

Oct. 6, 1925.

1,555,931

V. G. APPLE

METHOD OF BUILDING ARMATURES

Filed Oct. 11, 1920

4 Sheets-Sheet 1

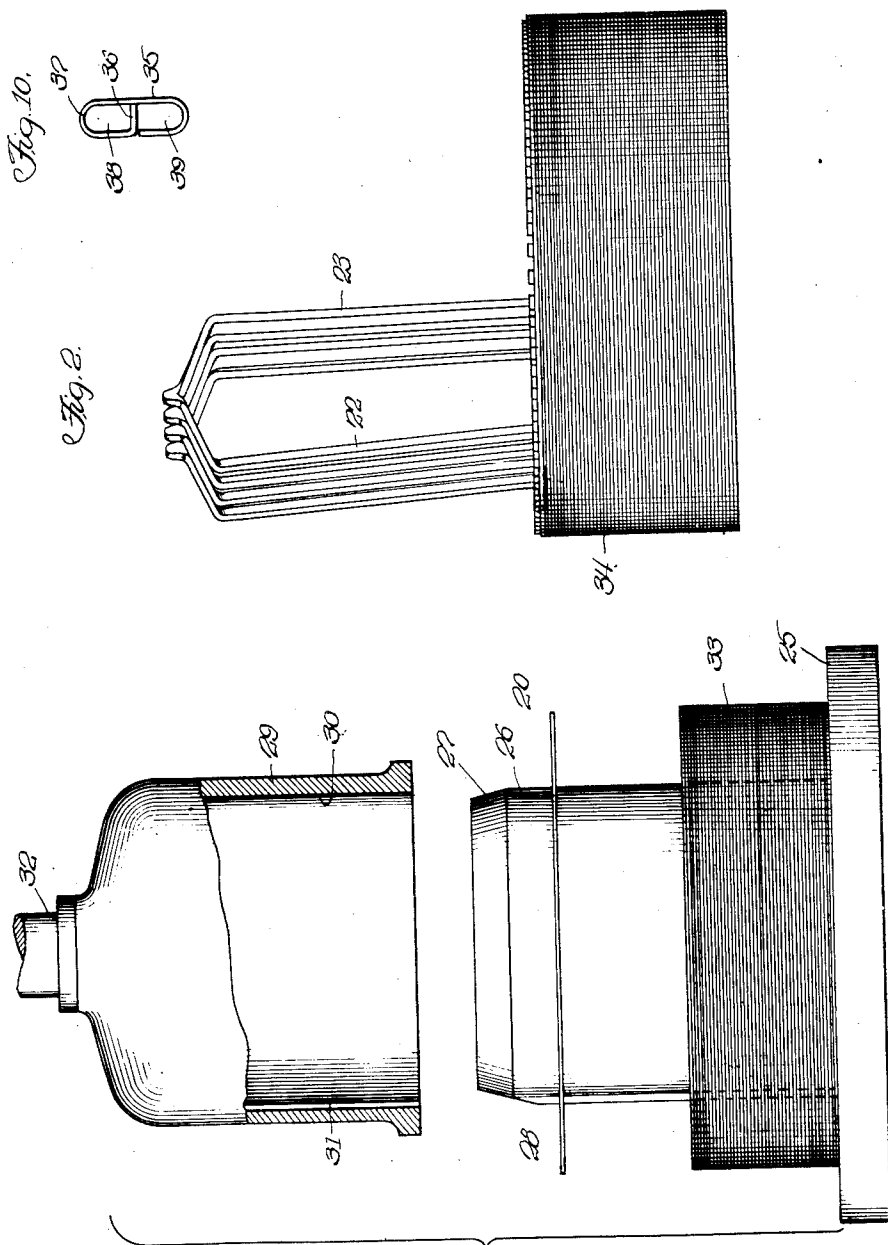


Fig. 1.

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4 Sheets-Sheet 2

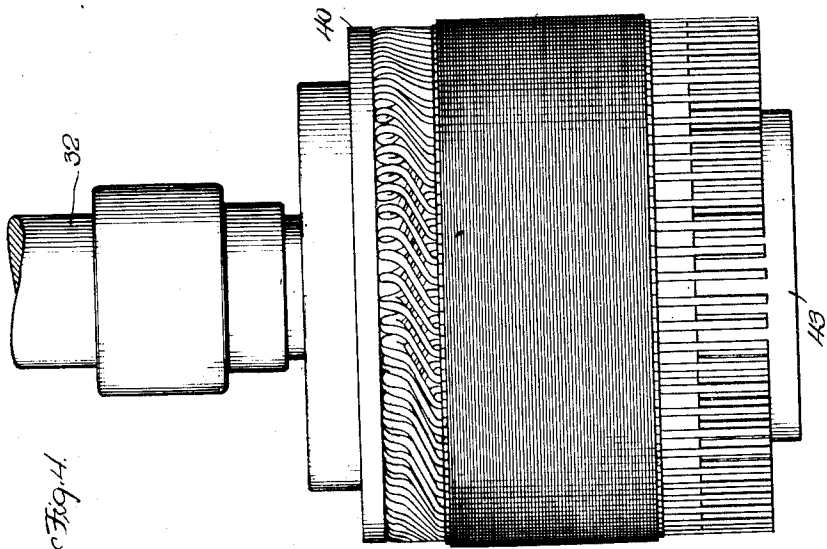


Fig. 4.

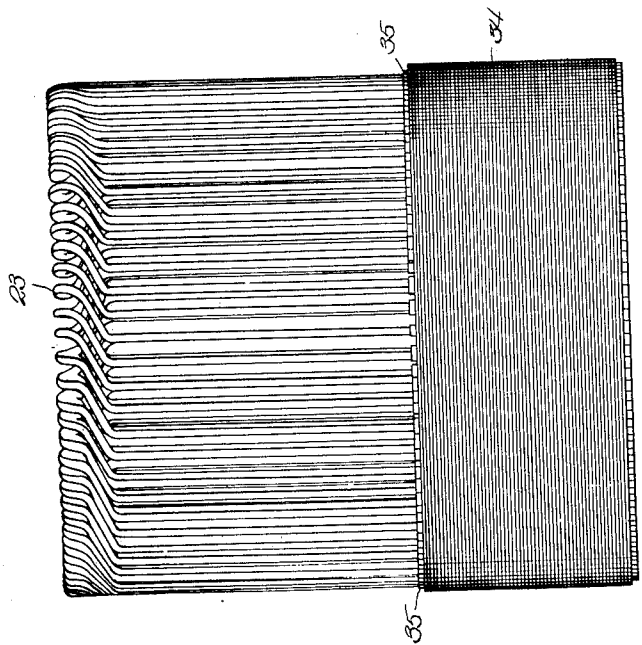


Fig. 3.

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4 Sheets-Sheet 3

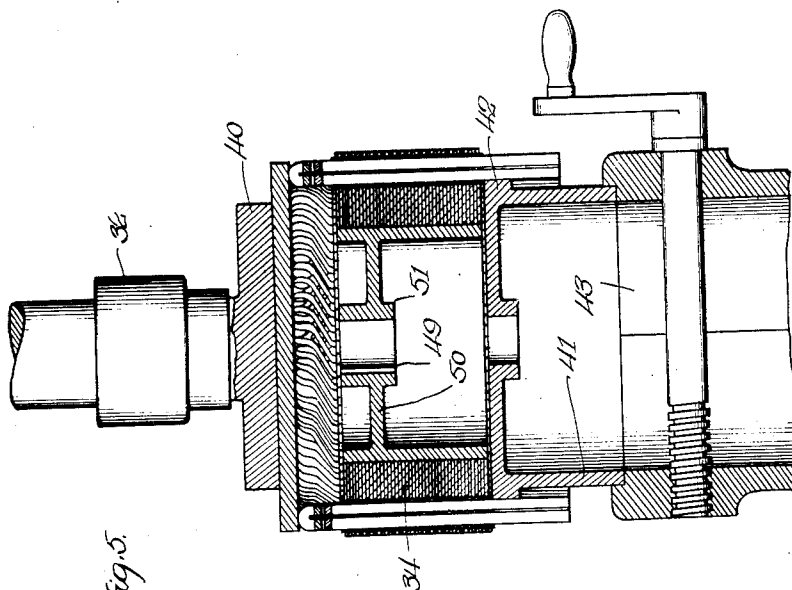


Fig. 5.

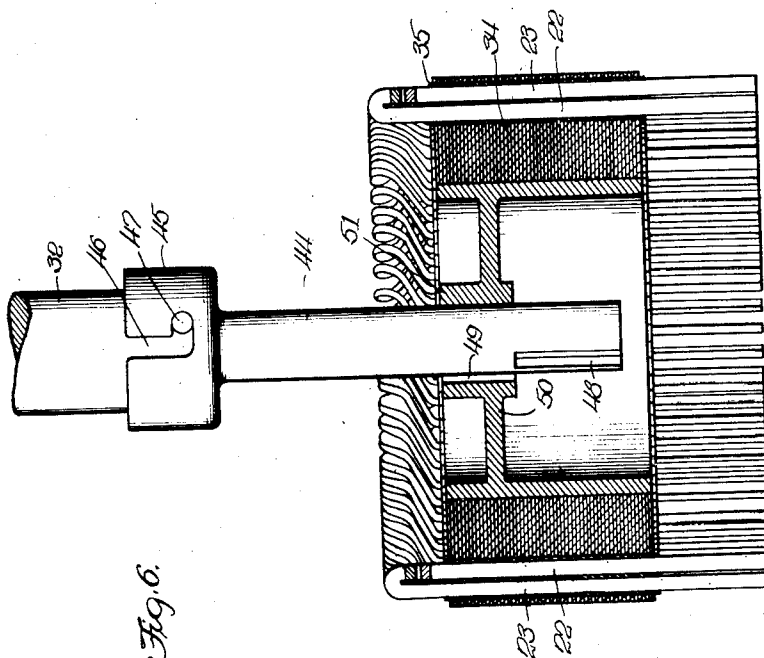


Fig. 6.

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4 Sheets-Sheet 4

Fig. 9.

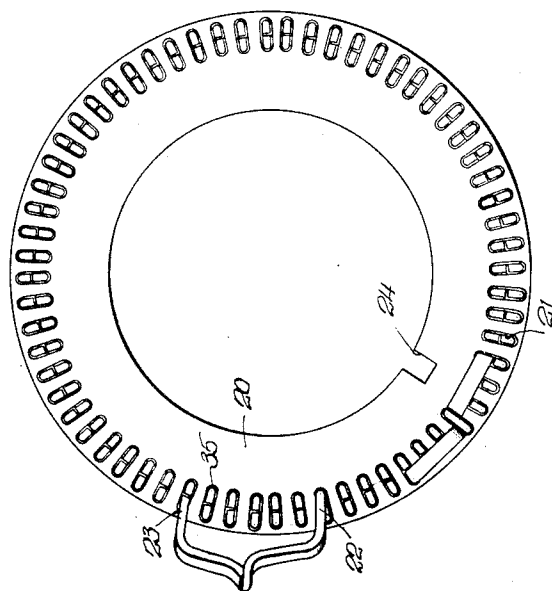


Fig. 8.

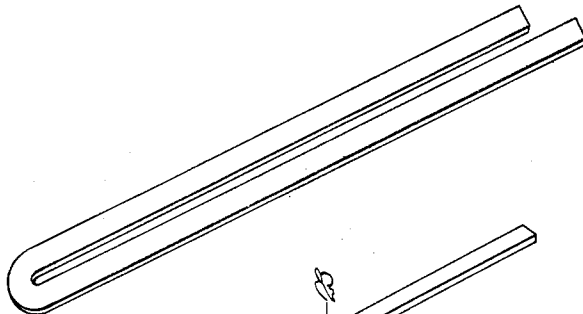
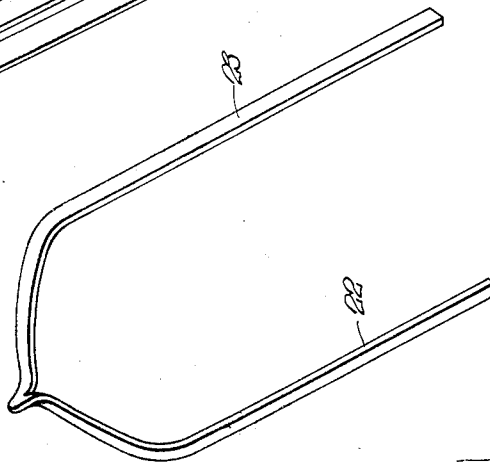


Fig. 7.



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UNITED STATES PATENT OFFICE.

VINCENT G. APPLE, OF DAYTON, OHIO.

METHOD OF BUILDING ARMATURES.

Application filed October 11, 1920. Serial No. 416,307.

REISSUED

To all whom it may concern:

Be it known that I, VINCENT G. APPLE, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Methods of Building Armatures, of which the following is a specification.

The invention relates to improvements in a method of building armatures and has especial reference to armatures of the bar-wound type.

One of the objects of the invention is to provide a new and improved mode of procedure for applying conductor bars on the cores of armatures.

Another object of the invention is the provision of the new method or mode of procedure for building the cores and insulating the conductors therein.

Other, further and more specific objects of the invention will become readily apparent, to persons skilled in the art, from a consideration of the following description, when taken in conjunction with the drawings, wherein:—

Figure 1 shows the manner of assembling the laminæ in making the cores of armatures.

Fig. 2 shows the manner of assembling the bar conductors with their free ends introduced into the proper perforations or openings in or near the periphery of the core, prior to pressing the entire number of assembled conductors into and through the core.

Fig. 3 shows all of the conductor bars assembled and entered in proper perforations of a core, preliminary to their insertion therein.

Fig. 4 shows, in elevation, the conductor bars after they have been pushed through the core with their free ends projecting therefrom.

Fig. 5 shows a section through the armature and the die that registers with the openings therein and the means for pushing the conductors through the core.

Fig. 6 is a similar section showing the means employed for withdrawing the ends

of the conductors from the die, to which they adhere with considerable tenacity.

Fig. 7 shows a hair-pin loop, or unit, the conductor bars or ends of which are to be passed through the core.

Fig. 8 is the straight loop of which the conductor unit shown in Fig. 7 is made.

Fig. 9 shows an end view of a core with a few of the conductor loops with their ends entered in the perforations or openings of the core.

Fig. 10 is an enlarged section of an insulator for lining the slots or perforations.

In all the views the same reference characters are employed to indicate similar parts.

Prior to making the core in which the conductors are to be supported, a series of rings 20 of relatively thin sheet, soft steel or iron, magnetically permeable, having a series of uniformly spaced apart perforations or peripheral openings 21 near its periphery and extending circumferentially of the ring, are made into each ring for the purpose of receiving the conductors 22 and 23 of a unit.

A keyway or notch 24 is made in each of the rings at a uniform point, with respect to the openings 21, so that when the notches 24 register in a pile of laminations of which the core is composed, the openings 21 will correspondingly register with each other.

The surfaces of the rings or the surface of one side thereof, is coated with a liquid adhesive that hardens by applications of heat, such, for example as a varnish composed of phenolic condensation product. The varnish is allowed to dry or to become substantially dry although it may be of a tacky or stick nature when the laminæ are assembled.

A plate 25, constituting the base of a template upon which the laminations or rings are to be assembled, is provided with a cylindrical, vertical extension 26 having, preferably, a tapered end 27 to more readily thread the rings thereupon.

At one point on the surface of the cylinder 26 is a feather, or key 28, that enters the keyways 24 in the rings, as the rings are

placed upon the cylinder 26, for the purpose of bringing the perforations or openings in the periphery of the rings in perfect axial alignment.

5 A hollow member 29 has a bore 30 that fits neatly over the cylinder 26. It is provided with a keyway 31 within which to receive the key or feather 28. The member 29 is secured to a vertically reciprocating member 32 of a press.

10 When a ring 20 is entered on the cylinder 26, as shown in Fig. 1, the press member 29 is brought down forcibly over the cylinder 26 and forces the ring 20 into contact with the stack of rings, at the time resting upon the plate 25, as clearly shown at 33 in Fig. 1.

After a sufficient number of rings 20 have thus been compiled, they constitute the core 20 34, the rings being subsequently compacted by producing sustained pressure thereon for a short period of time, not necessarily exceeding an hour, the effect of which is to cause the laminae to primarily adhere firmly and sufficiently so that the conductors may be inserted within the openings in the core without disturbing their associated relation and without the necessity of first baking the core. When the armature is subsequently 25 baked, the cementitious adhesive with which the rings are coated will cause more tenacious adherence of the contacting rings with each other, thus producing a self-sustaining core in which the laminae are firmly held together without the conductors or other means necessarily participating in any way to this end.

30 The openings in the periphery of the rings, and consequently in the finished core, may be made in form of perforations, as shown in Fig. 9, or they may be slots made into the periphery and open at the circumferential surface of the core.

35 Into each of the perforations or slots is threaded an insulator 35 composed, preferably, of paper such as that known in the art as fish paper, as more clearly shown in Fig. 10. The paper is rolled into a form substantially conforming with the shape of the openings or slots in the armature and has a division wall 36 serving as a separator between the two conductors that are to be inserted in each of the slots or openings. The form of insulation is, preferably, not 45 changed from that shown in Fig. 10, whether the slots are closed or open. In the latter case the part 37 serves to hold the outer bar tenaciously in the slot, said bar furthermore being held by the effect of the varnish which has a cementing quality, as will hereinafter be more fully disclosed.

50 The paper insulating linings 35 are first placed in all of the slots before the conducting bars 22 and 23 are placed within the

separated openings in each slot provided by the insulator. 65

By observing Fig. 9, it will be seen that the outside conducting bar 23 is always placed in the outside opening in the insulator, while the inside conducting bar 22 is always placed in the inside insulator opening of a spaced apart slot or perforation. 70

The conducting bars, or loop conductors, are thus arranged symmetrically around the entire armature. To facilitate entering the ends of the conducting bars in the openings 38 and 39 in the insulator, the bars are leaned outwardly from the armature axis with their upper ends further from the vertical axis of the core, as more clearly shown in Fig. 2 and Fig. 9. Before any of the conductors are passed entirely through the core, each and every one of the conductors must be so placed in its proper position with its end entering the openings 38 and 39 as heretofore explained. After the conductors have each been entered, the upper end is then pressed inwardly until they are substantially in line with the openings of the core. The entire number of conductors are pressed through the openings in the core until the ends project therebeyond, as more clearly shown in Figs. 5 and 6, wherein the plate 40 is shown placed over the top of the ends, when they are in the positions shown in Fig. 3 and pressure is applied, whereupon they are moved into the positions shown in Fig. 5, with their ends projecting therebeyond in a condition to be bent into pairs to be joined to the respective bars of a commutator. 75 80 85 90 95 100

To facilitate this operation and to prevent the insulators 35 from being pushed out of the openings or slots in the core by insertion of the conductors, I provide a die 105 41 having a flange 42 containing openings that neatly correspond with the openings of the core and that register therewith. In pressing these conductors thru the core, the ends must pass thru the openings in the die and the die serves to hold the insulators and prevent them from leaving the core openings with the conductors.

A clamp 43 holds the die in place so that it can not be removed during this operation. After the conductors have been placed in positions shown in Fig. 5, the press member 32 is raised, and the plate 40 is removed, whereupon a mandrel 44, having an enlarged end or hollow head 45 is fitted on the press member 32 by means of a bayonet joint consisting of a slot 46 and pin 47. The lower end of the mandrel is provided with a fixed feather or projection 48 corresponding in size with the feather to be placed in the spline 49 of the spider 50. The mandrel is passed thru the axial bore of the hub 51 of the spider and rotated until the feather is 115 120 125

out of alignment with the spline 49, whereupon the member 32 is raised and the die 41 being held by the clamp 43, the conducting bars are pulled thru the die, the mandrel 44 serving this purpose by engagement with the spider 50.

After the armature conductors have thus been placed in the cores, or on the cores, the conductors and the insulation surrounding them are subjected to a coating of the varnish of the nature of a phenolic condensation product, which hardens upon application of heat, and thereafter the armature structure is baked or subjected to the effect of dry heat for the purpose of further hardening the varnish around the conductors and between the laminæ of the core. By this means the laminæ in the structure are more firmly held together and the conductors are securely cemented in the perforations of the core, which they occupy. If the armature structure is provided with slots instead of openings near its periphery, the overlying portion 37 of the insulator 35, taken in connection with the adhesive qualities of the

varnish, will thoroughly and completely hold the conducting bars in the respective slots and sufficiently resist any centrifugal action to which the armature may be subjected.

Having described my invention what I claim as new and desire to secure by Letters Patent is:—

Steps in the method of making a dynamo electric machine element which consist in providing a core having a series of longitudinally extending openings to receive conductor bars; providing a plurality of conductor loops, each loop having two conductor bars; entering the ends of the loops in the openings; leaning the closed ends outwardly from the axis of the core, as they are entered; moving the closed ends inwardly until the bars of the loops are in line with the openings in the core; then simultaneously pushing all of the conductor bars thru the core.

In testimony whereof I hereunto subscribed my name.

VINCENT G. APPLE.