

Oct. 12, 1948.

R. B. JAMES

2,451,222

COIL FORMER

Filed Sept. 5, 1946

3 Sheets-Sheet 1

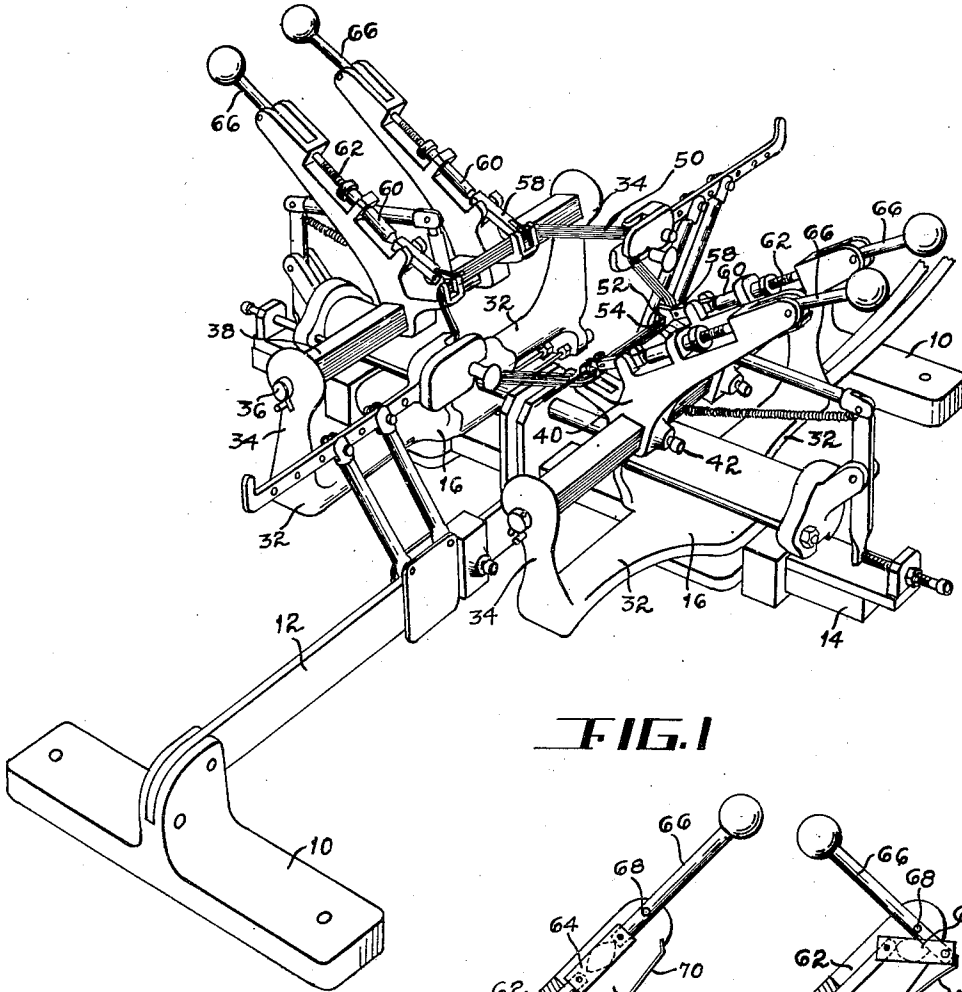


FIG. 1

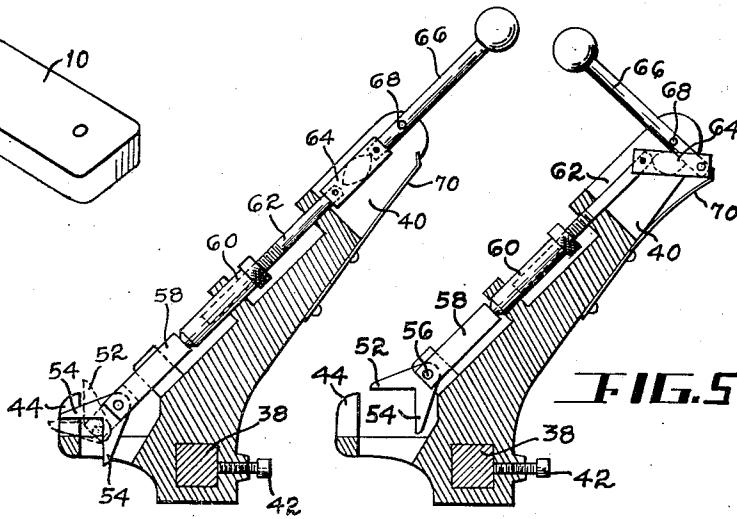


FIG. 4

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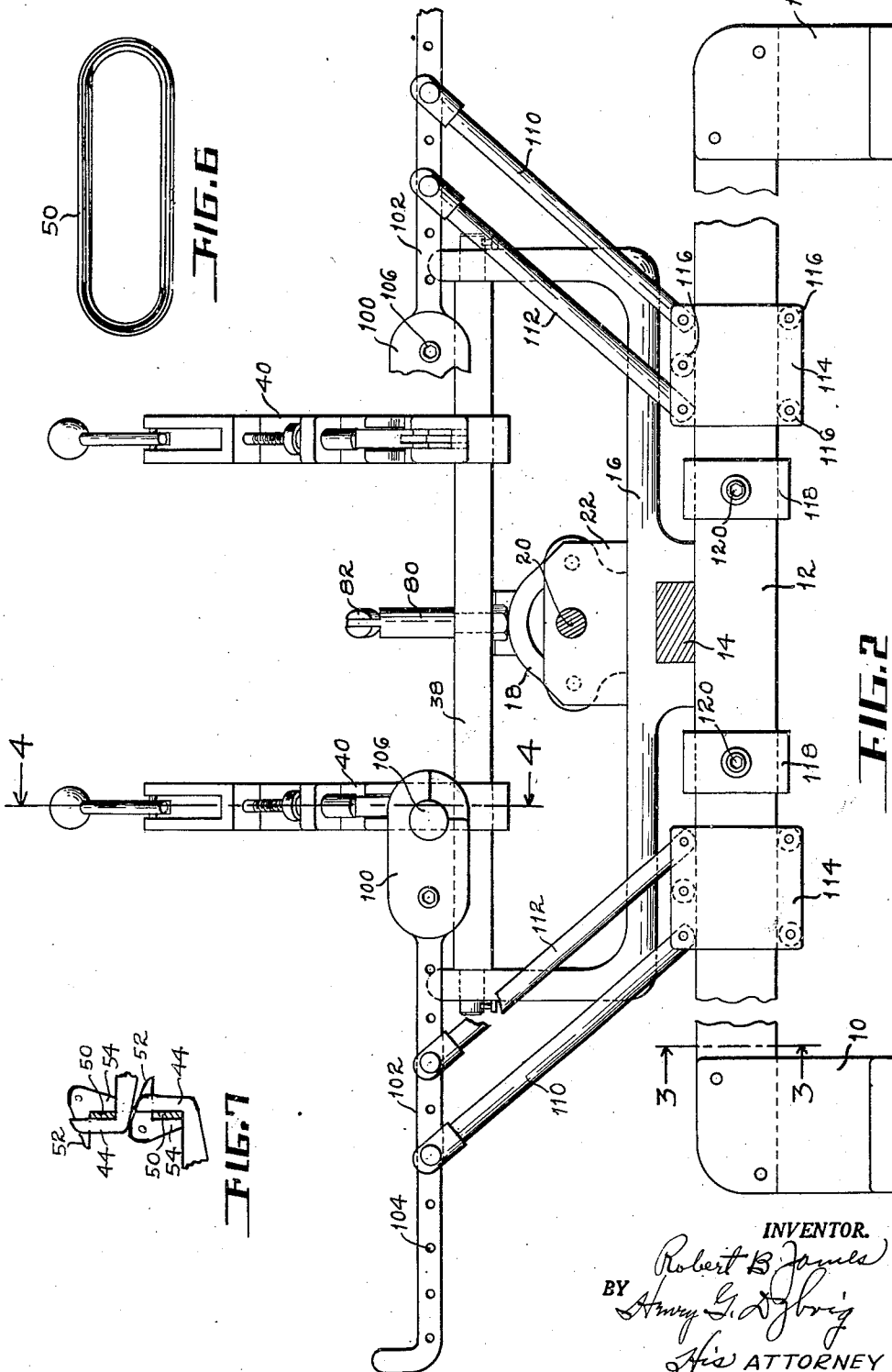
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COIL FORMER

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3 Sheets-Sheet 2



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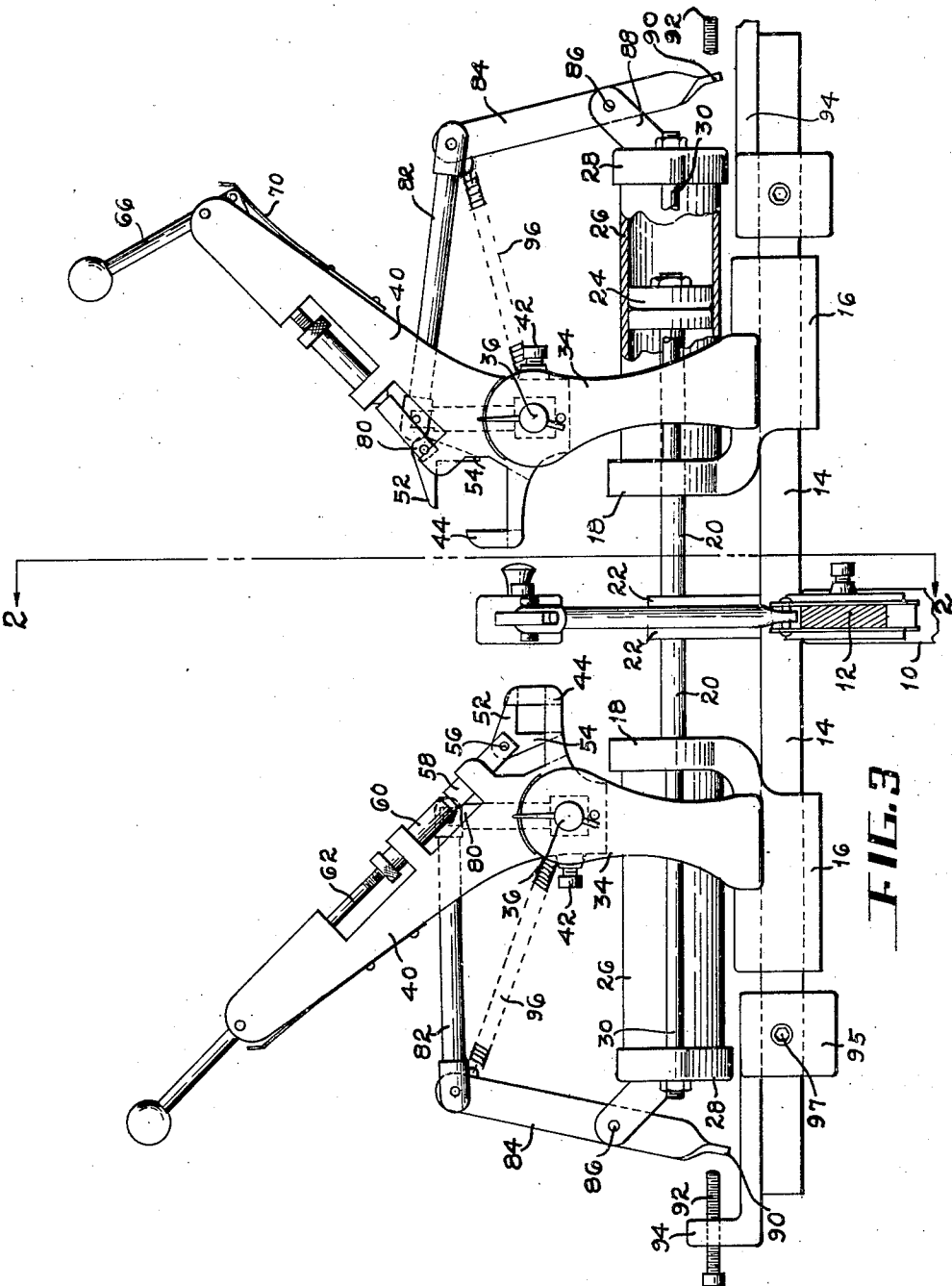
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3 Sheets-Sheet 3



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COIL FORMER

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13 Claims. (Cl. 153—11)

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This invention relates to a coil forming machine and more particularly to a coil forming machine used in forming a coil for insertion in the slots of an electric motor or dynamo, but not necessarily so limited.

An object of this invention is to provide a coil former that spreads the coil to the proper width and twists the sides of the coil so as to have the proper curvature to fit radially disposed slots and at the same time retain the ends of the coils in the proper angular relation, which coil former operates efficiently from any suitable source of power, in that it may be hand driven, pneumatically driven, hydraulically driven or electromagnetically driven. The coils that are formed are uniform as a finished product, resulting in economy of production and ultimate insertion.

Other objects and advantages reside in the construction of parts, the combination thereof and the mode of operation, as will become more apparent from the following description.

In the drawings,

Figure 1 is a perspective view of the coil forming machine showing a coil in the process of formation.

Figure 2 is a cross sectional view taken substantially on the line 2—2 of Figure 3, with parts broken away.

Figure 3 is a cross sectional view taken substantially on the line 3—3 of Figure 2, with parts broken away.

Figure 4 is a cross sectional view taken substantially on the line 4—4 of Figure 2.

Figure 5 is another cross sectional view similar to Figure 4, showing the coil-gripping fingers in retracted position.

Figure 6 is a side elevational view of the coil before it is expanded.

Figure 7 is a fragmentary cross sectional view of the coil-engaging members holding the coil in readiness to be expanded.

The coil forming device includes a pair of brackets 10 adapted to be rigidly secured to a work table or work bench or any other suitable stand or support. The brackets 10 support a rail 12 forming the main support for the device. This rail 12 supports a transversely disposed bar or rail 14. The bar 14 is attached to the rail 12 in any suitable manner, as for example, by welding. The rail 12 and the bar 14 cooperate to form the frame structure for the coil forming device. The coil forming device includes means for expanding the sides of the wire and for twisting the sides of the wire into proper angular relation. In addition thereto, the coil forming de-

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vice includes a pair of end-supporting floating devices that hold the ends of the coil in proper angular relation.

The coil-expanding means will now be described, and includes a pair of bracket members 16 mounted for reciprocatory movement upon the bar 14 which forms sides therefor. One bracket member 16 is mounted on one side of the rail 12 and the other bracket member 16 is mounted on the other side of the rail 12. Each bracket 16 is provided with an upwardly directed cylinder head portion 18 provided with a suitable opening for a piston rod 20. The piston rods 20 extend from one side to the other and are fixedly secured to the brackets 22, one on either side, supported in any suitable manner upon the rail 12 and the bar 14. The piston rod 20 has a piston 24 mounted on either end, only one of which has been shown, each piston 24 being located in a cylinder 26 closed by a cylinder head 28 secured to the cylinder head portion 18 by suitable bolts 30.

Each of the brackets 16 is also provided with a pair of laterally disposed arms 32 terminating in upwardly directed extensions or arms 34. The upwardly directed extensions 34 are provided with apertures or holes receiving the round ends 36 of square rods or bars 38.

Each of the rods 38 has adjustably mounted thereon expansion brackets 40. When the expansion brackets have been adjusted into position, they are held in such position by suitable set screws 42. A bifurcated coil-engaging extension or furcation 44 projects towards the center of the machine and constitutes a first jaw of a coil holding device. As may best be seen by referring to Figure 3, the extension 44, to the right of Figure 3, is on a higher level than the extension 44 to the left of Figure 3. This arrangement permits a coil of wire 50, having a contour like that shown in Figure 5, with the loops or convolutions of wire all lying in a common plane, to be positioned in the extensions 44, as shown in Figure 6. This is the initial position of the device. The sides of the coil 50 are clamped in position by coil-engaging fingers 52 or 54, as the case may be. The fingers 52 and 54 are integral and pivoted at 56 to a plunger 58 connected by universal joint to a tubular joint 60 receiving a threaded rod 62 connected to a link 64 actuated by a lever 66 pivoted at 68. The fingers 52 and 54 thus form a second jaw of a coil engaging device which is complementary to the first mentioned jaw 44, as best indicated in Figures 4 and 5 of the drawing. The complementary jaw, which includes the coil

engaging fingers 52 and 54, is removable relative to the jaw 44 in an angular direction relative to the sides of the coil, whereby both the vertical and horizontal sides of the coil are firmly gripped in response to movement of the plunger 58 in the angular direction.

As may be best seen in Figures 4 and 5, when the lever 66 is in the position shown in Figure 5, the fingers 52 and 54 are retracted in readiness to grip the sides of the wire. By actuating the lever 66 in the position shown in Figure 4, the finger 54 is actuated against the side of the coil and the finger 52 engages the top of the coil, as shown in the full line position. If the fingers 52 and 54 are actuated into the dot-dash position shown in Figure 4, the finger 52 will engage the side of the coil and the finger 54 will engage the bottom of the coil. These fingers clamp the coil against the furcations of member 44. A spring 70 is used in holding the lever 66 in the kinked position shown in Figure 5. By this arrangement, the fingers 52 and 54 may be held in the retracted position out of engagement with the sides of the coil. When the lever 66 is actuated into the position shown in Figure 4, it is preferably actuated a slight distance beyond dead center, so as to lock the fingers in engagement with the sides of the coil.

By separating the brackets or pulling the extensions 34 on one side of the coil and the extensions 34 on the opposite side of the coil laterally in the opposite direction, the sides of the coil are extended. This is accomplished either pneumatically or hydraulically by supplying a fluid to the cylinders 26 so as to cause the cylinders to move outwardly from the rail 12 to separate the sides of the coil.

However, it is not only necessary to separate the sides of the coil; but it is also necessary to impart an angular deflection of the coil, so as to cause the sides of the coil to be radially disposed with respect to a common center. This common center depends upon the use to which the coil is to be put.

The twist is imparted to the sides of the coil by a link mechanism including a pair of arms, 80, one for each of the rods 38. Each arm 80 is pivotally attached to a link 82 connected to a lever 84, pivoted at 86 to a bracket 88 integral with the cylinder head 28. The lever 84 terminates in a portion 90 that moves in a path of an adjusting screw 92 threadedly engaging a bracket 94 fixedly secured to a slotted guide 95 that is adjustably mounted upon the cross bar 14, and locked in position by a set screw 97. The guide 95 may be adjusted with respect to the bar 14 and provides a limit for the outward movement of the bracket 16 and the parts carried thereby. As the cylinders 26 advance outwardly from the center, the links 82 and the lever 84 are held in the position shown in Figure 3 by suitable springs 96 until the end portion 90 of the lever 84 engages the screw 92, at which time the lever 84 is rotated about the pivot 86, causing the link 82 to be pulled outwardly more rapidly than the extension 34, thereby oscillating each of the rods 38 and with them the brackets 40, so as to impart a twist to the sides of the coil. The degree of twist is determined by the adjustment of the screw 92.

Although the sides of the coil are expanded and twisted into the desired contour, it is quite desirable to hold the end of the coil in a common plane, which incidentally happens to be the original plane. This has been accomplished by a pair of floating supports including coil-engaging

brackets or members 100, carried upon links 102 provided with a plurality of apertures 104. The coil-engaging brackets 100 are provided with removable screws or pins 106 that are passed through the ends of the coil, extending into suitable slots in the bracket 100.

In order to provide a support for the brackets 100 and the links 102, a pair of supporting members 110 and 112 are pivotally mounted to the link 102 and pivotally mounted to a sliding support 114 mounted upon the rail 12. Suitable rollers 116 may be used for engaging the top and bottom sides of the rail 12 so as to permit the sliding supports 114 to move away from and toward each other in response to movement of the coil. Suitable stops 118 may be used in limiting the movement of the sliding supports 114 towards each other. These stops 118 are adjustably mounted upon member 12 and held in adjusted position by suitable set screws 120.

By properly adjusting the stops 118 these stops may be used in imparting a curvature to the ends of the coil. This is accomplished by members 114 engaging members 118 before the coil has been completely expanded. Then, as the coil continues to be expanded, members 114 cannot roll towards each other on the rail 12; but instead, the supporting members or links 110 and 112 pivoted to the sliding supports 114 will oscillate about the pivotal connection to members 114, thereby causing link 102 and with it coil-engaging brackets 100 to raise upwardly through an arc of a circle. As members 100 are raised upwardly, the ends of the coils are raised upwardly, so that the ends of the coils will then lie on a higher level than the sides of the coils. This may be desirable in forming certain types of coils where it is necessary to provide a central clearance under the ends of the coils.

Model of operation

Before inserting a coil into the coil forming machine, the brackets 16 are advancing towards the center of the machine, so that the coil-engaging extensions or furcations 44 and the coil-engaging fingers from the brackets located on the opposite sides will extend beyond the center of the machine. A flat coil of wire 50, is then ready to be inserted so that one side is engaged by the coil-engaging extensions or furcations 44 and the fingers 52 or 54 as the case may be, of the brackets 40 located on one side of the center. The opposite side of the coil is engaged by the coil-engaging extensions or furcations 44 and the fingers 52 or 54, as the case may be, mounted on the brackets 40 located on the opposite side of the center of the machine. The ends of the coils are inserted into the coil-holding members 100 and held in position by inserting the pins or screws 106.

The actuating fluid is then supplied in the cavity located between each piston and the cylinder head 28, so as to cause the cylinders 26 to spread the brackets 16 and with them the brackets 40. The sides of the coil are then pulled laterally in opposite directions. The end holding members 100 move towards the center. When the cylinders approach the end of their movement, the ends 90 of the levers 84 are engaged by the screws 92 so as to oscillate the bars 38 and with them the brackets 40 so as to impart a twist to the sides of the coil. At the same time, the coil-holding members 100 have been moved towards the center and may have been raised so as to deflect the ends of the coil upwardly, to thereby impart the proper contour to the coil. When this operation has been

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completed, each bracket 16 may advance towards each other slightly, so as to permit easy removal of the formed coil, which may be removed by removing the pins 106 and releasing the fingers 52 and 54 by oscillating the lever 66 into the position shown on the right hand side of Figure 3. After the coil has been removed, the machine may again be adjusted into "home" position for the loading of another coil to be expanded.

Although the preferred embodiment of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claims.

Having thus described my invention, I claim:

1. A coil spreading device for use in spreading a flatly wound coil so as to fit into radially directed slots arranged in angular spaced relation, said device including floating means for supporting the ends of the coil, a pair of carriages mounted for movement in opposite directions and located on opposite sides of the coil, two pairs of brackets pivotally mounted upon the carriages, there being one pair of brackets mounted upon one carriage and the other pair of brackets mounted upon the other carriage, means mounted upon the brackets for clamping the sides of the coil to be formed, means for actuating the carriages in opposite directions away from the plane of the coil so as to pull the sides of the coil laterally, and means for oscillating the brackets with respect to the carriages so as to deflect the sides of the coil so that the sides of the coil are radially disposed with respect to a common axis.

2. A coil spreading device for use in spreading a flatly wound coil so as to fit into radially directed slots arranged in angular spaced relation, said device including floating means for supporting the ends of the coil, a pair of carriages mounted for movement in opposite directions and located on opposite sides of the coil, coil-engaging means mounted upon each of the carriages, said coil-engaging means being mounted for oscillatory movement, the coil-engaging means mounted upon one carriage clamping one side of the coil and the coil-engaging means mounted upon the other carriage clamping the other side of the coil, means for actuating the carriages in opposite direction from the plane of the coil so as to pull the sides of the coil laterally, and means for oscillating the coil-engaging means so as to twist the sides of the coil so that the sides of the coil upon being formed will lie in intersecting planes.

3. A coil spreading device for use in spreading a flatly wound coil so as to fit into radially directed slots arranged in angular spaced relation, said device including a pair of movable floating means for supporting the ends of the coil, a pair of carriages mounted for movement in opposite directions and located on opposite sides of the coil, coil-engaging means mounted upon each of the carriages, said coil-engaging means being mounted for oscillatory movement, the coil-engaging means mounted upon one carriage clamping one side of the coil and the coil-engaging means mounted upon the other carriage clamping the other side of the coil, means for actuating the carriages in opposite direction from the plane of the coil so as to pull the sides of the coil laterally, means for oscillating the

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coil-engaging means so as to twist the sides of the coil so that the sides of the coil upon being formed will lie in intersecting planes, and said pair of movable floating means engaging the ends of the coil, said movable means being mounted for movement towards and from each other without orientation so as to hold the ends of the coil in a common plane.

4. A coil spreading device for use in spreading a flatly wound coil so as to fit into radially directed slots arranged in angular spaced relation, said device including floating means for supporting the ends of the coil, a pair of carriages mounted for movement in opposite directions and located on opposite sides of the coil, two pairs of brackets pivotally mounted upon the carriages, there being one pair of brackets mounted upon one carriage and the other pair of brackets mounted upon the other carriage, means mounted upon the brackets for clamping the sides of the coil to be formed, pneumatic means for actuating the carriages, said pneumatic means including a pair of pistons and a pair of cylinders, there being one piston and one cylinder for each carriage cooperating to actuate its carriage, and means for oscillating the brackets with respect to the carriages so as to deflect the sides of the coil so that the sides of the coil are radially disposed with respect to a common axis.

5. A coil spreading device for use in spreading a flatly wound coil so as to fit into radially directed slots arranged in angular spaced relation, said device including floating means for supporting the ends of the coil, a pair of carriages mounted for movement in opposite directions and located on opposite sides of the coil, coil-engaging means mounted upon each of the carriages, said coil-engaging means being mounted for oscillatory movement, the coil-engaging means mounted upon one carriage clamping one side of the coil and the coil-engaging means mounted upon the other carriage clamping the other side of the coil, pneumatic means for actuating the carriages, said pneumatic means including a pair of pistons and a pair of cylinders, there being one piston and one cylinder for each carriage cooperating to actuate its carriage, and means for oscillating the coil-engaging means so as to twist the sides of the coil so that the sides of the coil upon being formed will lie in intersecting planes.

6. A coil spreading device for use in spreading a flatly wound coil so as to fit into radially directed slots arranged in angular spaced relation, said device including floating means for supporting the ends of the coil, a pair of carriages mounted for movement in opposite directions located on opposite sides of the coil, two pairs of brackets mounted upon the carriages, there being one pair of brackets mounted upon one carriage and the other pair of brackets mounted upon the other carriage, and a plurality of toggle means cooperating with portions of the bracket means for clamping the sides of the coil, each of said toggle means including a member terminating in a pair of finger-like extensions one of which engages the side of the coil and the other engages the edge of the coil.

7. A coil spreading device for use in spreading a flatly wound coil so as to fit into radially directed slots arranged in angular spaced relation, said device including floating means for supporting the ends of the coil, a pair of carriages mounted for movement in opposite directions and located on opposite sides of the coil, two pairs of brackets pivotally mounted upon the carriages,

there being one pair of brackets mounted upon one carriage and the other pair of brackets mounted upon the other carriage, means mounted upon the brackets for clamping the sides of the coil to be formed, means for actuating the carriages in opposite directions away from the plane of the coil so as to pull the sides of the coil laterally, and means mounted in the path of movement of the carriages for oscillating the brackets with respect to the carriages so as to twist the sides of the coil from the original plane thereof.

8. A coil spreading device for use in spreading a flatly wound coil so as to fit into radially directed slots arranged in angular spaced relation, said device including floating means for supporting the ends of the coil, a pair of carriages mounted for movement in opposite directions and located on opposite sides of the coil, coil-engaging means mounted upon each of the carriages, said coil-engaging means being mounted for oscillatory movement, the coil-engaging means mounted upon one carriage clamping one side of the coil and the coil-engaging means mounted upon the other carriage clamping the other side of the coil, means for actuating the carriages in opposite direction from the plane of the coil so as to pull the sides of the coil laterally, and means mounted in the path of movement of the carriages for oscillating the brackets with respect to the carriages so as to twist the sides of the coil from the original plane thereof.

9. A coil spreading device for use in spreading a flatly wound coil so as to fit into radially directed slots arranged in angular spaced relation, said device including a pair of carriages mounted for movement in opposite directions and located on opposite sides of the coil, coil-engaging means mounted upon each of the carriages, said coil-engaging means being mounted for oscillatory movement, the coil-engaging means mounted upon one carriage clamping one side of the coil and the coil-engaging means mounted upon the other carriage clamping the other side of the coil, means for actuating the carriages in opposite direction from the plane of the coil so as to pull the sides of the coil laterally, means mounted in the path of movement of the carriages for oscillating the brackets with respect to the carriages so as to twist the sides of the coil from the original plane thereof, and a pair of movable means engaging the ends of the coil for supporting the same, said movable means being mounted for movement towards and from each other without orientation so as to hold the ends of the coil in a common plane.

10. In a coil spreading device for use in spreading a flatly wound coil so as to fit into radially directed slots arranged in angular spaced relation, a support, first means carried by said sup-

port for supporting the ends of the coil, a pair of carriages mounted on said support for movement in opposite directions and located on opposite sides of the coil, bracket means mounted upon the carriages, and a plurality of clamping means cooperating with portions of the bracket means for clamping the sides of the coil, each of said clamping means including a coil engaging member terminating in a pair of finger-like extensions, one of which engages the side of the coil and the other of which engages the edge of the coil, each of said clamping means including means for actuating said coil engaging member at an obtuse angle to the sides of the coil engaged thereby.

11. In a coil spreading device for use in spreading a flatly wound coil so as to fit into radially directed slots arranged in angular spaced relation, a coil engaging clamp comprising first means for engaging two adjacent sides of said coil, second means including a member terminating in a pair of finger-like extensions for engaging the opposite sides of said coil, and a single actuator for moving said member at an obtuse angle to the sides of the coil and into engagement with said coil whereby one of said finger-like extensions engages one side of said coil and the other of said finger-like extensions engages an adjacent side of said coil.

12. In a coil spreading device for use in spreading a flatly wound coil, a coil supporting bracket having a pair of fingers for engaging inner and bottom surfaces of said coil, a complementary member terminating in a pair of finger-like extensions, one of which is adapted to engage the top side of said coil and the other of which is adapted to engage the outer side of said coil, and means for actuating said complementary member at an obtuse angle relative to the sides of said coil so as to cause said coil to be gripped by said fingers.

13. In a coil spreading device, a coil engaging jaw including a portion having two coil engaging surfaces arranged at right angles to one another for engaging two sides of said coil, a second jaw having complementary surfaces arranged at right angles for engaging the two opposite sides of said coil, and means for supporting said second jaw for movement in a direction toward one corner of said coil whereby said coil may be gripped between said jaws.

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REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Name	Date
1,437,887	Comstock	Dec. 5, 1922