No. 838,017. PATENTED DEC. 11, 1906.

W. H. FOOT.

FORMER FOR ARMATURE COILS.

APPLICATION FILED MAY 8, 1905.

2 SHEETS—SHEET 1.

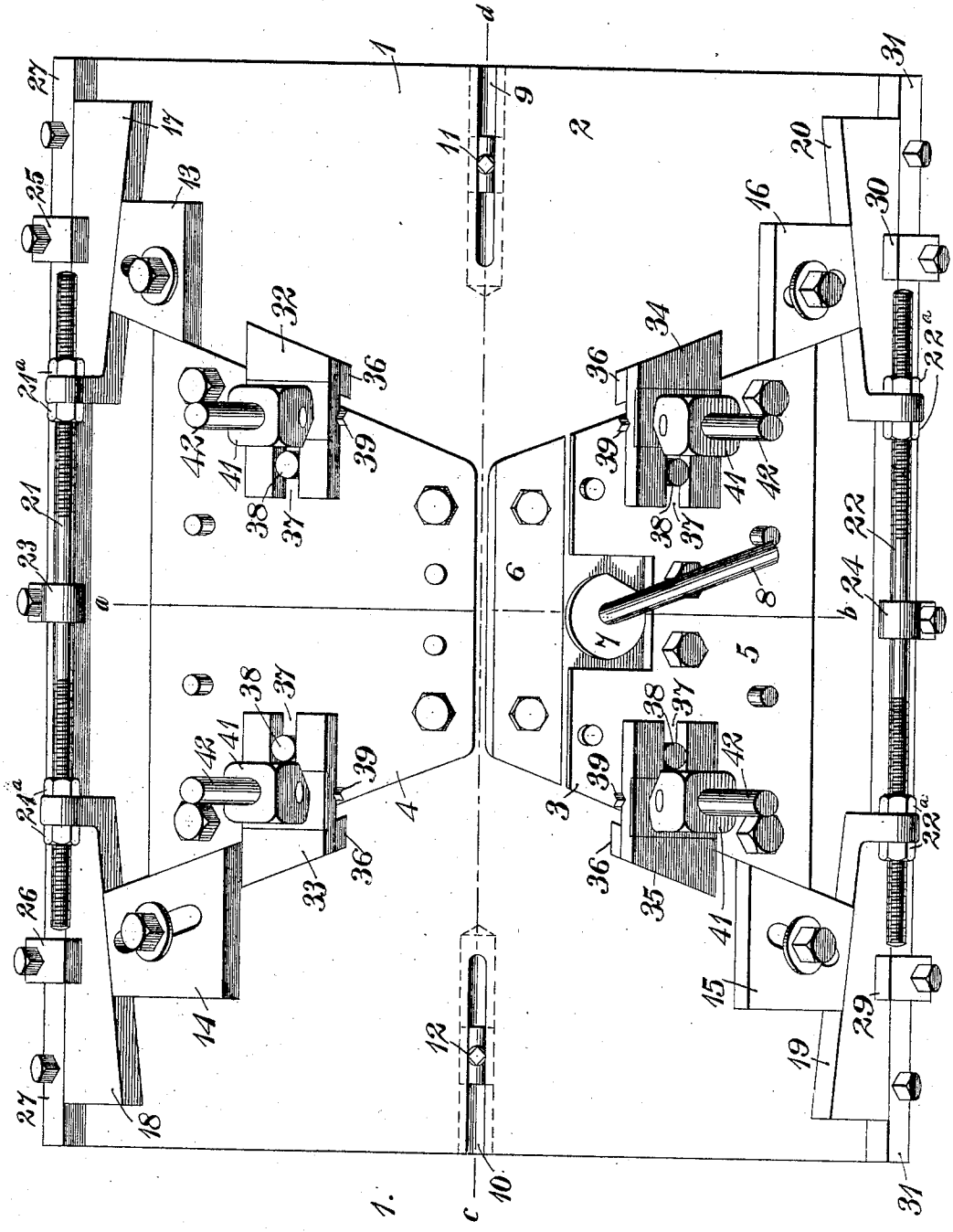

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

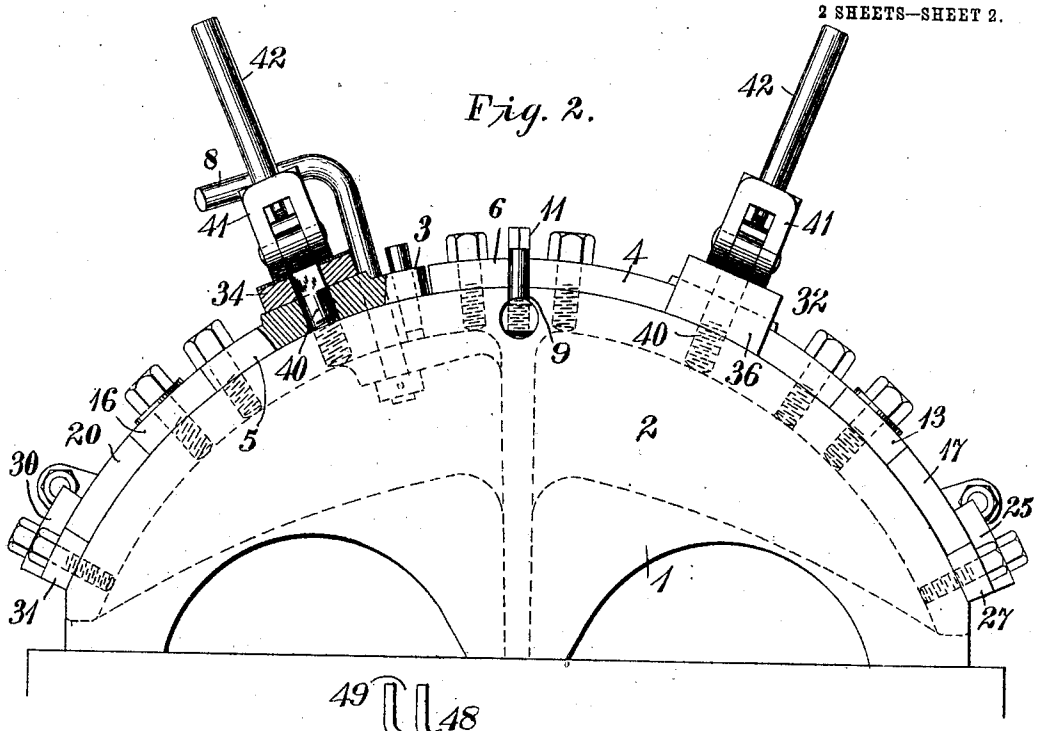


Fig. 3.

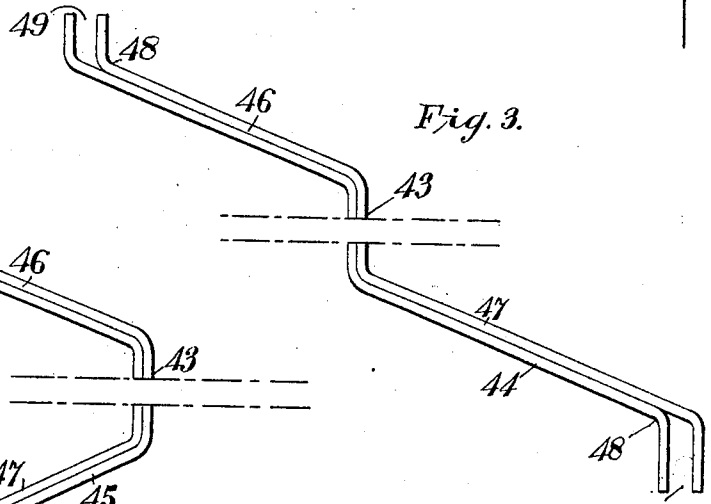
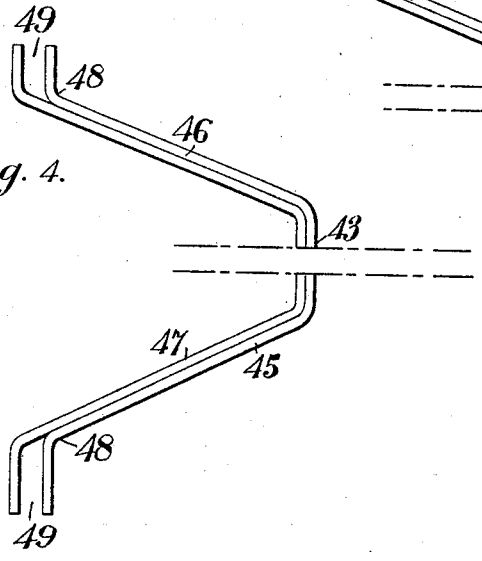


Fig. 4.



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FORMER FOR ARMATURE-COILS.

No. 838,017. Specification of Letters Patent. Patented Dec. 11, 1906.

Application filed May 8, 1905. Serial No. 259,436.

To all whom it may concern:

Be it known that I, WILLIAM H. FOOT, a subject of the King of Great Britain, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Formers for Armature-Coils, of which the following is a specification.

My invention relates to formers for metal-wire or strap coils, and has special reference to formers for coils which are adapted to the winding of open-slot armatures for dynamo-electric machines of the commutator type.

The object of my invention is to provide a former that is simple and durable in construction and that may be readily adjusted to suit relatively wide variations in size of conductor and form of coil.

Strap-coils for open-slot armatures were formerly shaped by first subjecting the conductors to a preliminary bending process and then completing the formation on a mold. This method involved the expenditure of a considerable amount of time and labor, which may be substantially reduced by the use of the former of my invention, since the conductors are merely cut to the proper length before they are clamped in the former and are removed only when complete.

A further advantage of the former of my invention lies in the fact that while it provides for variation of size and form of coil it may be securely fastened at any desired setting, so that a plurality of substantially identical coils may be constructed.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of a former constructed in accordance therewith. Fig. 2 is an end elevation showing the curvature of its surface, and Figs. 3 and 4 are plan views of coils molded on the former shown in Figs. 1 and 2.

Referring to the drawings, the former 1 comprises a base 2, which supports a plurality of forming-tools or shaping-blocks that serve to hold the coil in position and about which the coil may be bent into the desired shape. The base 2 is provided with an approximately semicylindrical surface, on which two main clamping-tools 3 and 4, that are trapezoidal in shape, are mounted, the short faces being set close together and parallel to a line $c\,d$, which is the line of intersection of a vertical plane through the axis of the base 2. The tool 3 comprises a fixed portion 5 and a movable portion 6, the latter being bolted to the base 2 in such a way as to permit a slight motion along a line $a\,b$, which is the intersecting line of a plane through the center of the former and perpendicular to its axis and the surface of the base 2. The tool 4 is rigidly fastened to the base 2, so that it acts, together with the movable portion 6 of the tool 3, as a clamp to hold the strap or wire in position during the bending process.

The tool 4 and the portion 5 of the tool 3 are severally made in two sections, the adjacent edges of which are represented in Fig. 1 by the unbroken portions of the line $a\,b$. The said portions may be so bolted to the base 2 that either, or both, of the sections may be adjusted parallel to the line $c\,d$ when desired. In case the sections are moved apart another portion 6 of corresponding length may be employed. The movable portion 6 is forced toward the tool 4 by an eccentric block 7, which is also fastened to the base 2 and is actuated by a lever 8. The ends of the base 2 are provided with tool-slots 9 and 10, that extend inwardly on the line $c\,d$ and are severally provided with bending-pins 11 and 12, which may be clamped at any point therein.

In the formation of a coil the desired number of straps or wires to form a single coil are cut to the proper length and are then clamped between the adjacent faces of the movable portion 6 of the tool 3 and the tool 4. One set of corresponding ends are then bent around the pin 11, forming an obtuse angle and extending from the line $c\,d$ in the one direction, and the other corresponding ends are bent around the pin 12 in either the same or the opposite direction from the line $c\,d$, as the case may be. One end of the coil is then bent along the side of the tool 3 and the other end of the coil is bent along the other side of the same tool or in the opposite direction from the line $c\,d$ along the side of the tool 4, the proper curvature being given to the coil along these sides, since the face of the base 2 is of cylindrical contour.

As is well known in the art, the end connections of the coil are both bent in the same direction from the line $c\,d$ when the coils are to constitute a lap-winding and are bent in

opposite directions for a wave-winding. The ends of the coil which were first bent around the pins 11 and 12 should now extend from the sides of the tools 3 and 4 in a line substantially parallel to the line *c d*. These ends are given their final form by shaping them against the edges of corresponding blocks 13, 14, 15, and 16, which are bolted to the base 2, but are allowed a certain limited movement along the sides of the tools 3 and 4, so that they may be set to accommodate coils of different lengths between the bends made at the ends of the clamping-surfaces of the parts 4 and 6 and the bends made by means of the pins 11 and 12. The blocks 13, 14, 15, and 16 are severally adjusted, by means of wedge-blocks 17, 18, 19, and 20, which are provided with projections, in which holes are drilled to receive screw-threaded rods 21 and 22. The blocks 17 and 18 may be adjusted along the rod 21 to any desired points and locked at such points by means of nuts 21ª, the rod being rigidly supported by a block 23. Blocks 19 and 20 may be similarly adjusted along the rod 22 and locked in position by nuts 22ª, the rod being supported by a block 24. The wedge-blocks 17 and 18 are further severally held in position by guide-blocks 25 and 26, which extend over their surfaces, and by a guide-strip 27, against which their outer edges rest, and the wedge-blocks 19 and 20 are similarly held in position by blocks 29 and 30 and by a strip 31, which correspond, respectively, to the blocks 25 and 26 and the strip 27.

When the wedge-blocks 17, 18, 19, and 20 have been adjusted to hold the blocks 13, 14, 15, and 16 in their proper positions with respect to the bending-pins 11 and 12, so that the ends of the coils at this stage of the formation rest against the front faces of the latter, a plurality of removable tools 32, 33, 34, and 35, which are provided with projections 36, are clamped to the tools 3 and 4 in such positions as to clamp the corresponding coil portions between the projections 36 and the edges of the tools 3 and 4 and also leave a definite clearance between the projections 36 and the edges of such of the blocks 13, 14, 15, and 16 as are in use. This clearance is so calculated that the several conductors which are comprised in a single coil may be properly separated from each other at this point to permit them to be separately connected to the commutator-bars. Mandrels of the proper thickness may be forced between the conductor ends which occupy the clearance-spaces between the blocks 32, 33, 34, and 35 and the blocks 13, 14, 15, and 16 in order to insure the proper form and spacing of such ends.

The inner end of each of the blocks 32, 33, 34, and 35 is provided with a slot 37, into which projects a pin 38, with which the corresponding plate is provided, and the under side of each of said blocks is provided with a V-shaped groove into which fits a projection 39, of the same shape, with which the corresponding plate is provided. By means of these devices the relation between each block and the plate to which it is connected is invariable, and they are clamped in this relation by means of a bolt 40, that projects through the slot 37, an eccentric head or block 41, pivoted to the head of the bolt, and a lever 42.

Referring to Figs. 3 and 4, the straight portion 43 of each of coils 44 and 45, which is to occupy an armature-slot, is held between the adjacent surfaces of the tool 4 and the movable portion 6 of the tool 3. The curved portions 46 and 47 are formed against the sides of the tools 3 and 4, the bends 48 having first been formed around the bending-pins 11 and 12. The clearance-spaces 49 between the separate conductors (of which two only are shown) are shaped by forcing a mandrel between the conductor ends when they occupy the clearance-space between the blocks 13 and 32 and the blocks 15 and 35 in the case of the coil 44, and that between the blocks 13 and 32 and the blocks 14 and 33 or the blocks 15 and 35 and the blocks 16 and 34 in the case of the coil 45.

While I have described and illustrated a specific arrangement, I wish it understood that my invention includes within its scope all variations in form and size which do not materially affect the method of formation or the result attained.

I claim as my invention—

1. A coil-former comprising a base having a curved surface and a pair of trapezoidal tools supported thereon, one of which has a movable portion, and means for adjusting said portion toward and away from the other tool, substantially as described.

2. A coil-former comprising a base having a curved surface, two principal tools and a plurality of auxiliary tools mounted thereon, one of said principal tools being fixed and the other having a movable portion which coöperates with the fixed tool to clamp the conductors during the coil-forming operation, substantially as described.

3. A coil-former comprising a base having a curved surface and provided with two fixed former-plates and a plurality of adjustable former-tools and bending-pins, one of said fixed plates being provided with an adjustable clamping portion which may be forced against one edge of the other plate, and both of said plates acting as guides for said adjustable tools.

4. A coil-former comprising a base having a curved surface, and provided with two fixed former-plates and a plurality of adjustable former-tools and bending-pins, said fixed plates being substantially trapezoidal in shape and being mounted with their two

shorter faces relatively near together and parallel to the axis of said curved surface.

5. A coil-former comprising a base having a cylindrically-curved surface and provided with two fixed former-plates and a plurality of adjustable former-tools and bender-pins, one of said fixed plates being provided with an adjustable clamping portion which may be forced against one edge of the other plate, and wedge-blocks for moving said adjustable tools.

6. In a former for coils, the combination with a base having a curved surface and a pair of trapezoidal forming-tools mounted thereon, one of which has a portion which is adjustable with reference to the other tool, of auxiliary adjustable tools that are mounted upon the base and others that are mounted upon the trapezoidal tools.

7. In a former for coils, the combination with a base having a curved surface and a plurality of relatively fixed and movable forming tools or plates mounted thereon, of means for adjusting said movable tools along the edges of said fixed tools which comprises a plurality of wedge-blocks, guides therefor, screw-threaded rods which pass through projections on said wedge-blocks, and set-nuts.

8. In a former for coils, the combination with a base having a curved surface and a pair of alined slots in opposite edges, of bending-pins adjustably mounted in said slots, a pair of trapezoidal plates clamped to the base, one of which has an adjustable portion, and auxiliary adjustable holding devices that cooperate with said plates.

9. In a former for coils, the combination with a base having a curved surface and a plurality of fixed and movable plates and bending-pins mounted thereon, of means for holding said coils that comprises a movable portion of one of said fixed plates that may be forced against another fixed plate to form a clamp, and means for adjusting said movable plates that comprises a plurality of wedge-blocks and guides therefor which are held in position by set-nuts on fixed screw-threaded rods which pass through projections in said wedge-blocks.

In testimony whereof I have hereunto subscribed my name this 5th day of May, 1905.

WILLIAM H. FOOT.

Witnesses:
A. R. GRAY,
BIRNEY HINES.