Feb. 26, 1929. 1,703,188

G. W. ELSEY

MACHINE FOR BENDING ARMATURE CONDUCTORS

Filed Dec. 22, 1925 2 Sheets-Sheet 1

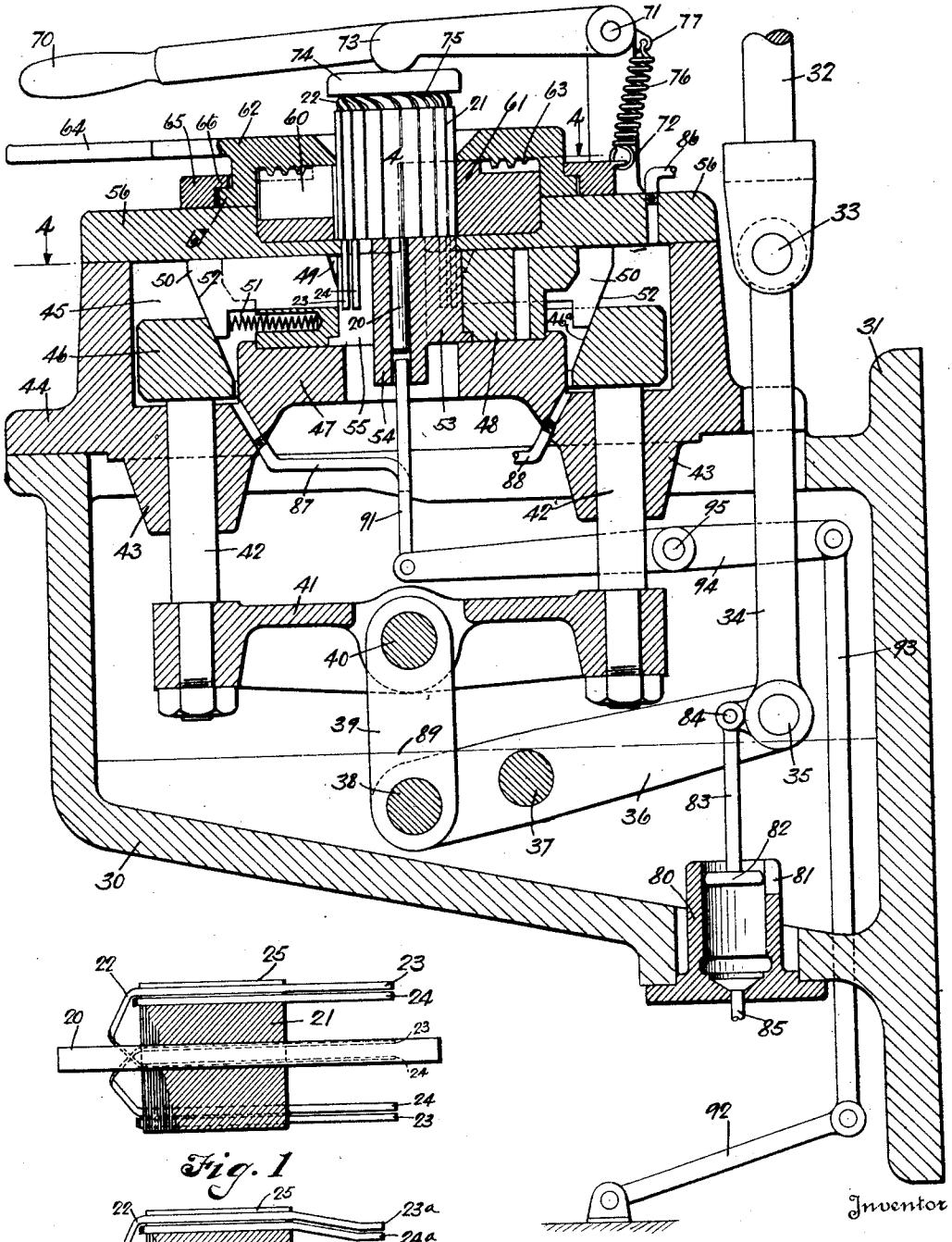


Fig. 1

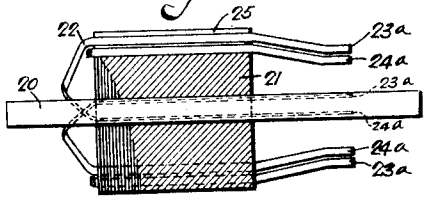


Fig. 2.

Inventor

Fig. 3. George W. Elsey

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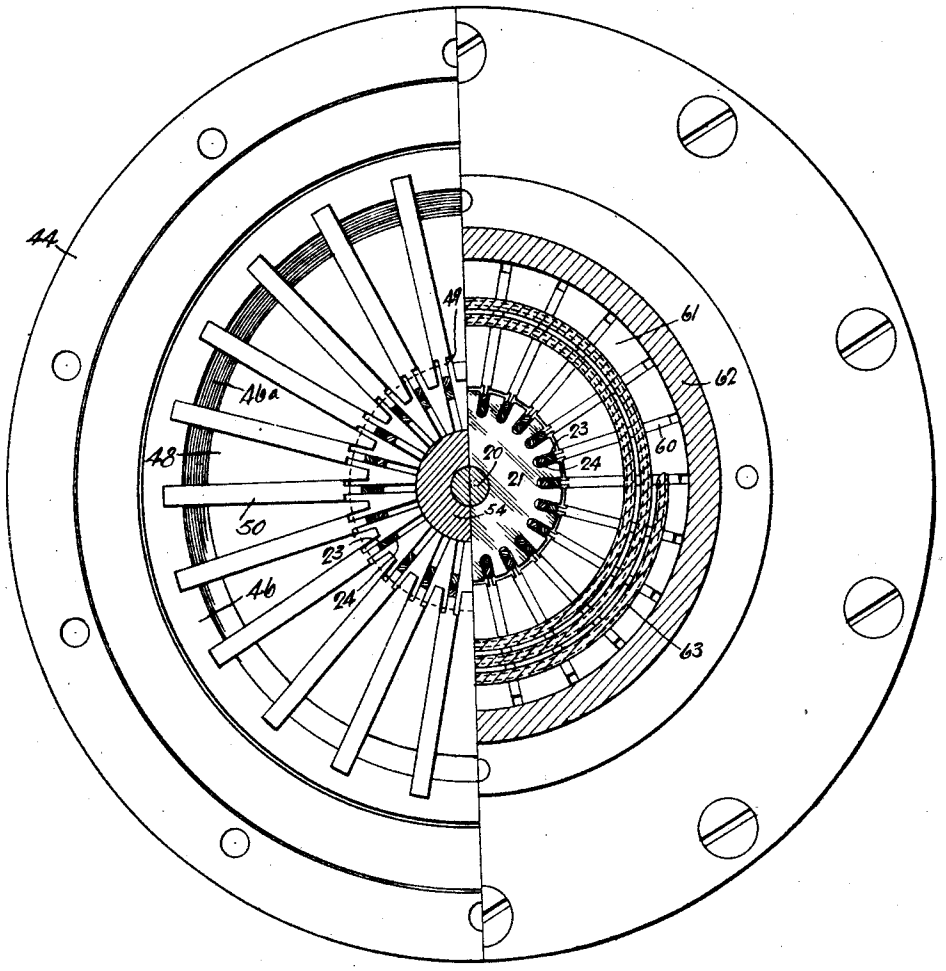


Fig. 4.

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UNITED STATES PATENT OFFICE.

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MACHINE FOR BENDING ARMATURE CONDUCTORS.

Application filed December 22, 1925. Serial No. 76,973.

This invention relates to the manufacture of armatures for dynamo electric machines and particularly to armatures having bar windings such as are used in motors for starting internal combustion engines.

In the manufacture of bar wound armatures, it has been the practice to use bar windings which are known as hair pin or single loop conductors having spaced parallel branches allowing the hair pin to be moved endwise through certain spaced slots of the armature core. When all of the hair pins have thus been assembled on the core, each core slot will contain portions of at least two hair pin conductors. The end of the conductor will extend from the core slot in a direction parallel to the axis of the core and toward that end of the armature shaft upon which the commutator is mounted. These ends are twisted or bent from the plane of the core slot from which the ends extend in order to bring these ends into alignment with the risers of the commutator bars to which these ends are to be united. In case the commutator risers do not extend radially from the shaft a distance equal to or slightly less than the radius of the armature core, the hair pin bar ends must be bent in toward the shaft as well as twisted relative to the shaft in order that the ends will be in alignment with the commutator risers.

One of the objects of the present invention is to bend all of the hair pin ends inwardly toward the armature shaft simultaneously and before the twisting operation is performed. The invention embodies a machine for receiving an assembly of armature shaft and bar windings and having mechanism for simultaneously bending the bar ends which emerge from each core slot toward the armature shaft.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a view partly in section of an assemblage of an armature core, armature shaft and bar windings before the windings have been bent in accordance with the present invention.

Fig. 2 is a view similar to Fig. 1 showing the bar ends bent toward the armature shaft.

Fig. 3 is a vertical sectional view showing a machine embodying the present invention.

Fig. 4 is a sectional view taken on the line 4—4—4 of Fig. 3.

The assemblage shown in Fig. 1 comprises an armature shaft 20 and laminated core 21 and a plurality of hair pin conductors 22 each having a branch 23 and a branch 24. Each core slot 25 receives the branch 23 of a certain hair pin conductor 22 and the branch 24 of a certain other hair pin conductor. The branch 24 is in radial alignment with branch 23 but is located near the bottom of the core slot or nearer the armature shaft. The machine to be described moves the ends of the bars 23 and 24 into the positions 23^a and 24^a respectively as shown in Fig. 2.

The machine for receiving the assemblage shown in Fig. 1 and performing the operation indicated by Fig. 2 comprises a frame 30 including a mounting pad 31 which is adapted to be secured to the vertical pedestal of a punch press, which is not shown, but which, as known to those skilled in the art, includes a vertical movable cross-head to which a punch may be attached. To adapt such a punch press for operating the mechanism of the present invention the cross-head of the press is connected with a rod 32 which is pivotally connected by pin 33 with a link 34 connected by pin 35 with a lever 36 which is pivoted upon a rod 37 supported by opposite walls of the frame 30. The lever 36 is connected by pin 38, link 39 and pin 40 with a plate 41 carrying two or more parallel rods 42. The rods 42 are slidable through guides 43 provided by a cover plate 44 which is secured to the frame 30 in any suitable manner. The cover 44 provides a chamber 45 for receiving a camming ring 46 having an internal conical camming surface 46^a. The ring 46 is attached to the rods 42 and consequently is moved upwardly when the rod 32 is moved downwardly and vice versa.

The cover 44 provides a central aperture and a centrally located boss 47 upon which is secured a guide block 48 having a plurality of radially disposed slots 49 for receiving and guiding a plurality of slides 50. A spring 51 cooperates with each slide 50 for urging the inclined end face 52 of the slide 50 against the camming surface 46^a of the ring 46. The guide block 48 is centrally apertured for receiving a guide block 53 which also rests upon the boss 47. The guide block 53

includes a centrally apertured hub 54 and is provided with a plurality of radially extending slots 55 equal in number to the slots 49 and in radial alignment therewith. The slots 55 receive the slides 50 and also the bar ends 23 and 24 when the latter together with the assemblage shown in Fig. 1 are placed in position upon the machine as shown in Fig. 3.

The apertured hub 54 receives the armature shaft 20, and the armature core 21 is supported by a cover 56 attached to the cover 44 and providing a closure for the chamber 45. The bar ends 23 and 24 extend through the central aperture in the cover 56 and a pair of bar ends 23 and 24 is received by each one of the slots 55. It is obvious that the upward movement of the ring 46 produced by downward movement of the rod 32 will cause the slides 52 to move simultaneously toward the armature core, thereby causing each pair of bar ends 23 and 24 to be bent from the position shown in Fig. 1 to the position shown in Fig. 2.

While the bar ends are bent the armature assemblage is maintained securely in position by mechanism which is supported by the cover 56. This mechanism includes a plurality of clamping slides 60 which are equal in number of slots in the armature core and each of which is movable radially against the bar windings in a core slot. These slides 60 are guided for radial movement by a radially slotted block 61 which is supported by the cover 56. The radial movement of the clamping slides is produced by a rotatable member 62 which together with the cover 56 provides an enclosure for the slides 60. The member 62 carries an involute spiral thread 63 which is adapted to engage notches provided in the upper surface of each of the slides 60. Each slide 60 is notched in such a manner that all of the slides will be moved simultaneously against the bar windings in the core slots when the member 62 is rotated by the movement of a handle 64 in one direction, and be retracted when the handle 64 is moved in the opposite direction. The guide block 61 provides a bearing for the member 62 which is retained in the position shown by a ring 65 having a flange 66 for engaging the flange 67 of the member 62. The ring 65 is secured to the cover in any suitable manner.

In order to force the core 21 against the cover 56 there is provided a lever 70 which is pivoted at 71 upon a bracket 72 attached to the cover 56. The lever 70 includes an arm 73 which is movable against a disk 74 which is placed by the operator upon the yokes 75 of the hair pin conductors. A spring 76 attached to an arm 77 of the lever 70 and to the member 65 tends to maintain the lever 70 in a vertical position.

The mechanism is lubricated by a quantity of lubricating oil contained within the frame 30. When the rod 32 is in the upper position shown in Fig. 3 this oil may enter into a cylinder 80 through a notch 81. The downward movement of the rod 32 will cause the downward movement of a piston 82 which is connected with link 34 by a piston rod 83 and a pin 84. Consequently lubricating oil will be forced from the cylinder 80 into the chamber 45 through pipes 85 and a pipe 86 connected therewith. The excess lubricant will flow through pipes 87 and 88 to the bearings of the rod 40. Other working parts are immersed in the lubricating oil in the frame 30, the normal level of which is indicated by numeral 89.

To facilitate removal of the armature from the machine there is provided a vertically movable knock out rod 91 which is connected with an operating pedal 92 by a link 93 and a lever 94 which is pivoted at 95 upon the frame 30. Downward movement of the pedal 92 will cause the rod 91 to move upwardly and engage the armature shaft 20 in order to force the armature assemblage upwardly from the machine.

The machine embodying the present invention prepares the ends of the bar wound armature for the subsequent operation of twisting them in order that they will be in radial alignment with the proper commutator segments. One form of twisting mechanism is shown in my copending application Serial No. 76,974, filed Dec. 22, 1925.

While the form of embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. Apparatus for bending armature conductors comprising, in combination, means for supporting an armature assemblage including a slotted core and hairpin conductors having branches located in the slots, and means for bending the branches of the conductors radially toward the axis of the core and for maintaining the branches in spaced relation during the bending operation.

2. Apparatus for bending armature conductors comprising, in combination, means for supporting an armature assemblage including a slotted core and hairpin conductors having branches located in the slots, and a plurality of means adapted individually to engage the respective branches for bending all of the branches of the conductors simultaneously, radially toward the axis of the core.

3. Apparatus for bending armature conductors comprising, in combination, means for supporting an armature assemblage including a slotted core and hairpin conductors having branches located in the slots, a plurality of radially movable slides each for engaging a respective outer one of the conductor

branches emerging from a core slot, and means for moving all of the slides simultaneously toward the axis of the core in order to engage said conductor branches and bend them radially toward the axis of the core, said means being adapted to maintain the branches in spaced relation during the bending operation.

4. Apparatus defined by claim 3, in which the slide moving means includes a ring having an annular camming surface for engaging the outer ends of the slides, and mechanism for moving the ring endwise parallel to the armature axis.

5. Apparatus for bending armature conductors comprising, in combination, means for supporting an armature assemblage including a slotted core and hairpin conductors having branches located in the slots, means for preventing dislodgment of the branch portions from the slots, and means for bending the ends of the branch portions outside of the core toward the axis of the core and for maintaining said branches in spaced relation during the bending operation.

6. Apparatus defined by claim 5, in which the means for preventing dislodgment includes a plurality of radially movable slides each adapted to enter one of the core slots and engage the outermost conductor therein, and includes mechanism for moving all of the slides simultaneously toward the core.

7. Apparatus defined by claim 5, in which the means for preventing dislodgment includes a plurality of radially movable slides each adapted to enter one of the core slots and engage the outermost conductor therein, and includes a plate rotatable coaxially of the core and provided on one face thereof with an involute spiral thread which engages notches provided by the slides in order to move all of the slides simultaneously toward the core.

In testimony whereof I hereto affix my signature.

GEORGE W. ELSEY.