

Aug. 8, 1944.

H. W. GARBE

2,355,522

ASSEMBLING APPARATUS

Filed March 5, 1942

8 Sheets-Sheet 1

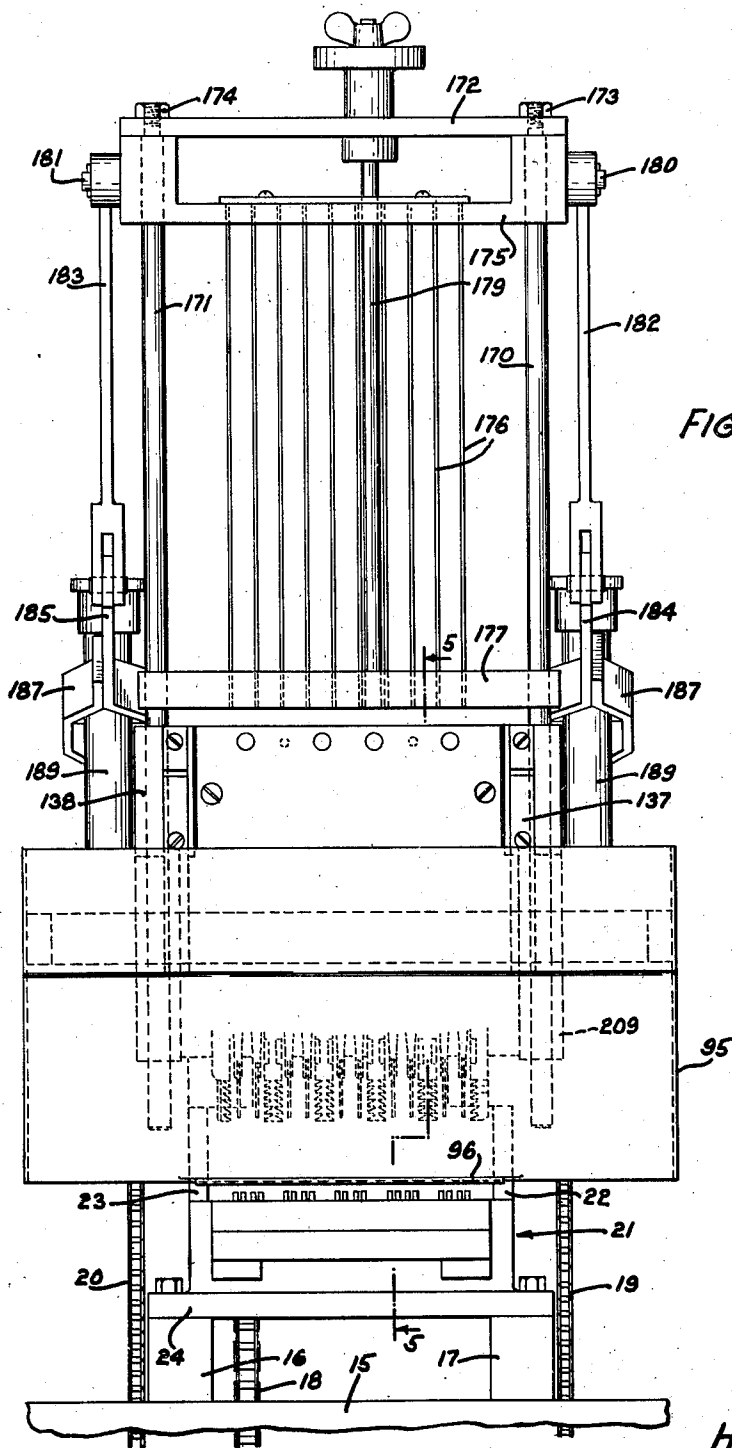


FIG. 1

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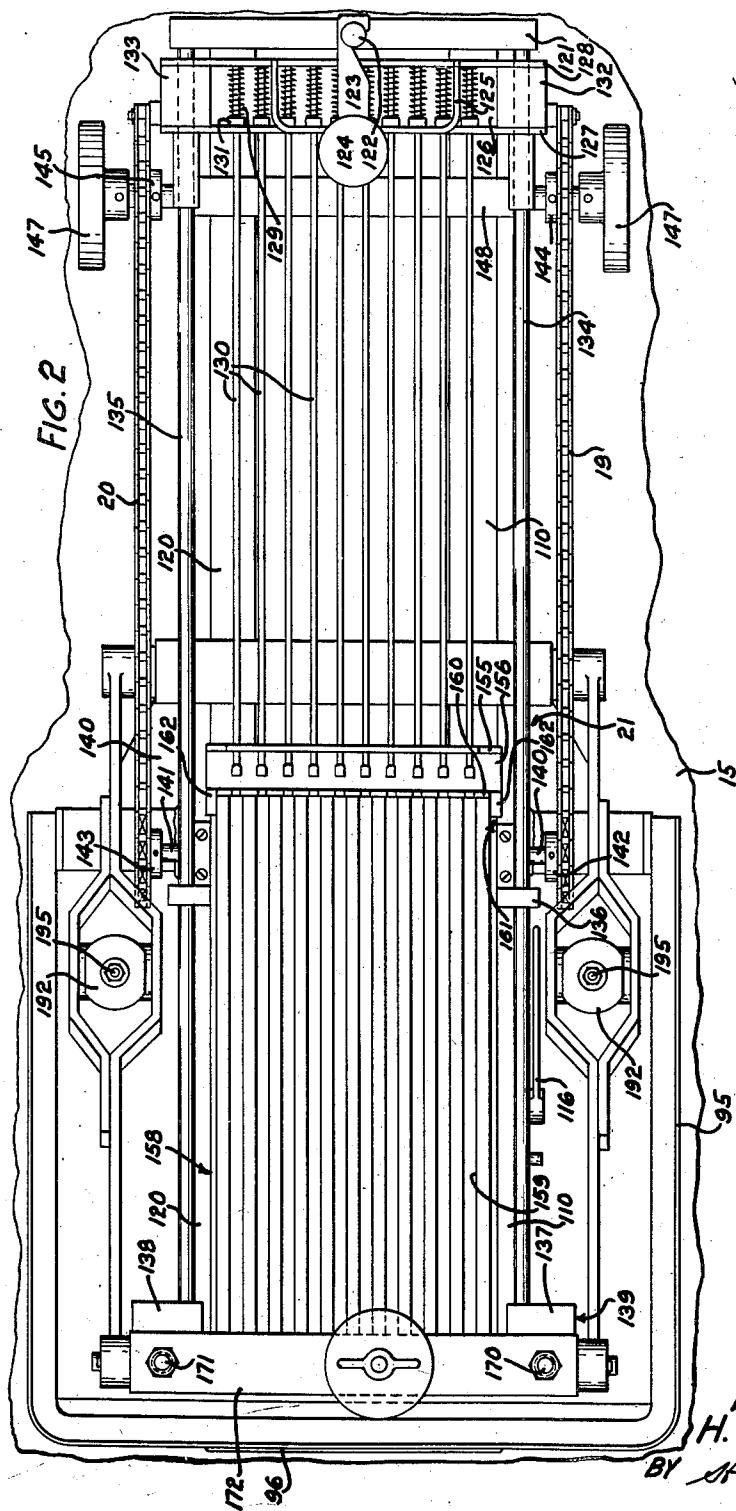
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8 Sheets-Sheet 2



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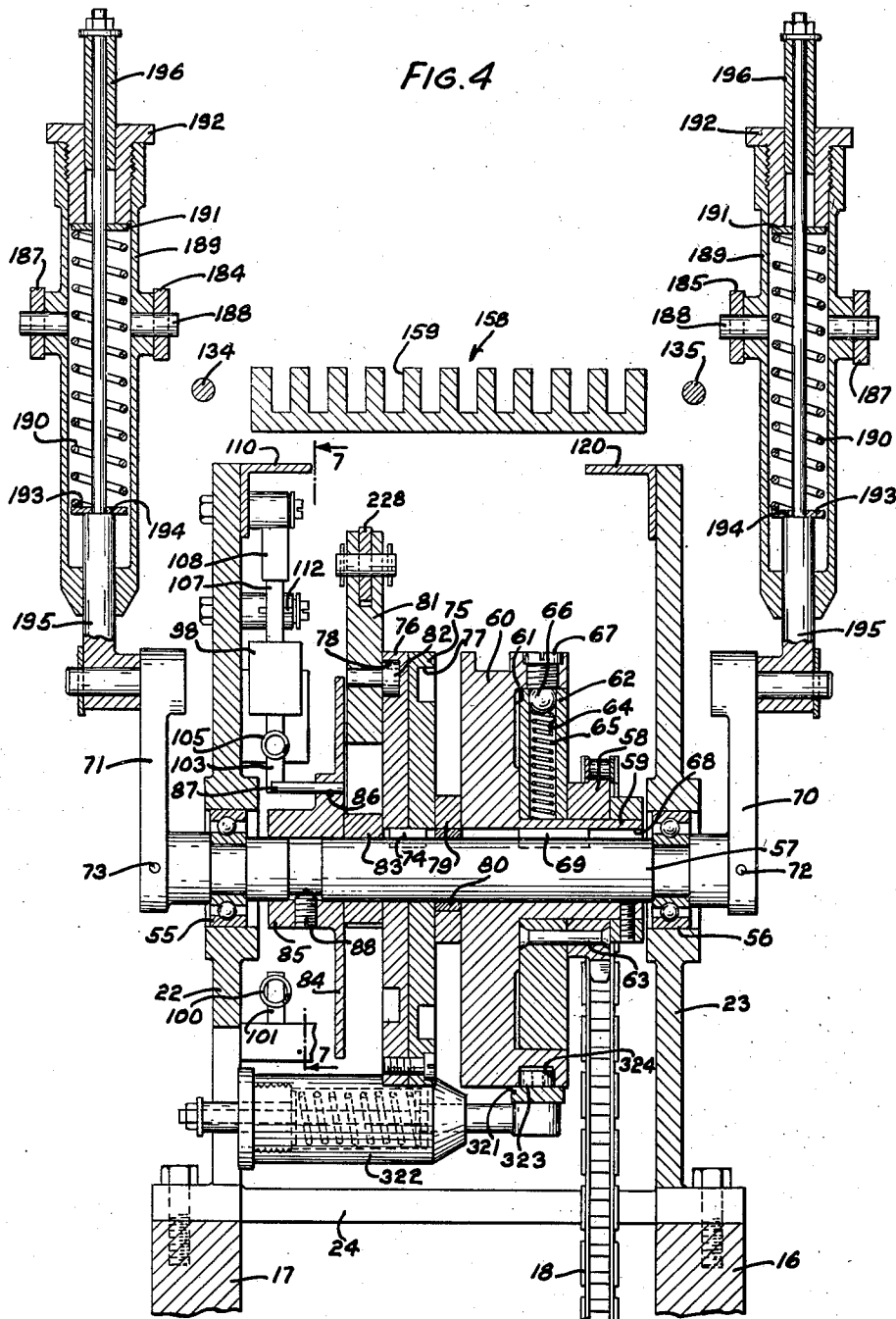
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ASSEMBLING APPARATUS

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8 Sheets-Sheet 4



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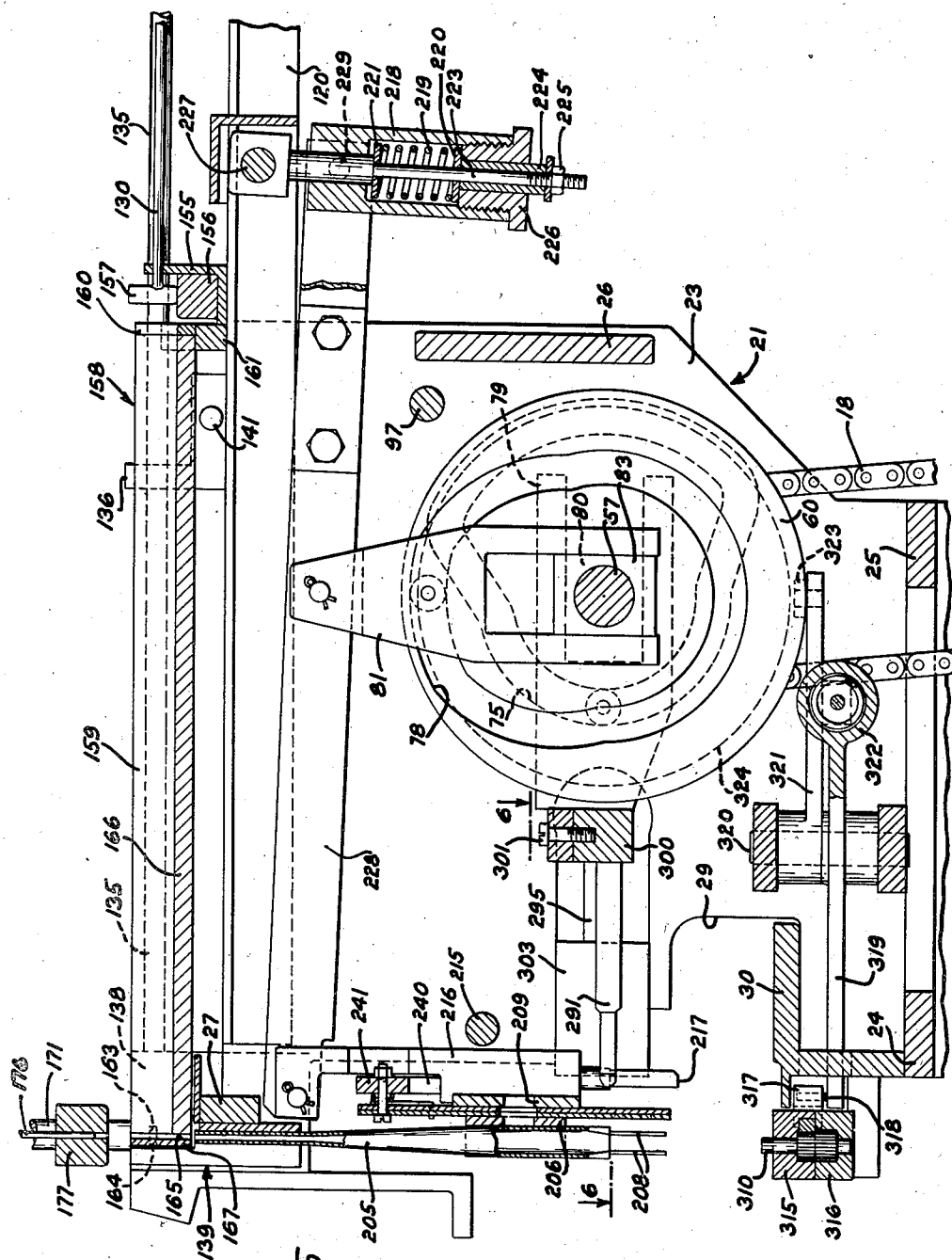
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ASSEMBLING APPARATUS

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Aug. 8, 1944.

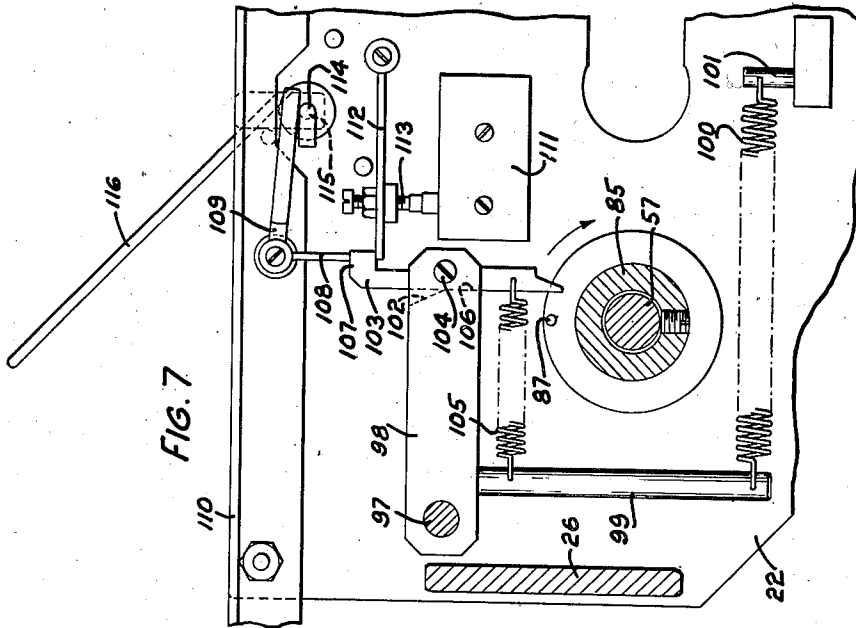
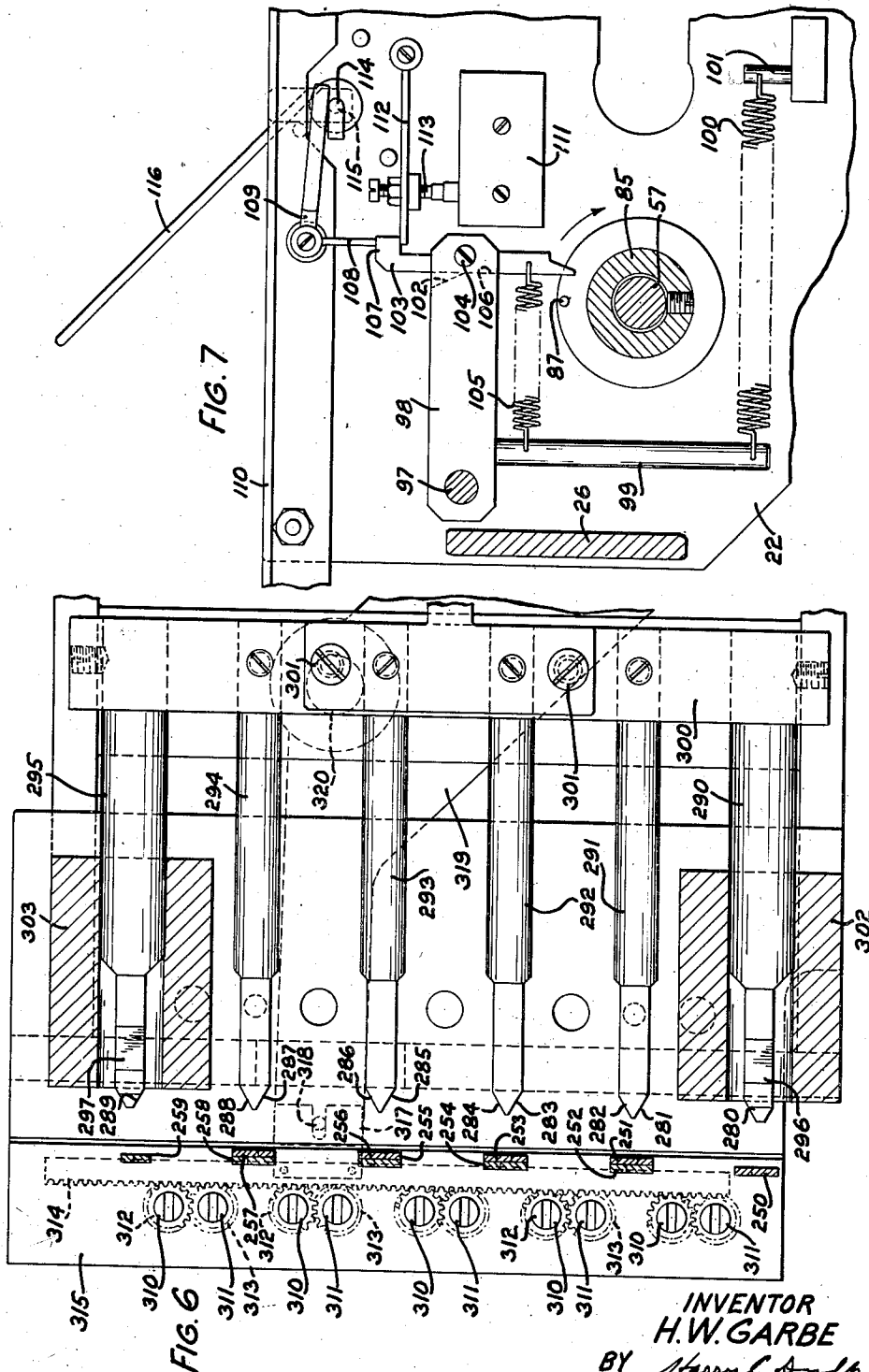
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ASSEMBLING APPARATUS

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8 Sheets-Sheet 6



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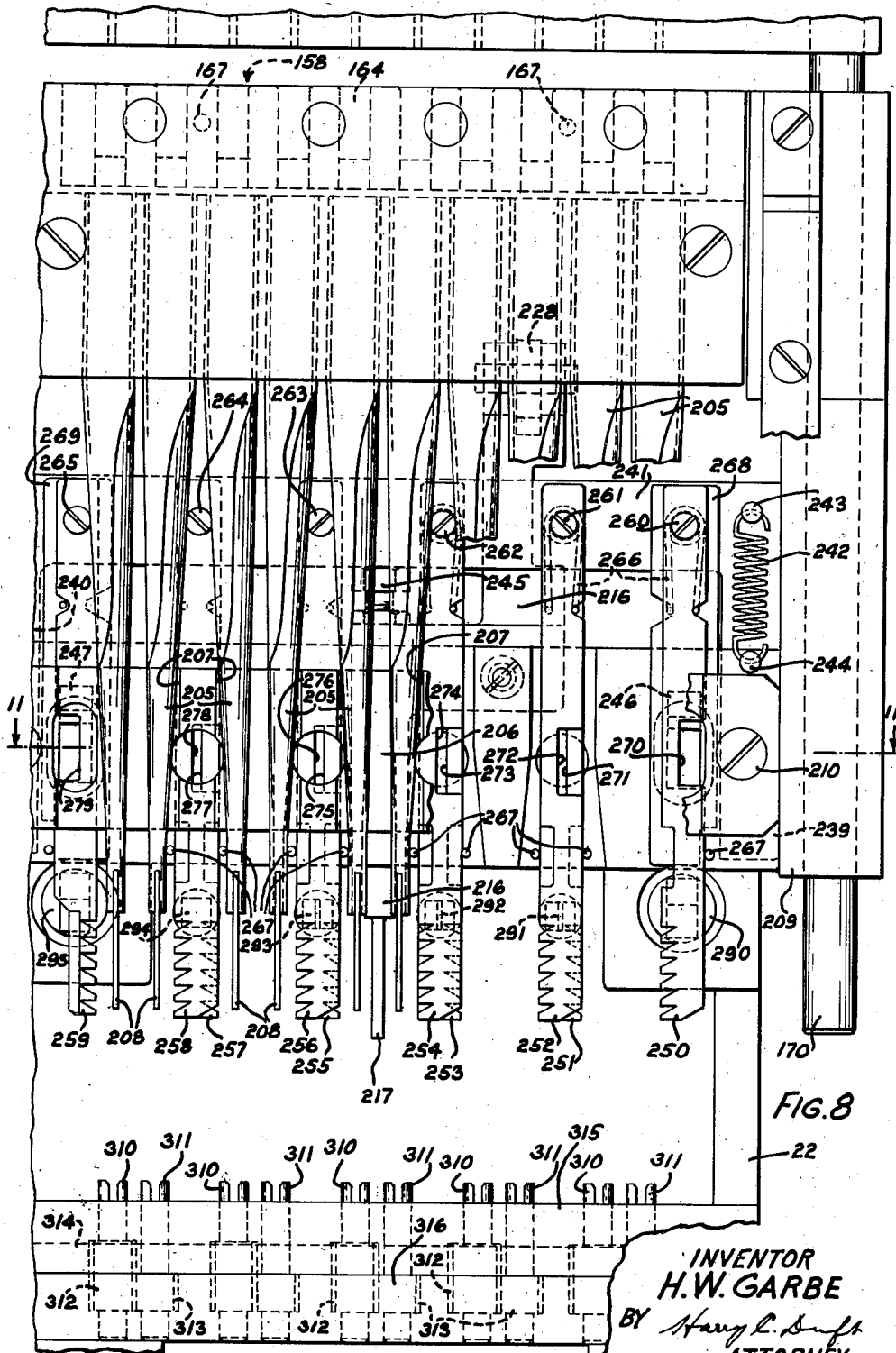
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Aug. 8, 1944.

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2,355,522

ASSEMBLING APPARATUS

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8 Sheets-Sheet 8

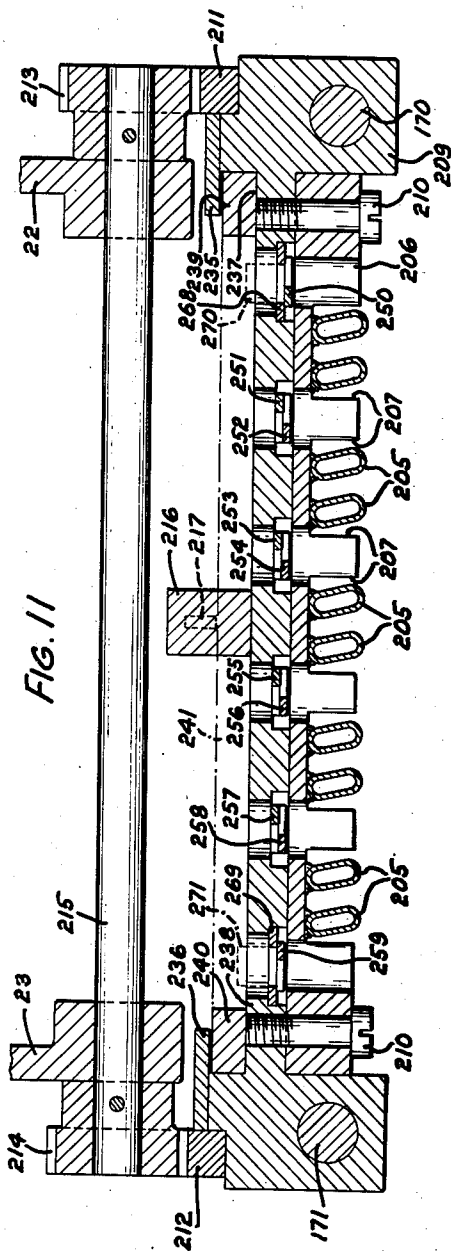


FIG. 11

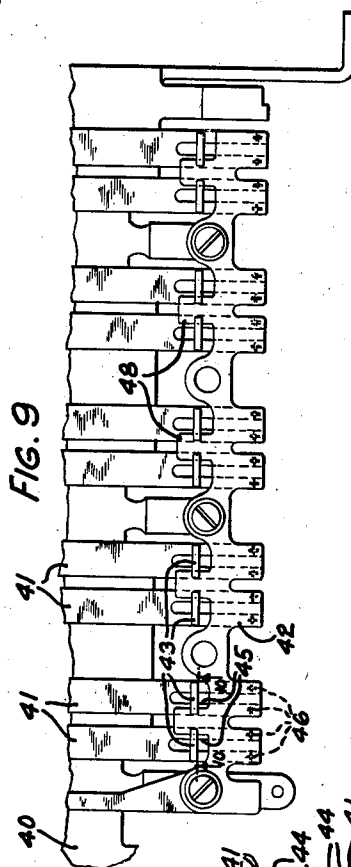


FIG. 9

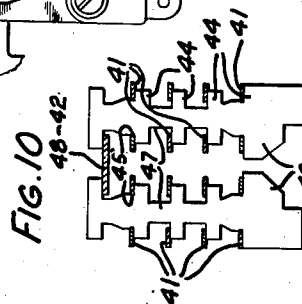


FIG. 10

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UNITED STATES PATENT OFFICE

2,355,522

ASSEMBLING APPARATUS

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Application March 5, 1942, Serial No. 433,480

13 Claims. (Cl. 29—203)

This invention relates to assembling apparatus and more particularly to apparatus for assembling insulators in electrical equipment.

In the manufacture of some electrical apparatus, for example, the vertical units of telephone cross bar switching apparatus, it is necessary to assemble a large number of small parts in each piece of apparatus. The cost of manufacturing such apparatus is appreciably greater when these assembling operations have to be done manually and, accordingly, a great amount of effort is directed to devising apparatus to perform these assembling operations automatically, particularly where manual assembling of the parts is exceedingly difficult and tedious.

It is an object of the present invention to provide an automatic apparatus for rapidly assembling parts that are difficult to assemble manually.

In accordance with one embodiment of the invention, as applied to the assembling of the contact spring actuators of a cross bar switch vertical unit, which actuators are small irregularly shaped insulators known as "cards," one of which must be wedged into engagement with each group of ten groups of three to six contact springs of the unit, a magazine holding ten rows of cards is provided for feeding ten cards at a time to an assembling position. The ten cards at the assembling station are pushed from the end of the magazine by push rods and directed into a series of ten guide tubes each time the apparatus is operated. The apparatus is of the single cycle type, which, upon being started in operation by a predetermined amount of movement of a guard member under control of an operator, will go through one entire assembling cycle and then come to rest. The series of ten guide tubes are mounted upon a reciprocable framework and after the cards are pushed into the tubes by the push rods, the tubes moved downwardly with the push rods to carry the ends of the cards into engagement with rotatable card locking devices positioned beneath the partially assembled vertical unit with which the cards are to be assembled in this apparatus. The vertical unit at this stage of its manufacture comprises a series of groups of contact springs and associated fixed contact members positioned in alternate arrangement, that is, there are ten rows of contact springs and fixed contact members. In each of these rows, there may be from three to six or more sets of fixed and movable contacts. In the construction of a vertical unit of this type, the contact springs are each split to provide two electrical contacts on each spring for insuring the

completion of a circuit through any of the springs that are actuated. Of course, the fixed contact members are also provided with two contacts associated with the contacts on the ends of the split springs.

The tubes which carry the cards move downwardly to direct the cards into the aligned slots of each group of springs, means being provided at the end of each tube for holding the cards in this position with the end of each card in engagement with a rotating element whereby, in the operation of the apparatus, the cards may be turned through 90 degrees to lock them in position in the slots in the springs.

To facilitate the feeding of the cards through the magazine, they are fed toward the assembling position in the same relative positions that they assume in the cross bar switch vertical unit after they are locked in position therein and the tubes are twisted in order to turn the cards 90 degrees to permit their being inserted in the slots of the contact springs. The apparatus described thus far is started in operation, after a partially assembled unit has been placed in the apparatus, by the operator moving a guard down over the face of the unit in the apparatus. The movement of the guard to this position trips a motor control mechanism and the motor drives a main shaft through one revolution to perform the operations described hereinbefore in proper sequence. In order to facilitate the positioning of the cards in the slots of the contact springs at a predetermined time in the cycle of the operation of the apparatus, the mechanism becomes operative to engage all of the contact springs in the unit simultaneously and raise them to a predetermined position where they will be in alignment with the proper portion of the cards. After the cards have been rotated to lock them in engagement with the contact springs, the spring lifting means is released and the apparatus is restored to normal condition to receive another partially assembled vertical unit and assemble the insulating cards with the unit.

A better understanding of the invention may be had by reference to the accompanying drawings, wherein

Fig. 1 is a front elevational view of apparatus embodying the invention;

Fig. 2 is a plan view of the apparatus shown in Fig. 1;

Fig. 3 is a partial side elevational view of the apparatus shown in elevation and plan in Figs. 1 and 2;

Fig. 4 is a transverse vertical sectional view

taken on the line 4—4 of Fig. 3 in the direction of the arrows showing details of the cam shaft which drives the various parts of the apparatus and some of the other mechanisms associated with the cam shaft;

Fig. 5 is an irregular longitudinal sectional view taken along the line 5—5 of Fig. 1 in the direction of the arrows;

Fig. 6 is a plan section taken on the line 6—6 of Fig. 5 in the direction of the arrows and showing some of the operating mechanism for rotating the cards after they are positioned in the slots in the contact springs and for lifting the contact springs to properly position them for receiving the cards;

Fig. 7 is a vertical sectional view taken on the line 7—7 of Fig. 4 in the direction of the arrows showing some of the details of the single cycle control mechanism;

Fig. 8 is an enlarged elevational view taken from the front of the apparatus just back of the guard and showing parts of the mechanism shown in Fig. 6 in front elevation, parts of the mechanism being broken away to more clearly illustrate the construction of the parts which are behind them in the apparatus;

Fig. 9 is a plan view of a portion of a cross bar switch vertical unit showing the cards in place in the unit;

Fig. 10 is a sectional view taken along the line 10—10 of Fig. 9 in the direction of the arrows showing the relative location of the contact springs and their associated fixed contacts with the cards after they are assembled; and

Fig. 11 is a transverse sectional view taken on the line 11—11 of Fig. 8 in the direction of the arrows.

General framework

Referring to the drawings, wherein like reference characters designate the same parts throughout the several views, the apparatus, which may be mounted upon a suitable bench 15, has a supporting framework 21 mounted on blocks 16 and 17, which may be, in turn, secured to the top of the bench. The bench may be suitably cut to permit the passage therethrough of a drive chain 18 (Figs. 1, 3, 4 and 5) and weight supporting chains 19 and 20 (Figs. 1, 2 and 3), the driving motor (not shown) being mounted underneath the bench in any suitable manner for driving the chain 18, as will be described hereinafter. The framework, indicated generally by the numeral 21, is comprised of side plates 22 and 23, which are held in spaced relation by welding cross members 24 and 25 to them (Fig. 3). The cross members 24 and 25 have portions thereof extending outwardly beyond the side plates 22 and 23, whereby the framework 21 may be mounted upon the blocks 16 and 17. Adjacent their upper ends, the side plates 22 are interconnected by a rear tie plate 26 (Figs. 5 and 7) and a front cross member 27. The front edges of the side plates 22 and 23 are cut out as shown at 28 and 29 (Figs. 3 and 5) to receive a positioning plate 30, on which partially assembled cross bar switch vertical units may be positioned to assemble cards in them.

The vertical unit

The vertical unit as shown in Figs. 9 and 10 comprises a mounting plate 40, on which there are suitably mounted a series of alternately positioned contact springs 41 and fixed contact plates 42, the free ends of the contact springs 75

being shown in Fig. 9, it being understood that the end of the springs, which are broken off, are suitably mounted on the plate 40 by means of spacers and insulating units (not shown) and that the springs are held in position on the mounting plate in any suitable manner. Since this portion of the construction of the vertical unit is not involved in the present invention, further detailed description of it is not believed to be necessary, it being sufficient to state that the springs are held in a predetermined position by their spacers and insulators and are adapted to have actuating insulators or "cards" 43 fixed to them so that all of the contacts on all of the springs in a given row of springs will simultaneously be moved into engagement with opposed contacts on the fixed contact plates 42 associated therewith when the card 43 is moved upwardly, as viewed in Fig. 10. It should be noted that the card 43 is provided with a series of projecting shoulders 44—44, one of which is associated with each contacting portion of the contact springs 41, the contact springs 41 being split as shown at 45 (Fig. 9) to receive the cards 43 and to provide two separate contact points, as indicated by the cross lines at 46. This is a common expedient in telephone switching apparatus and need not be described further herein. It should also be noted that the stem portion 47 of the card 43 is somewhat larger adjacent the top and bottom actuating shoulders 44 than at the intermediate actuating shoulders and, further, that the upper portion of the card extends outwardly from the stem 47 a sufficient distance so that this portion of the card will normally rest against an extension 48 on the top fixed contact plate. The contact springs 41 of apparatus of this type are normally biased to hold the contacts thereon out of engagement with the fixed contacts on the plates 42 and are adapted to be moved into engagement with the fixed contacts when the card 43 is moved upwardly, as shown in Fig. 10.

From the foregoing brief description of the cross bar switch unit which is to be assembled in the apparatus comprising the preferred embodiment of the present invention, it is believed to be clear that the cards 43 may be assembled in the slots 45 of the contact springs by inserting the cards in the slots and then turning them through 90 degrees to the position shown in Figs. 9 and 10.

The drive mechanism

Journalled in suitable bearings 55 and 56, mounted in the side plates 22 and 23, respectively, is a cam shaft 57 (Fig. 4) which supports a sprocket 58 adapted to be driven by the drive chain 18. The sprocket 58 is mounted on and may be rotated with respect to a sleeve 59, which has formed integrally with it, or suitably secured to it, a cam drum 60. The cam drum 60 is milled out, as shown at 61, to receive an overload clutch member 62, which is fixed to the sprocket 58 by means of a rivet 63 and which is provided with a radial bore 64, in which a spring 65 may be positioned. The inner end of the spring 65 bears against the sleeve 59 and the outer end bears against a ball 66, which is pressed into a suitable depression in a stud screw 67 threaded in the portion of the cam drum 60 which extends over the clutch member 62. The sleeve 59 is provided with a key slot 68, in which a key 69, extending outwardly from the shaft 57, may be received for interconnecting the shaft 57 and the cam drum 60. The just described structure com-

prises an overload clutch whereby, when rotation is imparted to the sprocket 58 by the drive chain 18, the clutch member 62, through the spring 65 and ball 66 carried by it, will tend to drive the cam drum 60 and impart rotation to the shaft 57, which is keyed to the sleeve 59 formed integrally with the cam drum 60. In this manner, the shaft 57 and cam drum 60 will be driven unless the load applied to the shaft 57 is great enough to cam the ball member 66 radially inwardly toward the shaft 57 and out of the socket in the stud screw 67. The cam drum 60 is adapted to drive the mechanism for rotating the cards 43 after the cards have been inserted in the contact springs 41, which are split at 45 to receive the cards 43, as will be described hereinafter.

Also mounted on the shaft 57 are a pair of crank arms 70 and 71 (Fig. 4) which are pinned to the outer ends of the shaft outside the plates 23 and 22 by pins 72 and 73. These crank arms are adapted to drive the mechanism for picking ten cards at a time from the end of the magazine and feeding them downwardly to position in the split contact springs 41. Mounted on the shaft 57, and keyed thereto by means of a key 74, are a pair of cams 75 and 76 having cam grooves 77 and 78, respectively, formed on their faces. The cam 75 serves to impart horizontal reciprocation to a forked member 79 slidable upon a guide block 80, which is freely mounted on the shaft 57 and is positioned between the tines of the forked member 79. The cam 76 imparts vertical reciprocation to a forked member 81, which carries a cam roller 82 in the cam groove 78 and which is freely slidable vertically on a guide block 83 mounted on the shaft 57. The forked member 79 serves to actuate the mechanism for raising the contact springs 41 to prepare them for receiving the cards 43, whereas the cam 76 serves to move the spring lifting mechanism and associated apparatus into association with the contact springs 41. Mounted adjacent the guide block 83 and forked member 81 on the shaft 57 is a control disc 84, having a hub portion 85 which is fixed to the shaft 57 by a set screw 88. The disc 84 has an enlarged portion 86, from which there extends a tripping pin 87, which controls the circuit to the driving motor (not shown).

Control mechanism

The moving parts of the apparatus which effect the insertion of the cards 43 into the split springs 41 are partially enclosed by a movable guard member 95 (Figs. 1, 2 and 3) which is provided with a forwardly projecting portion 96 whereby the guard may be pulled down over the vertical unit positioned on the positioning plate 30 to enclose the positioning plate 30 and the vertical unit and thereby prevent cards which might accidentally break in being inserted in the vertical unit from flying out and striking an operator. The guard member 95 also serves to initiate a cycle of the apparatus, it being mounted on and fixed to a shaft 97 (Figs. 3 and 7) which is rotatable in suitable bearings formed in side plates 22 and 23. Fixed to the shaft 97 is a lever 98 (Fig. 7) to which there is fixed a second lever 99. The bottom of the lever 99 is normally urged to the right (Fig. 7) by a coil spring 100 fixed to its lower end and to a pin 101 suitably mounted in the framework. Thus, the shaft 97 is urged to rotate counterclockwise (Fig. 7) through the action of the spring 100 and levers 99 and 98. Carried by the lever 98, in a slot 102 formed therein, is a pivoted latch 103, which is urged to

rock about a pivot screw 104 by a spring 105, which, in turn, is fixed to the lower end of the latch 103 and to the lever 99. The latch 103, under the influence of the spring 105, is normally held against the left hand edge 106 of the slot 102 and when an operator moves the guard 95 downwardly at the front of the machine, the shaft 97 will be rocked clockwise against the action of the spring 100 (Fig. 7) to carry the lever 98 to the position shown. The latch 103, in the position shown, will have carried its horizontally extending upper portion 107 under a locking member 108 forming a part of a bell crank 109, which is pivoted on an angle member 110. The angle member 110 forms a part of the framework of the apparatus and is secured to the side plate 22. Mounted on the side plate 22 is a highly sensitive switch 111 of the type known commercially as a "Microswitch," which has associated with it an actuating lever 112. The actuating lever 112 is normally urged upwardly by the mechanism of the switch whereby the switch is normally open and when the guard 95 is moved downwardly at the front of the machine to rock the shaft 97 clockwise (Fig. 7), the portion 107 of the latch 103 will catch the lever 112 and cause its adjustable switch actuating pin 113 to close the switch. In moving downwardly with the free end of the lever 98, the latch 103 will engage the locking member 108 and cam it counterclockwise about its pivot and will then engage the switch actuating lever 112 to close the switch 111. As soon as the portion 107 of latch 103 moves to position beneath the locking member 108, the locking member will return to the position shown in Fig. 7, where its substantially horizontally extending arm will engage a pin 114, thus holding the latch 103 and lever 98 in the position shown. The switch 111 is connected in the motor circuit of the motor (not shown) and upon being closed, will be held closed by the just described mechanism until the shaft 57 has been driven through one complete revolution to carry the tripping pin 87 into engagement with the lower end of the latch 103, whereupon the latch 103 will be rocked counterclockwise by the pivot screw 104 to release the switch actuating lever 112 from the horizontally extending portion 107 of the latch 103.

From the foregoing, it is believed to be apparent that each time the guard 95 is moved down to position to cover a cross bar switch vertical unit positioned on the positioning member 30, the circuit to the motor (not shown) will be closed and the motor will, through the chain 18, drive a shaft 57 through one complete revolution and then the circuit to the motor will be opened automatically. This is the normal single cycle operation of the machine. However, when it is desired to operate the apparatus through a portion of a cycle to make adjustments or otherwise service the apparatus, the single cycle mechanism may be disabled by rocking the pin 114 to a vertical position. The pin 114 is mounted on a shaft 115, to which there is also affixed a handle 116 and the shaft is rotatable in the side plate 22. Thus, the locking member 108 may be moved out of position to lock the switch 111 closed.

Magazine

Fixed to the side plates 22 and 23 are the angle member 110 and a corresponding angle member 120, which extend from a point adjacent the front of the machine to the extreme rear end of the machine, as seen in Figs. 2 and 3.

At the rear end of the angle members 110 and 120, they are interconnected by a cross frame 121, which, as best seen in Figs. 2 and 3, has a pin 122 extending upwardly from it for engagement by a latch 123, which is, in turn, provided with a knurled thumb wheel 124, whereby the latch may be engaged to the pin 122 or disengaged therefrom. The latch 123 is mounted upon the up-turned ends 125 of a channel-shaped frame 126. The channel-shaped frame 126 has flanges 127 and 128, between which compression springs 129 are positioned. The springs 129 surround a plurality of push rods 130, provided with shoulders 131, against which the forward end (left end in Fig. 2) of the springs 129 press. The other end of the springs 129 are in engagement with the flange 128 and tend to hold the push rods 130, with their collars 131, in engagement with the flange 127. These push rods are adapted to force cards or insulators toward the front of the magazine, as will be described more in detail hereinafter.

The channel-shaped frame 126 has a pair of blocks 132 and 133 mounted between its flanges and at the ends of it. These blocks are fixed in the channel and they, together with the flanges of the channel, have suitable apertures formed in them for receiving guide rods 134 and 135, whereby the channel-shaped frame 126 and the push rods 130 may be slidably supported. The rods 134 and 135 are fixed to the cross frame 121 at the rear of the machine and extend to and are supported by a cross member 136, which extends across on top of the angle members 110 and 120 (Figs. 2, 3 and 5). The guide rods 134 and 135 also extend toward the front of the machine and are fixed to extending portions 137 and 138 of a front frame, designated generally by the numeral 139. The horizontally extending portion of the cross member 136 (Figs. 2 and 3) has stud shafts 140 and 141 fixed in it, on which are freely rotatable sprockets 142 and 143, respectively, over which the chains 19 and 20 are passed. The chains 19 and 20 are secured to the blocks 132 and 133 and, after passing over the sprockets 142 and 143, are directed to sprockets 144 and 145 (Figs. 2 and 3) and thence down through the table, where a weight (not shown) may be attached to them so that normally the chains tend to draw the framework 126 toward the front of the machine. The sprockets 144 and 145 are mounted upon a shaft 146, which also has mounted on it a pair of hand wheels 147—147, whereby the shaft 146 may be rotated from either side of the machine to lift the weights when the framework 126 is being pushed back to the position in which it is shown after having been moved toward the front of the machine. The shaft 146 is supported in a suitable framework 148 extending over the angle members 110 and 120 and fixed thereto. One leg of the framework 148, as shown in Fig. 3, has a manually actuable pawl 149 mounted on it, whereby the chain 19 may be locked against movement by dropping the pawl 149 into any one of the links of the chain.

Mounted upon the angle members 110 and 120 and extending across between them at a point just to the rear of the cross member 136 (Fig. 5), is an angle member 155, which is suitably apertured to receive and slidably support the push rods 130. The angle member 155 has mounted on it a support block 156, which supports the actuator heads 157 of the push rods 130 and serves to guide them into a removable magazine, designed

generally by the numeral 158 (Figs. 2, 4 and 5). The magazine 158 is provided with a series of grooves 159 (Figs. 2 and 4), in which a plurality of cards 43 may be positioned, and the magazine 158 has its rear end partially closed by the slotted plate 160, which will permit the actuator heads 157 of the push rods 130 to pass into the grooves 159 to force cards 143, which may be positioned in the grooves 159, toward the front of the machine, but which will prevent the cards from falling out the rear end of the magazine while it is being transported. The magazine 158 is removable from the apparatus and when a supply of cards 43 in the magazine 158 has been exhausted, the magazine may be removed and a new one placed in the machine without waiting to load a magazine 158. When positioned in the machine, the magazine 158 is supported at its rear end by a positioning member 161, mounted upon the angle members 110 and 120, and provided with upwardly extending ends 162—162, which prevent transverse movement of the magazine 158 with respect to the apparatus. At its forward end, the magazine 158 is provided with apertures 163 (Fig. 5), into which pins 164, fixed in a portion of the front frame 139, may enter to support the forward end of the magazine 158. At its forward end, the magazine 158 is provided with a front plate 167, in which there are provided a series of grooves 165, one groove being in alignment with each of the grooves 159 in the magazine proper, thereby to provide a passage between the base 166 of the magazine and the front plate 167, through which cards 43 may be pushed to assemble them in the cross bar switch vertical unit.

Card feeding assembly

The extending portions 137 and 138 of the front frame 139 have guide posts 170 and 171 (Figs. 1 and 2) fixed in them and extending above and below the portions 137 and 138. The portion of the guide posts 170 and 171 which extend above the supporting portions 137 and 138 of the front frame 139 are shouldered at their upper ends, as shown in Fig. 1, to receive and support a top plate 172, the ends of the rods 170 and 171 being threaded to receive nuts 173 and 174 for holding the top plate 172 in place at the upper ends of the posts 170 and 171. In this manner, the top plate 172 is fixed at the upper end of the guide posts and serves as an abutment against which a push rod carrier 175 may abut. The push rod carrier 175 supports a plurality of push rods 176, which may be secured to it in any suitable manner, and which extend downwardly, as shown in Fig. 1, into a push rod guide plate 177, which is fixed to the guide posts 170 and 171 just above the supporting extending portions 137 and 138. The guide plate 177 is supported adjacent its mid portion by a tie rod 179, adjustably secured to the top plate 172 and fixed to the guide plate 177.

The push rod carrier 175 (Fig. 1) is slidable on the guide posts 170 and 171 and carries trunnions 180 and 181, to which are freely pivoted a pair of links 182 and 183, respectively. The links 182 and 183 are, in turn, connected at their lower ends to actuating levers 184 and 185. The actuating levers 184 and 185 are pivoted on a pivot rod 186, which extends through the angle members 110 and 120 and carries the actuating levers at its outer ends. Both the actuating levers 184 and 185 are of the same construction and are provided with bent plates 187 intermediate their

ends, forming, together with a bent portion of the levers, a bearing portion in which pins 188—188 (Fig. 3) are received. The pins 188—188 extend into opposite sides of spring receiving cylinders 189 (Figs. 1, 3 and 4). Positioned within the cylinders 189 are coil springs 190 (Fig. 4), which bear against washers 191, held in the upper ends of the cylinders by threaded members 192. The lower ends of the springs 190 bear against a washer 193, which presses against a shoulder 194 of a plunger rod 195 pivotally connected to crank arms 70 and 71. The plunger rods 195 extend upwardly through the washers 191 and are surrounded by the spring 190, the upper end of the rods 191 extending into sleeves 196, which are slidable within the threaded members 192. Thus, the actuating levers 184 and 185 are urged to operate each time the cam shaft 57 goes through a cycle of rotation and the levers will thus resiliently urge the push rod carrier 175 and the push rods 176 carried by it downwardly through a relatively long stroke each time the apparatus goes through one cycle of operation and will then return the push rods to their normal position, as shown. The push rods are held in direct alignment with the grooves 165 in the front plate 164 and each time the push rods are moved downwardly, each push rod will push a card or insulator from the magazine 158 into a tube 205, of which there is provided one for each groove 165.

The tubes 205 are mounted upon a tube-carrying plate 206 (Figs. 8 and 11) being soldered or otherwise suitably fixed to the plate and being positioned in notches 207 in the plate 206, two tubes 205 being positioned in each of the notches. Thus, across the face of the machine, there are five notches cut in the face of the plate 206 to carry the ten tubes 205 through which the push rods 176 push the insulating cards down to the cross bar switch into which they are to be assembled. Each of the tubes 205 is twisted through 90° so that the cards, which are fed toward the front of the apparatus with their widest surfaces abutting in the magazine 158 will be twisted through 90° for insertion in the slots 45 formed in the springs 41. In addition to being twisted 90°, each of the tubes is provided at its lower end with a pair of guide pins 208 (Figs. 5 and 8), which enter into the slots 45 in the springs and prevent the cards from tilting in the slots until the cards reach the devices which twist them 90° a second time to lock them in the position on the springs 41, as will be described hereinafter.

The plate 206 is mounted on a slidable carriage member 209 (Figs. 8 and 11), which extends across the face of the machine and is slidable on the lower ends of the guide posts 170 and 171, the plate 206 being secured to the carriage member 209 by machine screws 210. The assembly, comprising the carriage member 209 and the tube carrying plate 206, may be moved up and down to carry the tubes 206 from the position shown down to the position where the guide pins 208 enter into the slots 45 in the springs 41 and, in order to maintain this assembly level at all times, the rear surface of the member 209 has a pair of racks 211 and 212 fixed to it for engagement with pinions 213 and 214, respectively, mounted at opposite ends of a common shaft 215, journaled in the side plates 22 and 23. Fixed to the rear of the plate 209, adjacent the middle thereof, is a driving bracket 216, which has a projecting portion 217 (Figs. 5 and 8) adapted to engage the top plate of the cross bar switch vertical unit

positioned on the positioning plate 30 to hold the switch in place on the plate. This bracket 216, as seen most clearly in Figs. 4, 5 and 8, is pivoted on the forward end of an actuating lever 228, which is, in turn, pivotally connected to forked member 81, adapted to be actuated by the cam 76. The rear end of the lever 228 (Fig. 5) is forked to surround a spring cylinder 218, to which the lever 228 is pinned by means of pins 229. This cylinder 218 encloses a spring 219, which bears against washers 220 and 221 surrounding a rod 223, the washer 221 bearing against a shoulder formed on the rod and the washer 220 bearing against a sleeve 224 interposed between it and a washer and nut assembly 225, threaded on the free end of the rod 223. The free end of the cylinder 218 is closed by a plug 226 and the opposite end of the rod 219 is pivoted on a cross rod 227 extending between the angle members 110 and 120. In this manner, the forked member 81, under the actuation of the cam 76, will tend to move the bracket 216 downwardly, but if the bracket 216 encounters undue resistance, the spring 219 will be compressed in the cylinder 218 and no damage will be done to the mechanism. Since the bracket 216 is fixed to carriage member 209, the carriage member 209 will move with the bracket 216 to carry the tube carrying plate 206 and tubes 205 downwardly and move the guide pins 208 into the slots 45 in the springs 41. The timing of the cam 76 is such that after a row of insulating cards 43 have been moved from the magazine 158 into the tubes 205, the tubes will move downwardly to carry the pins 208 into the slots 45 in the springs 41 before the cards are pushed out of the tubes 205 by the push rods 176.

By reference to Fig. 11, it will be seen that the carriage member 209 has a pair of guide plates 235 and 236 fixed to its rear surface for cooperating with surfaces 237 and 238 of the carriage member 209 to guide the downwardly extending legs 239 and 240 of a U-shaped member 241. The U-shaped member 241 is normally urged downwardly into engagement with the bracket 216 by springs 242 (Fig. 8) attached to pins 243 and 244 on the plate 206 and member 241. The bracket 216 is provided with an adjustable abutment 245 (Fig. 8), against which the undersurface of the horizontal portion of the U-shaped member 241 strikes. Thus, the member 241 is urged to travel with the bracket 216.

Supported by the U-shaped member 241 are a plurality of spring positioning members 250, 251, 252, 253, 254, 255, 256, 257, 258 and 259 (Figs. 5, 8 and 11). These spring positioning members are mounted on and oscillatable about machine screws 260 to 265, respectively, the spring positioning member 250 being mounted on the screw 260 and spring positioning members 251 and 252 on screw 261, spring positioning members 253 and 254 on screw 262, spring positioning members 255 and 256 on screw 263, spring positioning members 257 and 258 on screw 264, and spring positioning member 259 on screw 265. Each of the screws 260 to 265 has a spring 266 coiled about it and bent downwardly to urge the spring positioning members to assume a vertical position (as shown in Fig. 3) where their vertical sides will abut pins 267. In addition to the spring positioning members, the screws 260 and 265 support vertically extending members 268 and 269, which have cams 246 and 247, respectively, mounted upon them.

When the carriage member 209 is in its uppermost position, the spring positioning members 250

to 259, inclusive, will be in the position shown in Fig. 8. However, when the carriage member 209 is moved to its lower position, where the pins 208 enter into the slots 45 in the springs 41, the spring positioning members 250 to 259 will have their cam surfaces 270 to 279, inclusive, respectively, in alignment with the camming surfaces 280 to 289 (Fig. 6) of camming pins 290 to 295. The camming pins 290 and 295 have additional camming surfaces 296 and 297 positioned just slightly in back of the camming surfaces 280 to 289. In the operation of the apparatus, the camming surfaces 280 to 289 will move the lower ends of the spring positioning members into engagement with springs 41 associated with them and after this operation has been performed, the camming surfaces 296 and 297 will engage the camming surfaces 246 and 247 to lift the U-shaped member 241 against the action of the springs 242, thereby to lift all of the springs 41 to the proper position to receive the cards 43 when the cards 43 are rotated, as will be described hereinafter. The camming pins 290 to 295 are fixed, as shown in Figs. 5 and 6, to a cross slide 300, which is, in turn, fixed to the forked member 79 by means of machine screws 301 and the pins 290 and 295 are slidable in bearings 302 and 303.

Card locking mechanism

Directly in alignment with the tubes 205, through which the cards are fed to the cross bar switch vertical unit assembly, are a series of rotatable slotted card locking members 310 and 311, arranged in pairs, as shown in Figs. 6 and 8. These card locking members constitute short stud shafts having gears 312 and 313 fixed to them. The gears 312 are approximately twice as long as the gears 313 and the upper ends of the gears 312 mesh with a rack 314, whereas the gears 312 and 313 of each pair are in mesh one with the other, the assembly of gears and the rack being mounted in cooperating guide members 315 and 316, suitably mounted at the front of the cross member 24 (Fig. 3). The rack 314 has a slotted member 317 fixed to it (Figs. 5 and 6) for receiving a pin 318 extending upwardly from an actuating lever 319. The lever 319 is pivoted on a pivot pin 320, suitably mounted in the base of the apparatus. The lever 319 is interconnected with the cam lever 321 by means of a spring cylinder mechanism 322, similar to the spring cylinders 189 and 218, which urges the lever 319 to follow lever 321. The right end (Fig. 5) of the lever 321 carries a cam roller 323, which rides in the cam groove 324 (Fig. 4) of cam 60, whereby, at the proper time in the cycle of the apparatus, lever 321 will be rocked about the pivot pin 320 and will tend to draw the lever 319 with it to move the rack 314 and thereby impart rotation to the card locking members 310 to lock the cards in position in the springs 41.

Operation

In the operation of the apparatus, a magazine 158, loaded with cards 43, is placed in position in the apparatus with the front plate 167 suspended on the pins 164 and the rear end of the magazine 158 resting on the positioning member 161. In order to so mount the magazine 158, the channel-shaped frame 126 may be drawn to extreme rear position, as shown in Fig. 2, by means of the hand wheels 147 and may be locked in that position by the latch member 123. A part of the weight suspended from chain 19 may be supported by the pawl 149. After a magazine 158, loaded with cards 43, has thus been positioned in

the machine, the pawls 149 may be released from the chains 19 and 20 and the latch member 123 released so that the chains 19 and 20 will draw the channel-shaped frame 126 toward the front of the machine, thereby to carry the rods 130 forward into engagement with the cards 43 in the magazine 158. If it happens that there are one or two less cards 43 in some rows of the magazine 158 than there are in the other rows, the springs 129 will compensate for this discrepancy and approximately equal pressure will be applied to all of the rows of cards, tending to force them against the front plate 167.

After the apparatus has thus been loaded with cards, the operator may place a cross bar switch vertical unit in position on the positioning plate 30 and then move the guard member 95 downwardly to thereby rock the shaft 97 counter-clockwise, as viewed in Fig. 3, and clockwise, as viewed in Fig. 7. When the shaft 97 is locked clockwise (Fig. 7), it will carry the latch 103 with it and move the switch actuating lever 112 downwardly to close the switch 111. As the latch member 103 moves down, it will fall under the locking member 108, camming the locking member 108 out of its way and then permitting the locking member 108 to fall back and lock the latch 103 in the position shown in Fig. 7, unless the handle 116 has been moved from the position shown in Fig. 7, to rock the pin 114 upwardly. The handle 116 is provided to disable the lock 108 when it is desired to operate the apparatus through a part of its cycle when making adjustments or otherwise operating the apparatus for less than a complete cycle. When the latch 103 is moved to the position shown, it will be locked in that position by the locking member 108 until the shaft 57 has been driven through one complete revolution, at which time the pin 87 will engage the lower end of the latch 103 and rock the latch counter-clockwise (Fig. 7) to permit the switch actuating lever 112 to move upwardly and release the switch 111.

From the foregoing, it is believed to be apparent that each time the guard member 95 is moved downwardly, the apparatus will go through one complete cycle and since the guard member 95 is fixed to the shaft 97, the guard member 95 will stay in its downward position until the cycle is complete, whereupon the pin 87 will disengage the latch 103 from locking member 108 and the spring 100 will, thereupon, reset the controls to normal position.

As the shaft 57 rotates through one cycle, the crank arm 71, in rotating with it, will, as soon as the shaft 57 begins to turn, start to draw the spring cylinder 189 downwardly and through the links 182 and 183 will move the push rod carrier 175 downwardly to push cards from the magazine 158 into the tubes 205. Very shortly after the push rod carrier 175 starts to move downwardly, cam 76 will become effective to move the tubes 205 downwardly through the operation of forked member 81, actuating lever 217, bracket 216, tube carrying plate 206 and carriage member 209. The action of the cam 76 will continue until the guide pins 208 are entered between the sides of the contact springs 41 where they are split at 45.

As the tube carrying plate 206 and carriage member 209 move downwardly, the U-shaped member 241 will move with them due to the fact that the springs 242 tend to hold the U-shaped member 241 and the carriage member 209 together. After the carriage member 209 has

reached its lowermost position, where the projecting portion 217 will engage and clamp the cross bar switch vertical unit on the positioning plate 30, the camming pins 291 to 295 will become effective to move the spring positioning members 250 to 259 into engagement with the springs 41 of the cross bar switch unit. After the spring positioning members 250 to 259 are engaged with their respective contact springs, the cam surfaces 296 and 297 will engage the cam surfaces 246 and 247 to lift the U-shaped member 241 and all of the spring positioning members 250 to 259 carried thereby upwardly. After the contact springs 41 have thus been lifted upwardly, the cards 43, having arrived in position between the springs due to the operation of the push rods 176 in the tubes 205, cam 60 will now actuate actuating lever 319 to shift rack 314 transversely of the machine to impart rotation to the card locking members 310 and 311, thereby to turn the cards 43 through 90° and lock them onto the contact springs 41. Cam 60 is so shaped that the card locking members 310 and 311 will remain in their shifted position until the next cycle of operation is initiated, at which time, the card locking members 310 and 311 will, early in the cycle of the shaft 57, rotate to position to receive cards in the notches formed therein. After the card locking members 310 and 311 have been operated to lock the cards in position on the contact springs 41, the camming pins 290 to 295 will be withdrawn by their cam 75, thereby permitting the spring positioning members 250 to 259 to release the springs after the camming surfaces 296 and 297 have permitted the U-shaped member 241 to be brought back into engagement with the carriage 209 by the springs 242. After the camming pins 290 to 295 have been withdrawn to their normal position, as shown, actuating levers 228, 183 and 184 will return to their normal position, as shown, thus restoring the push rod carrier 175 and carriage 209 to normal position, as shown in the drawings, and preparing the apparatus for its next cycle of operation.

What is claimed is:

1. A machine for assembling insulators in an electrical apparatus including means for supporting the apparatus during the assembling of the insulators therein, means positioned above the supporting means for simultaneously feeding a plurality of insulators to the apparatus, means for lifting parts of the apparatus a predetermined amount to align the parts with portions of the insulators, said feed means including instrumentalities for positioning the insulators in assembling relation with respect to the lifted parts, means for turning the insulators bodily through a predetermined angle to lock them in place on said lifted parts, and a driving means common to said feeding, turning and lifting means for actuating them individually to simultaneously manipulate the parts of the apparatus and assemble and lock the insulators therewith.

2. A machine for assembling insulators in electrical switches including guide tubes for guiding insulators into position to be assembled in a switch, a magazine for supplying insulators to the tubes, means for reciprocating the guide tubes in unison between the magazine and switch to carry insulators into the switch, means in alignment with the guide tubes for receiving the insulators and locking them in position in the switch, a common actuator for said guide tubes,

a common actuator for said locking means, and means for coordinating the common actuators for an assembling operation.

3. An assembling apparatus including a magazine for feeding rows of parts transversely of their width, means for simultaneously picking a plurality of parts from said magazine and advancing them to a predetermined position, means interposed between the magazine and said predetermined position for turning the parts through a predetermined angle, means at said predetermined position for rotating parts back to a position in a plane parallel to their position in the magazine to lock the parts in an assembly, means common to said picking means for actuating them, means common to said rotating means for actuating them, and means for coordinating the common actuators for an assembling operation.

4. An assembling apparatus including a magazine for feeding rows of parts transversely of their width, means for simultaneously picking a plurality of parts from said magazine and advancing them to a predetermined position, a cross head for supporting and actuating all of said picking means simultaneously, means interposed between the magazine and said predetermined position for turning the parts through a predetermined angle, means at said predetermined position for rotating parts back to a position in a plane parallel to their position in the magazine to lock the parts in an assembly, and means operable in a single cycle to actuate the hereinbefore defined means in a predetermined order.

5. A machine for assembling insulators in an electrical apparatus including means for supporting the apparatus during the assembling of said insulators therein, a magazine for containing a supply of insulators in a plurality of rows, means for simultaneously moving one insulator from each row of said magazine, guide tubes for receiving the insulators from the magazine and directing them to said electrical apparatus, means for simultaneously actuating all of said insulators for locking them in the electrical apparatus, said means for directing the insulators from the magazine to the electrical apparatus including means for preventing tilting of the insulators with respect to the electrical apparatus, and means for coordinating the operation of the various parts of the machine for an assembling operation.

6. In an assembling apparatus, a magazine for containing a plurality of parts, means for simultaneously feeding a plurality of parts from said magazine, a series of tubes for receiving the parts from the magazine, said tubes being rectangular in cross section and twisted for rotating the parts during their passage through the tubes, a carriage for supporting said tubes, means for moving said carriage to carry the tubes to a predetermined position after they have received the parts, means in alignment with said tubes for turning the parts back to a plane parallel to their plane in the magazine to lock the parts in a switch, means common to the means for turning the parts for actuating said means for turning the parts, means for positioning said switch to receive said parts, and means for coordinating the operation of the feeding means, carriage moving means, and the part-turning means for an assembling operation.

7. A machine for assembling insulators in electrical apparatus including means for sup-

porting the apparatus during the assembling of the insulators therein, means for simultaneously feeding a plurality of insulators to the apparatus, means for lifting parts of the apparatus a predetermined amount with respect to the remainder of the apparatus for positioning said parts of the apparatus with respect to the insulators, means for turning the insulators to lock them in place on said lifted parts, and means for operating said feeding, lifting and turning means in a definite cyclic order to simultaneously lock a plurality of insulators in the apparatus.

8. A machine for assembling insulators in electrical switches including guide tubes for simultaneously guiding a plurality of insulators into position to be assembled in a switch, a magazine for supplying insulators to the tubes, means for reciprocating the guide tubes between the magazine and switch simultaneously to carry a plurality of insulators into the switch, means operable in timed relation to said reciprocating means for pushing the plurality of insulators from the magazine and through the tubes, means in alignment with each of the guide tubes for receiving the insulators and locking them in position in the switch, and means for actuating the guide tubes, the insulator pushing means, and the means in alignment with the guide tubes in a definite cyclic order to simultaneously insert and simultaneously lock a plurality of insulators in the switches.

9. A machine for assembling insulators in electrical switches including guide tubes for guiding insulators into position to be assembled in the switches, a magazine for supplying insulators to the tubes, a single means for reciprocating the guide tubes between the magazine and switch to simultaneously carry a plurality of insulators into the switch, means in alignment with the guide tubes for receiving the insulators and simultaneously actuating the insulators to lock them in position in the switch, a common actuator for the means for actuating the insulators to lock them in the switch, and a plurality of push rods reciprocable in timed relation to the operation of the guide tubes for pushing insulators from the magazine into and through the guide tubes and into the insulator receiving and locking means.

10. An apparatus for assembling insulators in electrical switches comprising a support for an electrical switch, means for feeding a plurality

of insulators simultaneously to said switch, means for preventing tilting of said insulators with respect to said switch, means for locking said insulators in said switch, means for driving all the aforementioned means through one complete cycle, means under manual control for initiating the operation of said driving means, and means for locking said means under manual control in operative position for one cycle.

11. An apparatus for assembling insulators in electrical switches comprising a support for an electrical switch, means for feeding a plurality of insulators simultaneously to said switch, means for preventing tilting of said insulators with respect to said switch, means for locking said insulators in said switch, means for driving all the aforementioned means through one complete cycle, means under manual control for initiating the operation of said driving means, means for locking said means under manual control in operative position for one cycle, and means for rendering the locking means inoperative.

12. A machine for assembling insulators in an electrical apparatus including means for supporting the apparatus during the assembling of insulators therein, a magazine for containing a supply of insulators in a plurality of rows, means for simultaneously moving one insulator from each row of said magazine, guide tubes for receiving the insulators from the magazine and directing them to said electrical apparatus, means for simultaneously actuating all of said insulators for locking them in the electrical apparatus, and means for coordinating the operation of said moving means and actuating means in an assembling operation.

13. In an assembling apparatus for assembling blanks in an article, a magazine for said blanks, means for receiving a plurality of blanks from said magazine, means for moving said receiving means from association with the magazine to association with the article, means individual to each of said plurality of blanks for simultaneously actuating the plurality of blanks for locking them in the article, said means for actuating the blanks to lock them in the article including means for rotating the blanks with respect to the article through approximately 90°, and means common to all of the rotating means for actuating them simultaneously.

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