Feb. 17, 1959 S. D. MILLS 2,873,514

CAM-ACTUATED COIL INSERTER

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FIG. 1.

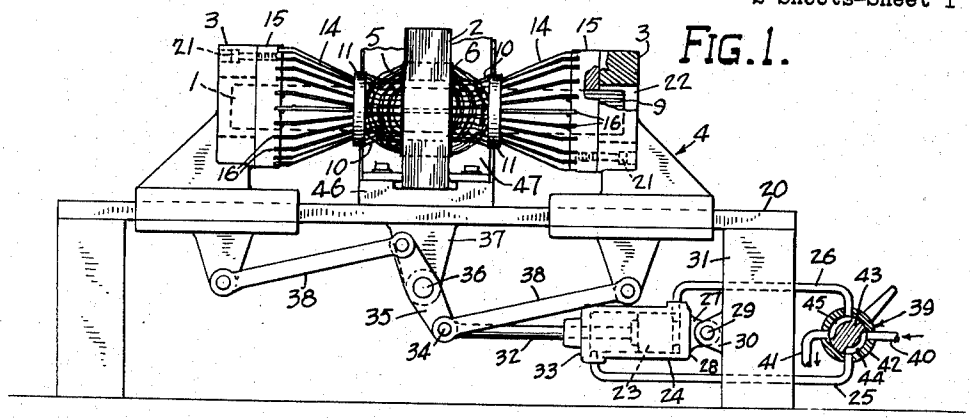


FIG. 2.

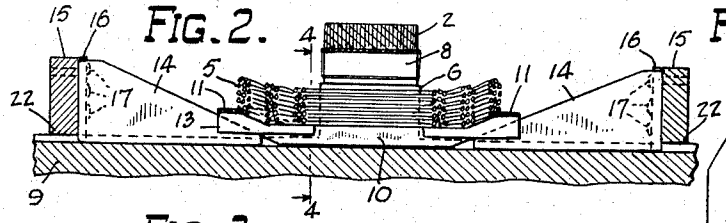


FIG. 3.

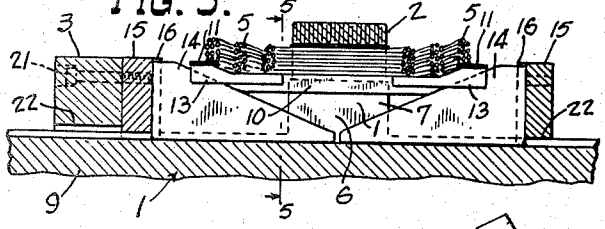


FIG. 4.

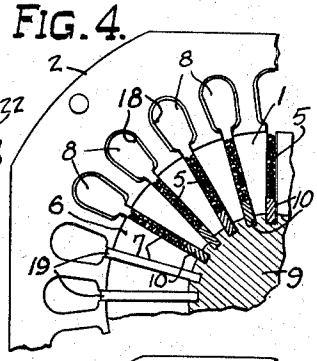


FIG. 5.

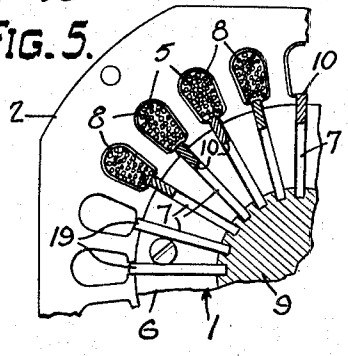


FIG. 6.

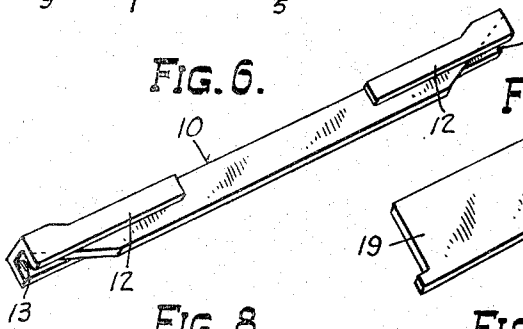


FIG. 7.

FIG. 8.

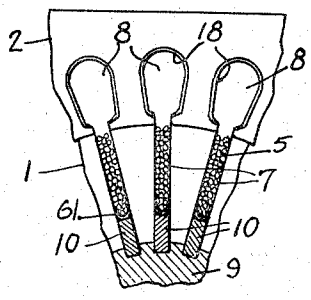


FIG. 9.

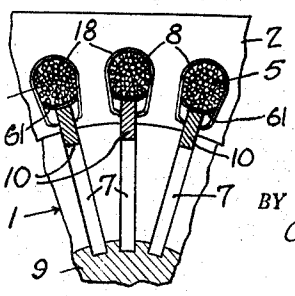
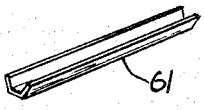


FIG. 10



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FIG. 11.

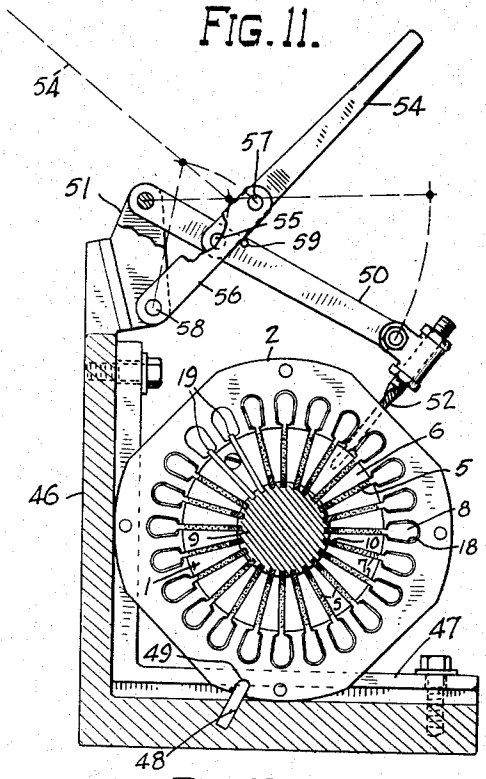


FIG. 12.

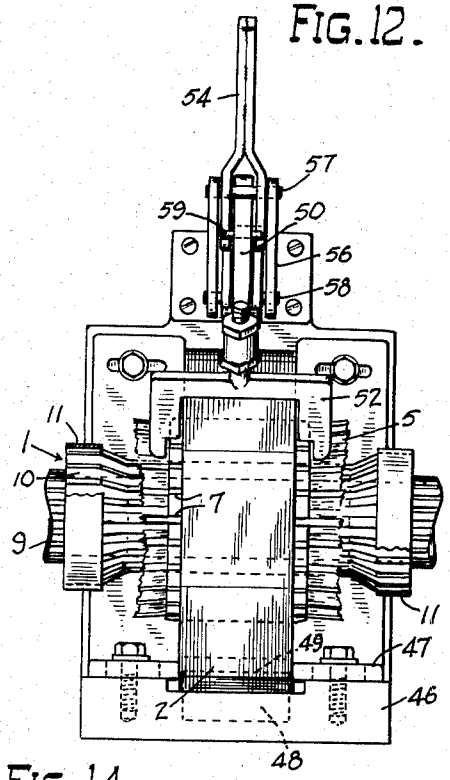


FIG. 13.

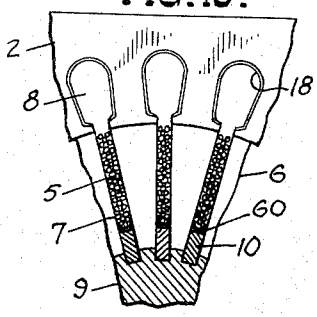


FIG. 14.

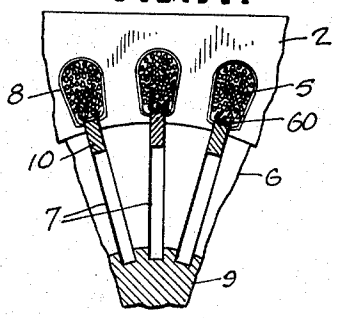


FIG. 15.

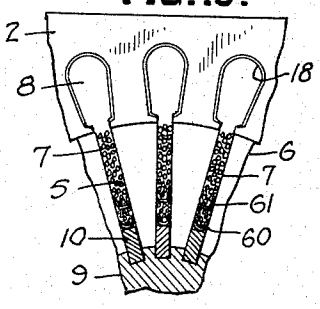
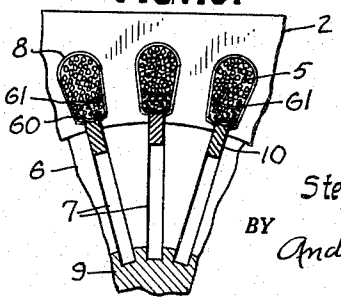


FIG. 16.



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CAM-ACTUATED COIL INSERTER

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Application December 31, 1954, Serial No. 479,197

4 Claims. (Cl. 29—205)

This invention relates to a coil inserter for embedding a winding in the annular core member of a dynamoelectric machine.

The conventional dynamoelectric machine comprises an annular core member with a winding disposed in a series of slots spaced about the inner circumference and a cylindrical core member having a winding disposed in a series of slots spaced about its peripheral surface. The mechanical embedding of the winding within the slots of the cylindrical core member is old and well-known in the art. In contrast, the embedding of the winding within the slots of the annular core member under the usual practice is accomplished manually. Under such practice the coils forming the winding are prewound and then manually inserted within the slots of the annular core member. The manual embedding of the coils prevents any substantial degree of uniformity and is extremely time-consuming with a resulting increase in the cost of the dynamoelectric machine.

In accordance with the present invention, the coils to be inserted in the core member are initially disposed in a slotted bobbin and then forced from the bobbin into the slots of an annular core member assembled around the bobbin by a plurality of circumferentially spaced members which are adapted to actuate blade means radially outwardly, which blade means are disposed in the slots of the bobbin beneath the windings. The bobbin is provided with a shaft having, in alignment with the slots in the central portion of the bobbin, a plurality of grooves which guide the blade actuating means.

The drawings furnished herewith illustrate the best mode presently contemplated for carrying out the invention.

In the drawings:

Figure 1 is a view in elevation of the coil inserter;

Fig. 2 is an enlarged longitudinal sectional view of the upper portion of the mechanisms shown in Figure 1 showing the coil windings within the false rotor slots;

Fig. 3 is a view similar to Fig. 2 but showing the windings transferred to the stator core;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 2;

Fig. 5 is a sectional view taken on line 5—5 of Fig. 3;

Fig. 6 is an enlarged perspective view of a coil moving blade employed in the coil inserter;

Fig. 7 is an enlarged perspective view of a locating key;

Fig. 8 is a fragmentary view similar to Fig. 4 showing a phase insulator interposed between the transfer blade and the coil;

Fig. 9 is a view similar to Fig. 8 but showing the coil and phase insulator transferred to the stator core;

Fig. 10 is a perspective view of the phase insulator;

Fig. 11 is a side elevational view of the clamping bracket for holding the stator core and bobbin, parts being shown in section;

Fig. 12 is a front elevational view of the clamping bracket;

Fig. 13 is a fragmentary detailed section illustrating a slot peg and windings located in the bobbin slots;

Fig. 14 is a view similar to Fig. 13 illustrating transfer of the slot peg and windings to the stator slots;

Fig. 15 is a view similar to Fig. 13 illustrating slot pegs, starting and running windings and slot separators loaded in the bobbin; and

Fig. 16 is a view similar to Fig. 13 illustrating transfer of the windings and pegs and separators of Fig. 15 into the stator slots.

Referring to the drawings and particularly to Figures 1, 2 and 3 there is shown a slotted bobbin or cylindrical winding support **1** inserted within a stator core **2** of a generally octagonal shape. The bobbin **1** is secured between a pair of heads **3** of a press unit **4**. A winding **5** which may be manually or mechanically wound on the bobbin **1** is forced from the bobbin **1** into the conventional stator slots of core **2** by movement of the heads **3**, as more fully described hereinafter.

The bobbin **1** comprises a core or central portion **6** having a plurality of circumferentially spaced slots **7** which are of sufficient depth to accommodate a portion of a coil of winding **5** to be inserted into slots **8** in stator core **2**. The core **6** is constructed integrally with a longitudinally grooved shaft **9** and the core slots **7** in core **6** are aligned with the grooves in shaft **9**.

A radially movable blade **10** is disposed within each of core slots **7** and as shown in Fig. 2 the blades are biased inwardly by the elastic tubes **11** located at the ends of the blades **10** on either side of core **6**. An enlarged view of a blade **10** is shown in Fig. 6. Each blade **10** is centrally reduced in cross section for a length equal to the length of the core **6**. To effect a longitudinal centering of each blade within a corresponding slot **7** longitudinally extending shoulders **12** are provided on each end of the blades **10** and engage the opposite sides of core **6** so that the blades are prevented against axial movement by core **6**. The outer ends of shoulders **12** are provided with a notch **13** to receive the tapered cams **14** for effecting radial movement of blade **10**.

The tapered cams **14** are of a thickness equal to the grooves in the shaft **9** and the slots **7** of core **6** and are slidably mounted therein. The cams are disposed to both sides of the core **6** with the tapered edges converging inwardly toward the core such that when moved toward each other the cams engage the notches **13** in the opposite ends of blades **10** and force the blades radially outwardly, as shown in Fig. 3 of the drawing. The cams **14** are welded or otherwise secured in position to a support to effect simultaneous movement thereof. In the construction illustrated in the drawings there is shown supports **15** of generally disc shape and having a central aperture through which the grooved shaft **9** extends. A plurality of circumferentially spaced grooves **16** are provided in supports **15** to accommodate the cams **14** which are welded to supports **15** as by spot welds **17**.

When the stator core **2** is disposed around the core **6** of the bobbin **1**, the radial movement of the blades **10** by cams **14** forces the winding **5** from the bobbin **1** and into the aligned slots **8** in the stator core **2**. Prior to the placement of the stator core **2** about bobbin **1** suitable electrical insulating material **18** is inserted in each stator slot **8** to insulate the winding **5** from the stator core **2** in the usual manner. After the insertion of the coils into the slots **8** of the stator, each slot may be closed in the conventional manner with a slot peg, not shown, which holds the coil within the slot or the slot may be closed as will be described with respect to Figs. 8 and 9 hereinafter.

To insure alignment between the slots **7** in bobbin **1** and the slots **8** in the stator core **2**, alignment keys **19** are forced within two adjacent slots on diametrically opposite portions of the periphery of bobbin **1**. A perspective view of an alignment key **19** is shown in Fig. 7

of the drawings. The key is force fitted into bobbin 1 to maintain the key in place. The keys 19 extend radially beyond the periphery of the core 6 and upon assembly of bobbin 1 and the stator core 2 the keys protrude radially within adjacent slots 8 in the stator core and axially of core 6 to facilitate alignment of the bobbin slots and the stator core slots, as shown in Figs. 4 and 5.

The described key alignment method is satisfactory where a number of slots on the stator core do not carry any windings. In the event all slots are to carry windings other suitable aligning means may be employed.

The press unit 4 employed to axially move the cams 14 comprises a pair of spaced heads 3 which are slidably mounted on a bed 20. The cam supports 15 are each attached to associated head 3 by a plurality of circumferentially spaced bolts 21 which extend through the heads 3 and are threaded into dics-shaped support 15.

To support the bobbin 1 between the two heads 3, each head and associated support is apertured as at 22 to receive the shaft 9 and provide a bearing for the grooved shaft 9 in supports 15.

The press heads and cams are moved in an axial direction by means of a piston 23 which operates within the hydraulic cylinder 24. Fluid pressure lines 25 and 26 communicate with the opposed surfaces of piston 23 within the cylinder. To pivotally mount the cylinder 24 to a stationary member of the machine, a lug 27 is formed integrally with the head 28 of the cylinder, shown to the right in Figure 1 of the drawing, and is bolted by bolt 29 to a lug 30 formed integrally with a support 31 for the bed 20.

A piston rod 32 extends from the piston 23 through the cylinder head 33 and is attached by bolt 34 to the lower end of a bell crank 35.

The bell crank 35 is centrally pivoted at 36 to a bracket 37, depending from bed 20, and a link 38 connects each end of the crank to its respective press head 3. The travel of the piston 23 is transmitted through the bell crank 35 and links 38 to simultaneously move the two heads 3 toward or away from each other.

Movement of the piston 23 is regulated by a valve 39 which interconnects the lines 25 and 26 to an incoming pressure fluid line 40 and a return fluid line 41. The valve 39 comprises a cylindrical casing 42 having the pressure line 40 and return line 41 communicating therewith at diametrically opposite points of the casing periphery and having the lines 25 and 26 communicating therewith at diametrically opposite points of the casing periphery, removed one-quarter of the casing circumference from the lines 40 and 41. A drum gate 43 is rotatably secured within the casing 42 and provided with diametrically opposite 90° arcuate recesses 44 and 45, respectively. Therefore, with the drum gate 43 in the position illustrated in Figure 1, the incoming fluid line 40 is connected with the fluid line 25 and the return fluid line 41 is connected to the fluid line 26 with a resultant rightwise movement of the piston 23 and piston rod 32. The bell crank 35 is thus rotated counter-clockwise, as shown in Figure 1, and through links 38 forces the press heads 3 and consequently the cams 14 to open or retracted position. Rotating the drum gate 43 90° connects the pressure line 40 to the fluid line 26 and the return fluid line 41 to the fluid line 25 with a resultant leftwise movement of the piston 23 and piston rod 32 to force the press heads 3 and the cams 14 toward each other.

In order to center the bobbin 1 and core 2 and hold the same securely within the press unit 4 during movement or transfer of windings 5 from the bobbin to the stator core, the generally L-shaped support 46 is secured to the bed of press 4 midway between heads 3. Spaced alignment brackets 47 also of L-shape are suitably secured to support 46 on either side thereof so that when the core 2 and bobbin 1 are in place in the press the bottom and rear portions of the core 2 nest between brackets 47 on the support 46. The support 46 may be undercut at the bottom surface. The brackets are provided with slotted bolt holes to accommodate different size stators.

To insure that the cams 14 are always aligned with blades 10 when the core and bobbin are disposed in the press a locating key 48 projects upwardly from the bottom surface of support 46 and mates with an axial groove 49 provided in the peripheral surface of core 2.

It is also necessary to prevent rotation of the assembled core and bobbin and to provide additional means that cooperates with brackets 47 to hold the core and bobbin against axial movement.

This holding means comprises a bracket such as that shown in Figs. 11 and 12 which has a lever arm 50, the inner end of which is pivoted to a channeled plate 51 secured to the upper end of support 46 and the outer end of which carries the clamp 52. Clamp 52 is shaped to receive the stator core 2 and its outer end portions extend along the sides of the bobbin 1. The clamp 52 when in place rests against one of the flat sides of the outer surface of stator core 2. The clamp 52 is adjustably supported in the outer end of arm 50 to accommodate different size stators.

The clamping bracket is manipulated to engage or disengage the core and bobbin by a handle 54 which has spaced legs which straddle lever arm 50 and are pivoted thereto by a pin 55 passing through aligned openings in the handle and lever. Handle 54 is also linked to channeled plate 51 by a link 56 which is pivoted to handle 54 as at 57 and pivoted to the lower portion of plate 51 as at 58. A stop pin 59 extending through the lever arm 50 limits the downward movement of handle 54 to the point where handle 54 and link 56 are aligned and the handle is in its dead-center position. This locks lever arm 50 in clamping position. The lever arm 50 is released and raised by the operator moving handle 54 rearwardly.

The operation of the invention is described as follows:

The alignment keys 19 and blades 10 are first inserted within the appropriate slots in the bobbin 1. The winding 5 is then wound on the bobbin, either manually or mechanically. Thereafter the stator core 2 having the slot insulators 18 previously inserted is forced about bobbin 1 with the locating keys 19 passing into adjacent stator core slots 8 to radially align the slots 7 in the bobbin 1 and the slots in the stator core 2.

The bobbin 1 is next placed on the press bed between the two press heads 3 of the press unit 4 with the grooved shaft 9 meshing with the cams 14 and bearing on supports 15 in the recesses 22. The key 48 engages groove 49 in core 2 and brackets 47 are adjusted against the side of the core 2 and bolted in place. Lever arm 50 is lowered over the core and bobbin by pulling on handle 54. This moves clamp 52 in engagement with the core and bobbin.

The drum gate 43 is then turned from the position shown in Figure 1 to register port 40 with line 26 and port 41 with line 25 and as previously described the press heads 3 and associated cams 14 move toward the core.

As the heads 3 move toward each other, the cams 14 each engage a notch 13 of the blades 10 and the blades ride up the tapered face of each cam 14 forcing the winding 5 from the slots 7 of the bobbin 1 and into the slots 8 of the stator core 2.

Thereafter, the press heads 3 are retracted by rotating the drum gate 43 through 90° and thereby connecting the pressure line 40 to the fluid line 25 and connecting the fluid return line 41 to the fluid line 26, as previously described. The clamp 52 is then lifted by handle 54 to release the stator core 2.

The bobbin 1 is then removed from the stator core and the latter now carries the winding 5.

It is also contemplated under the invention that the slot peg be inserted into the stator core simultaneously

with the winding. Fig. 13 illustrates this construction. The slot pegs 60 are inserted either manually or mechanically into the slots of bobbin 1 and rest against blades 10 which have previously been disposed in the bobbin. Thereafter the bobbin is provided with the winding coils 5 which rest against slot pegs 60. As illustrated in Fig. 14 as the blades 10 are forced radially outwardly as previously described the slot pegs 60 and windings 5 are forced into stator slots 8. Under this practice it would not be necessary to separately insert the slot pegs into the stator slots.

If a starting winding as well as a running winding is to be wound on the stator core 2 as when winding a split phase induction motor stator core, an insulator is required between the two windings. To automatically insert an insulating material between the two windings, a generally U-shaped slot separator 61 is inserted either manually or mechanically into the slots of the bobbin, as shown in Fig. 8, and rests on the blades 10 prior to the insertion into the bobbin slots 7 of the first winding which is to be transferred into stator core slots 8. As the blades 10 are forced radially outwardly by the cams 14 and into the stator slots, as previously described, the slot separators 61 are forced into the slots, as shown in Fig. 9 and provide the desired insulation as to subsequently inserted windings. Then the second windings and slot pegs can be separately or simultaneously inserted into the stator slots by the inserter. In larger motors when space permits both windings and the separators and slot pegs may be inserted simultaneously in one operation. This is illustrated in Figs. 15 and 16. The invention is also applicable to three-phase windings.

The present invention provides a low cost fixture for the automatic winding of annular core members of a dynamo-electric machine and the like.

Various modes of carrying out the invention are contemplated as within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In a fixture for mechanically inserting prewound windings into slots extending in the inner periphery of an annular core, a bobbin having longitudinal circumferentially spaced radial slots extending inwardly therein from the outer periphery of the bobbin and disposed complementary to the slots of the annular core to receive the prewound windings, a radially movable blade disposed in each slot beneath said windings, two sets of a plurality of circumferentially spaced separate actuating means disposed at axially opposite ends of the blades and engaging opposite ends of each blade, means to simultaneously actuate said actuating means to move said blades radially outwardly and thereby transfer the windings from the slots in the bobbin to the slots in the annular core, a support for said core and bobbin, and clamping means extending over the assembled core and bobbin into engagement with the core to rigidly clamp the core to the core and bobbin support and prevent shifting of the core and bobbin during transfer of the windings from the bobbin to the core.

2. A fixture for mechanically inserting prewound windings into slots extending in the inner periphery of an annular core, comprising a bobbin having longitudinal circumferentially spaced radial slots extending inwardly therein from the outer periphery of the bobbin and disposed complementary to the slots of the annular core to receive the prewound windings, a radially movable blade disposed in each slot beneath said windings, means biasing said blades radially inwardly, a plurality of circumferentially spaced separate actuating means adapted to engage each blades, means to simultaneously actuate said actuating means to move the actuating means into engagement with the blades to move said blades radially outwardly against the force of said biasing means and thereby transfer the windings from the slots in the bobbin to the slots in the annular core, a support for said core and bobbin with means thereon to prevent axial movement of the lower portion of the core and bobbin, and a clamp overlying the core and extending downwardly of the sides of the core to the bobbin to rigidly clamp the core to the support and prevent shifting of the core and bobbin either radially or axially during the transfer of the windings from the bobbin to the core.

3. In a fixture for mechanically inserting prewound windings into slots in the inner periphery of an annular core, a bobbin having longitudinal circumferentially spaced radial slots extending inwardly from its outer periphery and disposed complementary to the slots of the annular core to receive the prewound windings, a shaft formed integrally with the bobbin and extending from each end of the bobbin and having a series of longitudinal circumferentially spaced grooves aligned with the radial slots in the bobbin, a radially movable blade in each slot adapted to force the windings from the slots in the bobbin into the complementary slots in the annular core, means biasing said blades radially inwardly, a plurality of circumferentially spaced tapered cams disposed axially on opposite ends of the bobbin with each cam being disposed within a groove in the shaft to axially align each cam with a movable blade, means to simultaneously actuate said cams axially into lifting engagement with said blades to move the blades radially outwardly and thereby transfer the windings from the slots in the bobbin to the slots in the annular core, and means to prevent movement of the core and bobbin during the transfer operation.

4. In a fixture for mechanically inserting prewound windings into slots in the inner periphery of an annular core, a bobbin having longitudinal circumferentially spaced radial slots extending inwardly from its outer periphery and disposed complementary to the slots of the annular core to receive the prewound windings, a shaft extending from each end of the bobbin and formed integrally with the bobbin, said shaft having a series of circumferentially spaced longitiudinal grooves aligned with the radial slots, a blade disposed in each slot in the bobbin and adapted to force the winding from said slots into the complementary slots in the core, each of said blades having an enlarged end shoulder to center the blade on the bobbin and having a guide notch in the underside of each shoulder, a plurality of circumferentially spaced tapered cams disposed at opposite ends of the bobbin with each cam being slidably disposed within one of the grooves in the corresponding shaft, means to simultaneously actuate the cams longitudinally of the shafts into the notches in the blades and into lifting engagement with the blades to move the blades radially outwardly and thereby transfer the windings from the slots in the bobbin to the slots in the annular core, and means on the fixture adapted to engage the core and prevent movement of the core and bobbin during the transfer operation.

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