

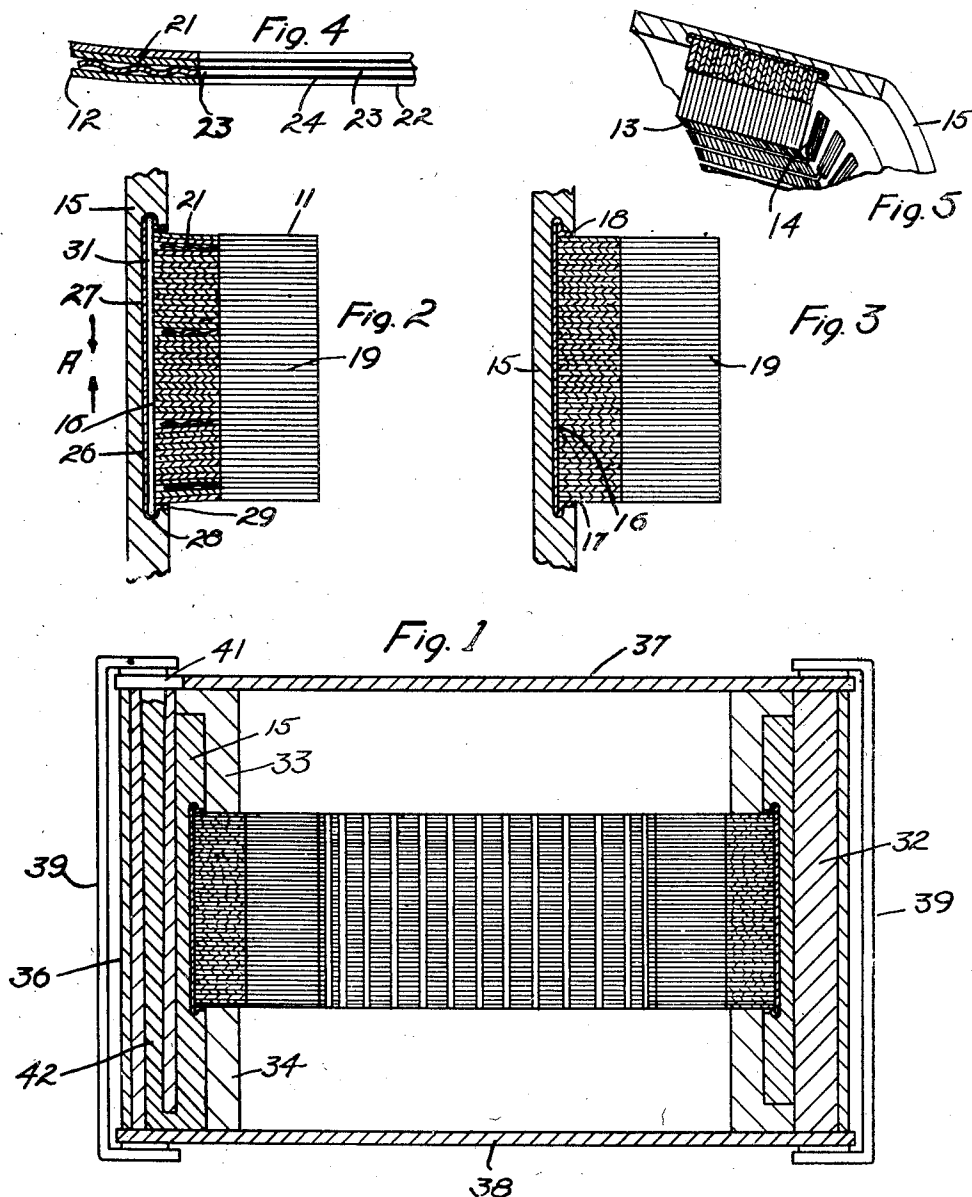
Jan. 3, 1950

M. MORRISON

2,493,414

METHOD OF MAKING CORES FOR ELECTRICAL APPARATUS

Filed Oct. 8, 1946



INVENTOR.

Montford Morrison

BY

Hunter & Thawron

UNITED STATES PATENT OFFICE

2,493,414

METHOD OF MAKING CORES FOR
ELECTRICAL APPARATUS

Montford Morrison, Upper Montclair, N. J., as-
signor to Ritter Company, Inc., Rochester,
N. Y., a corporation of Delaware

Application October 8, 1946, Serial No. 701,929

11 Claims. (Cl. 22—203)

1

My invention relates to a method of making cores for electrical apparatus and to the core or structure produced by such method.

The making of cores for electrical apparatus wherein a plurality of annular laminations are assembled in stacked relation with each other and are retained in assembled relation by a metal frame cast about the outer peripheries of the laminations is attended by several difficulties. As the metal of the retaining shell or casting cools it contracts in a direction such as to compress the stack of laminations adjacent their outer peripheries. This contraction, of course to a certain extent, is necessary to bind or retain the stack of laminations in assembled relation but results in a bulging of the stack adjacent the inner peripheries of the annular laminations which is extremely undesirable. In addition, during cooling, the casting contracts both radially and longitudinally of the axis of the core which often results in a cracked core casting due to exceeding the elastic limit of the material. Frequently this cracking of the core casting does not occur until long after the motor is in operation due to fatigue of the metal of the shell.

An object of my invention is to provide an improved method of making laminated cores for electrical apparatus which may be efficiently carried out at low cost.

Another object of my invention is to provide an improved and more efficient core structure for electrical apparatus.

A further object of my invention is to provide a method of making cores for electrical apparatus which results in a laminated core of substantially uniform width in a direction longitudinally of the axis of the core from the inner periphery of the core to the outer periphery thereof.

My invention further contemplates a method of making cores for electrical apparatus and the article produced thereby, wherein provision is made for contraction of the shell casting upon cooling, both in a direction axially of the core and radially thereof to thereby reduce the possibility of setting up excessive strains in the metal of the casting to the end that cracked core castings or shells are either eliminated or their prevalence greatly reduced.

Other objects and advantages of my invention will be particularly set forth in the appended claims and will be apparent from the following description, when taken in connection with the accompanying drawings, in which:

Fig. 1 is a sectional view of the assembled core in a mold after the frame or shell has been cast and the metal thereof has cooled;

2

Fig. 2 is a sectional view of the core showing the laminations in assembled relation and the frame or shell of the core cast about the periphery of the laminations, the view showing the conditions prior to the cooling of the metal;

Fig. 3 is a view similar to Fig. 2 showing the conditions after the metal has cooled;

Fig. 4 is an enlarged sectional view of three laminations showing how they are cemented together prior to casting the frame thereon and showing the outer periphery of one of the laminations which has been upset, rolled or crimped; and

Fig. 5 is a fragmentary sectional view of a portion of the finished stator prior to winding.

In the drawings I have illustrated how the method of my invention is carried out in the making of the stator of an electric motor. However, it will be understood that the method as a whole or particular steps thereof may be applied to the making of cores for other electrical apparatus. The core comprises a multiplicity of laminations or thin punched sheets of steel 11, each of which has an outer preferably circular edge 12 (Fig. 4) and an inner circular edge 13 (Fig. 5), each lamination thus constituting an annulus. The inner peripheral edge is provided with a series of slots 14 which, as well known in the art of electric motors, are adapted to receive the stator windings.

The assembled stack of laminations is adapted to be secured in an annular relatively thin frame or shell 15 (Fig. 3) of aluminum, iron or other metal cast about the outer peripheral surface 16 formed by the assembled laminations and in pressing relation with the adjacent sides 17 and 18 of the outer laminations. The metal is cast about the laminations in such a manner as to clamp the laminations in assembled relation.

In casting the metal frame about the stack of laminations or core, as previously mentioned, a problem is encountered in preventing the stack of laminations from bulging at the slotted section 19 of the stack. This bulging is caused by the shrinking of the metal frame or shell, which causes a compressive force at the sides 17 and 18 or in a direction axially of the bore of the laminations. This shrinkage of the metal also results in cracking of the castings both during manufacture and sometimes, due to fatigue of the metal, long after the motor has been in service. Cooling of the metal also causes a contraction of the frame or shell radially thereof which also it is an object of my invention to prevent or at least materially minimize.

In the carrying out of the method of my invention certain of the laminations are upset,

3

corrugated or crimped at the outer sections thereof as shown at 21 in Figs. 2 and 4. This upsetting of the laminations may be done in any suitable manner, the purpose being to increase the overall width of the laminations in this outer section. Any desired number of laminations may have their effective width in the outer section increased in this manner. The expression "upsetting" a lamination when used in the specification and claims is intended to mean a deformation of the lamination such that when it lies on a plane surface its overall thickness is increased.

In Fig. 2 I have shown four laminations which have been increased in width whereby, upon application of pressure resulting from shrinkage of the frame, these corrugations will be partially or wholly flattened out to allow for shrinkage of the metal frame in the direction of the arrows A in Fig. 2.

Any desired number of laminations may be crimped, corrugated or upset depending upon the shrinkage encountered with the metal employed. In the case of an aluminum shell, the shrinkage may be about three or four hundredths of an inch. The preferred allowance is such that the corrugations are flattened out during the cooling of the metal frame and some pressure is applied on the stack of laminations.

For the purpose of maintaining the inner or slotted section of the core in assembled relation and preventing the bulging thereof, as previously mentioned, I preferably bind adjacent laminations throughout the stack, for example, the laminations 22 and 23 together with a cement 24 prior to casting the frame or shell thereon. For this purpose a very high temperature cement, such as some of the glass cements should preferably be used. Such cements also serve as an insulator between adjacent laminations. The cement may be applied in any suitable manner as by passing the laminations over rollers which carry the cement to the laminations.

For the purpose of allowing for radial contraction of the metal frame or shell, I preferably apply to the core prior to casting, an annular metal cap 26 which has an annular outer periphery 27, inwardly turned side edges 28 and straight annular flange parts 29 which snap over the outer laminations. The cap is applied to the core and is shaped in such manner that a space 31 exists between the cap and the outer periphery surface 16 of the laminations.

Preferably the cap is of a metal or other material which has a somewhat higher melting point than the metal of the cast shell so that the space 31 will be maintained while the metal of the shell is hardening. As the shell casting cools and contracts in a radial direction the cap is deformed or collapsed due to the contraction of the shell in a radial direction so that the completed core assembly appears somewhat as shown in cross-section in Fig. 3.

As previously mentioned, the shell also contracts in the direction indicated by the arrows A in Fig. 2. Such contraction presses the side flanges of the cap against the faces of the outer laminations applying pressure on the flanges of the cap and pressure on the laminations to iron out the laminations 21 which have been upset, as previously described.

In Fig. 1, I have shown a mold suitable for use in carrying out the method of my invention

4

which comprises a mold 32 which is preferably of the permanent type but may be of such material as molding sand and which cooperates with cores 33 and 34 to form, with the stator core itself, a complete mold.

The mold is supported by a flask 36 arranged between top and bottom boards 37 and 38 which may be held together by clamps 39. The top board 37 is provided with an opening 41 communicating with a gate 42 into which the metal is poured in casting the frame or shell 15.

It will thus be apparent that I have provided a method of making a core structure for electrical apparatus in which the laminations of the core are retained in the desired assembled relation by a continuous metal frame or shell, cast about the periphery of the laminations. The method enables the casting of the shell without bulging of the inner peripheries of the laminations with the method at the same time allowing for both radial and axial shrinkage of the cast shell thereby preventing or minimizing the formation of cracks in the shell.

Although I have shown and described the method of my invention as applied to the making of the stator of an electric motor, it is apparent that the method may be applied in the making of cores for other types of electrical apparatus. Moreover, it will be apparent that one or more of the steps may be used separately and that various modifications and changes may be made in the method without departing from the spirit of my invention as set forth in the appended claims.

I claim:

1. The method of making a core for electrical apparatus having a plurality of stacked annular laminations each of which has an inner and an outer edge defining approximately a circle which includes the steps of upsetting at least some of the laminations adjacent the outer of said edges, cementing the laminations together adjacent the inner edges, applying an annular deformable cap having side flanges to the core adjacent the outer edges of the laminations in a manner such that a space exists between the cap and the outer periphery of the core and the side flanges of the cap lie against the outer laminations of the core, said steps being performed prior to a casting step, and casting a metal frame about the cap which extends along the side flanges of the cap and which upon cooling, deforms the cap and contracts to bind the cap and laminations in assembled relation.

2. The method of making a core of the character described wherein a plurality of annular laminations are provided, each having an edge defining approximately a circle and an edge having a series of slots therein which comprises cementing said laminations together at least adjacent their slotted edges, upsetting at least some of said laminations adjacent their circular edges to increase the overall width of the plurality of laminations when they are stacked together, and casting an annular metal frame about the stack which extends across the stack adjacent the circular edges of the laminations and part way along the sides of the two outer laminations of the stack.

3. The method of making a core of the character described wherein a plurality of annular laminations are provided, each having an edge defining approximately a circle and an edge having a series of slots therein which comprises

5

cementing said laminations together at least adjacent their slotted edges, upsetting at least some of said laminations adjacent their circular edges to increase the overall width of the plurality of laminations when they are stacked together, applying an annular cap to said stack which extends across the stack of laminations and is slightly spaced from the circular edges thereof and extends part way along the sides of the two outer laminations of the stack, and casting a metal frame about said cap which upon cooling contracts to deform said cap, substantially close said space and clamp the laminations together.

4. The method of making a core of the character described wherein a plurality of annular laminations are provided, each having an edge defining approximately a circle and an edge having a series of slots which comprises upsetting at least some of said laminations adjacent their circular edges to increase the overall width of the plurality of laminations when they are stacked together, applying an annular cap to said stack which extends across the stack of laminations and is slightly spaced from the circular edges thereof and extends part way along the sides of the two outer laminations of the stack, and casting a metal frame about said cap which upon cooling contracts to deform said cap, substantially close said space and clamp the laminations together.

5. The method of making a core of the character described wherein a plurality of annular laminations are provided, each having an edge defining approximately a circle and an edge having a series of slots therein which comprises cementing said laminations together at least adjacent their slotted edges, upsetting at least some of said laminations adjacent their circular edges to increase the overall width of the plurality of laminations when they are stacked together, applying an annular cap to said stack which extends across the stack of laminations and is slightly spaced from the circular edges thereof and extends part way along the sides of the two outer laminations of the stack, and casting a metal frame about said cap which upon cooling contracts to deform said cap, substantially close said space and clamp the laminations together, the material of said cap being of a higher melting point than the metal of which the frame is cast.

6. The method of making a core for electrical apparatus having a plurality of stacked annular laminations each of which has an inner and an outer edge defining approximately a circle which includes the steps of upsetting at least some of the laminations adjacent one of said edges, cementing the laminations together adjacent the other edges, and then casting a metal frame about the laminations adjacent the edges of the laminations which have been upset with the frame extending part way down the sides of the outer laminations of the stack.

7. The method of making a core for electrical apparatus having a plurality of stacked annular laminations each of which has an inner and an outer edge defining approximately a circle which includes the steps of applying an annular deformable cap having side flanges to the core adjacent the outer edges of the laminations in such manner that a space exists between the cap and the outer periphery of the core and the side flanges lie against the outer laminations of the core, and then subsequent thereto casting a metal

6

frame about the cap which extends along the side flanges of the cap and which upon cooling, deforms the cap and contracts to bind the cap and laminations in assembled relation.

8. The method of making a core of the character described wherein a plurality of annular laminations are provided, each lamination having an edge defining approximately a circle and an edge having a series of slots therein which comprises upsetting at least some of said laminations adjacent their circular edges in such manner as to increase the effective width of the upset laminations thereby to increase the overall width of the plurality of laminations when they are stacked together, and casting an annular metal frame about the stack which extends across the stack adjacent the circular edges of the laminations and part way along the sides of the two outer laminations of the stack the metal upon cooling applying compressive forces on the two outer laminations and tending to flatten out the upset laminations.

9. The method of making a laminated core for electrical apparatus which includes the steps of cementing each individual lamination to its adjacent laminations to thereby produce an assembled stack of laminations which has an outer periphery and is self-supporting with the laminations in proper stacked relation for casting, and then casting a metal frame about the outer periphery of the stack of laminations to bind them together.

10. The method of making a laminated core for electrical apparatus having a plurality of stacked annular laminations each of which has an inner and outer edge defining approximately a circle which includes the steps of upsetting at least some of said laminations adjacent their outer circular edges in such manner as to increase the effective width of the upset laminations thereby to increase the overall width of the plurality of laminations when they are stacked together, cementing each individual lamination to its adjacent laminations to thereby produce an assembled stack of laminations which is self-supporting with the laminations in proper stacked relation for casting, and then casting a metal frame about the laminations adjacent their outer circular edges to bind them together.

11. The method of making a laminated core for electrical apparatus having a plurality of stacked annular laminations, each lamination having an inner and an outer edge defining approximately a circle which includes the steps of cementing each individual lamination to its contiguous lamination adjacent its inner edge to form a rigid stack of laminations, and then casting a metal frame about the outer edges of the stack of laminations which extends only part way down the sides of the outer laminations of the stack and shrinks upon said sides when the metal cools.

MONTFORD MORRISON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

70 Number	Name	Date
1,711,414	Kanaky	Apr. 30, 1931
1,812,748	Kayser	June 30, 1931
2,072,769	Reeder	Mar. 2, 1937
2,083,395	Pfalzgraff	June 8, 1937
75 2,280,981	Schuh	Apr. 28, 1942