A. J. FATHAUER.

COIL FORMING APPARATUS.

APPLICATION FILED DEC. 23, 1920.

1,435,284.

Patented Nov. 14, 1922.

4 SHEETS—SHEET 1.

Fig. 1

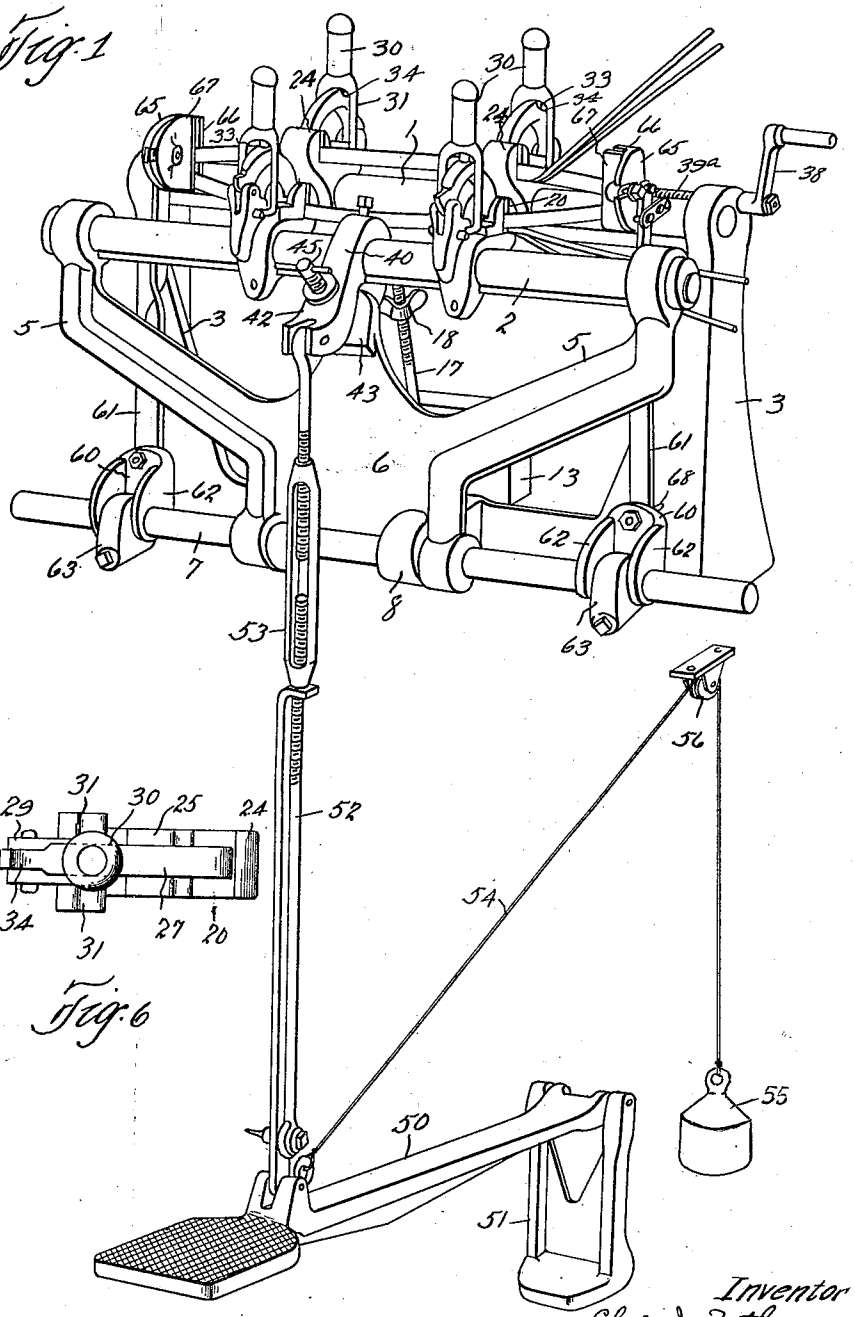


Fig. 6

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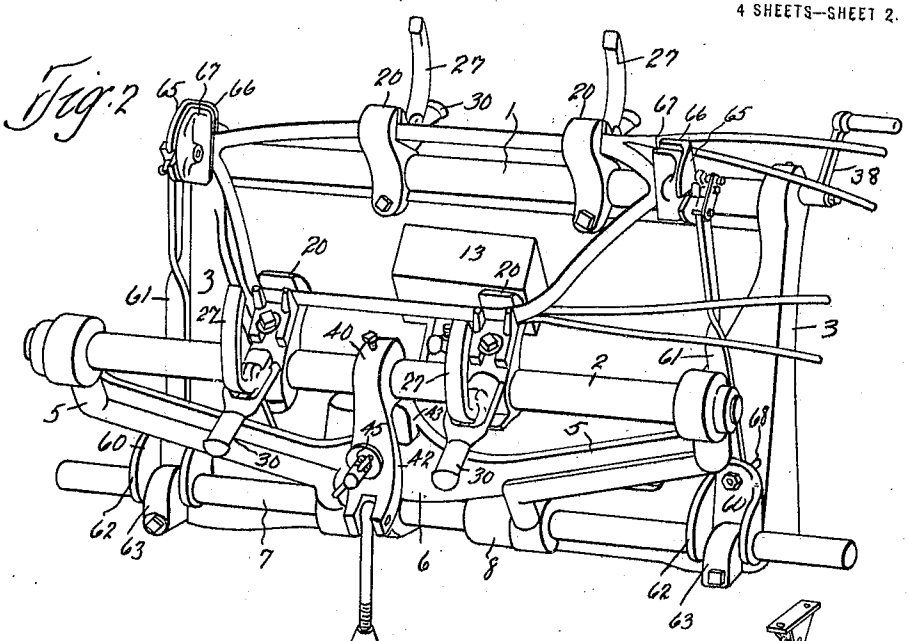
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4 SHEETS—SHEET 2.

Fig. 2



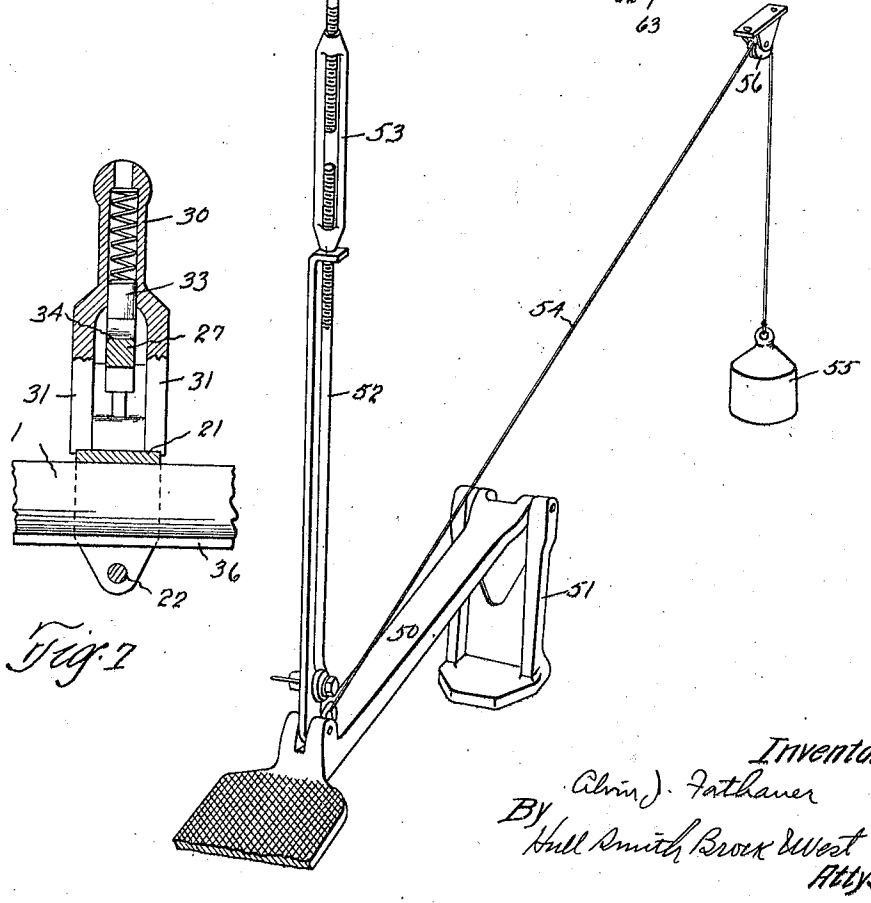


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4 SHEETS—SHEET 3.

Fig. 3

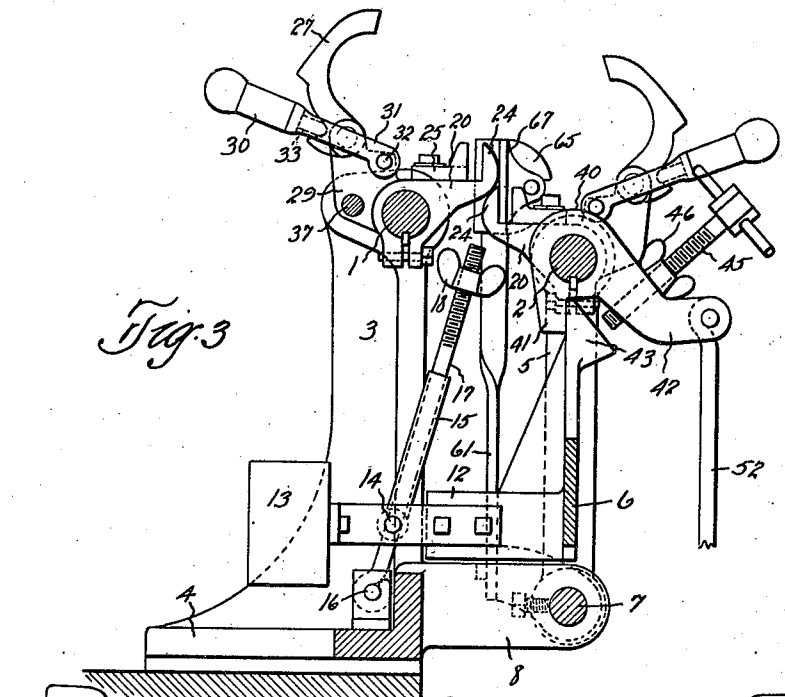
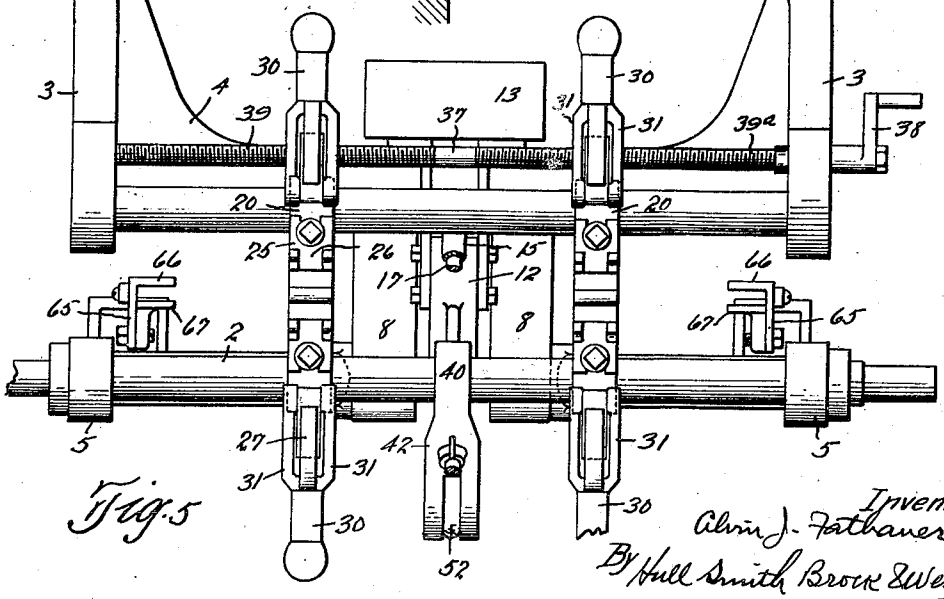


Fig. 5



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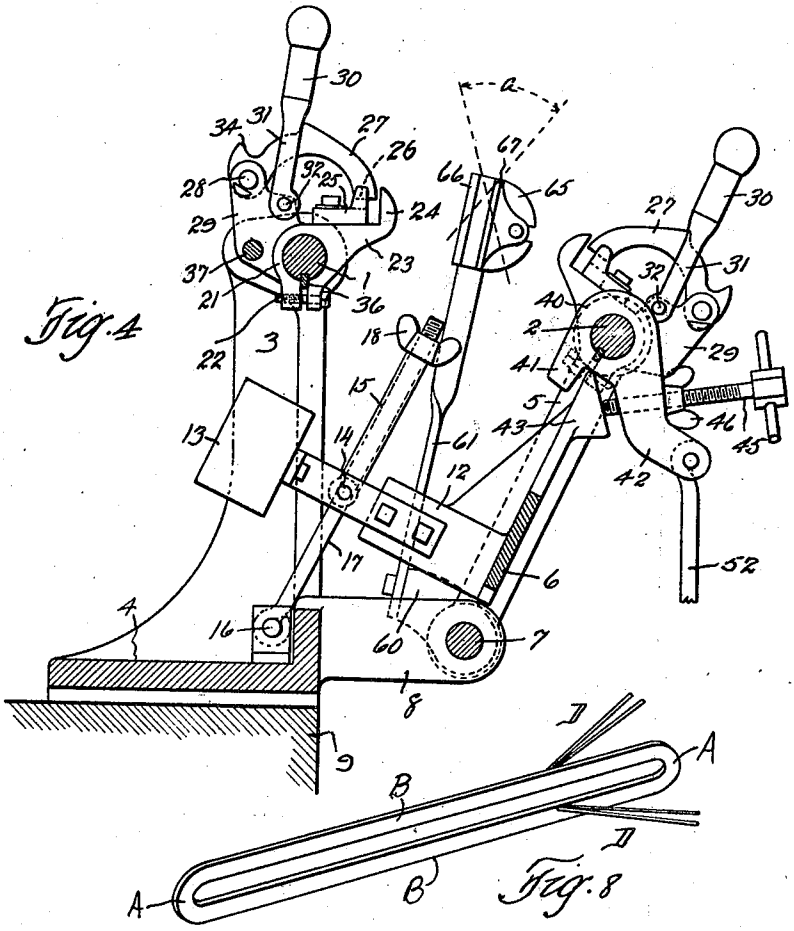


Fig. 4

Fig. 8

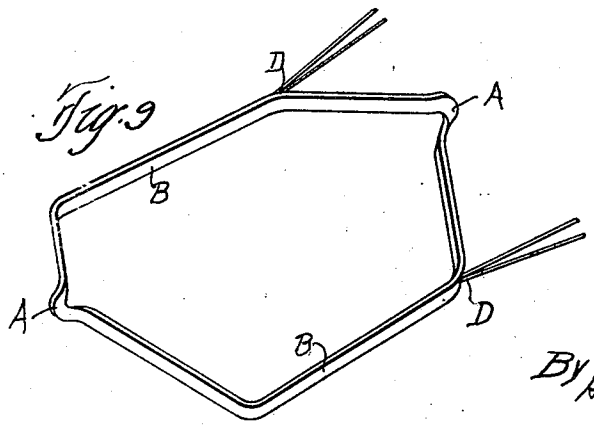


Fig. 9

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UNITED STATES PATENT OFFICE.

ALVIN J. FATHAUER, OF CLEVELAND, OHIO.

COIL-FORMING APPARATUS.

Application filed December 23, 1920. Serial No. 432,701.

To all whom it may concern:

Be it known that I, ALVIN J. FATHAUER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Coil-Forming Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to the manufacture of coils for dynamo-electric machinery and has for its general object the provision of simple, inexpensive and compact apparatus by means of which coils of a great number of shapes and sizes may be formed for armatures and field windings. Machinery of this nature consists essentially of cylindrical, slotted members, the slots receiving coils of special sizes and shapes, which are formed outside the machine and subsequently applied thereto. Usually these coils approximate in form irregular hexagons and they are generally formed by first winding the wire into a plain oblong coil, and afterwards displacing the different parts of such coil so as to produce the particular conformation desired. However the devices heretofore employed for this purpose have generally been complicated, expensive, and capable of only a small number of adjustments, wherefore it is the object of the present invention to provide an apparatus which shall be simple, inexpensive, and capable of a great range of adjustments so that by its use manufacturers and repairers can readily make or repair practically all kinds and sizes of these machines. Subsidiary objects are the provision of a new and improved type of clamp for holding the wire; the provision of new and improved expedients for relatively inclining the two sides of the coil; the provision of improved expedients for adjusting the width of the coil; while further objects and advantages of the invention will become apparent as this description proceeds.

In the drawings accompanying and forming a part of this application, I have illustrated one embodiment of my invention, wherein Fig. 1 is a perspective view of the complete machine showing a newly wound coil in place ready for forming; Fig. 2 is a similar view of the same machine but showing the parts separated and the coil formed; Fig. 3 is a central vertical section through the parts shown in Fig. 1 showing the machine prior to forming the coil; Fig. 4 is a central vertical section through the same machine showing the parts separated as in Fig. 2; Fig. 5 is a top plan view of the machine with the parts in the position which they occupy in Fig. 3; Fig. 6 is a top plan view of one of the clamps showing the latch closed; Fig. 7 is a sectional view of one of the clamps; Fig. 8 is a perspective view of the wire coil prior to forming; and Fig. 9 is a perspective view of the same coil after forming.

Describing the parts by reference characters, 1 and 2 represent a pair of parallel supporting rods, one of which is mounted so as to be movable bodily toward and from the other rod, this being most conveniently effected by pivoting the same upon an axis which is parallel to both rods. The rod 1 is shown as horizontal and is here mounted in fixed position by the rigid uprights 3—3 which rise from the ends of the base 4. The other rod is carried by the branching arms 5—5 of the bracket 6 which is pivoted upon the horizontal pivot shaft 7 carried by the brackets 8—8 that project from the base. In operation the base 4 is preferably applied to the top of a table or pedestal 9, the brackets 8—8 projecting forwardly past the edge of the same as shown in Figs. 3 and 4.

Projecting rearwardly from the bracket 6 at a point adjacent the pivot shaft is a rigid arm 12, to the end of which is secured the weight 13. The length of this arm, and the magnitude of the weight are so chosen relatively to the weight of the bracket and its attached parts that when the bracket is in upright position, as shown in Fig. 3 the center of gravity will fall at the rear of the shaft 7, thereby retaining the bracket in its upright position, and when the bracket is in the inclined position illustrated in Fig. 4 the center of gravity of the same will fall outside of the pivot shaft 7, thereby holding the bracket in that position also. At a point between the bracket and weight the arm 12 is formed with a recess in which is pivoted the rocker 14, a part of which comprises a sleeve 15; and pivoted to the base 4 at the point 16 is a threaded bolt 17 passing through said sleeve and having at its upper end a stop nut 18 by which the swinging movement of the bracket is limited. It will be understood that other countervailing devices can be employed.

Secured to each of the rods 1, 2 and adjustable therealong are a pair of coil-receiving clamps indicated generally at 20—20, which may be of any suitable or convenient type, but according to my preferred species are constructed as follows.

Each of the present clamps comprises a cast-metal base-part, an adjustable jaw-member, a latch, and a handle. The base part comprises an apertured portion 21 adapted to be gripped upon its rod by the tangent screw 22, there being a flat topped portion 23 projecting towards the clamp carried by the other rod and terminated by the upstanding rigid jaw 24 whose inner face is square and whose outer face is rounded. Adjustably secured to the upper flat face of this part is the movable jaw member 25 having its working face parallel to the working face of the fixed jaw 24 and also vertically slotted as shown at 26 for the reception of the latch 27. This latch consists of a curved metal member, pivoted at one end to a pin 28 carried by a flange 29 which projects rearwardly from the part 21; the forward end of the latch swings just inside the fixed jaw 24 and into the slot 26 of the jaw 25 as shown in Fig. 4, so as to retain in place any coil of wire embraced between said jaws. The handle comprises a body portion 30 and two legs 31—31 which straddle the latch 27 and are pivoted at the point 32 to the flange 29. Carried by the handle is a spring-pressed plunger 33 which rides upon the top of the latch. When the handle is in the position shown in Fig. 4, this plunger, pressing upon a portion of the latch forward of its pivot, holds the same in closed position, but when the handle is swung rearwardly as shown in Fig. 3 the plunger engages a shoulder 34 carried by the latch at the rear of said pivot, as a result of which said latch is opened and held firmly in open position until the same is manually restored.

In order to prevent these clamps from rotating upon the rods 1 or 2, which are preferably cylindrical, I employ a spline 36 which may conveniently extend into the space cut away for the tangent screw 22; and in order to assist in adjusting these clamps to measured positions along their rods I have illustrated a rotatable shaft 37 carried by the uprights 3—3 immediately at the rear of the rod 1 and provided at one end with the crank 38. The opposite halves of this shaft are formed with right-hand and left-hand threads, respectively, as indicated at 39—39ª which are screwed in suitable holes in the flanges 29 so that as the crank 38 is turned the two clamps approach or recede from each other, maintaining always equal distances from the middle of the rod. The clamps which are carried by the movable rod 2 are adjusted separately in accordance with the positions assumed by the first clamps.

This rod 2 is also preferably pivoted about an axis other than the pivot shaft 7, in order to adjust the pitch of the coils. In the present embodiment this rod is merely pivoted upon its own axis in the sockets formed in the ends of the arms 5—5, and its movements are preferably effected, limited, and adjusted as follows. Rigidly secured to the middle of this rod is a yoke member 40 having at the one side a depending lug 41 and at the opposite side a forwardly projecting handle 42. The bracket 6 carries an upstanding finger 43 which projects between this lug and handle in such wise that when the movable bracket is upright and the lug 41 engages said finger as shown in Fig. 3 the curved outer face of one clamp jaw 24 will project beneath the complementarily curved face of the corresponding jaw of the opposite clamp. Adjustably threaded in the handle 42 is a screw 45 which limits the rocking of the rod in the opposite direction as shown in Fig. 4, its end engaging the outer face of the finger 43. By this rocking movement added to the spreading movement I am enabled to reproduce the spread and pitch of coils made by practically all other machines.

For operating this coil former I preferably provide a treadle 50 carried by a suitable floor bracket 51 and connected to the handle 42 by means of a suitable drag-link 52, preferably including a turn-buckle 53 to permit the necessary adjustment. It will be noted that the first effect of depressing the treadle will be to rock the rod 2 about its independent pivot by an amount permitted by the adjustment of the screw 45, after which the entire bracket will be drawn to the position illustrated in Figs. 2 and 4. 46 denotes a lock nut for holding the adjustment of the stop screw 45. It will be understood that the rocking movement of the rod 2 may take place about some axis other than its own, within the requirements of this machine, although the construction I have illustrated is the simplest and most practical. I have illustrated a simple device for holding the treadle yieldingly in elevated position so as to prevent the weight of the treadle and its drag-link from rocking this rod outwardly during the time that the apparatus is in closed position as shown in Fig. 3. The means here illustrated consists of a cord 54 and counterweight 55, the cord running over a pulley 56 which is attached to the underside of the table on which the apparatus rests. The effect of this counterweight, or other means, is so chosen as merely to overcome the weight of the parts sufficiently to hold the rod 2 in the position described, but without restoring the bracket and its attached parts to their

upright positions after the same has once been depressed. This counterweighting influence accordingly operates only in conjunction with the rocking effect of this shaft and is typical of numerous other devices and expedients which could be employed to accomplish the same result.

The pivot shaft 7 is preferably made of considerable length so as to project horizontally at each side of the machine and slidably mounted thereon are a pair of brackets 60—60 to which are pivoted the upright arms 61—61. In the present embodiment each of these brackets consists of a U-shaped member having its sides 62 apertured for the reception of the shaft, accidental longitudinal movement of the brackets being prevented by means of collars 63—63 clamped to the shaft between the sides. Secured to the upper ends of the arms 61—61 are the end-clamps which here consists of a semicircular, flat, base-plate 65, having at its straight margin a right angled jaw 66, in combination with a movable jaw 67 adjustably clamped to the forward face of said base plate. With the arrangement described, these jaws are preferably substantially upright when the apparatus is in closed position as shown in Fig. 3, although the pivotal connection between the brackets 60 and shaft 7 enables the end clamps to accompany the spreading movement of the coil as indicated in Fig. 4, while the arms 61—61, being pivoted to the brackets upon axes perpendicular to the rods, are enabled to approach each other as the coil is shortened. The base plates 65 are preferably secured to the arms 61 in such wise as to be adjustable through the arc *a* shown in Fig. 4, thus enabling the end portions of the coil to be twisted to different angles if desired; but ordinarily these end clamps have no function whatever excepting to assist in the longitudinal positioning of the coil, inasmuch as the stretching of the coil of itself affords substantially the same configuration as is obtained by the use of these clamps, unless these clamps are used in an inclined position for such special purpose. In the ordinary use of the machine it is customary to remove one of these members together with the movable clamp-portion of the other member, retaining only the base-plate as a measuring stop. A check pin 68 is employed to prevent these arms moving outwardly beyond the vertical.

The wire is first wound in a plain oblong coil as shown in Fig. 8, with round ends A, A, and straight sides B, B, the latter lying in the same plane and spaced slightly apart. The terminals D D are brought out at the proper points and in the proper number for the coil in question, and the wires are taped, clipped, or cemented together in any suitable manner. One end of this coil is then applied to one of the end-clamps, and the coil rocked downwardly so that its lower run will enter the movable side clamps and the upper run will enter the fixed side clamps. This is very easily accomplished by reason of the proximity of the clamps and the fact that the curved end 24 of the upper constitutes a direct guide into the open mouth of the lower. The construction of the latches enables them to be swung entirely out of the way while this is being done, and also to be moved into securing position without obstruction from the opposite clamps. The movable jaws of the clamps are set to the proper width either before or after applying the coil. The stop screw 45 is also set to afford the correct pitch of the coil which depends upon the size of the machine for which it is designed and also the width between the two sides.

The treadle is then depressed and the coil drawn to the shape shown in Fig. 9. It is removed from the clamps prior to releasing the treadle after which the movable part is restored to its initial position by hand, ready to receive another coil.

The lateral adjustability of the clamps enables the shaping of coils of a great range of sizes; the angular adjustment enables the shaping of coils for machines of varying diameters; while the shape and construction of the clamps themselves enables the rapid and convenient operation of the machine. Also the action of fastening the latches is accomplished by a motion which tends merely to close the machine which cannot injure the coil since the machine is already closed and the action of opening the latches is accomplished by a motion which tends merely to open the parts still wider, which cannot injure the coil since the parts are already at their open position.

It will be understood, however, that many and great changes in detail can be made within the scope of my invention and I do not limit myself in any wise except as specifically stated in the annexed claims.

Having thus described my invention, what I claim is:

1. In a coil forming apparatus, in combination, a pair of parallel supporting rods, means hinging said rods together for relative movement about an axis at one side thereof and parallel thereto, and a pair of coil receiving clamps secured to each rod and adjustable therealong.

2. In a coil forming apparatus, in combination, a pair of parallel supporting rods, means hinging said rods together for relative movement about an axis at one side thereof and parallel thereto, and a pair of coil receiving clamps secured to each rod and adjustable therealong, one of said rods being rotatable about an axis other than said pivot axis so as to afford to said coil

a pitch other than that which corresponds to such first pivot axis, and coil receiving clamps carried by said rods.

3. In a coil forming apparatus, in combination, a pair of parallel supporting rods, one of which is mounted for swinging movement toward and from the other about an axis located at one side of and parallel to both rods, and a pair of coil receiving clamps secured to each rod and adjustable therealong.

4. In a coil forming apparatus, in combination, a pair of parallel supporting rods, one of which is mounted for swinging movement toward and from the other about an axis located at one side of and parallel to both rods, and one of which is also rotatable about its own axis between predetermined limits, and coil receiving clamps secured to said rods.

5. In a coil forming apparatus, in combination, a pair of coil receiving clamps mounted for relative swinging movement toward and away from each other, one of said clamps being independently pivoted for rotation about an axis other than that of such swinging movement, and means whereby the movement of a single clamp in either direction will effect both such rotation and such swinging in a corresponding direction.

6. In a coil-forming apparatus, in combination, a pair of parallel supporting rods, one of which is fixed and the other of which is movable toward and from the first rod by movement about an axis which is parallel to both rods, a pair of coil receiving clamps slidably mounted on said first rod, a rotatable shaft parallel to said first rod and having right- and left-hand threaded portions engaging said clamps respectively, a pair of clamps movably mounted on said second rod, and means for securing them in place thereon.

7. In a coil forming apparatus, in combination, a fixed part having coil receiving clamps, a movable part having coil receiving clamps adapted to swing toward and from the first part, and a counterweight attached to and movable with said second part and adapted to hold the same in stable position at either extreme of its movement.

8. In a coil forming apparatus, in combination, a pair of relatively movable members, coil receiving clamps carried thereby, there being a clamp on each member opposite to that on the other member, an adjusting screw for variably limiting the separation of said members, and countervailing means operating across the center of movement for securing the relative position of the members at both extremes of such movement.

9. In a coil forming apparatus, in combination, a fixed rod, a bracket mounted for swinging movement toward and from the same upon an axis parallel thereto, a rod carried by said bracket parallel to said first rod and journaled for rocking movements upon its own axis, means for adjusting the degree of swinging movement and of rocking movement and coil receiving clamps carried by both rods.

10. In a coil forming apparatus, in combination, a fixed member, coil receiving clamps carried thereby, a second member movable toward and from said fixed member, other coil receiving clamps carried by said second member, and means for rocking said last clamps through a predetermined angle which is independent of the angle or amount of movement between said members.

11. In a coil forming apparatus, in combination, a fixed rod, a bracket mounted for swinging movement toward and from the same upon an axis parallel thereto, a rod carried by said bracket parallel to said first rod and journaled for rocking movements upon an axis other than the pivot axis, means for adjusting the degree of swinging movement and of rocking movement, coil receiving clamps carried by both rods, and a single operating member connected to said second rod and adapted by a single actuation to produce both said swinging movement and said rocking movement.

12. In a coil forming apparatus, in combination, a horizontal fixed rod, a bracket mounted for swinging movement toward and from the same, a second rod journaled in said bracket parallel to said fixed rod, means for limiting the swinging movement of said bracket, means cooperating with a part of said bracket for limiting the rotation of said rod in each direction, a treadle operatively connected to said second rod, means for normally holding said second rod at one limit of its rocking movement, said treadle being arranged when depressed first to rotate said second rod to the other limit of its rocking movement and then to move said bracket to the extreme of its swinging movement, and coil holding clamps carried by the respective rods.

13. In a coil forming apparatus, in combination, a pair of members mounted for movement, one toward and from the other, an upwardly-opening coil-receiving clamp carried by each member and arranged on different levels, each clamp having a fixed jaw with a convex end whereby opposed clamps may be brought close together, the end of the upper clamp constituting a guide into the jaw of the lower clamp, and a latch for each clamp movable into and out of position above the same in all positions of said members.

14. In a coil forming apparatus, in combination, a pair of members mounted for movement, one toward and from the other, an upwardly-opening, coil-receiving clamp car-

ried by each member and arranged on different levels, a movable latch adapted to cover the top of each clamp, means for moving said members bodily toward and from each other, and means for inclining said clamps, one relatively to the other.

15. In a coil forming apparatus, in combination, a horizontal rod, a bracket pivoted on a horizontal axis below and in front of said rod, a second rod carried by the free end of said bracket parallel to said first rod, one of said rods also being angularly movable relatively to the other rod, a pair of upwardly-opening, coil-receiving clamps carried by each rod and projecting toward the other rod, said clamps having rounded ends and being so mounted that when the bracket is swung toward said first rod, one set of clamps will lie slightly above the other set, with the rounded ends thereof forming a guide into the open mouths of such other set, a counter-vailing device operatively connected to said bracket and adapted to hold the same rigidly at each extreme of its movement, and an operating member adapted to displace said bracket away from said fixed rod and also to rock one rod relatively to the other.

16. In a device of the character described, in combination, a base member having an upturned end at the one part and an upstanding flange at the other part, an upwardly curved, arcuate latch member pivoted to said flange and swinging just inside said upturned end, a movable jaw adjustably secured to the top of said base member and cooperating with said upturned end to define a coil-receiving slot, said movable jaw being notched for the reception of said latch, and means for opening and closing said latch and for holding it closed.

17. In a device of the character described, in combination, a base member having an upwardly facing surface terminating in an upturned end constituting a jaw, an upwardly curved, arcuate latch member pivoted to said member at a point removed from said jaw and swinging just inside the same, a movable jaw adjustably secured to the top of said base member and cooperating with said first jaw to define a coil-receiving slot, and a handle pivoted to said base member and having a part overlapping said latch to hold it closed.

18. In a device of the character described, in combination, a base member having at one end an upturned rigid jaw, an upwardly curved, arcuate latch member pivoted to said base member at a point removed from said jaw and swinging just inside the same, a movable jaw adjustably secured to the top of said base member and cooperating with said first jaw to define a coil-receiving slot, and a handle pivoted to said base member upon an axis parallel to the latch pivot, said handle having a spring-pressed part movable along the top of said latch and adapted when moved forward of the latch pivot to close the latch and hold it closed or when moved to the rear of the latch-pivot to open the latch and hold it open.

19. In a device of the character described, in combination, a base member having an upturned end at the one part and an upstanding flange at the other part, an upwardly curved, arcuate latch member pivoted to said flange and swinging just inside said upturned end, a movable jaw adjustably secured to the top of said base member and cooperating with said upturned end to define a coil-receiving slot, a handle having a pair of legs straddling said latch and pivoted to opposite sides of said flange, and a spring pressed member carried by said handle and riding on the convex edge of said latch.

20. In a device of the character described, in combination, a base member having at one end an upturned jaw whose inner face is flat and whose outer face is rounded about a horizontal axis, a swinging latch member pivoted to said base member at a point removed from said jaw and swinging just inside the same, and a handle carried by one of said members and operatively engaging the other member to hold said latch depressed.

In testimony whereof, I hereunto affix my signature.

ALVIN J. FATHAUER.