations and thus the waste incident to rejection, is minimized. Since the usual pressure casting alloys undergo a certain substantial shrinkage on cooling, according to the present method this shrinkage takes place prior to the time when the bars are brought into assembly with the laminations and particularly before compression thereof, thus obviating the very extensive failure of bars when cast in place in the core.

It will have appeared from the foregoing description that the advantageous disposition of successive laminations in angularly displaced relation so as to produce a structure of the general type shown by Fig. 3, is greatly facilitated by the present process and method, according to which, by preforming the bars at other than a right angle to the first end ring, such as 10, the angular disposition of the stacked laminae is positively determined.

It will, of course, be understood that the description of the invention herein refers only to a single embodiment thereof, and that substantial alterations and modifications may be made without departing from the full intended scope of the invention, as defined by the appended claims.

I claim as my invention:

1. The described method of forming a secondary member of an induction machine which consists in casting, in a single operation as a unit, bars and one ring member interconnecting said bars near one end thereof, in bridging the opposite end portions of the bars, by attaching thereto an external bar-spacing and holding element, in assembling a magnetic core to said bars and ring, and in metallically securing said core, bars and ring by casting a second ring adjacent the free ends of said bars.

2. The herein described method of constructing a rotor for an induction machine, which consists in casting, under pressure, as a unit, an end ring, rotor bars, each having connection on one end, with said ring, and in restraining the opposite ends of said bars from spreading, in assembling a plurality of laminations of magnetic material, to said end ring and bars, in subjecting said laminations to pressure, and while under pressure, casting a second end ring, under pressure, about the opposite ends of said bars.

3. The herein described method of constructing a rotor for an induction machine, which consists in casting under pressure, as a unit, an end ring, together with a plurality of rotor bars, in mechanically assembling the preformed cage structure consisting of said ring and bars, to a stack of laminations, in subjecting said laminations, and end ring to pressure sufficient to bring the required number of laminations within said cage structure, and of casting under pressure a second end ring, apart from the free ends of said bars and adjacent one end face of the laminated structure.

4. A method of forming the secondary member of an induction machine, which consists in die-casting, as an integral structure, one end ring and a plurality of rotor bars, in assembling core punchings over the free bar ends, in maintaining the punchings compressed, in die-casting a second end ring to the free ends of the rotor bars, and in releasing the compressed punchings so that they may assume their final operative position between the end rings of the completed secondary member.

5. A method of forming the secondary member of an induction machine which consists in die-casting fan blades and rotor bars integrally and endwise connected to one end ring, the opposite ends of the bars being free, in holding the free ends of the bars in spaced relation by casting thereto a temporary ring, in assembling core punchings between the spaced rotor bars; in compressing the punchings; in die-casting a second end ring to the free ends of the rotor bars; in releasing the compressed punchings, and in removing the temporary cast ring.

6. A method of forming the secondary member of an induction machine which consists in die-casting an end ring with spaced fan blades projecting from one side face thereof, and spaced rotor bars having free ends projecting from the opposite side face thereof, at an angle to the axis of the end ring, in disposing a temporary holding member in constraining relation to the bars near their free ends to retain them in spaced relation; in stacking core punchings against the inner side face of the end ring and with the bars extending through suitable slots provided in the punchings; in compressing the punchings; in die casting a second end ring to the free ends of the bars; and in constraining relation to the punchings, in releasing the compressed punchings, and in removing the temporary holding member.

7. The herein described method of constructing a rotor for an induction machine which includes a first step of casting the bars and one end ring, in a single casting operation as a unit, apart from the core, bridging the bars by attachment externally thereto, and inwardly of their free ends, a bar-positioning and spacing ring, thereafter assembling the core thereto, casting the other end ring onto the bars, and thereafter removing the bridging ring.

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