

Oct. 3, 1944.

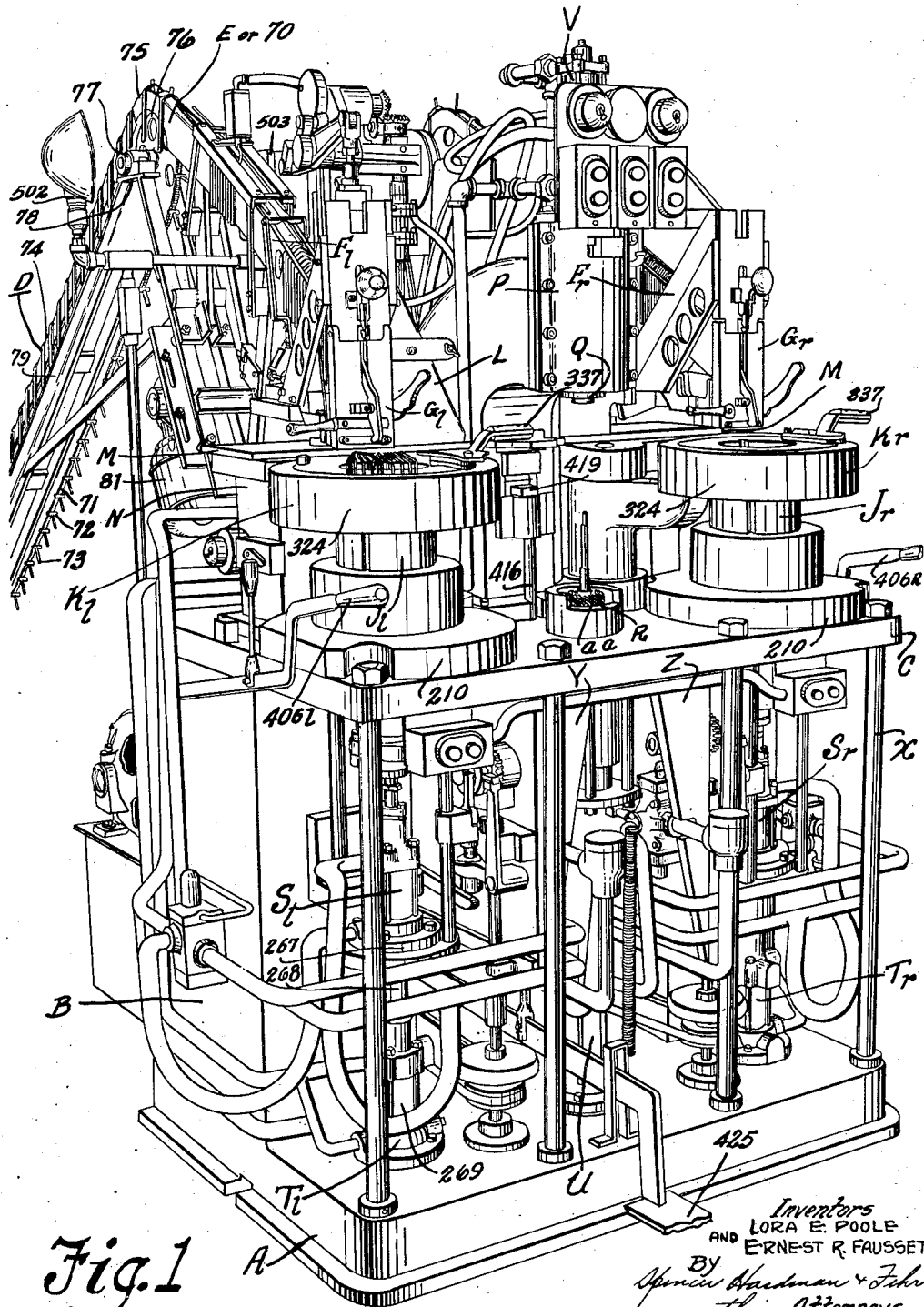
L. E. POOLE ET AL

2,359,384

ARMATURE ASSEMBLING MACHINE

Original Filed Nov. 20, 1940

8 Sheets-Sheet 1



Oct. 3, 1944.

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ARMATURE ASSEMBLING MACHINE

Original Filed Nov. 20, 1940

8 Sheets-Sheet 2

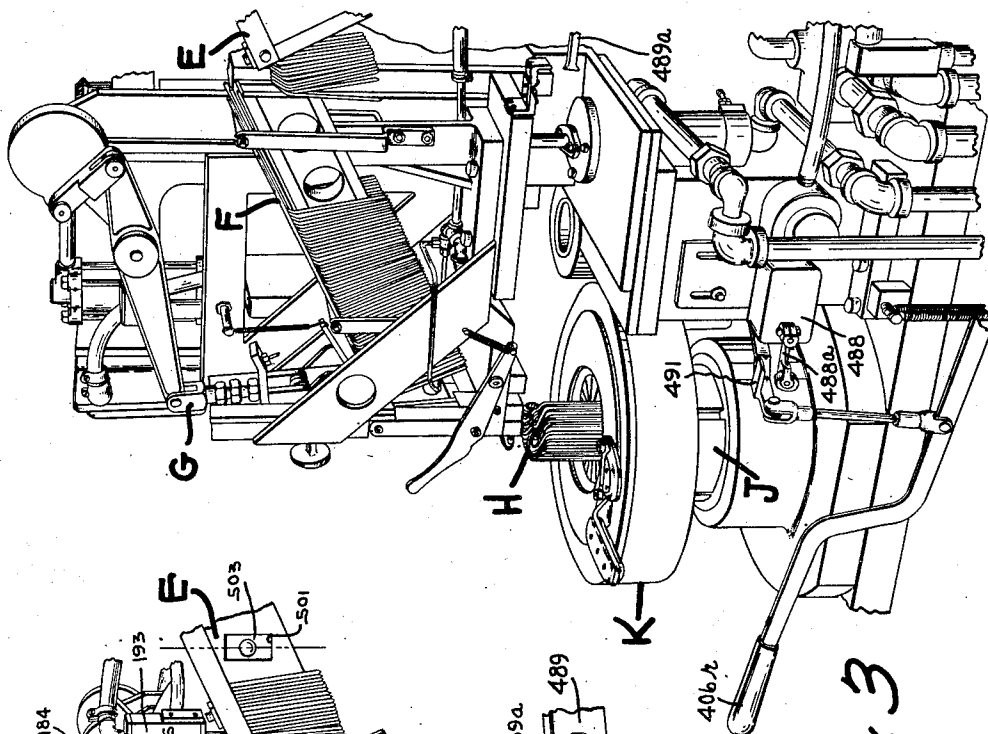


Fig. 3

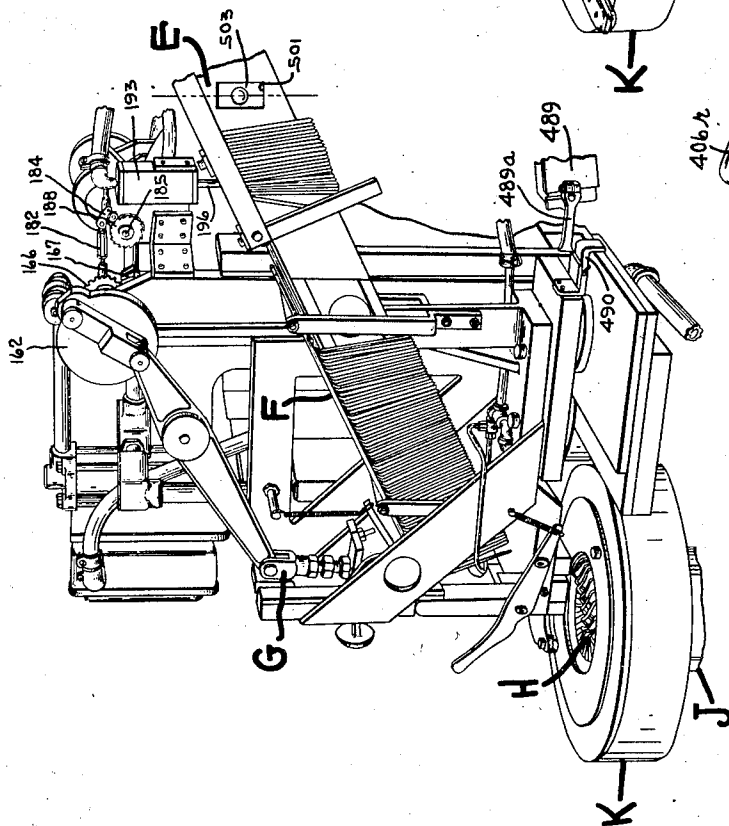


Fig. 2

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Oct. 3, 1944.

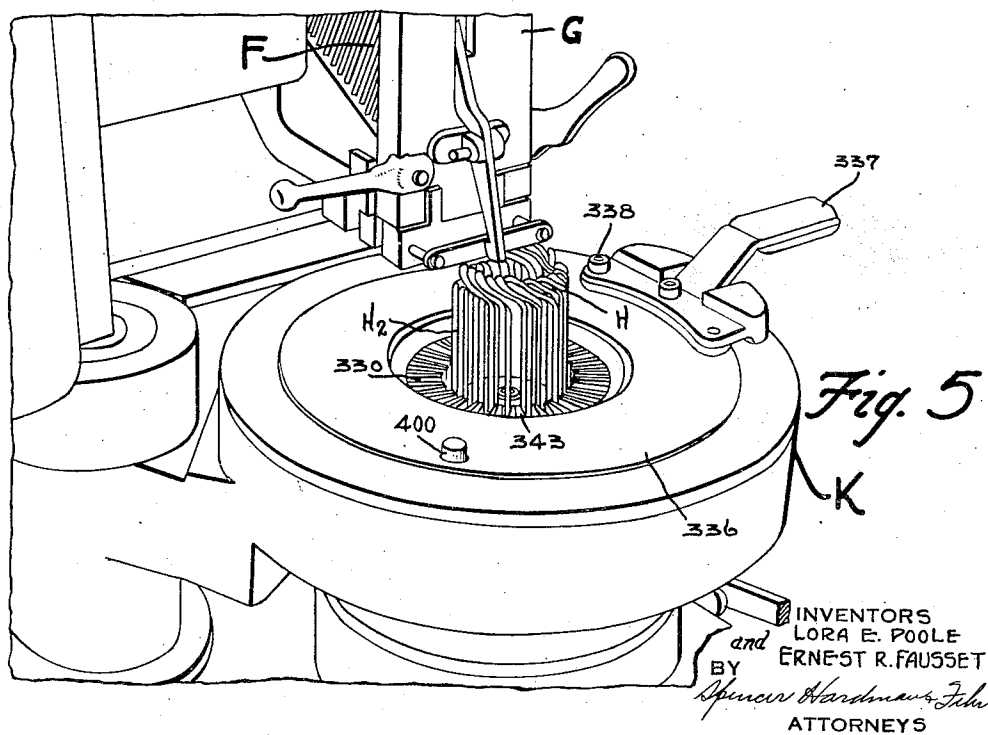
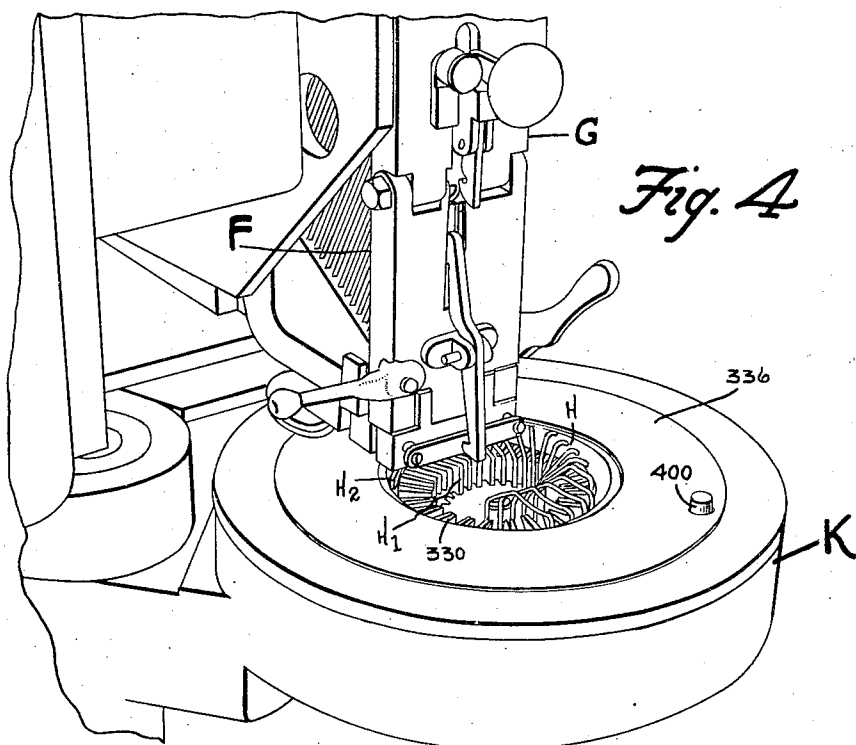
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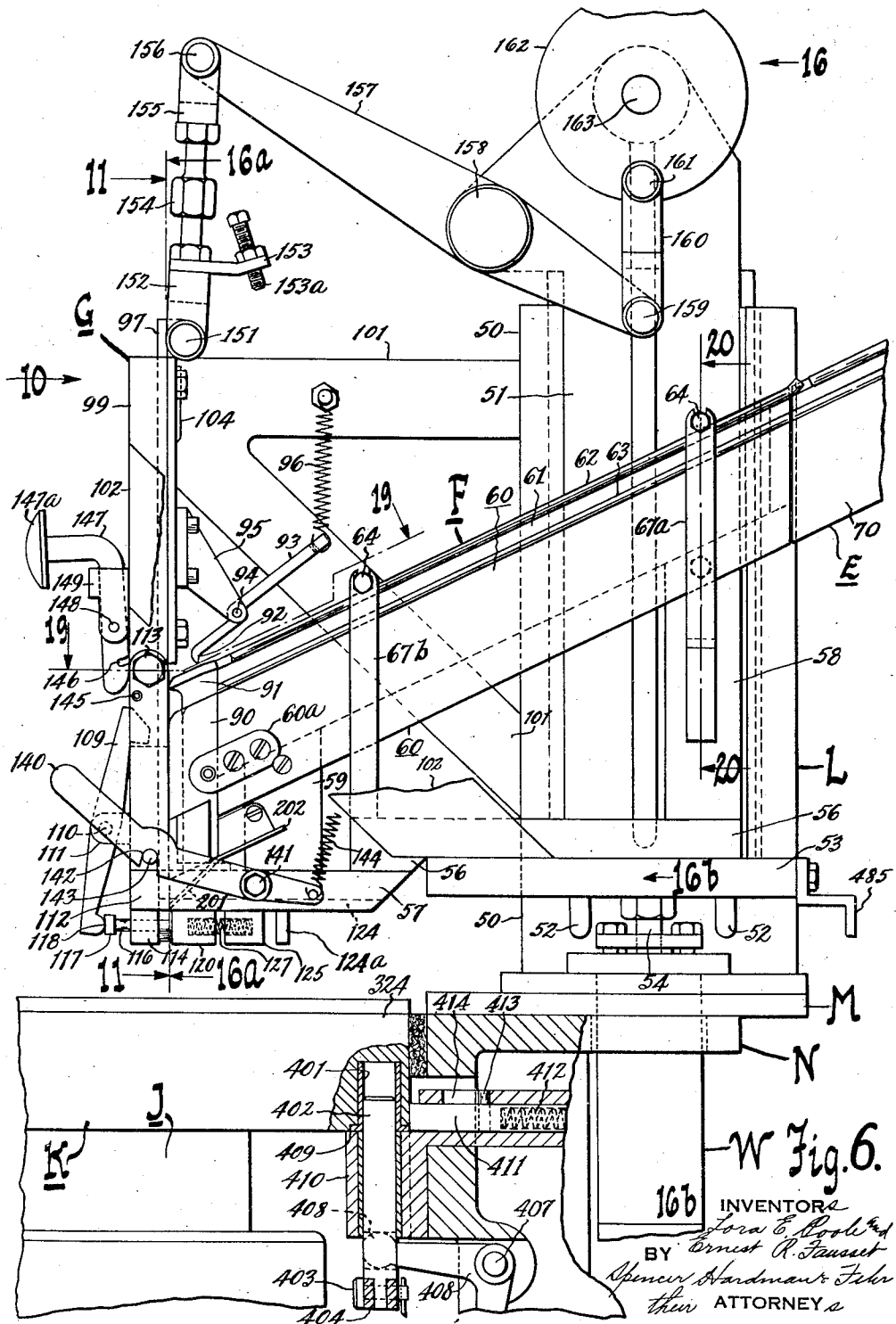
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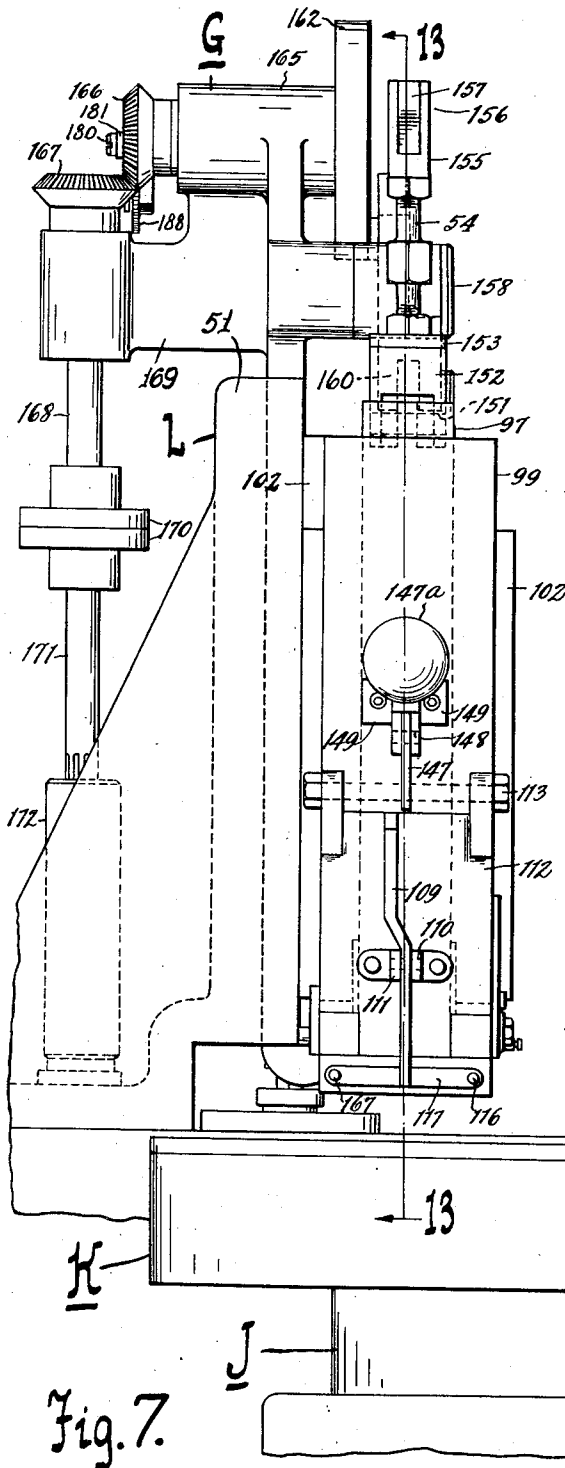


Fig. 7.

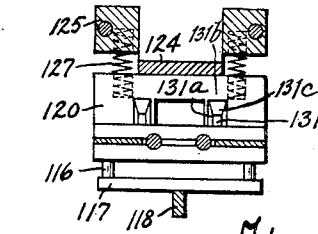


Fig. 9.

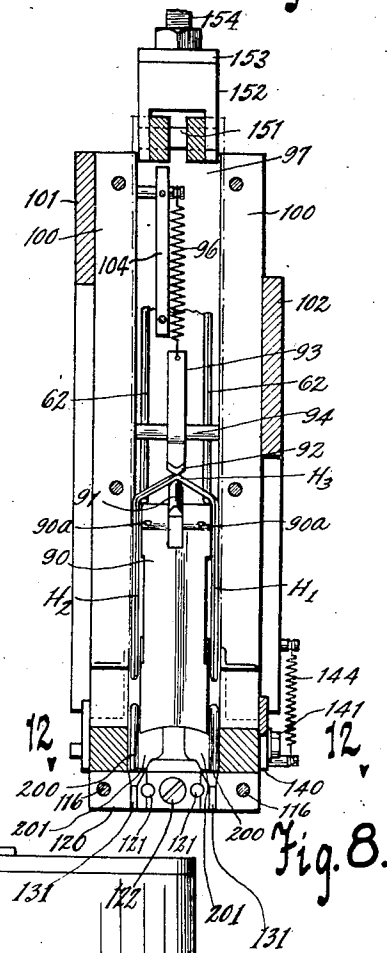


Fig. 8.

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ARMATURE ASSEMBLING MACHINE

Original Filed Nov. 20, 1940

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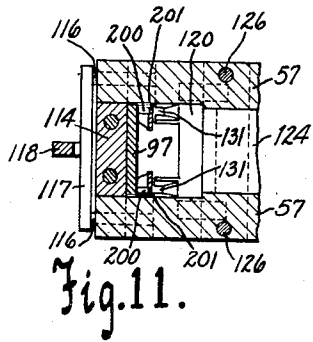


Fig. 11.

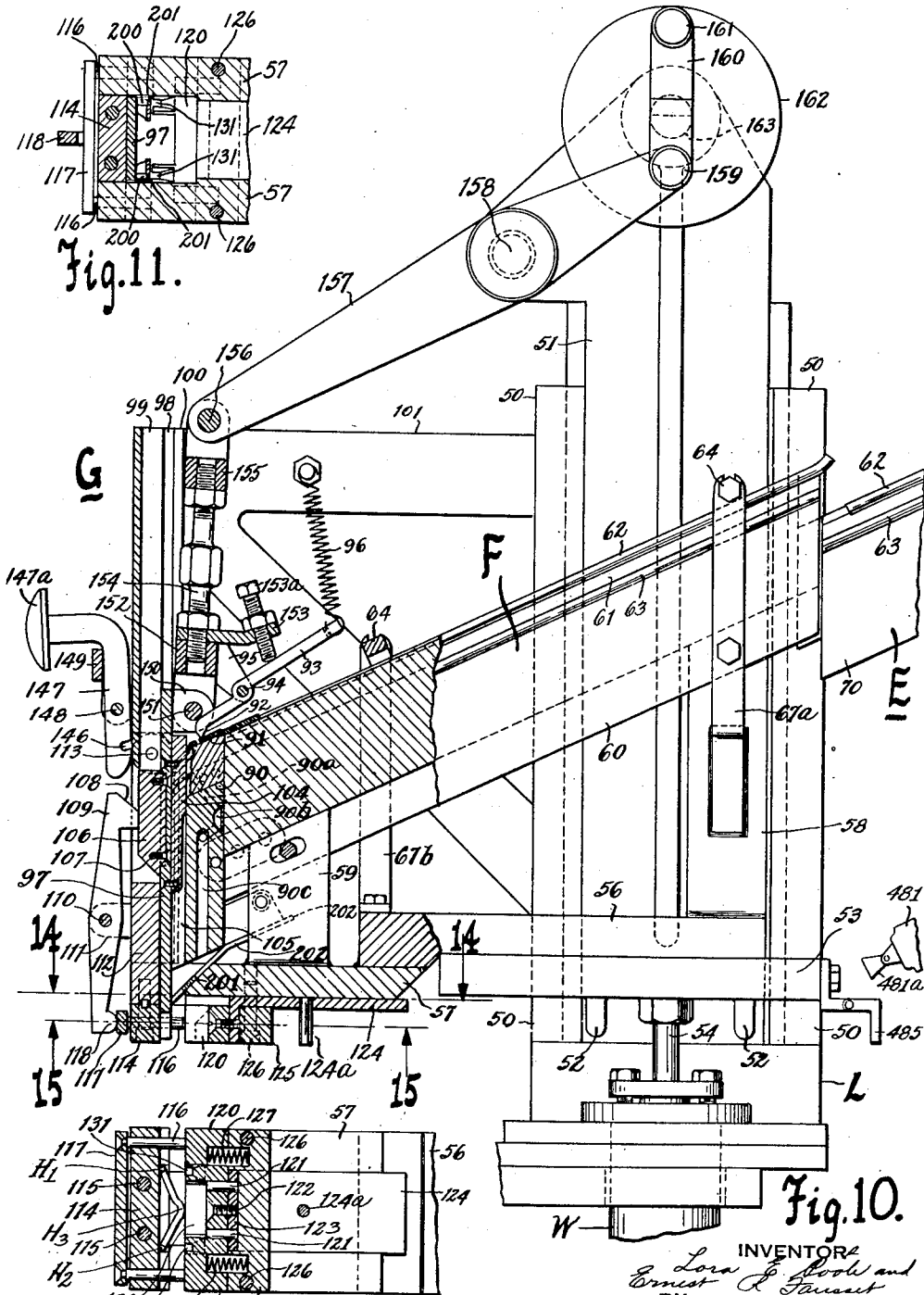
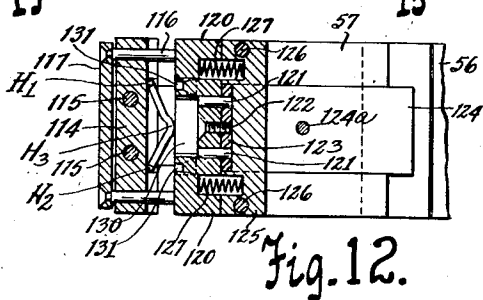


Fig. 10.



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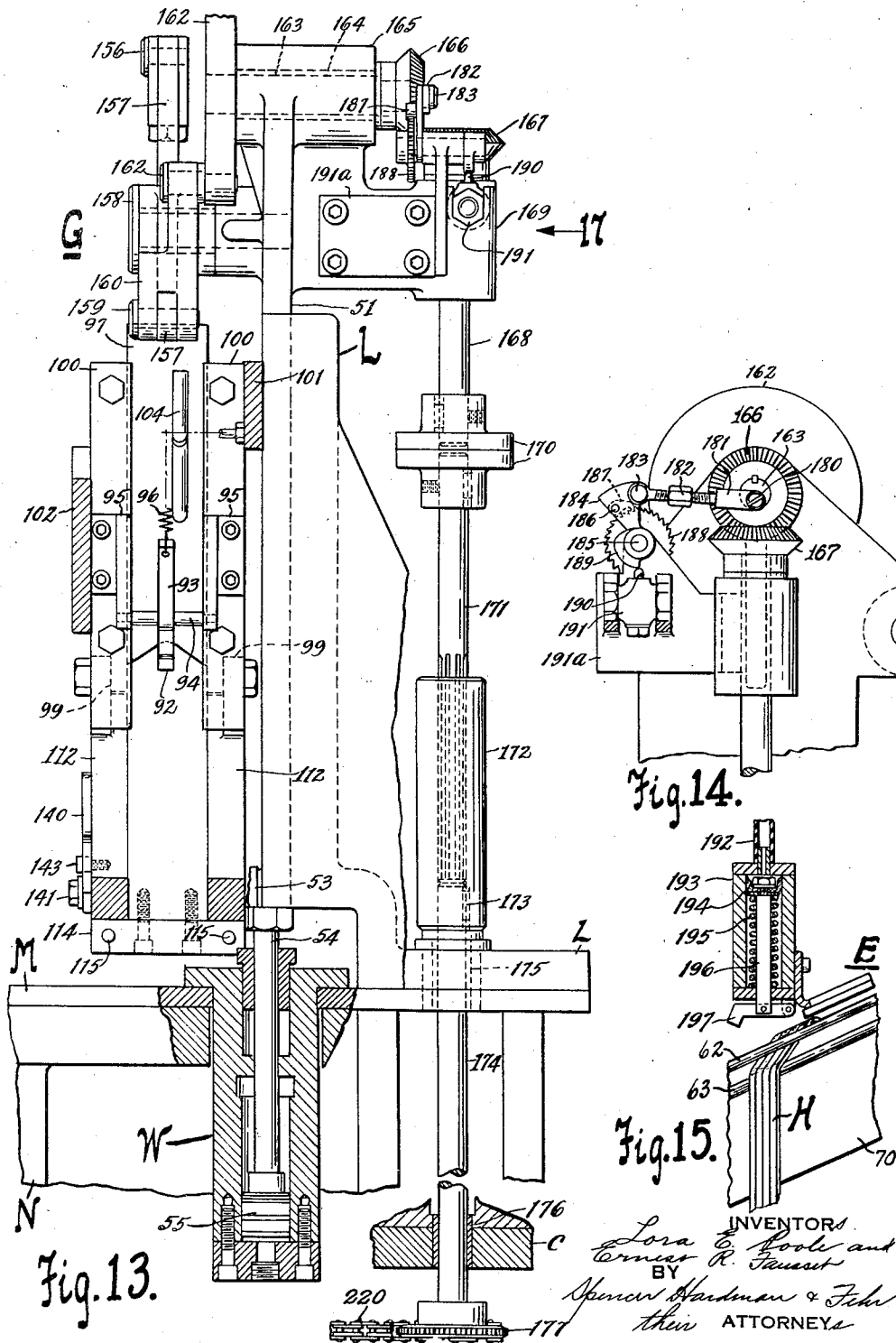
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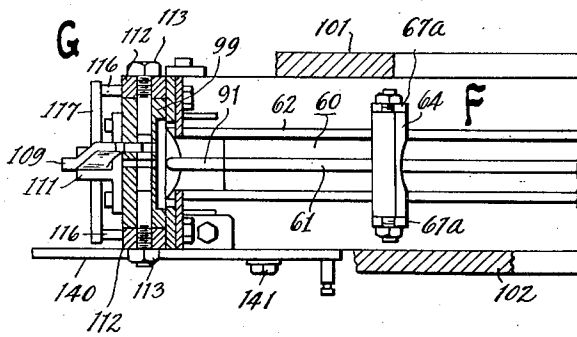


Fig. 16.

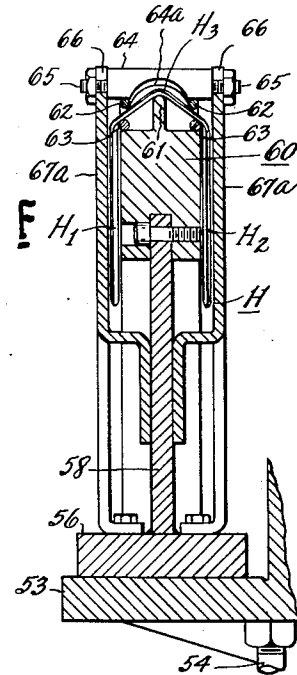


Fig. 17.

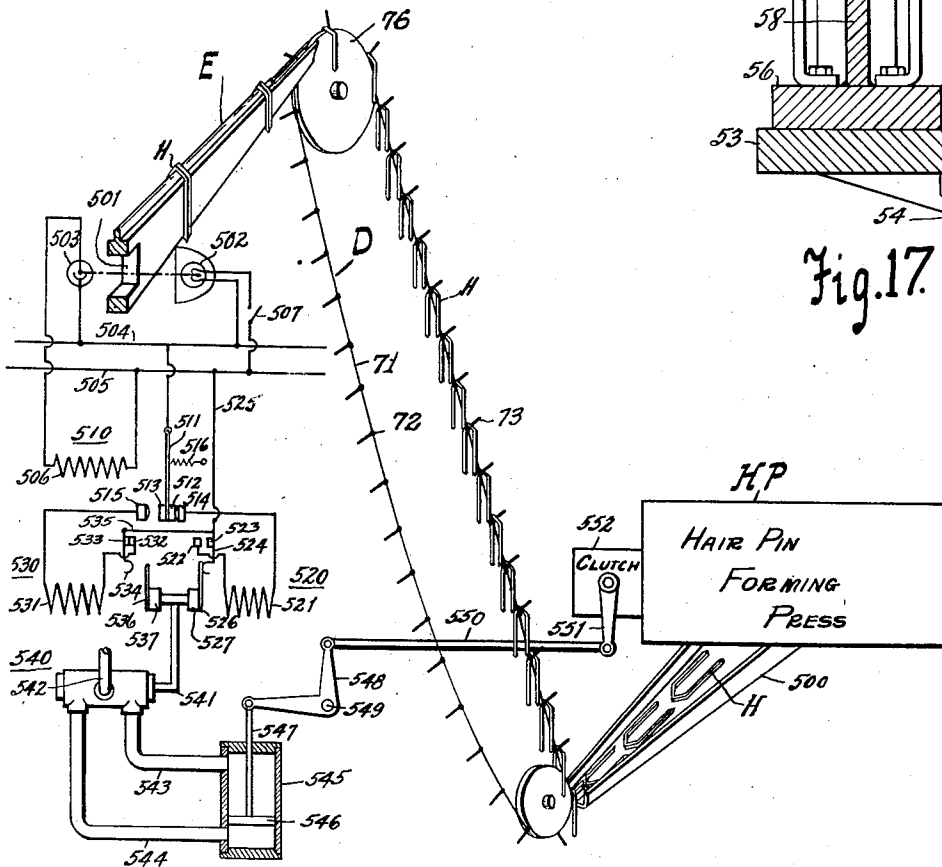


Fig. 18.

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UNITED STATES PATENT OFFICE

2,359,384

ARMATURE ASSEMBLING MACHINE

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Original application November 20, 1940, Serial No.
366,456, now Patent No. 2,290,381, dated July
21, 1942. Divided and this application January
23, 1942, Serial No. 427,910

9 Claims. (Cl. 214—1)

This invention relates to the manufacture of bar wound armatures for dynamoelectric machines and, more particularly to machines for assembling armatures for electric motors for starting internal combustion engines on automotive vehicles. Such armatures are provided with single turn armature coils each coil having two straight parallel coil sides or active portions joined by an intermediate yoke so shaped that one active coil side will occupy a portion of the armature core slot adjacent to the bottom of the slot while the other coil side occupies a portion of another slot adjacent to the periphery of the armature core. An armature coil of this type will be designated hereinafter as a "hairpin" on account of its resemblance to the ordinary hairpin.

The present invention is concerned with a method by which all of the hairpins required for any particular armature assembly can be assembled simultaneously with an armature core by effecting relative longitudinal movement between the hairpins and the core, the legs of the hairpins passing endwise through the slots of the core. The hairpins are first assembled in an annular row with one leg of each hairpin disposed in an inner annular row conforming to the location of the inner or bottom portion of the core slots. The other legs of the hair pins are located in an outer annular row remote from the inner row. In this preliminary arrangement of the hairpins in an annular row, the hairpin yokes are spaced apart circumferentially. This arrangement permits placing the hairpins one at a time in this annular row since the hairpin yokes do not touch and therefore are not nested one within the other as they will be later on in the final assembly. The next step is to move all of the hairpin legs in the outer row simultaneously toward the inner row so as to bring all of these legs in the outer row into an annular row conforming to the locations of the outer portions of the armature core slots. During this movement of the outer row of hairpin legs, the other row of hairpin legs remain in the annular row in which they were first placed. The operation of moving the outer annular row of hairpin legs inwardly will be known hereafter as gathering. During this gathering operation the hairpin yokes become nested one within the other. The next step is to clamp the hairpins in the gathered position to a transferring device by which the entire group of hairpins is moved from the gathering device into alignment with a slotted armature core. Then relative longitudinal

movement is effected between the armature core and the group of hairpins thereby causing all of the hairpin legs to be passed endwise into core slots, each slot receiving two hairpin legs.

5 A machine by which the method referred to can be practiced with great facility is described and claimed in our copending application Serial No. 366,456, filed November 20, 1940, now Patent No. 2,290,381, granted July 21, 1942, of which
10 this present application is a division. This machine comprises a magazine having a chute to which the hairpins are delivered by a conveyor from a hairpin forming machine. The magazine is provided with a feed mechanism which dis-
15 charges the hairpins singly to a gatherer which arranges a predetermined number of them for simultaneous endwise entry into the slots of the armature core. The gatherer cooperates with a transfer head having fingers for clamping the
20 hairpin legs in the positions in which they are finally located by the gatherer. The transfer head is movable from the gatherer to the assembler in order to locate the hairpin legs in alignment with the slots of the armature core.
25 The assembler effects relative longitudinal movement between the core and the group of hairpins while retracting the clamping fingers after the hairpin legs have been entered into the core slots.

30 In this present application we describe and claim per se the magazine and feed mechanism which forms a part of the machine of our application Serial No. 366,456.

In the drawings:

35 Fig. 1 is a perspective view of the machine looking to the front and left side.

Fig. 2 is a fragmentary perspective view showing the magazine in lower position. This view is taken from a position at the right side of the machine looking diagonally from the rear toward
40 the front of the machine.

Fig. 3 is a perspective view similar to Fig. 2 showing the magazine in upper position in order to permit the gathering of the hairpins as
45 shown.

Fig. 4 is a fragmentary perspective view showing the front of the magazine, gatherer and the transfer head. In this view the hairpins are being arranged in an annular row preliminary
50 to gathering.

Fig. 5 is a view similar to Fig. 4 but showing the magazine elevated as in Fig. 3 and showing the completion of the gathering operation and the engagement of the hairpin legs by clamping fingers carried by the transfer head.

Fig. 6 is a fragmentary side elevation of the right hand magazine unit which is shown in perspective in Fig. 2. In this view certain parts are shown in section for sake of clearness.

Fig. 7 is a front elevation of the magazine shown in Fig. 6 and is a view taken in the direction of the arrow 10 of Fig. 6. In Figs. 6 and 7 the feed slide is up.

Fig. 8 is a sectional view on the line 11—11 of Fig. 6.

Fig. 9 is a sectional view on the line 12—12 of Fig. 8.

Fig. 10 is a side elevation of the magazine with the feed slide down, and parts in section are taken generally on the line 13—13 of Fig. 7 but it will be understood that in Fig. 10 the feed slide is down whereas in Fig. 7 the slide is up.

Figs. 11 and 12 are sectional views taken, respectively, on the lines 14—14 and 15—15 of Fig. 10.

Fig. 13 is a view looking in the direction of the arrow 16 of Fig. 6; and the sectional parts are taken on the lines 16a—16a and 16b—16b of Fig. 6.

Fig. 14 is a fragmentary elevational view looking in the direction of arrow 17 of Fig. 13.

Fig. 15 shows a vertical sectional view of a pneumatic latch associated with the hairpin chute.

Figs. 16 and 17 are sectional views taken respectively, on the lines 19—19 and 20—20 of Fig. 6.

Fig. 18 is partly a sectional view through the magazine chute showing the relation thereto of a photoelectric cell which controls the press which forms the hair pins supplied to the magazine. Fig. 18 includes a diagram of the press and the conveyor from the press to the magazine.

General construction

Referring to Fig. 1, the machine comprises a base casting A supporting a back pedestal B in the form of a rectangular box. Pedestal B has a depth horizontally about one-half of the depth of the base A and a horizontal width approximately the same as the width of the base A as viewed from the front of the machine. Pedestal B supports a table C. Table C supports a portion of a conveyor mechanism D which delivers hairpins H to a chute E leading into a magazine F. The hairpins H are removed one at a time by a feed mechanism G and are caused to descend one at a time through a transfer head K and into a gatherer J. There are two sets of elements F, G, J and K, one on the right side of the machine and the other on the left. Each magazine F is supported by a pedestal L, in turn supported by a plate M carried by a frame N. There are two frames O each providing a pivotal support for a transfer head K. Between the two frames O is located a pedestal P providing a support for the upper part of the assembling mechanism designated as Q. The lower part of the assembler, designated as R, is supported by the table C.

Each gatherer J is operated by pistons cooperating with hydraulic cylinders S and T. The assembling apparatus R carried by table C is operated by a piston cooperating with a hydraulic cylinder U. The two cylinders S, the two cylinders T and the cylinder U and controls associated therewith are located between the base A and the table C in the front of the machine as shown in Fig. 1. The pedestal P supports a cylinder V cooperating with a piston for operating the upper

portion Q of the assembling apparatus. As viewed in Figs. 6 and 13, each plate M supports a cylinder W for raising and lowering a magazine F.

The front edge of the table C is supported by rods X connected with the base A. The table C is supported also by pedestals Y and Z.

Magazine F

Referring to Fig. 6, the pedestal L provides ways 50 which guide for vertical sliding movement the magazine unit F. More particularly the ways 50 support a frame 51 having integral brackets 52 supporting a table 53 which is attached to the upper end of a piston rod 54 connected with a piston in the cylinder W which is attached to plate M mounted on frame N. (Fig. 13.) To the table 53 is attached a plate 56 welded to a plate 57 (Fig. 10). Plate 56 supports a pedestal 58. Plate 57 supports a pedestal 59. Pedestals 58 and 59 support a chute 60 for supporting a plurality of hairpins H as shown in Figs. 2 and 3. From the chute 60, the hairpins H are discharged singly by a feed mechanism G to be described. The yoke portions H₃ of each hairpin H rest upon a rib 61 or flange extending from the chute 60, the legs or branches H₁ and H₂ of the hairpins extending downwardly along the sides of the chute 60. The hairpins are retained in proper position due to the fact that the yoke portions H₃ are required to slide between pairs of rods, each pair comprising a rod 62 and a rod 63. The rods 63 are supported directly by the chute 60. The rods 62 are welded to a cross member 64 having threaded ends 65 received by notches 66 in brackets 67a and 67b. The brackets 67a are attached to the pedestal 58. The brackets 67b are attached to the plate 56. The cross members 64 are notched at 64a to provide clearance for the uppermost portion of each hairpin yoke H₃.

The chute 60 is an extension of an inclined bar E or chute 70 upon the upper end of which the conveyor D deposits hairpins H as shown in Fig. 1. The moving part of the conveyor D comprises a chain 71 having spaced lugs 72. From each lug 72 there extends a pin 73 which pushes a hairpin upwardly along a track 74 and then around a curved track 75 which is an extension of the chute E or 70. The chain 71 passes around suitable sprocket wheels indicated at 76. The sprocket 76 is mounted on a shaft journaled in a bearing 77 mounted on a plate 78 welded to the juncture of frames 79 and 80. The lower end of frame 79, not shown, is supported on the floor adjacent to the discharge chute from the hairpin forming press HP in Fig. 18. It will be understood that the hairpins are discharged from press HP with yoke foremost so that the hairpins will be conveyed upwardly on the conveyor track 74 and then down along the chutes 70 and 60 in the manner shown. The lower end of the frame 80 is supported by the table C. An electric motor 81 is connected with the sprocket 76 in any suitable manner in order to drive the same.

Referring again to Fig. 10, it will be seen that the chute 60 terminates in a block 90 having a mid-rib or flange 91 forming a continuation of the flange 61 of the chute 60. However, the upper portion of this flange 91 is slightly offset upwardly from the flange 61. The purpose of this is to retard the descent of the hairpins along the chute 60. As shown in Fig. 10 the hairpin next to the lowest one is located adjacent the finger portion 92 of a lever 93 pivoted at 94 upon a

fixed bracket 95. Lever 93 is normally urged clockwise by spring 96 so that normally the finger 92 engages the yoke of said hairpin. In this figure the descent of the lowest hairpin is obstructed by a feed bar 97 which is received by grooves 98 provided by a plate 99 to which plates 100 are attached as shown in Fig. 13 thereby providing ways for guiding the bar 97. Bar 97 is a part of the hairpin feed mechanism G. The way plates 100 support the brackets 95 which support the shaft 94 carrying the lever 93. The plate 99 is fixed to brackets 101 and 102 attached to the frame 51. Bar 97 supports a block 104 received by a notch 105 in the block 90. Bar 97 is attached to a cam block 106, the lower edge of which is beveled at 107 to engage the beveled upper edge 108 of a lever 109 pivoted upon a rod 110 supported between ears 111 provided by a plate 112. The plate 112 is pivotally attached to the plate 99 by screws 113. Plate 112 supports at its lower end a block 114 attached by screws 115. Block 114 supports rods 116 attached to a plate 117 adapted to be engaged by the lower end 118 of a lever 109. The rods 116 are adapted to engage a block 120 attached by dowel pins 121 and a screw 122 to the downwardly extending flange 123 of a plate 124 which moves horizontally along the underside of the plate 57 and is guided for such movement by a block 125 having a notch for receiving the plate 124. Block 125 is secured to plate 57 by screws 126. The block 120 is normally urged against the block 114 by springs 127 as shown in Fig. 9. Block 120 is provided with a recess 130 for receiving the hairpin yoke H₃ and with notched lugs 131 each for receiving a hairpin leg H₁ or H₂.

The plate 112 is retained normally in vertical alignment with the plate 99 by means of a latch comprising a latch lever 140 (Fig. 6) pivoted upon a screw 141 attached to plate 57. Lever 140 has a notch 142 for receiving a pin 143 on plate 112. A spring 144 urges the lever 140 counterclockwise so that the lever notch 142 normally receives the pin 143 thus latching the plate 112 in operating position. If a hairpin should jam between the block 90 and the plate 112 the lever 140 can be retracted from the pin 143 and the plate 112 moved away from the block 90 into a horizontal position until a stud 145 carried by the plate 112 is received by a notch 146 in a latching lever 147 pivoted at 148 upon a bracket 149 carried by plate 99. Lever 147 has a knob 147a which serves as a weight tending to urge the lever 147 counterclockwise. Therefore, when the plate 112 has been brought into a horizontal position, the stud 145 will strike the lever 147 and cam it clockwise until the stud 145 comes into alignment with the notch 146, whereupon the weight of the knob 147a will cause the lever 147 to move counterclockwise to hold the plate 112 in the horizontal position. To release the plate 112 in order that it may be restored to vertical position, the operator pushes upon the knob 147a whereupon the plate 112 is released and it descends and causes the rod 143 to strike the lower edge of the lever 140 and cam the same upwardly against the action of the spring 144 until the plate 112 is in the normal vertical position, whereupon its rod 143 registers with the notch 142 of lever 140 and lever 140 returns to latching position under the action of the spring 144.

The feed bar 97 is provided near its upper end with a pair of lugs 150 supporting a rod 151 attached to a notched lug 152 which together with a plate 153 are attached to the lower thread-

ed end of a turn buckle 154 having its upper end threaded into a notched block 155 carrying a pin 156 by which the block is attached to a lever or walking beam 157 pivoted at 158 upon the plate 51. Lever 157 is connected by a pin 159 with a link 160 connected by a pin 161 with a crank disc 162 mounted on a shaft 163 journaled in a bearing 164 provided by a bearing bracket 165 integral with the plate 51. Shaft 163 carries a bevel gear 166 meshing with a bevel gear 167 connected with a vertically disposed shaft 168 journaled in a bearing bracket 169 also integral with the plate 51. Shaft 168 is connected by a coupling 170 with a shaft section 171 longitudinally splinedly connected with a shaft sleeve 172 keyed at 173 to a shaft section 174 journaled in a bearing 175 provided by pedestal L and in a bearing 176 provided by table C. At its lower end to shaft 174 carries a sprocket wheel 177 driven in a manner to be described and coordinated with rotary movements of parts associated with the gatherer J and the transfer head K. Referring to Fig. 14 the shaft 163 carries a crank pin 180 connected by clevis 181 and turn buckle 182 and pin 183 with a ratchet lever 184 loosely journaled on a shaft 185. Lever 184 carries a pin 186 pivotally supporting a pawl 187 engageable with a ratchet 188 pinned to the shaft 185. To the shaft 185 there is also pinned a cam 189 engageable with the operating member 190 of a valve 192. It is apparent that after a predetermined number of revolutions of the shaft 163 have taken place, the valve 191 will open for the purpose of causing air to flow through a pipe 192 (Fig. 15) into a cylinder 193 thereby causing a piston 194 to move downwardly against the action of the spring 195 and to cause the rod 196 to move a finger 197 downwardly for the purpose of engaging a hairpin descending along the chute E in order to limit the number of hairpins accumulating at a time upon the chute 60. It is desirable to hold some hairpins in reserve upon the chute E. Obviously the shaft 185 (Fig. 14) will rotate once during each cycle of operations required for the filling of the gatherer with hairpins; therefore the number of teeth on the ratchet 188 will equal the number of hairpins to be assembled in the gatherer. The shape of cam 189 is such that valve operating member 190 is all the way down for about ¼ revolution of shaft 185 and member 190 is all the way up for over ½ revolution. During about ¼ revolution the member 190 is moving down. Therefore, the hairpins on chute E will be prevented from descending to chute 60 during over ¼ the cycle during which the gatherer is receiving hairpins from the magazine feed. Figs. 1 and 2 show that the hairpins on chute E are held back while about ¼ of the required full number of hairpins are received by the gatherer J. By that time the cam 189 has arrived in the position shown in Fig. 14, wherein its high land is about to leave the member 190. Then the hairpins on chute E will be released and they will slide down upon chute 60. Before the gatherer J has made one complete revolution, the cam 189 will have moved the member 190 down sufficiently to cause valve 191 to open to admit pressure fluid to cylinder 193 to cause finger 197 to move down again to prevent hairpins from sliding from chute E to chute 60. When the gatherer J is filled, it stops rotating and the magazine feed stops; and there is a gap between the lowest hairpin on chute E and the highest hairpin on chute 60. Therefore chute 60 of mag-

azine F' can be elevated above chute E after the gatherer J is filled without dislodging any hairpins since there are no hairpins located at the gap between these parts. The foregoing describes the normal operation. However, it might happen that the compressed air line to cylinder 192 might be shut off after the magazine F' (Fig. 3) had been elevated above magazine E. In such case the finger 197 would be lifted and the hairpins on chute E would descend against the upper end of the chute of magazine F' as shown in Fig. 3. No harm is done, however, since the hairpins will descend upon the chute of magazine F' when it is lowered.

For each rotation of shaft 163 there will be a reciprocation of feed bar 97. As stated before, when the bar 97 is down, the lowermost hairpin on the chute 60 engages the slide, the legs H₁ and H₂ directly engaging the bar 97, and the yoke H₃ engaging the block 104. When the bar 97 is down, the screw 153a carried by the plate 93 will engage the lever 93 to cause its finger 92 to be moved slightly away from the yoke of the hairpin next to the lowest hairpin. When the bar 97 moves upwardly the screw 153a will immediately release the lever 93 so that, by the action of the spring 96, it will engage the yoke of the hairpin next to the lowest hairpin. When the bar 97 and the block 104 have been moved entirely above the hairpin, as shown in Fig. 8, the lowest hairpin is free to move off the block 90 and then down between the block 90 and the plate 112. It is started in this movement by directing against it a blast of air issuing from two small holes 90a block 90. These holes are connected with a passage 90b and with a passage 90c connected in any suitable manner with a source of compressed air. Just as the bar 97 moves above the lowermost hairpin, the compressed air is admitted to the passage 105 and then issues from the holes 90a to start a hairpin in its movement toward the plates 99 and 112. Then the hairpin is free to gravitate downwardly. As it moves downwardly the lower ends of its legs will first be received by grooves 200 in the branches 201 of a notched plate 202 fastened to the pedestal 59. These grooves 200 guide the legs into the notches 131 provided by the block 120. As shown in Fig. 9, these notches 120 flare out to the top surface of the block as indicated by the surfaces 131a, 131b and 131c. Thus the legs of the hairpins are guided into the notches 131. When the bar 97 descends, the cam 107 carried thereby will engage the lever 109 to cause it to move counterclockwise, thereby causing the bar 117, the rods 116 and the block 120 to move from the left to the right into the position shown in Figs. 10 and 12 thereby retracting the block 120 from the yoke of the supported hairpin thereby permitting the hairpin to gravitate from the magazine into the gatherer as shown in Fig. 4. If for any reason the hairpin does not gravitate from the block 90 it will be forced downwardly during downward movement of the bar 97. As stated before, the downward movement of the bar 97 to clear the space through which a hairpin should normally gravitate is followed by an elevation of the finger 92 of the lever 93 so that the hairpin last retained by the finger 92 is released so it may gravitate down the block 90 and against the feed bar 97 when in the lower position. Following the upward movement of the bar 97 the cycle is again repeated as the released hairpin will then be free to gravitate between the block 90 and the plate 112 until it hangs upon the block

120. Then the block 120 is then retracted during downward movement of the bar 97 again so that this hairpin may descend into the gatherer.

Electric eye control of hairpin forming press

Referring to Figs. 1, 2 and 18, it will be seen that the hairpin forming press HP is provided with a chute 500 down which hairpins H slide with their yoke foremost. As each hairpin is discharged from the lower end of the chute 500 it is engaged by a pin 73 of conveyor D which discharges hairpins upon the chute E which discharges the hairpins downwardly to the magazine F. Chute E is provided with an opening or window 501 through which rays from a lamp 502 are projected toward a photoelectric cell 503 connected with a line wire 504 and with a relay magnet coil 506 connected with line wire 505. A switch 507 controls the connection of lamp 502 with wires 504 and 505. Coil 506 is a part of a relay 510 having an armature 511 carrying contacts 512 and 513 engageable respectively with contacts 514 and 515. Spring 516 urges armature 511 counterclockwise so that contacts 512 and 514 are engaged.

A valve controlling solenoid 520 comprises a coil 521 connected with contact 514 and with a stationary contact 522 engageable with a movable contact 523 carried by a spring blade 524 having its fixed end connected by wire 525 with line wire 504 and having its free end engageable with a bar 526 attached to a solenoid armature 527. A valve controlling solenoid 530 comprising magnet coil 531 connected with contact 515 and with a contact 532 engageable with a contact 533 carried by a spring blade 534 having its fixed end connected by wire 535 with wire 525, and having its free end engageable with a bar 536 carried by a solenoid armature 537.

A fluid pressure controlling valve 540 has an operating rod 541 connected with the solenoid armatures 526 and 536. Valve 546 controls the communication between an inlet pipe 542 and outlet pipes 543 and 544 leading, respectively, to the upper and lower portions of a cylinder 545 cooperating with a piston 546 connected by rod 547 with a bell crank lever 548 pivoted at 549 and connected by rod 550 with a lever 551 for controlling a clutch 552 of the hairpin forming press HP.

When the accumulation of hairpins on chute E, Fig. 2, is not sufficient to block the window 502 the light from the lamp 502 will strike the cell 503 and render it electrically conductive so that the coil 506 of the relay 510 will be energized. Armature 511 will be attracted to cause contacts 513 to engage contacts 515 thereby connecting solenoid coil 531 with a current source. Then solenoid armature 537 will be attracted toward the left to cause rod 541 to move toward the left thereby interrupting communication between pipe 542 and pipe 543 and venting the latter and thereby connecting pipe 542 with pipe 544. Then the piston 546 is elevated to cause clutch lever 541 to move toward the right to cause clutch 552 to connect the press HP with an operating shaft. Then the hairpin press operates to form hairpins and discharge them down the chute 500.

When the accumulation of hairpins upon chute E is such that the window 502 is blocked, the coil 506 of relay 510 is deenergized and spring 516 returns armature 511 to the position shown in Fig. 18 thereby rendering solenoid coil 521 operative to attract the solenoid armature 527

toward the right into the position shown thereby moving rod 541 to the right in order to cut off communication between the pipes 542 and 544 and to vent the latter and in order to establish communication between pipes 542 and 543. Then the piston 546 descends into the position shown in Fig. 18, and causes the clutch 552 to disconnect the press HP from the operating shaft.

When the solenoid coil 531 has performed its function of attracting armature 537 toward the left, the circuit of coil 531 is open at contacts 533 and 532 due to the engagement of bar 536 with switch blade 534. Similarly, when coil 521 has performed its function of attracting armature 527 toward the right the circuit of coil 521 is broken at contacts 522 and 523, as shown in Fig. 18, due to the engagement of bar 526 with switch blade 524. In this way the coils 521 and 531 do not carry current any longer than is necessary for the functioning of the control system.

As stated previously, the conveyor D is operated by motor 81 (Fig. 1). It is not necessary to provide for any automatic control of this motor because the chute E has a capacity sufficient for receiving all of the hairpins which have accumulated upon chute 500 and conveyor D at the time the press HP is caused to stop due to the blocking of the window 501.

In addition to the manual control of the circuit of the lamp 502, the Nichols and Fausset application S. N. 376,676, filed January 30, 1941, now Patent No. 2,312,845, granted March 2, 1943, discloses an automatic control coordinated with the means which feeds wire to the hairpin forming press. This automatic control functions in such manner that the lamp 502 will not burn when the supply of wire to the press has been exhausted. Therefore, regardless of whether the window 501 is blocked with hairpins or is open, the press HP will not operate after all of the wire has been unwound from the supply reel.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a machine for assembling hair pin conductors with a slotted core, a magazine having a chute supporting hairpins by their yokes with their legs down, means providing a vertical passage at the lower end of the chute into which the hair pins pass singly from the chute, means provided at the lower end of the vertical passage for catching a hair pin by its yoke when it descends through the vertical passage, the supported hair pin having its legs extending below the vertical passage, a member having a part for engaging the yoke of the hair pin in the vertical passage, means for moving said member so that its part moves part way down the vertical passage to assist the descent of the hair pin toward the yoke-catching means, said yoke-engaging part stopping above the yoke-catching means, and means operating during downward movement of said member for retracting the yoke-catching means whereby the hair-pin gravitates freely below the vertical passage.

2. In a machine for assembling hair pin conductors with a slotted core, a magazine having a chute supporting hair pins by their yokes with their legs down, means providing a vertical pas-

sage at the lower end of the chute into which the hair pins pass singly from the chute, a vertically movable slide for assisting movement of the lowermost hair pin through the vertical passage whereby the hair pin may be discharged at the bottom, a device at the bottom of the vertical passage for supporting a single hair pin by its yoke with its legs down, a mechanism operated by a cam on the slide for retracting said device from the hairpin yoke during downward movement of the slide, and means for reciprocating the slide.

3. In a machine for assembling hair pin conductors with a slotted core, a magazine having a chute supporting hair pins by their yokes with their legs down, means providing a vertical passage at the lower end of the chute into which the hair pins pass singly from the chute, a vertically movable slide for assisting movement of the lowermost hair pins through the vertical passage whereby the hair pins may be discharged at the bottom, a device at the bottom of the vertical passage for supporting a single hair pin by its yoke with its legs down, a mechanism operated by a cam on the slide for retracting said device from the hair pin yoke during downward movement of the slide, means for retaining the next to the lowest hair pin on the chute whereby only the lowest hair pin on the chute will be permitted to pass into the vertical passage, and means for reciprocating the slide and for retracting said hair pin retaining means when the slide is down.

4. In a machine for assembling hair pin conductors with a slotted core, a magazine having a chute for supporting hair pins with their legs down, a vertical passage through which the hair pins descend singly when released from the chute, said passage being provided between the lower end face of the chute and a plate hinged to a stationary plate, a slide guided by the stationary plate for movement through the vertical passage to assist in the descent of the hair pin, means for releasing hair pins singly from the chute to the passage, a device at the bottom of the passage for catching a hair pin by its yoke, a mechanism mounted on the hinged plate for retracting the hair pin catching device, a cam movable with the slide for operating said mechanism, means for latching the hinged plate in working position, means for latching the hinged plate in non-working position to permit access to the lower end face of the chute, and means for reciprocating the slide.

5. In a machine for assembling hair pin conductors with a slotted armature core, the combination comprising, a storage chute supporting hair pins by their yokes, a feed magazine chute supporting hair pins by their yokes and forming a continuation from the lower end of the storage chute, means for feeding hair pins singly from the feed-magazine chute and causing them to descend legs down therefrom, a frame for supporting the feeding means and feed magazine chute, said frame being vertically movable so as to clear a space below the feeding means with the result that the upper end of the magazine chute is located above the lower end of the storage chute, means for stopping the descent of the hair pin from the storage chute to the magazine chute, and means coordinated with the feeding means for rendering the hair-pin-stopping means operative during a certain consecutive cycle of operation of the feeding means.

6. Apparatus according to claim 5 further characterized by the provision of a conveyor for delivering hair pins to the storage chute, and means responsive to accumulation of hair pins on the storage chute for limiting the number of hair pins delivered to the storage chute by the conveyor to the capacity of the storage chute, thereby avoiding the crowding of hair pins against the hair pin stopping means at the storage chute due to attempt to force hair pins upon the storage chute in excess of its capacity.

7. Apparatus according to claim 5 further characterized by the provision of a continuously moving conveyor, means for causing hair pins to be delivered to the conveyor, and means responsive to accumulation of a certain number of hair pins on the storage chutes for stopping operation of the delivery means, said number being the capacity of the storage chute less the number of hair pins on the conveyor between the delivery means.

8. In a machine for assembling hair pin conductors with a slotted armature core, the combination comprising, a chute for supporting hair pins by their yokes, means for feeding hair pins singly from the chute, a finger for stopping the descent of hair pins toward the feeding means, means coordinated with the feeding means and rendered operative, during certain consecutive cycles of operations thereof, for urging the hair

pin stopping finger against the chute, means for retracting the finger from the chute, a conveyor for delivering hair pins to the chute, and means responsive to the accumulation of hair pins on the chute for limiting the number of hair pins delivered by the conveyor to the capacity of the chute, thereby avoiding the crowding of hair pins against the hair pin stopping finger at the chute due to attempt to force hair pins upon the chute in excess of its capacity.

9. In a machine for assembling hair pin conductors with a slotted armature core, the combination comprising, a chute for supporting hair pins by their yokes, means for feeding hair pins singly from the chute, a finger for stopping the descent of hair pins toward the feeding means, means coordinated with the feeding means and rendered operative, during certain consecutive cycles of operations thereof, for urging the hair pin stopping finger against the chute, means for retracting the finger from the chute, a continuously moving conveyor, means for causing hair pins to be delivered to the conveyor, and means responsive to accumulation of a certain number of hair pins on the chute for the stopping operation of the delivery means, said number being the capacity of the chute less the number of hair pins on the conveyor.

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