July 16, 1929. L. E. POOLE 1,720,923

ARMATURE CORE INSULATING MACHINE

Filed Feb. 7, 1928 4 Sheets-Sheet 1

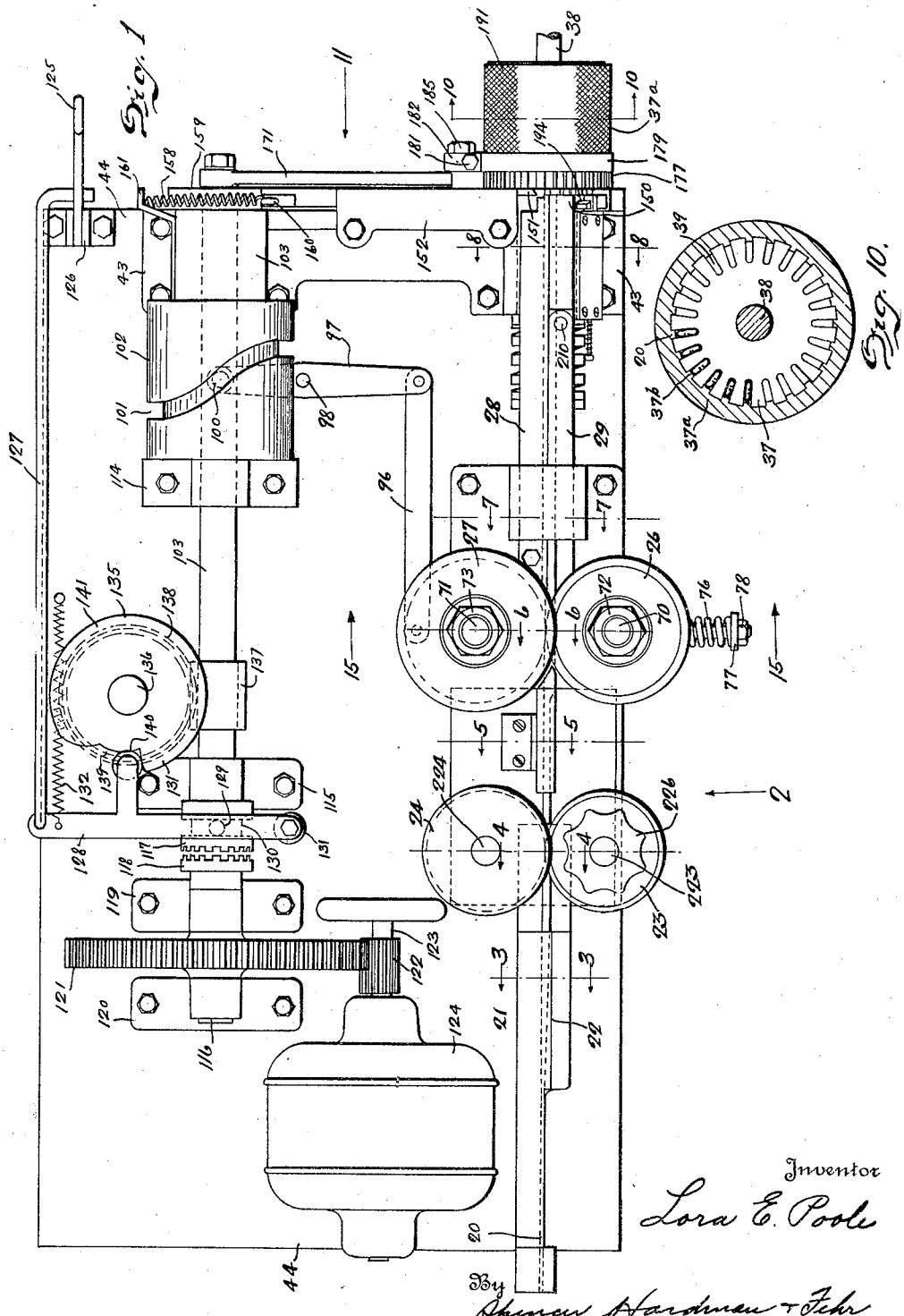


Fig. 1

Fig. 10.

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ARMATURE CORE INSULATING MACHINE

Filed Feb. 7, 1928 4 Sheets-Sheet 2

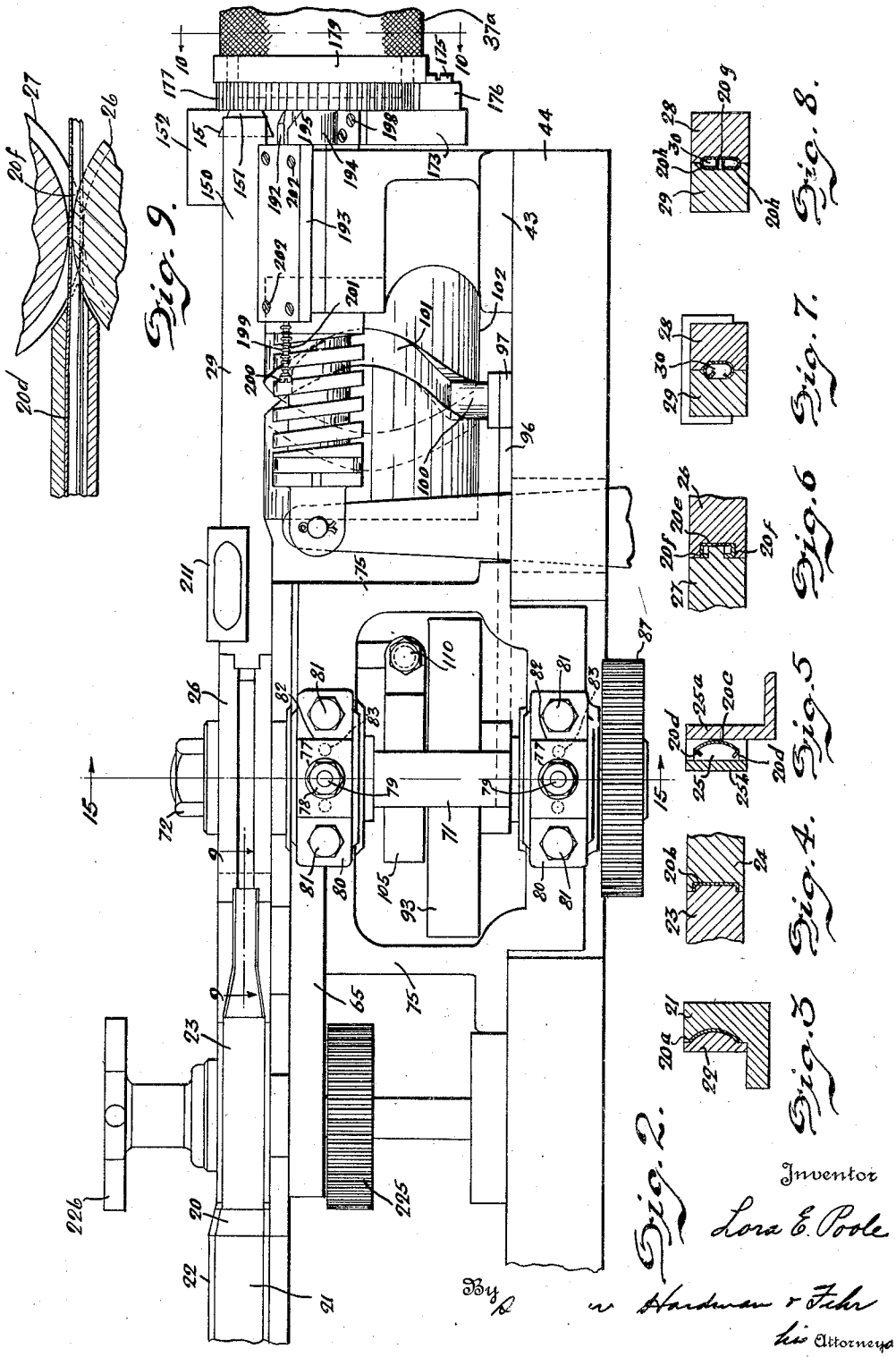


Fig. 9.

Fig. 8.

Fig. 7.

Fig. 6.

Fig. 5.

Fig. 4.

Fig. 3.

Fig. 2.

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ARMATURE CORE INSULATING MACHINE

Filed Feb. 7, 1928 4 Sheets-Sheet 3

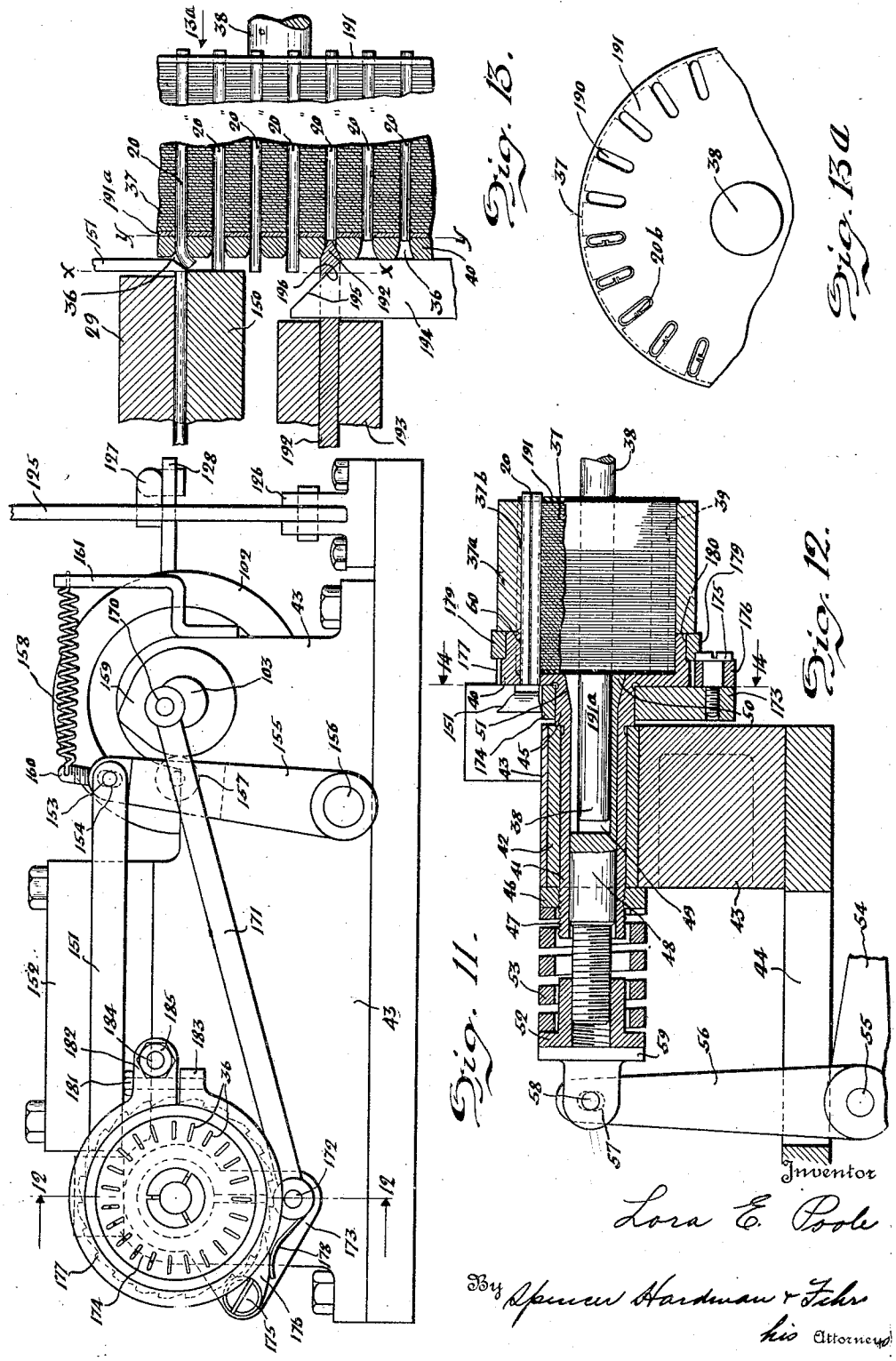


Fig. 15.

Fig. 15a

Fig. 12.

Fig. 11.

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July 16, 1929. L. E. POOLE 1,720,923

ARMATURE CORE INSULATING MACHINE

Filed Feb. 7, 1928 4 Sheets-Sheet 4

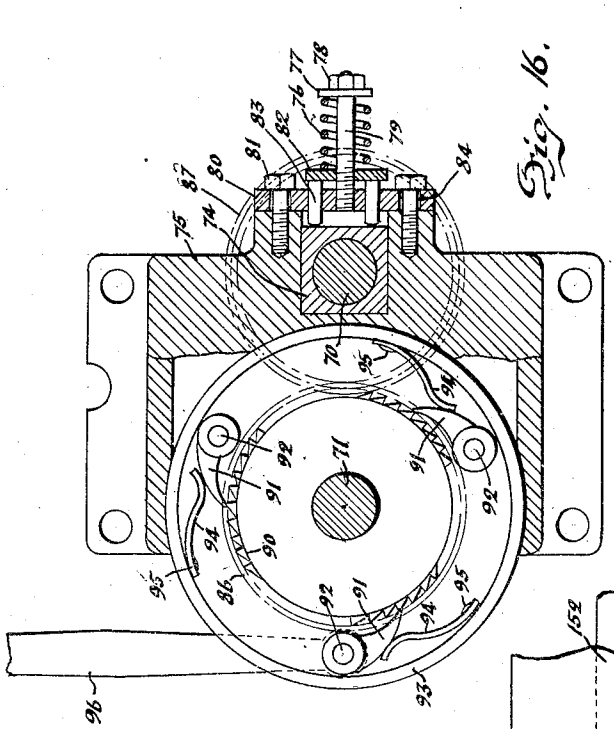


Fig. 16.

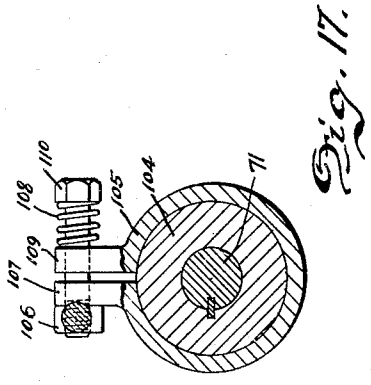


Fig. 17.

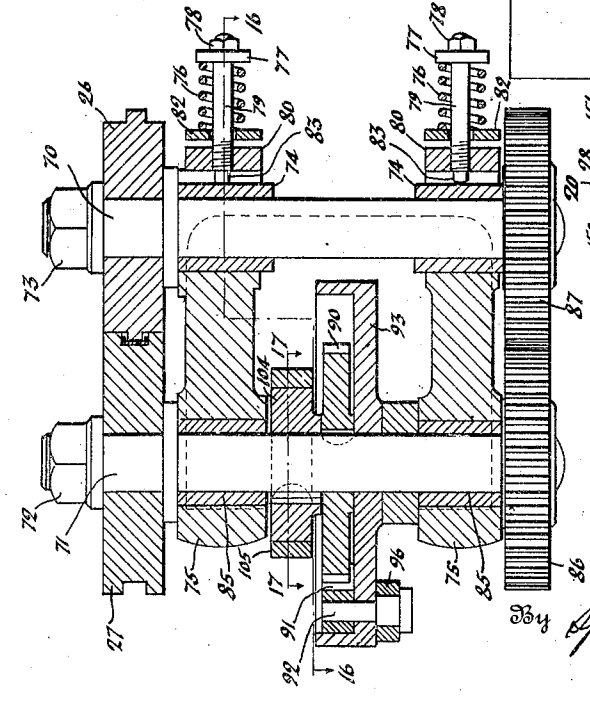


Fig. 15.

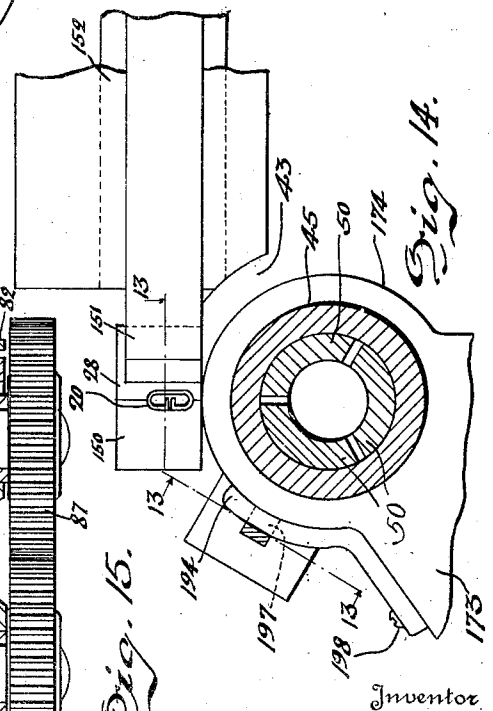


Fig. 14.

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UNITED STATES PATENT OFFICE.

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ARMATURE-CORE-INSULATING MACHINE.

Application filed February 7, 1928. Serial No. 252,622.

This invention relates to the manufacture of armatures for dynamo electric machines, and particularly to the insulation of the armature core slots and of the conductors located within these slots.

In one of its aspects the present invention provides a novel method and apparatus for folding a flat strip of insulating paper into the desired shape for insulating the armature core slots and the conductors located within the slots, and is particularly adapted to be used with the armature slot insulating machine described and claimed in my copending application Serial No. 104,404, filed April 24, 1926, said machine comprising means for rotatably supporting a slotted armature core, means for folding a flat strip of insulating material into such form that it may be passed into the slots of the armature core and will there provide insulating recesses extending longitudinally of the core for receiving the conductors which are received by the slots of the core, means for automatically feeding the folded insulation strip into the core, means for severing that portion of the strip within the core from the remainder, and means for intermittently rotating the core in order to locate its various slots in alignment with the free end of the folded insulation strip.

The folding means disclosed in application Serial No. 104,404, folds a flat strip of paper into a strip which is somewhat **S**-shaped in cross section, the loops of the **S** providing the insulating recesses which extend longitudinally of the core and receive the armature conductors.

It is particularly an object of the present invention to provide a novel method and apparatus for folding a flat strip of insulating material into a strip, the cross section of which approximately resembles a script **J**, the loops of the **J** being on the same side of the stem and providing the longitudinally extending insulating recesses for receiving the armature conductors.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred embodiment of the present invention will be clearly shown.

In the drawings:

Fig. 1 is a plan view of a machine embodying the present invention.

Fig. 2 is a side elevation looking in the direction of the arrow 2 of Fig. 1.

Figs. 3 to 10 inclusive are sectional views taken respectively on similarly marked section planes in Figs. 1 and 2.

Fig. 11 is an end elevation of the machine looking in the direction of arrow 11 of Fig. 1.

Fig. 12 is a sectional view on the line 12—12 of Fig. 11.

Fig. 13 is a sectional view on the line 13—13—13 of Fig. 14, this view being developed into a single plane instead of two planes, as indicated in Fig. 14. Fig. 13 shows also a developed sectional view of an armature core and its rotatable support.

Fig. 13^a is a fragmentary end view of the armature slot looking in the direction of the arrow 13^a of Fig. 13.

Fig. 14 is a sectional view on the line 14—14 of Fig. 12.

Fig. 15 is a sectional view on the line 15—15 of Figs. 1 and 2.

Figs. 16 and 17 are sectional views taken on lines 16—16 and 17—17, respectively, of Fig. 15.

Referring to Figs. 3 to 10 inclusive, the method of folding the paper to form slot insulation pieces will first be described. The flat strip of paper designated by numeral 20 in Fig. 1 is unwound from a supply roll (not shown) and is passed between plates 21 and 22 which gradually change the shape of the strip from flat to substantially semicylindrical, as shown at 20^a in Fig. 3. The strip then passes toward the right between forming rolls 23 and 24 which change the cross sectional shape of the strip from semicylindrical, as shown at 20^a, to channel shaped as shown at 20^b in Fig. 4. From the forming rolls 23 and 24 the strip passes through a groove 25 formed in a plate 25^a and covered by plate 25^b. This operation causes the web 20^c of the channel to be changed from flat to semicylindrical in shape and causes the flanges 20^d of the channel to extend in converging relation from the web 20^c. After passing through the groove 25, the strip passes between feed and forming rolls 26 and 27 which cause the strip to be folded so that its cross sectional shape is that of a channel whose web 20^e is flat and whose flanges 20^f are angular in cross section as shown in Fig. 6. As the paper strip passes between the forming blocks 28 and 29 shown in Figs. 7 and 8, its cross sectional shape is

gradually changed from that shown in Fig. 6 to that shown in Fig. 8. In Fig. 8 the strip may be said to have a cross sectional shape which is approximately similar to a script J, including a stem 20^g which joins loops 20^h which provide non-conducting tunnels for receiving the armature conductors. From this description it is apparent that the present invention includes a method of folding a flat strip of insulating material which consists in compressing the material transversely to its lesser cross sectional dimension while causing the side marginal portions 20^f of the work to approach each other and finally to be located in adjacent relation with the free edges of said marginal portions 20^f terminating adjacent that portion of the material intermediate its edges, namely the portion 20^g as shown in Fig. 8, whereby an insulating piece is formed comprising two tubular portions 20^h integral with an intermediate web portion 20^g. After leaving the tunnel 30 provided between the blocks 28 and 29 the strip passes through a guide passage 36 provided in a rotatable work holder 40 which receives and supports an armature core 37 carried by a shaft 38 and provided with a plurality of slots 39. As the strips 20 are inserted into the slots 39, they are maintained in contact with the bottoms of slots, for a purpose to be described later, by band 37^a which is placed temporarily around the armature core 37 (see Figs. 10 and 12). The band 37^a is provided on its interior with longitudinally extending ribs 37^b which are spaced so that each will be received by a core slot 39.

Referring to Fig. 12, the work holder 40 is a cup-shaped member having a horizontally disposed shank 41 rotatably supported by a bearing 42 attached to a bracket 43 which is mounted upon the base plate 44 of the machine. Endwise movement of the shank 41 is provided by the engagement with the bearing 42, of a shoulder 45 provided by the shank 41 and by a nut 46 engaging the threaded end 47 of the shank. The shank 41 is tubular and receives a rod 48 having a central recess 49 for receiving the armature shaft 38. The recess 49 is surrounded by three resilient spring arms 50 integral with the rod 48. These arms cooperate with an internal conical surface 51 provided by the shank 41. Thus the shank 41 and the resilient members 50 constitute a collet chuck for gripping the shaft 38 when the rod 48 is pulled toward the left so that the ends of the chucking jaws 50 will be forced against the conical surface 51 and will grip the shaft 38. The rod 48 is threadedly connected with a flanged nut 52. A spring 53 located between the nut 52 and the nut 46 urges the rod 48 toward the left so that the shaft 38 will be gripped by the members 50. In order to release the chuck so that the core and shaft may be removed from the machine, the operator will press a pedal not shown but connected with a lever 54 causing it to move in a clockwise direction. Levers 54 and 56 are attached to a shaft 55 supported by the base 44. Lever 56 is provided with a hole 57 which receives a pin 58 connected with a plate 59 which is adapted to bear against the nut 52. Obviously, downward movement of the lever 54 will be transmitted through the shaft 55 and the lever 56 causing it to move toward the right in order to compress the spring 53 and relieve the chucking jaws 50 from wedging engagement with the shank 41. The interior of the cup 40 is provided with a rib 60 which will be received by one of the core slots in order to locate the core properly relative to the work holder.

The plates 21 and 22 are supported by a bracket 65 which also rotatably supports the forming wheels 23 and 24. The forming and guiding blocks 28 and 29 are supported by a bracket 75 and the bracket 43.

The feeding and folding rolls 26 and 27 are drivingly connected with shafts 70 and 71 respectively and are maintained in driving engagement therewith by nuts 72 and 73 respectively engaging threaded ends of the shafts. The shaft 70 is journaled in bearing blocks 74 which are supported for horizontal sliding movement by a bracket 75 supported by the base plate 44. Each bearing block 74 is yieldingly urged horizontally by spring 76 which bears at one end against a washer 77 bearing against a nut 78 threadedly connected with a rod 79 having one end connected with a plate 80 which is attached by screws 81 to the bracket 75. One end of the spring 76 bears against a disc 82 having studs 83 connected therewith, each stud 83 passing through a hole 84 in the plate 80 and bearing at its one end against the block 74. The shaft 71 is supported by bearings 85 carried by the bracket 75 and is drivingly connected with the shaft 70 by gears 86 and 87 connected respectively with shafts 71 and 70.

The mechanism for imparting intermittent rotary motion to the shaft 71 in a clockwise direction as viewed in Fig. 16, comprises a ratchet 90 attached to the shaft 71 engageable with a plurality of pawls 91 each mounted on a stud 92 supported by a disc 93 which is rotatably supported by the shaft 71 but is not drivingly connected therewith. Each pawl is urged toward the ratchet by a leaf spring 94 fixed at 95 to the periphery of the disc. The disc 93 is oscillated by a link 96 connected at one end with the disc and at the other end with a lever 97 rotatably supported by a stud shaft 98 supported by the base 44. The lever 97 carries a cam following roller 100 which is received by a slot 101 of a drum cam 102 which is mounted on a shaft 103. Obviously, for each rotation of the shaft 103 there will be one complete oscillation of the lever 97 and link

96. This movement will produce rotation of the feed rollers 26 and 27 then a backing up of the pawls 91 by a movement in a clockwise direction as viewed in Fig. 16 preparatory to the next feeding operation. The ratchet 90 is prevented from backing up by a friction device including a drum 104 attached to the shaft 71 and engaged by a split clamping band 105 which is prevented from turning by the engagement of one of its lugs 107 with a post 106 attached to the bracket 75. The band 105 is urged into frictional engagement with the drum 104 by a spring 108 bearing against a lug 109 of the clamp and the head of a screw 110 which passes through plain holes in the lugs 107 and 109 and threadedly engages the post 106. Turning the screw 110 will vary the friction pressure exerted by the clamp 105.

The shaft 103 is supported by the bracket 43, a bracket 114 and a bracket 115. The shaft 103 is connectible with a shaft 116 by a clutch member 117 which is drivingly connected with the shaft 103 and is endwise movable into engagement with a clutch member 118 fixed to the shaft 116. The shaft 116 is supported by brackets 119 and 120 and is attached to a gear 121 meshing with a gear 122 which is supported by a shaft 123 operated by an electric motor 124 carried by the base plate 44. The clutch members 117 and 118 are engaged by means including a lever 125 which is pivotally connected with a bracket 126 attached to the base plate 44. The lever is connected by a link 127 with a lever 128 carrying a roller or stud 129 which is received by a groove 130 provided by the clutch member 117. The lever 128 is pivoted upon a post 131 attached to the base 44. A spring 132 connecting the lever 28 with the base plate 44 tends to disengage the clutch member 117 from the clutch member 118. To cause rotation of the shaft 103, the operator, who stands facing the end of the machine shown in Fig. 11, and therefore facing in the direction of the arrow 11 of Fig. 1, will push the lever 125 away from him in order to cause the link 127 to move toward the left in Fig. 1 and the lever 128 to move counterclockwise to engage the clutch 117 with the clutch 118. The motor 124 will then operate the shaft 103. The operator will maintain the lever 128 in this position manually until a cam 135, which is rotatably supported by a stub shaft 136 and is driven by the shaft 103 through gearing 137 and 138, has been rotated sufficiently to cause a notched portion 139 to move away from a roller 140 attached to the lever 128. Then the operator may release the lever 125 so that the spring 132 will draw the roller 140 into engagement with the outer periphery 141 of the cam 135. The shaft 103 will continue to rotate until the cam 135 has made substantially a complete revolution to bring the notch 139 opposite the roller 140. Then the spring 132 will be released to move the lever 128 clockwise in order to disconnect the clutch member 117 from the member 118.

Due to the rotation of the rollers 26 and 27 to feed the paper endwise as well as to perform one of the steps of forming it, a portion of the strip of paper is fed through one of the guide passages 36 in work holder 40 into an armature core slot 39 in alignment therewith, and this portion is severed from the remainder of the strip by means including a shear block 150 which cooperates with a slidable knife 151 which is guided by a bracket 152 attached to the bracket 43. The knife 151 is provided with a slot 153 for receiving a stud 154 carried by lever 155 which is supported by a pivot stud 156 carried by the bracket 43. The lever 155 carries a roller 157 which is yieldingly urged by a spring 158 against a cam 159 which is attached to the shaft 103. Spring 158 is connected with a screw 160 attached at one end to the lever 155 and to the other end with a bracket 161 attached to the bracket 43. Soon after the end of the paper feeding operation, the knife 151 will shear the paper at the adjacent edge of the shear block 150.

After the shearing operation, the operation of rotating the work holder 40 in a counterclockwise direction, as viewed in Fig. 11, is performed in order to bring the next core slot 39 opposite the tunnel 30. It will be understood that the shear block 150 is provided with a groove forming an extension of the groove in the block 29 so that the blocks 28 and 150 may cooperate with the block 29 to provide a tunnel forming an extension of the tunnel 30 provided by the blocks 29 and 28 as described with reference to Fig. 8.

The mechanism for intermittently moving the work holder in the manner described, comprises a crank pin 170 attached to the shaft 103, and a link 171 connecting the pin 170 with a stud 172 attached to a lever 173 having a hub 174 which is rotatably supported by the shank 41 of the work holder. The lever 173 carries a screw 175 providing a pivot for a ratchet pawl 176 which cooperates with ratchet teeth 177 provided by the periphery of the work holder 40. A leaf spring 178 attached to the lever 173 bears against the pawl 176 in order to yieldingly maintain engagement with the ratchet 177. The shaft 103 is rotated in a clockwise direction as viewed in Fig. 11, so that, after the knife bar 151 has sheared the paper and begins movement toward the right in Fig. 14, the lever 173 will start substantially at the same time to move in a counterclockwise direction in order that the work holder 40 will be rotated through an angular distance substantially equal to the spacing of the guide slots 36. After the indexing of the work holder has been performed the next feeding operation will take place during which the ratchet

lever 173 will be moved clockwise an angular distance slightly greater than the spacing of the ratchet teeth 177. Rotation of the ratchet in a clockwise direction is prevented by a band 179 which frictionally engages a cylindrical surface 180 provided by the work holder 40. The band is in the form of a split ring and may be adjustably clamped about the work holder 40 by turning the screw 181 which passes through a plain hole in the band lug 182 and threadedly engages the band lug 183. The band lug 182 is apertured to receive a stud 184 attached to the bracket 43 and cooperating with a nut 185 to prevent endwise and rotary movement of the band 179.

It is therefore apparent that each cycle of operation of the machine includes feeding a folded strip of paper into an armature core slot, the severing of that portion of the paper within the armature core from the remaining portion, and the turning of the armature core relative to the paper feeding means in order that the next core slot to be insulated will be brought into alignment with the passage 30 through which the insulation strip is guided into the armature core. During the feeding operation, a portion of the strip of paper is being folded preparatory to being fed into the armature core during a succeeding feeding of the operation. The machine will operate continuously until all of the armature core slots have been provided with insulation pieces. Then the machine will stop automatically. This is accomplished through the clutch control device described. If, for example, the armature core has 23 slots, the speed ratio of the gearing 137 and 138 is as 23 to 1. That is, the shaft 103 will make 23 revolutions in order to rotate the cam 135 once so that its notch 139 will be brought again opposite to the roller 140, thus permitting the clutch member 117 to be disengaged from the clutch member 118 by the operation of the spring 132.

Referring to Figs. 12, 13 and 14, it will be apparent that it is not practical to locate the cutting edge of the knife bar 151 in the same plane as the left hand end of the armature core 37. Therefore a portion of the strip 20 measured by the distance between planes *x*—*x*, *y*—*y* in Fig. 13 will project beyond the left hand end of the core 37. It is desirable to shove substantially all of the insulation pieces 20 through the core slots in order that the ends of the strips may be received by closed slots 190 located in alignment with the slots 39 of the armature core and provided in a non-conducting disc 191 located adjacent that end of the armature core which is to be remote from the commutator. The function of the disc 191 is to assist in maintaining the armature conductors within the core slots. The insulating disc 191[a] which is placed against that end of the core which is to be adjacent the commutator may have open slots, since the soldered connections between the armature conductors and commutator risers will suffice to retain the conductors at the commutator end of the core. After each insulating strip 20 has been pushed through the core so that its right hand end will be received by a closed slot 190 of the non-conducting disc 191 that end will be prevented from coming out of the armature core. It will now be apparent that the ring 37[a] will facilitate movement of the insulation pieces through the closed slots of the end non-conducting disc 191, since the ribs 37[b] provided by the ring 37[a] maintain the strips 20 against the bottoms of the core slots 39. After the strips 20 have been moved past the shear lock 150 they are shoved further toward the right in Fig. 13 by means including a bar 192 which is slidably supported by guide block 193 for endwise movement parallel to the direction of movement of the strip 20. Endwise movement of the bar 192 toward the strips 20 in order to push them further into the armature core as shown in Fig. 13 is produced by a plate cam 194 having a beveled surface 195 which cooperates with a beveled surface 196 which defines a notch 197 with which the bar 192 is provided for receiving the cam 194. The cam 194 is attached by screws 198 to the lever 173. Therefore during clockwise rotation of the lever 173 the slide 192 is moved toward the right in Fig. 13 in order to move the strip 20 further into the armature core 37. During counterclockwise movement of the lever 173 the slide 192 is moved toward the left by spring 199 bearing at one end against the guide block 193 and at the other end against a shoulder 200 provided by a rod 201 which is attached to the bar 192. The guide block 193 is attached by screws 202 to the bracket 43.

Obviously, it would be necessary where a 23 slot core is loaded to operate the machine 27 cycles before stopping in order that all of the strips 20 would have the same location relative to the core 37 as the strips 20′ in Fig. 13. This has not been found necessary as it is a relatively simple matter to push in the strips 20″ after the core 37 has been removed from the work holder 40.

The guide bar 29 is pivoted upon a stud 210 supported by the bracket 43 so that bar 29 may be separated from guide bar 28 to permit access to the paper strip between the bars 28 and 29. A U-shaped clip 211 embracing the bars 28 and 29 maintains the bar 29 against the bar 28.

The forming wheels 23 and 24 are attached to rotatably supported shafts 223 and 224 respectively, and these shafts are connected by gears of the same pitch diameter, one being marked 225 in Fig. 2. The shaft 223 is attached to a handle 226 by which both wheels

23 and 24 may be rotated to feed the paper strip 20 to the power operated feed wheels 26 and 27.

While the form of 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. The method of making slot insulation pieces for electrical apparatus from a flat strip of material which consists in progressively compressing the material transversely to its lesser cross sectional dimension while causing side marginal portions of the work to approach each other and finally to be located in adjacent relation with the free edges of said marginal portions terminating adjacent that portion of the material intermediate its edges, whereby an insulating piece is formed comprising two tubular portions integral with an intermediate web.

2. The method of making slot insulation pieces for electrical apparatus from a flat strip of material which consists in changing its cross sectional shape from flat to channel-shape having web and flange portions, in causing the flanges to be turned toward each other and to lie in substantially the same plane and parallel to the web, and in compressing the web to cause the flanges to be turned toward the web in order to provide an insulating piece comprising tubular portions integral with an intermediate web.

3. The method of making slot insulation pieces for electrical apparatus from a flat strip of material which consists in changing its cross sectional shape from flat to channel-shape, having web and flange portions, and in compressing the web while causing the flange portions to turn inwardly toward the web and to be located in adjacent relation in order to provide an insulating piece comprising tubular portions integral with an intermediate web.

4. The method of making slot insulation pieces for electrical apparatus from a flat strip of material which consists in changing its cross sectional shape from flat to channel-shape and in progressively compressing the web of the channel-formation of the material while causing the web to be bent in such manner that the flange portions of the channel-formation are caused in one stage to extend from the web portion in converging relation and finally to be located in adjacent relation and to terminate adjacent that portion of the material intermediate its edges, whereby an insulation piece is formed which has a cross section shape approximately the shape of a script J.

5. Apparatus for folding slot insulation pieces for electrical apparatus from flat strip material which comprises, in combination, means for progressively compressing the material transversely to its lesser cross-sectional dimension while causing side marginal portions of the work to approach each other and finally to be located in adjacent relation with the free edges of said marginal portions terminating adjacent that portion of the material intermediate its edges, and means for producing relative movement between the strip material and the folding means in a direction parallel to the side margins of the strip.

6. Apparatus according to claim 5 in which the means for producing relative movement comprises a pair of feed rolls which perform a part of the forming operation.

7. Apparatus for folding slot insulation pieces for electrical apparatus from flat strip material which comprises, in combination, means for changing the cross-sectional shape of the material from flat to channel-shape having web and flange portions, means for causing the flanges to extend toward each other and to lie in substantially the same plane, and parallel to the web, and means for compressing the web to cause the flanges to be turned toward the web in order to provide an insulating piece comprising tubular portions integral with an intermediate web.

8. Apparatus according to claim 7 in which the second-mentioned means includes feed wheels which cause the strip to be moved in a direction parallel to its side margins.

9. Apparatus for folding slot insulation pieces for electrical apparatus from flat strip material which comprises, in combination, means for changing the cross-sectional shape of the material from flat to channel-shape having web and flange portions, and means for compressing the web while causing the flange portions to turn inwardly toward the web and to be located in adjacent relation in order to provide an insulating piece comprising tubular portions integral with an intermediate web.

10. Apparatus according to claim 9 in which a pair of feed rolls is included in the second-named means, said rolls being operated so as to cause the strip to move in a direction parallel to its side margins.

11. Apparatus for folding slot insulation pieces for electrical apparatus from flat strip material which comprises, in combination, means for changing the cross sectional shape of the material from flat to channel shape having web and flange portions, and means for progressively compressing the web of the channel-formation of the material while causing the web to be bent in such manner that the flange portions of the channel-formation are caused in one stage to extend from the web portion in converging relation and finally to be located in adjacent relation and to terminate adjacent that portion of the material intermediate its edges,

whereby an insulation piece is formed which has a cross-section shape approximately the shape of a script J.

12. Apparatus according to claim 11 in which a pair of feed rolls is included in the second-named means, said rolls being operated so as to cause the strip to move in a direction parallel to its side margins.

13. Apparatus for folding slot insulation pieces for electrical apparatus from flat strip material which comprises, in combination, means for changing the cross-sectional shape of the material from flat to channel-shape having web and flange portions, means for changing the shape of the cross section of the material from a channel-section having plane flanges to one which has angular flanges, the free legs of which extend toward one another, and means for compressing the web while causing the free legs of the angular flange to be turned toward the web and to lie in adjacent relation in order to form an insulation piece which has tubular portions joined by a part of said web.

14. Apparatus according to claim 13 in which a pair of feed rolls is included in the second-named means, said rolls being operated so as to cause the strip to move in a direction parallel to its side margins.

15. Apparatus according to claim 13 in which a pair of resiliently mounted intermittently operated pair of feed rolls is included in the second named means, said rolls being operated so as to cause the strip to intermittently move in a direction parallel to its side margins.

In testimony whereof I hereto affix my signature.

LORA E. POOLE.