Aug. 14, 1928. 1,680,847

A. W. BJORKMAN

COIL SPREADING DEVICE

Filed Jan. 4, 1927 5 Sheets-Sheet 1

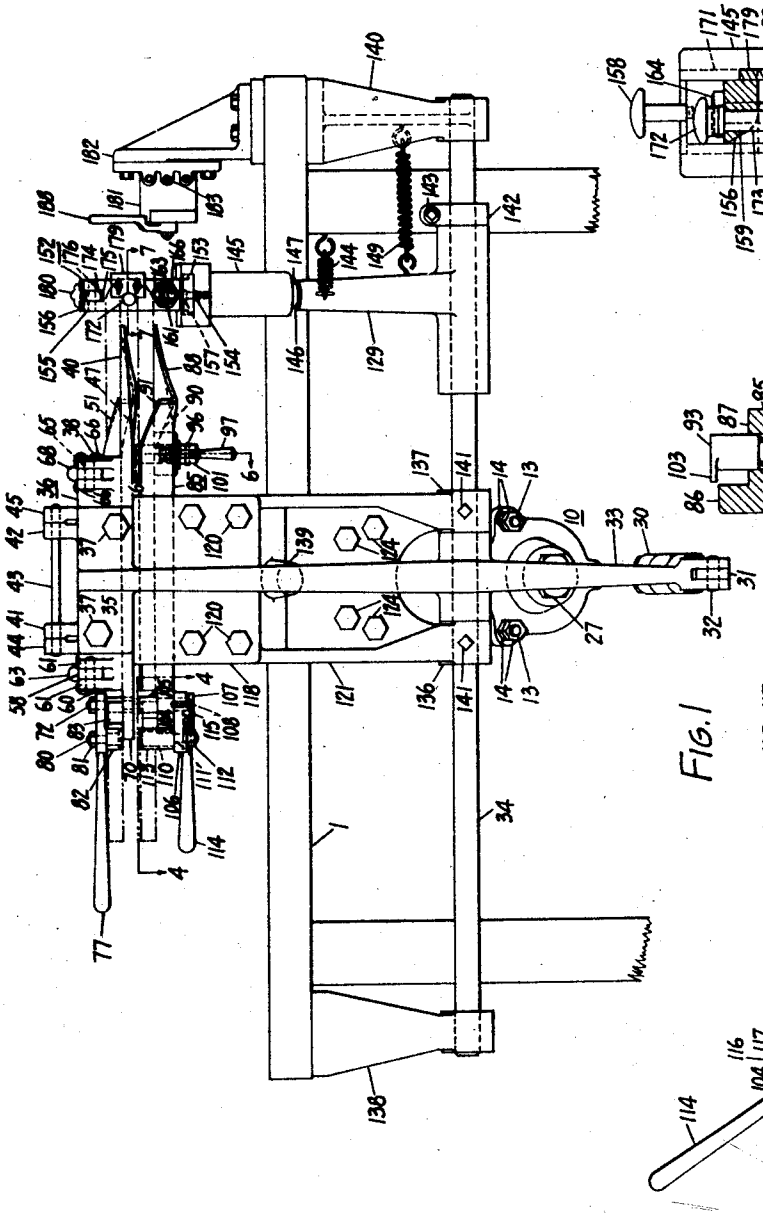


FIG. 1

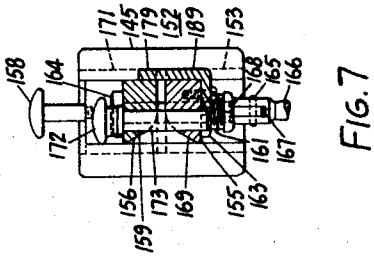


FIG. 7

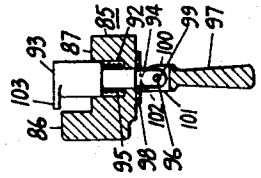


FIG. 6

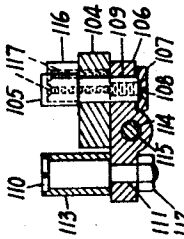


FIG. 5

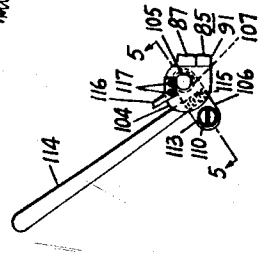


FIG. 4

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Aug. 14, 1928. 1,680,847

A. W. BJORKMAN

COIL SPREADING DEVICE

Filed Jan. 4, 1927 5 Sheets-Sheet 2

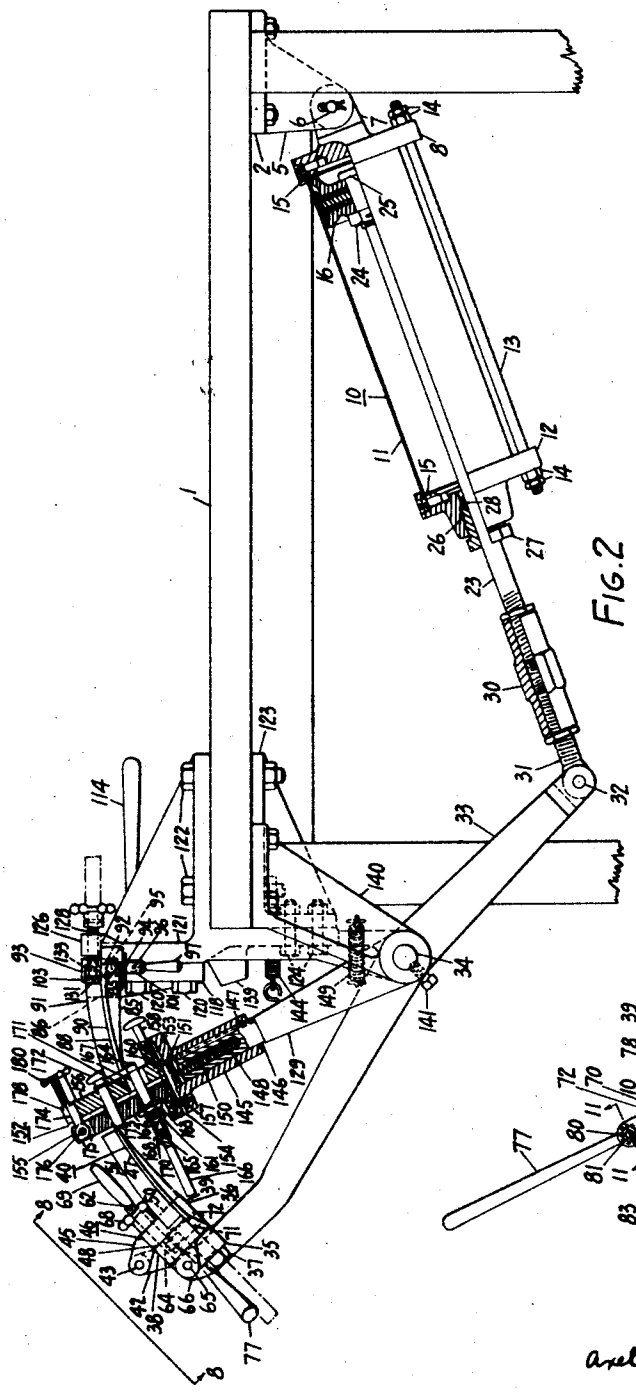


FIG. 2

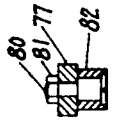


FIG. 11

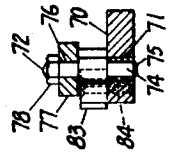


FIG. 10

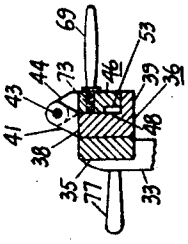


FIG. 9

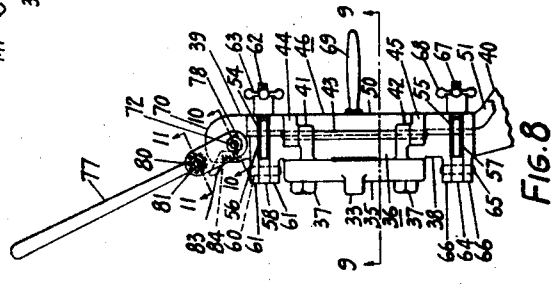


FIG. 8

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Aug. 14, 1928. 1,680,847

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COIL SPREADING DEVICE

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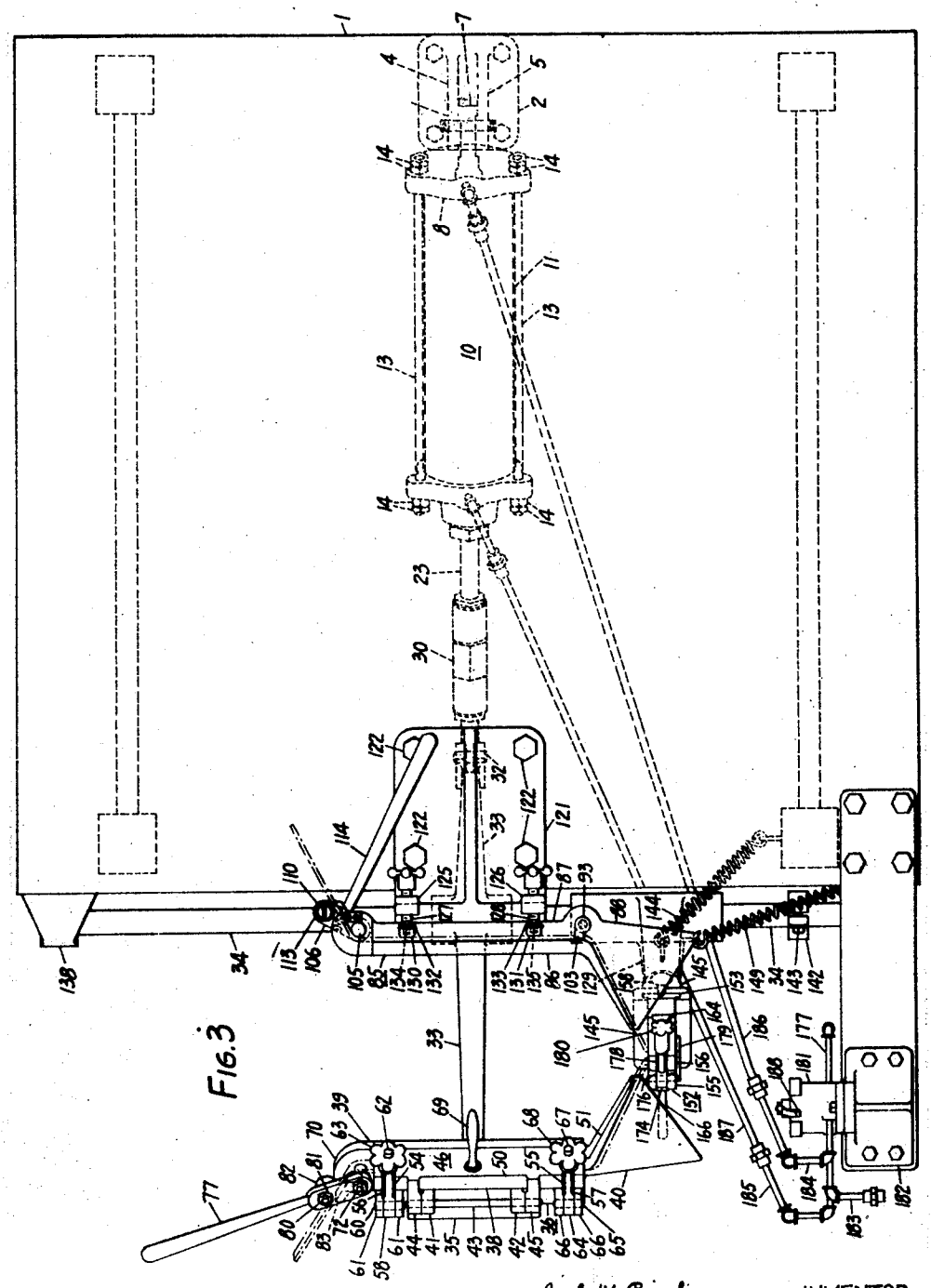


FIG. 3

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Aug. 14, 1928. 1,680,847

A. W. BJORKMAN

COIL SPREADING DEVICE

Filed Jan. 4, 1927 5 Sheets-Sheet 4

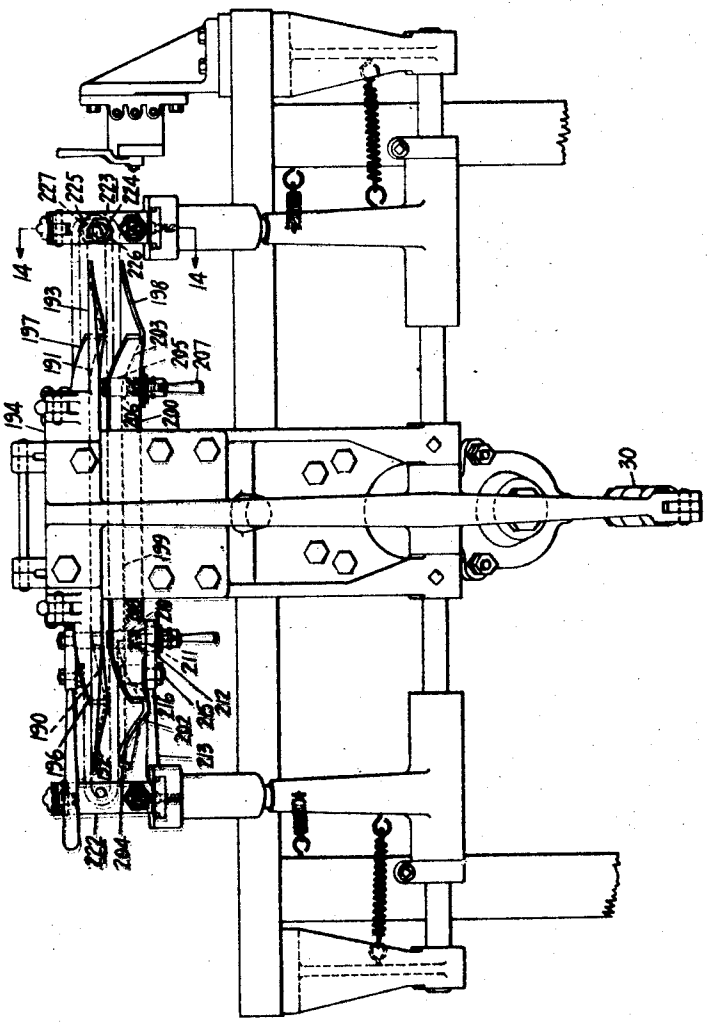


FIG. 12

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Aug. 14, 1928. 1,680,847

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COIL SPREADING DEVICE

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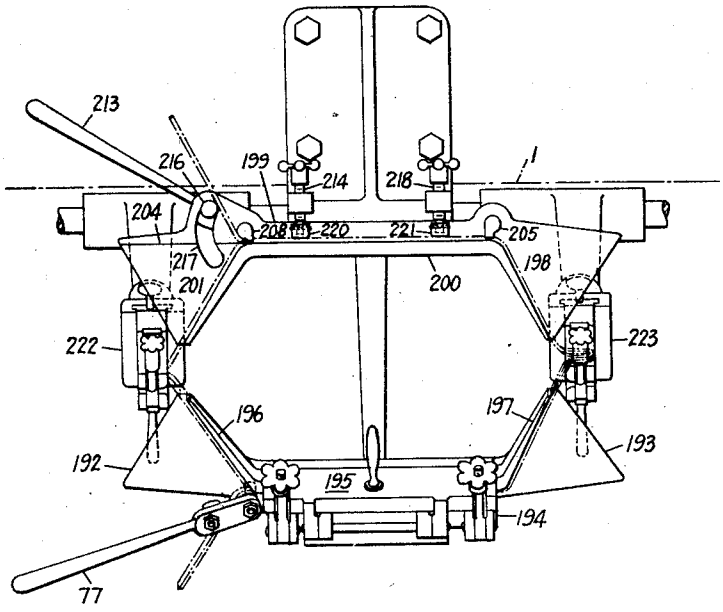


FIG. 13

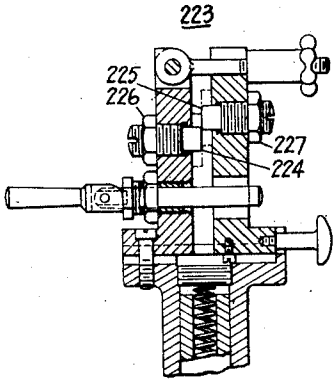


FIG. 14

Axel W. Bjorkman INVENTOR

BY Matthew F. Bradley ATTORNEY

Patented Aug. 14, 1928. 1,680,847

UNITED STATES PATENT OFFICE.

AXEL W. BJORKMAN, OF BROOKLYN, NEW YORK, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

COIL-SPREADING DEVICE.

Application filed January 4, 1927. Serial No. 158,893.

This invention relates to coil spreading devices and particularly to devices for spreading coils to be used for armatures of dynamo electric machines.

A feature of the invention is to provide a device of the above character that is of simple construction and easily operated.

Another feature of the invention resides in the provision of a device of the above character that requires but little manual adjustment and reduces to a minimum the time required to spread a coil.

A third feature of the invention is to provide a coil spreading device that will not injure the coil or its insulation either during the spreading operation or during the removal of the coil from the device.

Other features and advantages will become apparent from the specification, taken in connection with the accompanying drawings wherein the invention is embodied in concrete form.

In the drawings:—

Figure 1 is a front elevation of the coil spreading device with a coil mounted thereon preparatory to spreading;

Figure 2 is a side elevation of the coil spreading device, with parts broken away, and illustrates the form taken by the coil after spreading;

Figure 3 is a plan view of Figure 2;

Figure 4 is a view taken along the line 4—4 of Figure 1;

Figure 5 is a sectional view taken along the line 5—5 of Figure 4;

Figure 6 is a sectional view taken along the line 6—6 of Figure 1;

Figure 7 is a sectional view taken along the line 7—7 of Figure 1;

Figure 8 is a view taken along the line 8—8 of Figure 2;

Figure 9 is a sectional view taken along the line 9—9 of Figure 8;

Figure 10 is a sectional view taken along the line 10—10 of Figure 8;

Figure 11 is a sectional view taken along the line 11—11 of Figure 8;

Figure 12 is a view similar to Figure 1 and illustrates the coil spreading device preparatory to spreading a closed type of coil;

Figure 13 is a plan view of the coil spreading device with parts broken away and illustrates the form taken by the closed type of coil after spreading; and

Figure 14 is a sectional view taken along the line 14—14 of Figure 12.

Reference may first be had to Figures 1 and 2 illustrating the device as a whole wherein, according to the preferred arrangement, a bench 1 is provided to support the coil spreading machine. A bracket 2 is secured to the underside of the bench 1. The bracket 2 is formed with two downwardly extending spaced lugs 4 and 5. Lugs 4 and 5 are provided with aligned cylindrical apertures and a pin 6 extends through these apertures and is retained in them as by cotter pins. A lug 7 is formed on a cylinder end cover 8 and this lug extends between lugs 4 and 5 on the bracket 2. Pin 6 extends through an aperture in lug 7 and acts as a pivotal support for one end of a pneumatic cylinder 10. Pneumatic cylinder 10 comprises the end cover 8, a tubular portion 11, and a head 12. Three tie rods 13 extend through apertures in the end cover 8 and through similar apertures in the head 12. Nuts 14 on the end of the tie rods serve to secure the end cover 8 and head 12 to the tubular portion 11. Washers 15 of fibrous material are positioned between the tubular portion 11 and parts 8 and 12 in order to obtain air-tight joints between the tubular portion 11 and these parts. A nut 24 is threaded on the piston rod 23 adjacent one side of the piston 16 and urges the piston against the headed end 25 of the piston rod, thereby holding the several parts of the piston together. The piston rod 23 extends through an aperture 26 in the head 12. A packing nut 27 is threaded into the aperture 26 and bears against a packing washer 28 surrounding the piston rod 23. The outer end of the piston rod is threaded and is connected by a turnbuckle 30 to the threaded end of a connecting rod 31. The thread on the connecting rod is opposite to that on the outer end of the piston rod. The other end of the connecting rod is flat and is pivotally mounted on a pin 32 carried by the lower bifurcated end of an operating lever 33. Operating lever 33 is pivotally mounted on a stationary shaft 34. From the shaft 34 the lever 33 extends upwardly and has a flat enlarged upper end

portion 35. In the event that the device is to be used to spread open type coils, i. e. those wherein the sides of the coil form a loop at only one end, then a movable former 36 is secured to the end portion 35 of the operating lever by screws 37 extending through apertures in the end portion 35 and threaded into the movable former 36. The movable former 36 comprises a body portion 38 having a ledge 39 extending therefrom and a fan shaped forming portion 40. The upper surface 47 of the fan shaped forming portion 40 is curved. The center of curvature of the surface 47 lies in the plane of a clamping face 48 of the body portion 38. The body portion 38 has two hinge lugs 41 and 42 extending upwardly therefrom. Lugs 41 and 42 are provided with aligned apertures. A hinge pin 43 extends through similar apertures in lugs 44 and 45 formed on a hinge clamp 46. The hinge clamp 46 comprises a body portion 50 and an offset guide portion 51. The lower surface of the offset guide portion 51 is curved and this surface conforms to the curvature of the upper surface 47 of the fan shaped forming portion of the former 36. With the hinge clamp 46 in the position shown in Figure 2, the lower surface of the guide portion 51 rests upon the upper surface 47 of the former 36. The body portion 50 of the hinge clamp is rabbeted at 52 thereby providing a recessed clamping face 53 extending parallel to the clamping face 48 of the former 36. This body portion is formed with two recesses 54 and 55 that are in alignment with similar recesses 56 and 57 provided in the body portion of the former 36. An eye-bolt 58 is pivotally mounted on a pin 60 carried by lugs 61 formed in the body portion of the former. The shank 62 of the eye-bolt 58 extends through the recesses 54 and 56 and has a star nut 63 threaded on its outer end. Similarly, an eye-bolt 64 is pivotally mounted on a pin 65 and is carried by lugs 66 formed on the body portion of the former. The shank 67 of the eye-bolt 64 extends through the recesses 55 and 57 and has a star nut 68 threaded on its outer end. The star nuts 63 and 68 engage a side of the body portion 50 of the hinge clamp. A handle has a reduced end 73 threaded into the body portion 50 of the hinge clamp.

A lug 70 extends from one end of the ledge 39 of former 36. Lug 70 has a bushed bearing aperture 71 extending therethrough.

A pivot bolt 72 has a reduced lower end portion 74 positioned within the bearing aperture 71. The end of this reduced end portion is beveled at 75 so as to permit the ready insertion of the end portion 74 into the bearing aperture 71. The pivot bolt 72 also has a reduced upper portion 76 that extends through an aperture in a handle 77. A nut 78 is threaded on the outer end of the portion 76 adjacent the handle 77 and secures the handle 77 to the pivot bolt 72. A bolt 80 has a reduced portion extending through an aperture in the handle 77. A nut 81, threaded on the end of this reduced portion, secures the bolt 80 to the handle 77. A roller 82 is rotatably mounted on the bolt 80. A stop member 83 is positioned adjacent the bearing aperture 71 and is secured to the lug 70 by screws 84.

A stationary former 85 is arranged to cooperate with the movable former 36. Former 85 comprises a body portion 86 having a ledge 87 extending therefrom and a fan shaped forming portion 88. The upper surface 90 of the fan shaped forming portion 88 is curved. The curvature of the surface 90 is similar to the curvature of surface 47 of the movable former 36. A guide flange 91 is formed on the forming portion 88. Flange 91 is a continuation of the body portion 86.

The ledge 87 has an aperture 92 of circular cross-section extending therethrough. A portion of the aperture 92 is of greater diameter than the remaining portion. A clamp stud 93 extends into the portion of the aperture 92 that is of greater diameter and has a reduced shank 94 that extends through the portion of aperture 92 that is of lesser diameter. A compression spring 95 surrounds the shank 94 within the aperture 92 and bears at one end against the clamp stud 93 and at the other end against a shoulder formed in the ledge 87 by the portion of aperture 92 that is of lesser diameter. The outer end portion of shank 94 is flattened and has a transverse aperture 99 extending therethrough. A pivotal pin 96 extends through aperture 99 and through aligned apertures in the bifurcated end part 101 of a releasing lever 97. A washer 98 is positioned on the flattened end portion of shank 94 between the underside of ledge 87 and part 101 of the releasing lever 97. The distance between a side 100 of the end part 101 and the pivotal pin 96 is less than the distance between the end 102 of end part 101 and this pivotal pin. The surface of the end part 101 joining the side 100 and the end 102 is curved, and constitutes a part of a cam surface comprising the side 100, the curved surface and the end 102. The spring 95 causes the end part 101 of the releasing lever to bear against the washer 98. A clamping lug 103 is formed on the upper end of the clamp stud 93.

A lug 104 is formed on the end of the ledge 87. A pivotal stud 105 has a reduced portion extending through an aperture in the lug 104 and through an aperture 109 in a bending block 106. A washer 107 is secured to the end of the reduced portion of the pivotal stud 105 by a screw 108. This

washer retains the bending block on the stud 105. A roller stud 110 has a reduced portion extending through an aperture 111 in the bending block. A nut 112, threaded on the reduced portion of the roller stud 110, retains this portion of the stud within the aperture 111. A roller 113 is rotatably mounted on the roller stud 110. A handle 114 has a reduced end threaded into a recess 115 provided in the bending block 106. A stop member 116 is secured to the lug 104 by screws 117.

The body portion 86 of the stationary former has a downwardly extending flange 118 that is provided with four apertures. Screws 120 extend through these apertures and are threaded into a supporting bracket 121, thereby securing the stationary former to this supporting bracket. Supporting bracket 121 is mounted on the bench 1 and is secured to this bench by bolts 122 extending through aligned apertures provided in the supporting bracket, the bench and a sub-bracket 123. The sub-bracket is also directly secured to the supporting bracket by bolts 124. Two similar lugs 125 and 126 are formed on the upper end of the supporting bracket 121. Clamp screws 127 and 128 are threaded through apertures in the lugs 125 and 126 and have reduced end portions that extend into clamp blocks 130 and 131. Pins 132 and 133 extend through apertures in the clamp blocks 130 and 131 and are positioned within annular grooves 134 and 135 provided in the reduced end portions of the clamp screws, thereby retaining the clamp blocks on the reduced end portions of the clamp screws. By turning the star heads of these clamp screws, the clamp blocks may be moved towards or away from the body portion 86 of the stationary former.

Supporting bracket 121 is formed with downwardly extending supporting lugs 136 and 137. Stationary shaft 34 extends through aligned apertures in lugs 136 and 137 and has its ends supported in brackets 138 and 140 secured to the bench 1. Set screws 141 are threaded through the walls of the lugs 136 and 137 and engage the shaft 34, thus retaining this shaft in fixed position. A stop 139 is formed on the bracket 121 and is arranged to be engaged by the operating lever 33.

A clamp lever 129 is pivotally mounted on the shaft 34 and is positioned adjacent the bracket 121. A tension spring 149 has one end secured by an eye-bolt to the clamp lever 129 and its other end likewise secured to the bracket 140. Spring 149 tends to retain the hub of clamp lever 129 in engagement with a stop collar 142 secured on the shaft 34 by a screw 143. A similar tension spring 144 has one end secured by an eye-bolt to the clamp lever and its other end secured to the underside of the bench 1. Spring 144 tends to retain the clamp lever in a vertical position and in engagement with the bench 1.

The upper portion 146 of clamp lever 129 is reduced in diameter and is surrounded by a clamp sleeve 145. Clamp sleeve 145 may slide along the upper portion 146 but is prevented from turning by a key 147 secured to portion 146. Portion 146 is provided with a longitudinal recess 148. A compression spring 150 is positioned within the recess 148 and bears at one end against the bottom of this recess and at its other end against a plug 151 threaded into the clamp sleeve 145. Spring 150 supports the weight of clamp sleeve 145 together with that of an end clamp 152 carried by this sleeve, so that the plug 151 is spaced from the upper end of the clamp lever. The upper end of the clamp sleeve has a transversely extending T slot 153 provided therein. The bottom of this slot has a groove 154 that extends for the greater portion of the length of this slot.

End clamp 152 comprises a stationary jaw 155 and a movable jaw 156. The lower portion of these jaws are T-shaped and are positioned within the T slot 153 provided in the clamp sleeve 145. Stationary jaw 155 is secured to the clamp sleeve by a screw 157 extending through an aperture in the jaw 155 and threaded into the clamp sleeve. A handle 158 has a reduced end threaded into an aperture in the movable jaw 156. A stop screw 160 is threaded into the lower end of the movable jaw 156 and has its head extending into the groove 154. A sleeve 161 is adjustably threaded into an aperture 162 provided in the stationary jaw 155. A lock nut 163, threaded on the sleeve 161 and bearing against the jaw 155, retains the sleeve 161 in its adjusted position in the aperture 162. The shank 167 of a T bolt 164 extends through a guide aperture in the sleeve 161 and has a transverse aperture in its end. A pivotal pin 165 is carried by the bifurcated end portion of a releasing lever 166 and extends through the aperture in the end of the shank 167. The bifurcated end portion of the releasing lever has the form of a cam. The distance between the end 168 of this bifurcated end portion and the pivotal pin 165 is greater than the distance between the side 170 of this end portion and the pivotal pin 165.

The shank 167 of the T bolt also extends through an elongated aperture 171 provided in the movable jaw 156. The head of the T bolt 164 extends across the aperture 171 and abuts the side of the jaw 156. The aperture 171 conforms to the shape of the head of the T bolt 164. A positioning pin 172 has a shank 173 extending through aligned apertures 159 and 169 in the clamp jaws 156 and 155. A coil stop bracket 179

is adjustably secured by screws to the jaw 155 and has a flange 189 extending parallel to the positioning pin 172. An I-bolt 174 has its head positioned within a slot 175 provided in the stationary jaw 155. The head of the I-bolt 174 is pivotally mounted on a pin 176 that extends through the jaw 155 and through the eye of the I-bolt. The shank of the I-bolt 174 rests in a slot 178 provided in the movable jaw 156. A star nut 180 is threaded on the shank of the I-bolt 174 and engages the side of the movable jaw 156.

A compressed air valve 181 is mounted on a bracket 182 carried by the bench 1. An inlet pipe 183 connects the valve 181 to a source of compressed air. The valve 181 has a pipe 184 connected by a flexible hose 186 to piping threaded into a port formed in the end cover 8. The port in the end cover 8 extends to the inside of pneumatic cylinder 10 to the space in this cylinder under the piston 16. The valve also has a pipe 185 connected by a flexible hose 187 to piping threaded into a port formed in the head 12. The port in the head 12 extends to the inside of the pneumatic cylinder 10 to the space in cylinder 10 above the piston 16. The valve is also provided with an exhaust pipe 177.

The valve 181 is controlled by a handle 188. When handle 188 is in the position that causes the inlet pipe 183 to be connected to the pipe 184, then the pipe 185 is connected to the exhaust pipe 177. Likewise when the handle 188 is in the position that causes the inlet pipe 183 to be connected to the pipe 185, then the pipe 184 is connected to the exhaust pipe 177.

The operation of the coil spreading device is illustrated in Figures 1, 2 and 3. Preliminary to placing the coil in the spreading device, the handle 188 of the valve 181 is positioned so that the inlet pipe 183 is connected to the pipe 185. With handle 188 in this position the piston 16 is at the inner end of its stroke and the spreading device is in its spread position, the movable former 36 being spaced away from the stationary former 85 as shown in Figure 2. The hinge clamp 46 is placed in its inoperative position upon the top of the movable former 36 with the body portion 50 disengaged from the clamping face 48 of the movable former. In this position of the hinge clamp the I-bolts 58 and 64 hang down from their pivot pins 60 and 65 and do not engage the recesses provided for them in former 36 and in hinge clamp 46.

The clamp blocks 130 and 131 and the clamping lug 103 on the clamp stud 93 are positioned so as to permit the insertion of one side of the coil between these members and the body portion 86 of the stationary former. The movable jaw 156 of the end clamp 152 is spaced from the stationary jaw 155 so as to permit the insertion of the closed end of the coil between these jaws.

In carrying out the spreading operation, one side of the coil to be spread is inserted between the body portion 86 and the clamp blocks 130, 131 and stud 93. This side of the coil is permitted to rest on the ledge 87 while the closed end of the coil is placed between the jaws 156 and 155 of the end clamp 152 so that the end of this coil abuts the stop bracket 179. The end of the positioning pin 172 is then passed through aperture 159 in the jaw 156, through the coil and through aperture 169 in the jaw 155. The eye-bolt 174 is swung about its pivot pin 176 so as to cause its shank to enter the slot 178 provided in the movable jaw 156. Star nut 180 is turned to cause the jaws of the end clamp to grip the end of the coil. The head of the T bolt 164 is passed through aperture 171 in the jaw 156 and then turned one-fourth of a revolution so as to engage the jaw 156 on opposite sides of the aperture 171. Releasing lever 166 is then turned from an upright to a horizontal position so as to cause its end 168 to engage the end of the sleeve 161. This movement of the releasing lever 166 causes the jaws 155 and 156 to further grip the end of the coil. The clamp stud 93 is turned by means of the releasing lever 97 so that the clamping lug 103 extends over the side of the coil that rests on the ledge 87. The releasing lever 97 is then turned about its pivotal pin 96 from a horizontal to a vertical position, thereby causing the clamping lug to move down and firmly press the side of the coil against the ledge 87 without injuring the coils. The clamp screws 127 and 128 are turned so that the clamp blocks 130 and 131 engage this side of the coil and clamp it against the body portion 86 of the stationary former. These clamp blocks exert a powerful force against the side of the coil and prevent its slipping during the spreading operation without injuring the coil or its insulation.

The handle 188 of valve 181 is now turned so that inlet pipe 183 is connected to the pipe 184, thereby causing compressed air to be admitted to the space in cylinder 10 under the piston 16. The piston moves outwardly while the air above the piston escapes through the exhaust pipe 177. The outward movement of the piston causes the operating lever 33 to turn about the shaft 34, thereby moving the movable former 36 towards the stationary former 85. The movement of the operating lever 33 is finally checked by its engagement with the stop 139. In this position of the operating lever the upper side of the coil rests on the ledge 39 of the movable former 36. The hinge clamp 46 is then turned about its hinge pin 43 by means of handle 69 so that the upper side of the coil

is positioned between the clamping face 48 of the former 36 and the recessed clamping face 53 of the hinge clamp 46. Eye-bolts 58 and 64 are then turned about their pivot pins so that their shanks enter the recesses provided for them in the movable former and hinge clamp. Star nuts 63 and 68 are turned so as to cause the upper side of the coil to be gripped firmly between the former 36 and the hinge clamp.

Handle 77 is placed over the upper side of the coil so that the end portion 74 of the pivot bolt 72 enters the aperture 71 in the former 36. Handle 77 is then turned causing the roller 82 to deflect the upper side of the coil, thus bending this side of the coil about the pivot bolt 72 until it strikes the stop member 83. Handle 114 is likewise turned, causing the bending block 106 to turn about its pivotal stud 105. Roller 113 carried by the bending block 106 deflects the lower side of the coil and bends this side of the coil about the pivotal stud 105 until the stop member 116 is engaged by the coil.

The operator now turns the handle 188 of valve 181 so as to cause piston 16 to move inwardly of cylinder 10 and thereby bring about the spreading operation. As the movable former moves away from the stationary former the lower side of the coil slides over the upper surface 90 of the fan shaped forming portion 88 of the stationary former, while the upper side of the coil slides over the upper surface 47 of the fan shaped forming portion 40 of the movable former. The lower side of the coil bends around and takes the shape of the guide flange 91, while the upper side of the coil bends around and takes the shape of the offset guide portion 51 of the hinge clamp 46. During this movement of the movable former the end of the coil moves outwardly of the bench 1 and, by overcoming the tension of springs 144 and 149, causes the clamp lever 129 to swing about the shaft 34 and at the same time slide along this shaft thus moving away from the stop collar 142. The spreading operation ends with the piston 16 in engagement with the end cover 8 of cylinder 10.

The completed coil may now be removed from the spreading device by releasing the hinge clamp, end clamp, clamp screws and clamp stud. The handle 77 is also removed from the movable former in order to permit the coil to be taken from the device. The spreading device is now ready for another operation.

In the event that the device is to be used to spread closed type coils, i. e. those wherein the sides of the coil form a loop at both ends, then formers having fan shaped forming portions at both ends of their body portions are employed, as illustrated in Figures 12 and 13. The fan shaped forming portions 192 and 193 of the movable former 194 are of the same construction and their upper surfaces 190 and 191 have the same curvature and lie in a common cylindrical surface. The hinge clamp 195 is similar to the hinge clamp 46 with the exception that clamp 195 has two offset guide portions 196 and 197 conforming to the curvature of the surfaces 190 and 191.

The fan shaped forming portion 198 of the stationary former 200 is similar in construction to that of the forming portion 88 of the stationary former 85. The fan shaped forming portion 201 of the former 200 is of somewhat different construction, however, since the end of the coil formed on this forming portion is composed of a single turn whereas the opposite end of the coil has two turns. Inasmuch as forming portion 201 accommodates but a single turn of the coil, the upper face 202 of this forming portion lies in a cylindrical surface that is higher than the cylindrical surface of the upper face 203 of forming portion 198. The ledge 199 of the stationary former 200 extends the entire length of the forming portion 201 forming a shoulder at 204. A clamp stud 205 extends through an aperture 206 provided in ledge 199 and has a releasing lever 207 pivoted on its lower end. This clamp stud and its associated parts are of the same construction as clamp stud 93 and its associated parts. An additional clamp stud 208 extends through an aperture 210 provided in the ledge 199. Clamp stud 208 is similar to clamp stud 205 with the exception that the former has a shank 211 that is longer than the shank of clamp stud 205. Shank 211 extends through a bushing 212 that is threaded into aperture 210. A handle 213 is pivotally mounted on the bushing 212. Handle 213 has an aperture through which extends the reduced shank 215 of a block 216. A nut on the end of shank 215 retains the block 216 on the handle 213. Block 216 extends through a curved aperture 217 provided in the stationary former. Handle 213 and block 216 perform the function of bending one coil lead of the double loop coil just as handle 114 and roller 113 perform the function of bending one coil lead of the single loop coil. Clamp studs 208 and 205 press one side of the coil to be spread against the ledge 199. Clamp screws 214 and 218 and clamp blocks 220 and 221 perform the same function for the double loop or closed type coil that clamp screws 127 and 128 and clamp blocks 130 and 131 perform for the single loop or open type coil.

Two end clamps are employed in spreading the closed type of coil. End clamp 222 is of the same construction as end clamp 152 and therefore is believed to require no further description. This clamp grips the end of the coil that is composed of a single turn.

End clamp 223 grips the end of the coil that is composed of two turns. Instead of using a single positioning pin for supporting the end of the coil, this clamp has two positioning pins 224 and 225. Positioning pins 224 and 225 are axially offset and are adjustably threaded into the stationary and movable clamp jaws of the end clamp. Lock nuts 226 and 227 secure these pins in position. In mounting the coil in the spreading device one turn is positioned on one of the positioning pins while the other turn is positioned on the other positioning pin.

In spreading the coil the upper leads of the two turns are secured by the hinge clamp 195 to the movable former 194 whereas the lower leads of the two turns are secured by clamp studs 208 and 205 and clamp blocks 220 and 221 to the stationary former 200.

It is to be noted that the amount that the coils are spread may be varied by adjusting the turnbuckle 30 connected to the piston rod.

Owing to the positive gripping of the sides of the coil during the spreading operation, there is no slipping of the coil during this operation with the result that accurately formed coils are produced.

Owing to the smooth and extensive gripping faces of the various clamps, neither the coil nor its insulation is injured during the spreading operation.

It is to be noted that by merely changing the type of formers employed an unlimited variety and sizes of coils may be spread.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A coil spreading device comprising, means for gripping the sides of the coil to be spread, means for gripping an end of the coil to be spread, templates for the portions of the coil between said sides and said end, and operating means, said operating means causing the first named gripping means to spread the coil to the form of the templates, while the second named gripping means operates to permit the spreading of the coil.

2. A coil spreading device comprising, a movable former, a clamp for securing one side of the coil to be spread to said movable former, a stationary former, clamping means for securing the other side of the coil to said stationary former, a movable end clamp for gripping an end of the coil, and operating means, said operating means causing said movable former to be moved so as to spread the coil and thereby effect movement of the end clamp.

3. A coil spreading device comprising, a movable former, a clamp for securing one side of the coil to be spread to said movable former, means carried by said movable former for bending a lead of the coil, a stationary former, clamping means for securing the other side of the coil to said stationary former, means carried by said stationary former for bending another lead of the coil, and operating means, said operating means causing said movable former to be moved so as to spread the coil.

4. A coil spreading device comprising, a movable former, a clamp for securing one side of the coil to be spread to said movable former, removable means carried by said movable former for bending a lead of the coil, a stationary former, clamping means for securing the other side of the coil to said stationary former, means carried by said stationary former for bending another led of the coil, a movable end clamp for gripping an end of the coil, and operating means, said operating means causing said movable former to move so as to spread the coil and simultaneously causing movement of the end clamp.

5. A coil spreading device comprising, a movable former, a clamp for securing one side of the coil to be spread to said movable former, removable means carried by said movable former for bending a lead of the coil, a stationary former, clamping means for securing the other side of the coil to said stationary former, means carried by said stationary former for bending another lead of the coil, movable end clamps for gripping the ends of the coil, and motive means, said motive means causing said movable former to move so as to spread the coil and thereby effect movement of the end clamps.

6. A device for spreading coils comprising, motive means, a movable former, a clamp associated with the movable former and arranged to grip a side of the coil to be spread and to act as a guide for a portion of an end of the coil, a stationary former, clamp blocks associated with the stationary former and arranged to grip the other side of the coil to be spread, and a clamp stud associated with the stationary former and arranged to grip said other side of the coil, said movable former being operated by the motive means to cause the coil to be spread into the form of an armature coil that may be withdrawn from the device upon the release of the clamp, the clamp blocks and the clamp stud.

In testimony whereof, I have signed my name to this specification.

AXEL W. BJORKMAN.