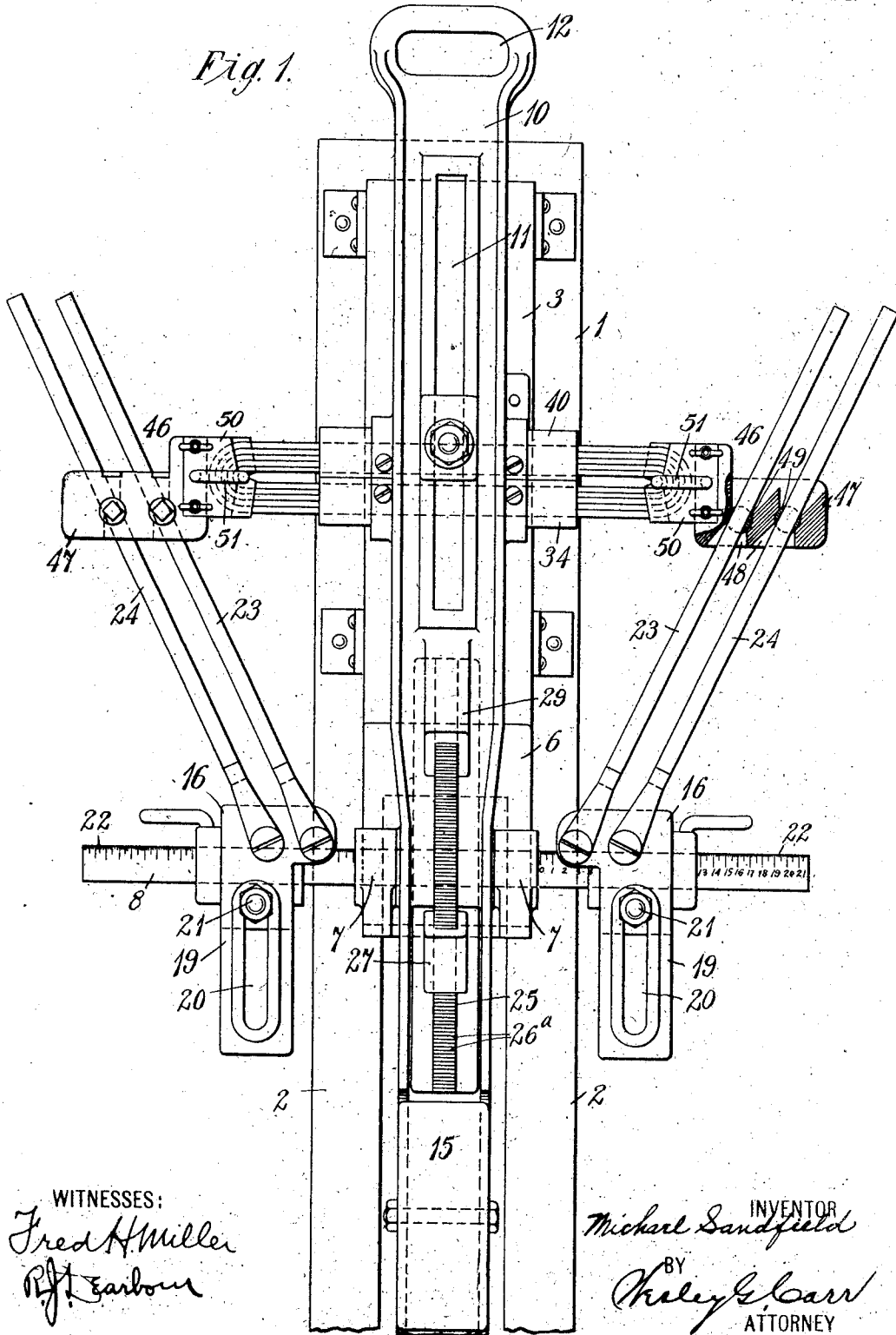


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COIL FORMING APPARATUS.
APPLICATION FILED DEC. 21, 1910.

1,037,998.

Patented Sept. 10, 1912.

4 SHEETS—SHEET 1.

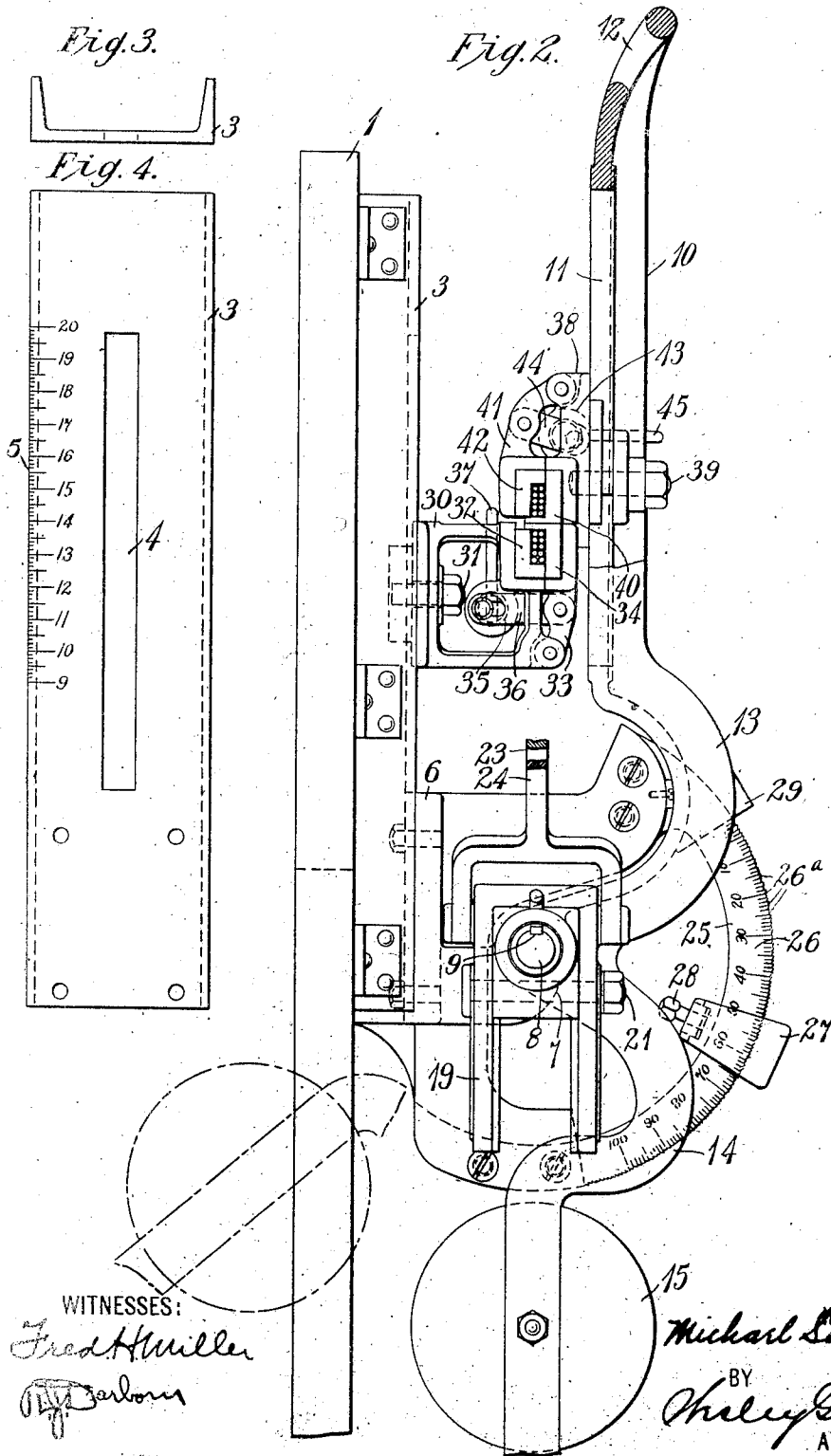


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4 SHEETS—SHEET 2.



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4 SHEETS—SHEET 3.

Fig. 6.

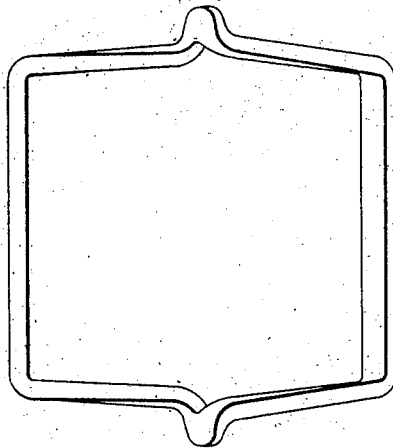
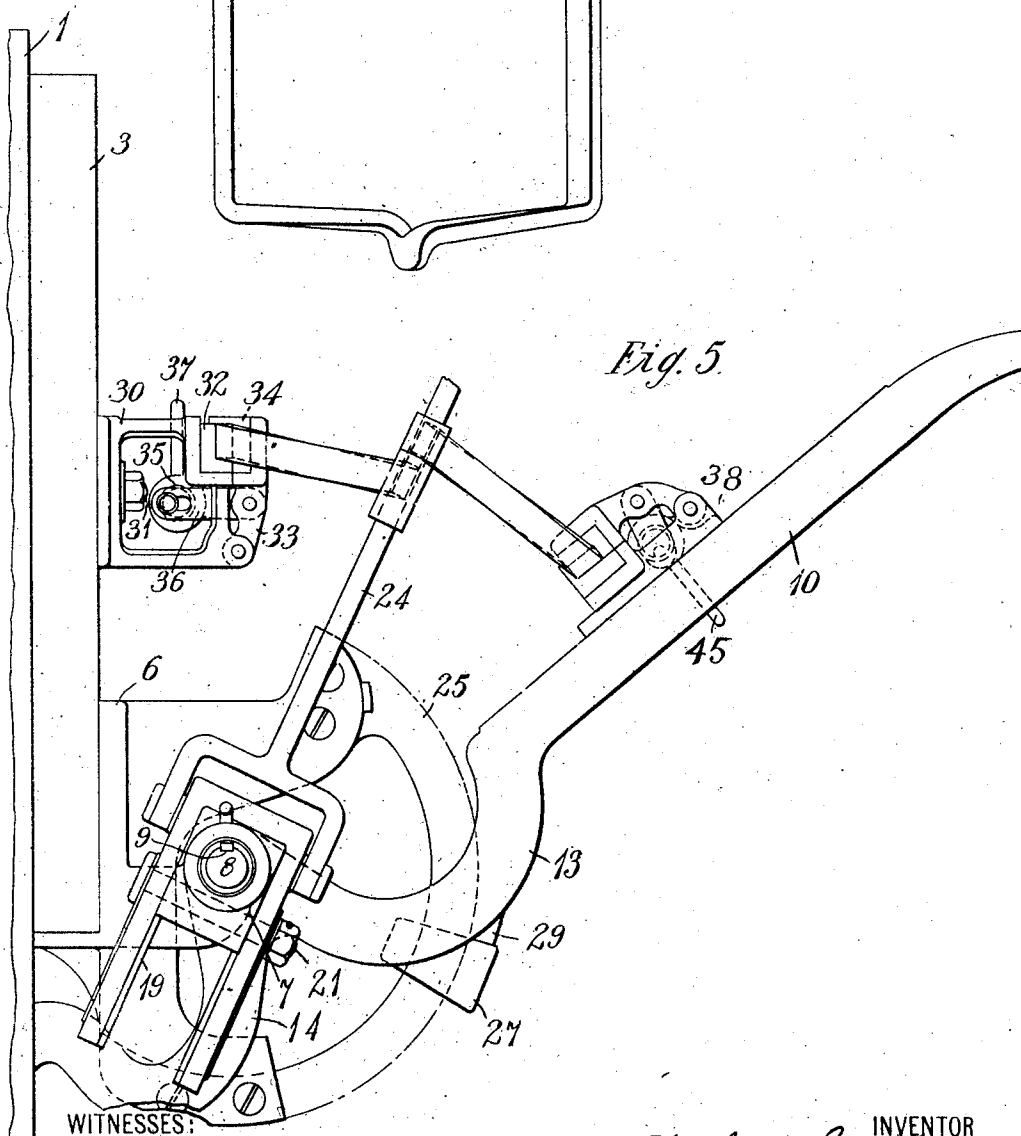


Fig. 5.



WITNESSES:

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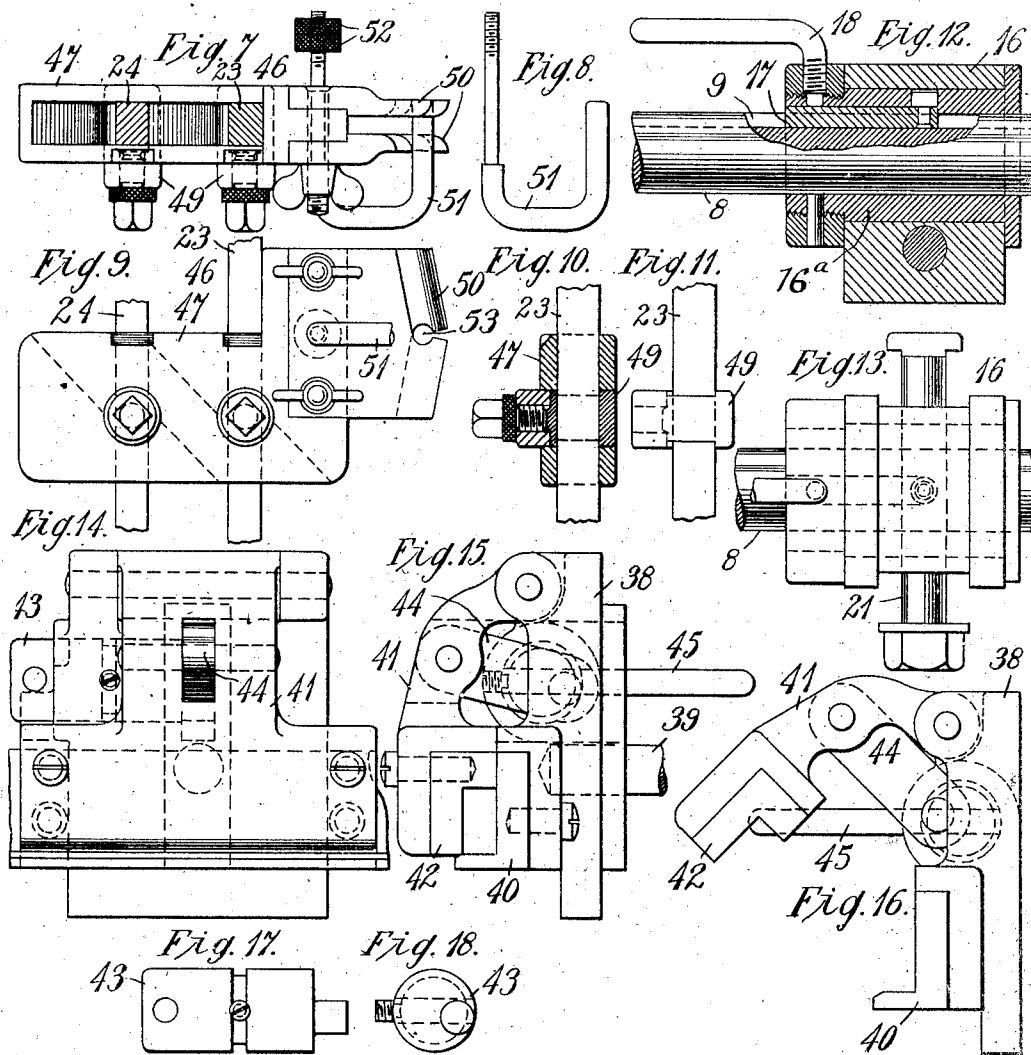
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4 SHEETS—SHEET 4.



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COIL-FORMING APPARATUS.

1,037,998.

Specification of Letters Patent.

Patented Sept. 10, 1912.

Application filed December 21, 1910. Serial No. 598,520.

To all whom it may concern:

Be it known that I, MICHAEL SANDFIELD, a citizen of the United States, and a resident of Wilkesburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Coil-Forming Apparatus, of which the following is a specification.

My invention relates to machines for forming coils to be used in dynamo-electric machines and it has for its object to provide a simple, durable and effective mechanism whereby a wire coil blank of an elongated form and having all of its turns in the same plane may be bent into suitable form for application to the slots of a cylindrically curved core by a single movement of the operating parts, and whereby the operation may be repeated upon any number of successive duplicate coil blanks with the certainty of producing finished coils of exactly the same form and dimensions.

The machine which embodies my invention is so constructed that its cooperating parts may be adjusted to adapt it for bending coils of a great variety of different sizes, and, to some extent, coils of different form, though it is specially adapted for the formation of coils of the so-called diamond type.

In the accompanying drawings, Figure 1 is a view in front elevation, of the apparatus embodying my invention and showing a coil blank in position. Fig. 2 is a side elevation of the apparatus shown in Fig. 1; and Figs. 3 and 4 are, respectively, a plan and a front elevation of one of the members of the supporting frame. Fig. 5 is a side elevation of a portion of the mechanism shown in Figs. 1, 2, 3 and 4, the movable member of the apparatus being shown in open position and the coil in its final form. Fig. 6 is a plan view of a completed coil. Figs. 7 to 18, inclusive, are detail views of various parts of the operating mechanism.

The frame 1 upon which the operating mechanism of the apparatus is mounted is preferably disposed in a vertical, or substantially vertical, plane, and comprises standards 2 and a vertical channel plate 3 provided with a slot 4 and with a graduated scale 5 upon its front face. A casting 6, which is provided with projections 7, is bolted to the lower end of the channel plate

3, and a horizontal shaft 8, having a longitudinal groove 9 in its upper side, extends through and is rigidly secured to the projections. A lever 10, having a longitudinal slot 11 in its upper portion and a transverse slot 12 at its extreme upper end, to provide a handle, has two curved portions 13 and 14 below the longitudinal slot 11, and its lower end is provided with a weight 15. Between the two curved portions 13 and 14, the lever is provided with a bearing to receive the shaft 8, so that a rotative movement of the lever relative to the shaft is permitted.

Each end of the shaft 8 is provided with an adjustable block 16 loosely mounted on a sleeve or bushing 16^a having a spline 17 (see Fig. 12), which fits into the groove 9 in the shaft 8. The sleeve is readily movable longitudinally of the shaft except when the spline is pressed into the groove by means of a curved rod 18, the horizontal portion of which serves as a handle and the vertical portion of which may be screwed into the sleeve, so that its inner end will bear against the spline. The block 16 is free to rotate about the sleeve 16^a, but its position is otherwise determined by the sleeve. Mounted upon the block 16, is a U-shaped frame 19 having vertical slots 20 to receive a bolt 21 with which the block is provided, the frame being vertically adjustable to the limit of the length of the slots and being clamped in any position to which it may be adjusted, by means of the bolt 21 and its nut. The shaft 8 is provided with a graduated scale 22 in order that the degree of longitudinal adjustment of the blocks may be accurately determined. The lower ends of two rods 23 and 24 are pivotally attached to each frame 19, such lower ends being of U-shape (see Figs. 2 and 5) and of such dimensions as to receive the upper end of the frame 19 between the arms of the U-shaped portions.

The arrangement of the rods 23 and 24 is such that the clamping block 50 is maintained horizontal, thereby avoiding friction between the parts 50 and 51 and the coil ends during the forming process. This is particularly important since the insulation on the coil would otherwise be injured. The casting 6 is provided with a sector 25 having a graduated scale 26 and teeth 26^a corresponding to the scale graduations.

Mounted upon the sector 25 is a stop block

27 having a clamping screw 28, so that it may be adjusted to any desired position on the sector and securely locked in that position with its upper face coinciding with any one of the scale graduations. The curved portion 13 of the lever 10 is provided with a portion 29 which embraces the sector 25 and is adapted to engage the stop block 27 and thus limit its degree of movement, to such extent as may be desired.

A casting 30 is mounted upon the channel plate 3 and is so clamped in position thereon, by means of a bolt 31 and the slot 4, as to be adjustable vertically in accordance with the diameter of the core member for which the coil to be bent is intended, the degree of adjustment being determined by means of the graduated scale 5. The casting 30 constitutes one member of a clamp and is provided with a seat 32 for one side of the coil to be bent, the other member 33 of the clamp being hinged to the lower edge of the casting and having a seat 34 which is the counterpart of the seat 32 in the casting. The hinged member 33 of the clamp is connected to an eccentric 35, by means of a link 36, and the eccentric is turned, to open and close the clamp, by means of a rod or lever 37.

A casting 38, which is similar to the casting 30, is mounted upon the lever 10 and is clamped thereto by means of a bolt 39 which projects through the longitudinal slot 11 and therefore constitutes means whereby the casting may be adjusted along the lever in accordance with such adjustment as may be provided for the casting 30 on the channel plate 3. The casting 38 is provided with a seat 40 for one side of the coil to be bent and a clamp member 41 is hinged to the upper edge of the casting, its lower edge being provided with a seat 42 which is the counterpart of that in the casting. The hinged clamp member is connected to an eccentric 43 by means of a link 44 and the eccentric is rotated to open and close the clamp by means of a rod or lever 45, this clamp structure being substantially like that which is mounted on the channel plate and is illustrated in detail in Figs. 14 to 18, inclusive.

Each pair of rods 23 and 24 is provided with a clamp 46 for one end of the coil blank, this clamp comprising a block 47 having slots 48 and bearing pieces 49 therein for the rods 23 and 24 which are so disposed as to permit freedom of relative movement between the rods and the block. Clamped to the inner end of the block are two plates 50 having front edges of such form as to receive the coil ends and, in a measure, to determine the form which such ends shall take when the bending is completed. A rod 51 of approximately L-shape has its longer arm projecting through a hole in the plates 50 and the end of the block 47

and is provided with nuts 52 to prevent its accidental withdrawal, and its shorter arm fits into holes 53 in the ends of the plates and also in the end of the opening between the sides of the coil blank so as to hold the coil blank in position while it is undergoing the bending operation. (See Figs. 1, 7 and 9). The two sets of rods and the cooperating clamps are similar and, consequently, a description of one will suffice for both.

In using the apparatus to bend a coil into final form, the sides of the coil blank, having the form indicated in Fig. 1, are clamped in the seats 32 and 34, and 40 and 42, by means of the eccentrics 35 and 43 and the levers 37 and 45. The end clamps 46 are then brought into position, with the ends of the coil blank projecting into the spaces between the plates 50, and the L-shaped rods 51 are inserted. The handle of the lever 10 is then grasped by the operator and is drawn away from the frame until its part 29 engages the stop 27 which has been set in accordance with the width of the coil desired, the parts being then in the position indicated in Fig. 5. The L-shaped rods 51 may now be removed and the coil be released from the clamps, when it may be readily removed and the parts returned to the original position for the insertion of another coil blank. The operation may be repeated any desired number of times with the certainty that the resulting coils will be alike in form and dimensions, provided the original blanks are alike.

The adjustment features provided and hereinbefore described, are obviously such as to permit adaptation of the apparatus to coils of various sizes which are intended for use with either stationary or rotatable core members of various diameters, the block 16 being adjusted upon the shaft 8 to such positions that when the lever 10 is in its outermost position and the coil is bent to its final form, the rods 23 and 24 will substantially be at right angles to the shaft 8. The end clamps 46 are adjusted upon the rods 23 and 24 to such positions that the coil ends will be offset, relative to the imaginary surface generated by the sides of the coil as they are separated, in the forming process.

When the coils are intended for insertion in slots in the concave face of the stator core of an induction motor or in the slots of any similar stationary core member, clamps 46 will be so adjusted on the rods 23 and 24 that the coil ends will be forced outwardly from the center of the shaft 8. But, if the coils are intended for insertion in the slots formed in the convex cylindrical surface of a core member, such as a rotor, the clamps will be so adjusted that the coil ends will be pulled inwardly toward the center of the shaft 8. By this means, the ends of the coil are properly offset in every case to clear the

opposed member when they are assembled in a dynamo-electric machine. This feature of my mechanism is very important since no bending or forming of the coil is necessary after it is removed from the machine, and I believe that it is broadly new.

While the apparatus here shown and described has been found to be well adapted for the service intended, it will be understood that variations of structural details and arrangements of parts may be made without departing from the spirit and scope of my invention.

I claim as my invention:

15 1. A coil former comprising relatively movable hinge-connected members, side clamps secured to the respective members and adjustable thereon toward and away from each other, and end clamps independently adjustable relative to the hinge-connected members.

2. A coil former comprising a vertical plate or frame, a lever pivotally connected thereto, side clamps respectively supported 25 on the plate or frame and on the lever and adjustable thereon toward and away from each other, end clamps and supporting means therefor, whereby said end clamps are adjustable only in parallelism with the 30 axis of the lever.

3. A coil former comprising a vertical plate or frame, a casting or bracket secured thereto, a shaft supported by the casting or bracket, a lever rotatably mounted on the 35 shaft, side clamping members secured to the plate or frame and to the lever and adjustable thereon toward and away from each other, and opposing end clamps supported on the respective ends of the shaft and adjustable only in parallelism relative thereto.

4. A coil former comprising a vertical plate or frame, a casting or bracket secured thereto, a shaft supported by the casting or bracket, a lever rotatably mounted on the 45 shaft, side clamping members secured to the plate or frame and to the lever and adjustable thereon toward and away from each other, opposing end clamps, supporting blocks therefor adjustably mounted on the 50 respective ends of the shaft, and connecting links between the end clamps and the supports.

5. A coil former comprising a vertical plate or frame, a casting or bracket secured 55 thereto, a shaft supported by the casting or bracket, a lever rotatably mounted on the shaft, side clamping members adjustably secured to the plate or frame and to the lever, opposing end clamps, supporting blocks 60 therefor adjustably mounted on the respective ends of the shaft, and parallel-motion connections between the shaft and the end clamps.

6. A coil former comprising a vertical 65 plate or frame, a casting or bracket secured

thereto, a shaft supported by the casting or bracket, a lever rotatably mounted on the shaft, side clamping members adjustably secured to the plate or frame and to the lever, opposing end clamps, sleeves disposed on the respective ends of the shaft and adjustable longitudinally thereof, supporting 70 blocks rotatably mounted on the sleeve, and a pair of parallel links between each supporting block and its end clamp.

7. A coil former comprising a vertical plate or frame, a casting or bracket secured thereto, a shaft supported by the casting or bracket, a lever rotatably mounted on the 80 shaft, side clamping members adjustably secured to the plate or frame and to the lever, opposing end clamps, pivoted supporting blocks therefor disposed on the respective ends of the shaft and adjustable longitudinally thereof, and a pair of parallel links between each supporting block 85 and its end clamp, whereby the end clamps are adjustable only in parallelism with the shaft.

8. A coil former comprising a vertical plate or frame, a casting or bracket secured thereto, a shaft supported by the casting or bracket, a lever rotatably mounted on the 90 shaft, side clamping members adjustably secured to the plate or frame and to the lever, opposing end clamps, sleeves or bushings disposed on the respective ends of the shaft and adjustable longitudinally thereof, supporting blocks pivotally mounted on the 95 sleeves, a pair of parallel interposed connecting links between each support and its end clamp, and means for adjusting the end clamps to vary the effective length of the connecting links.

9. A coil former comprising relatively 105 movable hinge-connected members, adjustable means on one member for limiting the relative movement of the other, and side clamps secured to the respective members and adjustable thereon toward and away 110 from each other.

10. A coil former comprising a vertical plate or frame, a lever pivotally connected thereto, a graduated segment secured to the 115 plate or frame, an adjustable stop thereon for limiting the movement of the lever, and side clamps respectively supported on the plate or frame and on the lever and adjustable thereon toward and away from each 120 other.

11. A coil former comprising a vertical plate or frame, a lever pivotally connected thereto, a graduated segment secured to the 125 plate or frame, an adjustable stop thereon for limiting the movement of the lever, side clamps respectively supported on the plate or frame and on the lever, end clamps and supporting means therefor, whereby said end clamps are adjustable only in parallelism with the axis of the pivoted lever. 130

12. A coil former comprising relatively movable hinge-connected members, side clamps respectively supported on the members and adjustable thereon toward and away from each other, end clamps, and means for so supporting the end clamps as to offset the coil ends as the hinge-connected members are separated.

In testimony whereof, I have hereunto subscribed my name this 10th day of Dec. 10 1910.

MICHAEL SANDFIELD.

Witnesses:

R. J. DEARBORN,
B. B. HINES.