

Feb. 20, 1951

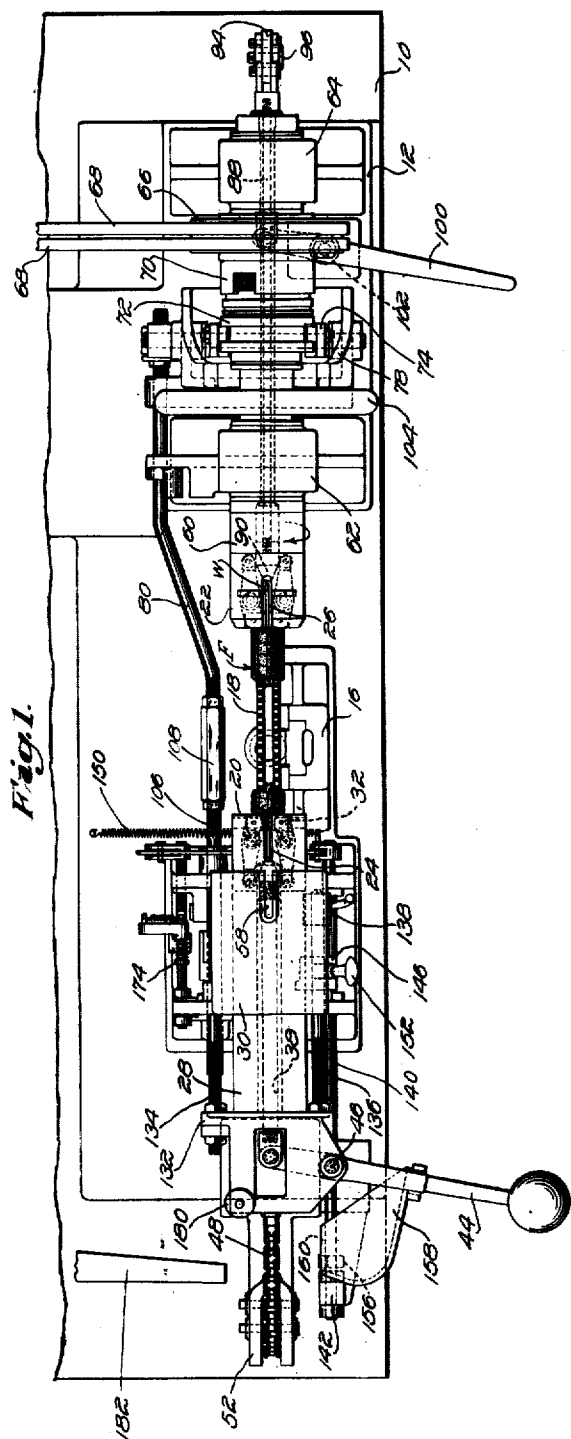
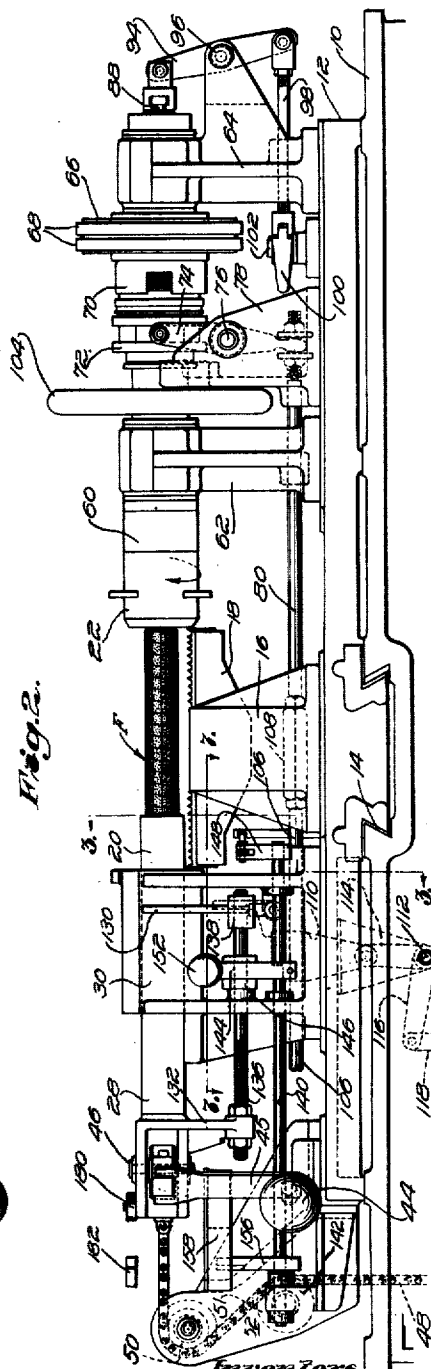
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TWISTING CONTROL MECHANISM FOR BRUSH MAKING MACHINES

Filed Oct. 3, 1947

5 Sheets-Sheet 1



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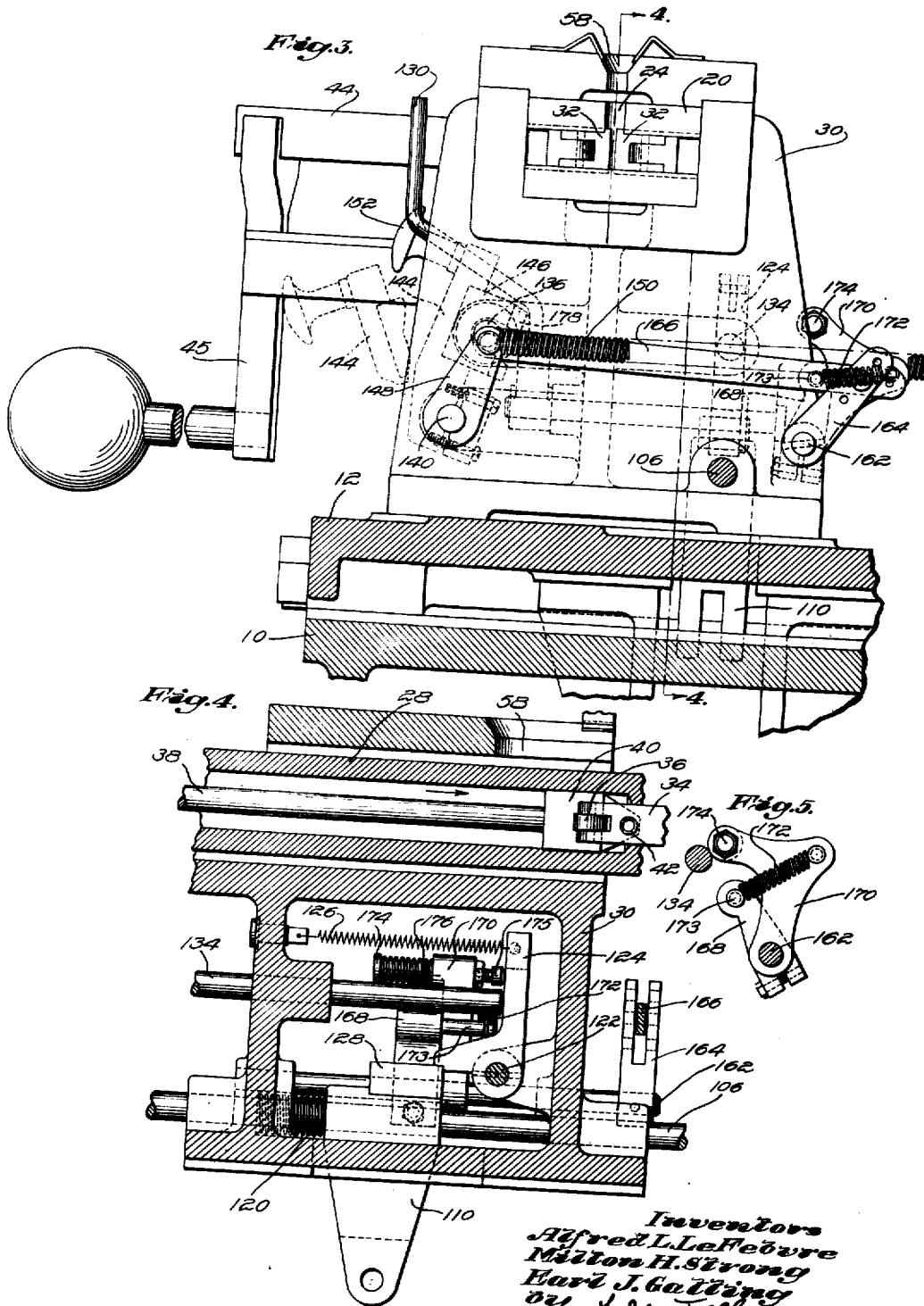
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5 Sheets-Sheet 2



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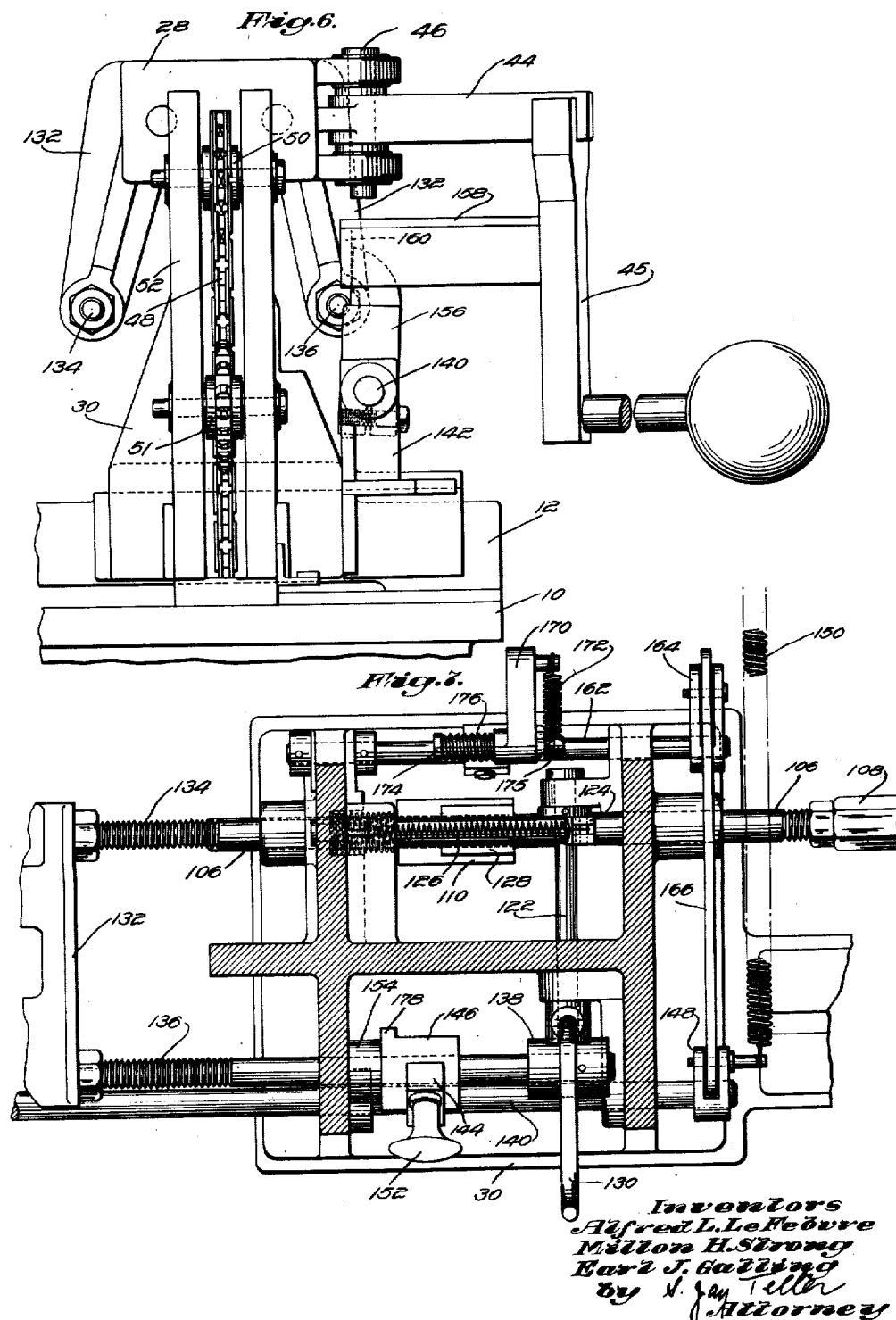
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TWISTING CONTROL MECHANISM FOR BRUSH MAKING MACHINES

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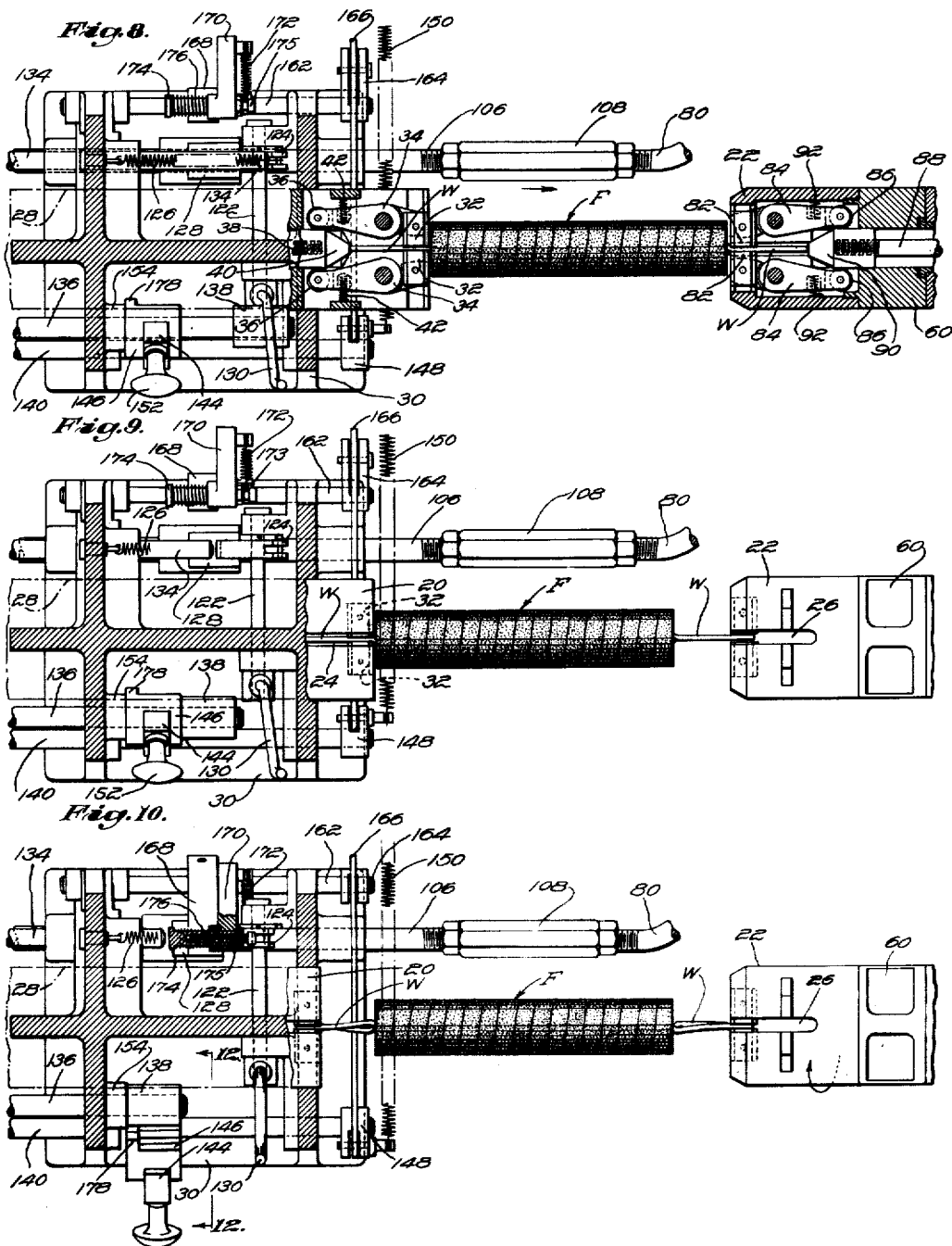
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5 Sheets-Sheet 4



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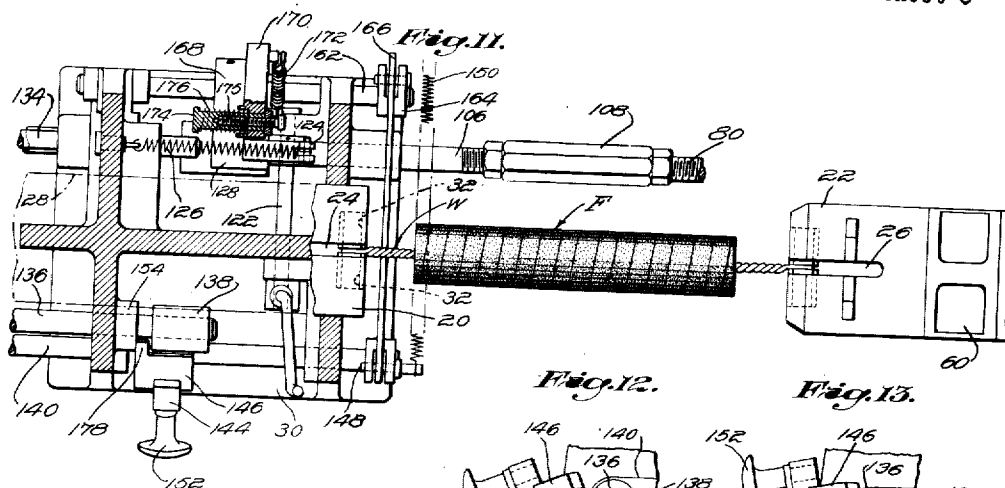
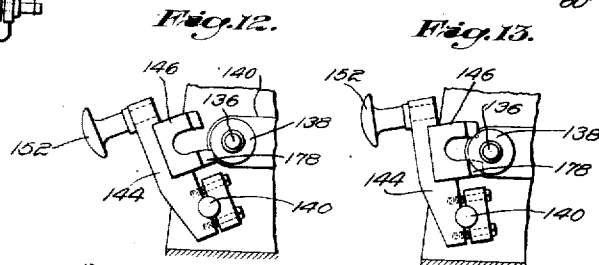
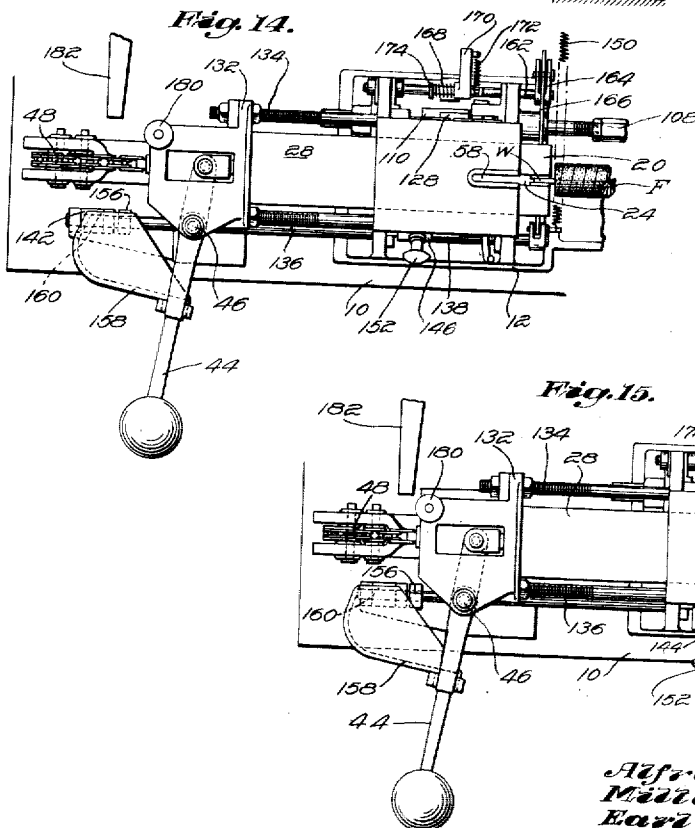
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TWISTING CONTROL MECHANISM FOR BRUSH MAKING MACHINES

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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

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TWISTING CONTROL MECHANISM FOR
BRUSHMAKING MACHINES

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Application October 3, 1947, Serial No. 777,778

29 Claims. (Cl. 300—2)

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A mechanism embodying the present invention is particularly adapted for use as a part of a brush making machine of the type disclosed in the application of Alfred L. Le Febvre for Brush Making Machine, Serial No. 666,735, filed May 2, 1946. Reference is made to the said application for various features of the machine not herein fully shown and described.

In a machine of the type referred to two aligned wire gripping devices are provided, these being adapted to engage two superposed wires with a transverse layer of fibers interposed between them. The wire gripping devices are relatively rotatable and preferably one of the said devices is a nonrotatable vise and the other of the said devices is a rotatable chuck. The wire gripping devices initially grip the wires near the ends of the layer of bristles and when the chuck is rotated the wires are twisted to engage and hold the fibers. During twisting one of the gripping devices is longitudinally movable toward the other gripping device in accordance with the shortening of the effective length of the wires due to the twisting. Preferably it is the chuck that is longitudinally movable as stated. After the primary twisting of the wires as above described it is necessary for the gripping devices to release the wires and reengage them near the ends thereof. Thereafter the chuck is again rotated to twist the end portions of the wires and the vise is again longitudinally moved toward the chuck in accordance with the further shortening of the effective length of the wires.

One of the objects of the present invention is to provide means for controlling the movement of the vise when the wires are released by the gripping devices so that the said devices may be reengaged with the wires near the ends thereof. In accordance with the invention one wire gripping device first releases the wires and a relatively movable abutment properly limits the longitudinal outward movement of the vise. Thereafter the other wire gripping device releases the wires, and further longitudinal outward movement of the vise is properly limited by stationary abutment.

A further object of the invention is to provide means whereby the relatively movable abutment is withdrawn from its operative position automatically upon the release of the wires by the second wire gripping device.

A still further object of the invention is to provide means whereby longitudinal outward movement of the bodily movable gripping device upon release of the wires after final winding is stopped at a position different from either of the posi-

tions in which it is stopped to enable the wire gripping devices to reengage the wires.

A still further object of the invention is to provide means for stopping the relative rotation between the gripping devices after the primary twisting and after the twisting of the end portions of the wires.

Other objects of the invention will be apparent from the drawings and from the following specification and claims.

In the drawings we have shown in detail a preferred embodiment of the invention, but it will be understood that various changes may be made from the construction shown, and that the drawings are not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawings,

Fig. 1 is a plan view of a brush twisting mechanism embodying the invention, this mechanism constituting a portion of a complete brush making machine.

Fig. 2 is a front view of the mechanism shown in Fig. 1.

Fig. 3 is an enlarged transverse vertical sectional view taken along the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary longitudinal vertical sectional view taken along the line 4—4 of Fig. 3.

Fig. 5 is a fragmentary detail view of certain parts appearing in Fig. 3, but with the parts in different relative positions.

Fig. 6 is an enlarged left end view of the mechanism shown in Figs. 1 and 2.

Fig. 7 is an enlarged fragmentary horizontal sectional view taken along the line 7—7 of Fig. 2.

Fig. 8 is a horizontal sectional view on a scale larger than that of Figs. 1 and 2 but smaller than that of Figs. 3 to 7, this view being taken partly along the center line of the wire gripping devices and partly along the line 7—7 of Fig. 2.

Figs. 9, 10 and 11 are views similar to Fig. 8 but showing the wire gripping devices in plan and showing the several parts in different relative positions.

Fig. 12 is a fragmentary vertical sectional view taken along the line 12—12 of Fig. 10.

Fig. 13 is a view similar to Fig. 12 but showing the parts in different relative positions.

Fig. 14 is a fragmentary plan view similar to a portion of Fig. 1, but showing the parts in relative positions corresponding to the relative positions shown in Fig. 9.

Fig. 15 is a fragmentary plan view similar to Fig. 14, but showing the parts in relative posi-

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tions corresponding to the relative positions shown in Fig. 11.

Referring particularly to Figs. 1 and 2, the machine comprises a main bed or base 10. While the invention is not necessarily so limited, most of the parts to be herein specifically described are shown as being mounted on a slide 12 which is horizontally movable forward and rearward on the base 10 along a guideway 14.

Mounted on the slide 12 is a bracket 16 and a carrier 18 is supported by the bracket 16, the carrier being vertically movable with respect to the bracket by manually operable means, not shown. Associated with the carrier 18 is a twisting mechanism comprising two wire gripping devices 20 and 22 respectively positioned near the ends of the carrier, provision being made for relative rotation between the said gripping devices. Preferably and as shown, the gripping device 20 is a nonrotatable vise and the gripping device 22 is a rotatable chuck. The nonrotatable vise 20 is initially in a position toward the left from that shown in Figs. 1 and 2. As already stated, the carrier 18 is movable vertically, and it is shown in Fig. 2 in its lowermost position. When the carrier is in its uppermost position the top thereof is approximately at the axis of the wire gripping devices 20 and 22.

With the carrier in its uppermost position, and with the vise 20 in its said position toward the left, the slide 12 is moved rearward and again forward, the carrier and the twisting mechanism being movable with it. During the rearward and forward movements two superposed longitudinal wires and an interposed layer of transverse brush fibers are placed on the carrier 18, the ends of the wires extending beyond the layer of fibers and into the gripping devices so as to be adapted to be engaged thereby. In order that the left ends of the wires may enter the nonrotatable vise 20, the said vise is provided at the top thereof with a wire receiving slot 24. In order that the right ends of the wires may enter the rotatable chuck 22, the said chuck is provided with a wire receiving slot 26. Prior to the placing of the wires, the chuck 22 is turned manually or otherwise so that the wire receiving slot 26 is at the top as shown in Fig. 1. The wires and the fibers are in place and ready for twisting when the carrier and the twisting mechanism reach their forward positions after rearward movement. The wires and the fibers are not shown in their initial positions, but in Figs. 8 to 11 the twisted wires are marked W and the fibers are marked F.

The vise 20 is at the right end of a longitudinally movable slide 28 which is supported by and guided in a bracket 30 secured to the main slide 12. As shown more clearly in Fig. 8, the vise 20 comprises transversely movable wire engaging jaws 32, 32 which are movable inward to their wire engaging positions by means of pivoted levers 34, 34. The levers 34, 34 carry rollers 36, 36 at their left ends and a longitudinally movable rod 38 is provided having a tapered head 40 at its right end which is adapted to be forced between the rollers 36, 36 as shown in Fig. 8. When the head 40 on the rod 38 is between the rollers, the jaws 32, 32 are forced into gripping engagement with the wires W. When the rod 38 and its head 40 are moved toward the left, the levers 34, 34 can swing inward under the action of biasing springs 42, 42 so as to separate the jaws 32, 32 and release the wires. For operating the rod 38 there is provided a forward ex-

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tending hand lever 44 which is pivoted at 46 on the slide 28. The lever preferably has a downward offset as shown at 48 in Figs. 2 and 3. The operator, by moving the lever 44, can actuate the vise 20 to grip the wires or to release them, the wires being engaged when the lever is moved toward the left and disengaged when the lever is moved toward the right.

The slide 28 is biased for movement away from the chuck 22, that is, toward the left, and this movement will be referred to as "outward" movement. The biasing of the slide is preferably effected by means of a chain 48 to which is attached a suitable weight, not shown. The chain passes over pulleys 50 and 51 on a bracket 52 secured to the main slide 12. As already stated, the vise 20 is initially at the left of the position shown in Figs. 1 and 2, being within the guideway in the bracket 30. In order that the left ends of the wires may enter the slot 24 in the vise, the bracket 30 is provided at the top with a slot 54 positioned to register with the said slot 24.

The rotatable chuck 22 is carried by a rotatable spindle 60 mounted in bearing brackets 62 and 64 on the main slide 12. Mounted on the spindle 60 for relative rotation is a belt pulley 66, this pulley being driven by belts 68, 68 passing over a suitable drive pulley which is not shown, but which is mounted on the main slide 12 and bodily movable rearward and forward in unison therewith. A clutch 70 is provided for operatively connecting the pulley 66 with the spindle 60, this clutch having a grooved collar 72 into which project pins or rollers carried by a pivoted yoke 74. The yoke 74 is pivoted at 76 to a bracket 78 carried by the main slide 12. Connected with the yoke 74 below the pivot 76 is a longitudinally movable rod 80 which serves to turn the yoke about its pivotal axis and to move the collar 72 longitudinally so as to engage or disengage the clutch 70. The construction of the clutch is such that movement of the rod 80 toward the left effects engagement and that movement of the rod toward the right effects disengagement.

As shown more clearly in Fig. 8, the rotatable chuck 22 comprises transversely movable wire engaging jaws 82, 82 which are movable inward to their wire engaging positions by means of pivoted levers 84, 84. The levers 84, 84 carry rollers 86, 86 at their right ends and a longitudinally movable rod 88 is provided having a tapered head 90 at its left end which is adapted to be forced between the rollers 86, 86, as shown in Fig. 8. When the head 90 on the rod 88 is between the rollers 86, 86, the jaws 82, 82 are forced into gripping engagement with the wires W. When the rod 88 and its head 90 are moved toward the right, the levers 84, 84 can swing inward under the action of biasing springs 92, 92 so as to separate the jaws 82, 82 and release the wires. For operating the rod 88 there is provided a lever 94 which is pivoted at 96 between its ends on an extension on the bracket 64. The upper end of the lever 94 is connected with the rod 88 in a manner permitting the rod to rotate with the spindle 60. Connected with the lower end of the lever 94 is a longitudinal link 98 which is pivoted at its left end to a forward extending hand lever 100, the said hand lever being pivoted at 102 to a bracket on the main slide 12. The operator, by moving the lever 100, can actuate the chuck 22 to grip the wires or to release them, the wires being engaged when the lever is moved

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toward the left and disengaged when the lever is moved toward the right.

A hand wheel 104 is secured to the spindle 60 and serves as a means for manually rotating the spindle and chuck.

For the initial twisting of a brush, the vise 20 is toward the left of the position shown in Figs. 1 and 2, the end face of the vise being substantially flush with the adjacent face of the bracket 30. The chuck 22 is manually turned by means of the hand wheel 104 so that the slot 26 therein is at the top. The carrier 18 is elevated from the position shown in Fig. 2 so that the top thereof is approximately at the center line of the vise and the chuck. With the parts in the relative positions described, the slide 12 and the several parts carried thereby are moved first rearward and then forward. As they move rearward a wire is placed in longitudinal position on the carrier 18. At or near the rearward positions a layer of transverse fibers is placed on the carrier 18 above the before-mentioned wire. As the parts move forward a second longitudinal wire is placed on the carrier, this wire being above the first-mentioned one and above the layer of fibers. It will be understood that the two wires are entered in the vise and in the chuck through the slots 24 and 26 that are provided for that purpose.

When the slide 12 and the parts thereon have returned to their forward positions with the superposed wires and with the interposed layer of transverse fibers in place on the carrier 18, the levers 44 and 100 are manually moved toward the left to the positions shown in Fig. 1 to cause the vise and the chuck to grip the ends of the wires. The carrier 18 is manually lowered to the position shown in Fig. 2 so as to provide room for the twisting operation. Then the clutch 70 is manually engaged to rotate the spindle 60 and the chuck 22. Rotation of the chuck 22 causes the wires to be twisted in the usual manner for brushes of this type, the fibers being gripped between the wires and relatively rotated. The twisting of the wires causes a shortening of the brush, the vise 20 being drawn toward the right against the resistance offered by the chain 48 and the weight, this movement of the vise continuing until it reaches the position shown in Figs. 1 and 2. Thereupon the clutch 70 is disengaged by automatic mechanism to be presently described. The initial twisting has now been completed and the brush and the various parts of the machine are in the positions shown in Figs. 1, 2 and 8.

For operating the clutch 70 there is provided a longitudinally movable rod 106 which extends through bearing apertures in the bracket 30, as shown most clearly in Fig. 4. The rod 106 is connected with the rod 80 by means of a threaded member 108 shown in Figs. 1 and 2. Secured to the rod 106 is an arm 110 which extends downward through slots in the bracket 30 and in the main slide 12. As shown in Fig. 2, a transverse rockshaft 112 is mounted in the base 10. An arm 114 is splined to the rockshaft, being movable along the shaft in accordance with transverse movement of the slide 12 and of the parts carried thereby. The said arm 114 is operably connected with the arm 110 on the rod 106. Also connected with the rockshaft 112 is an arm 116, a downward extending link 118 being connected with the arm. The link 118 is connected at its lower end with a foot treadle, not shown. It will be seen that when the link 118 is moved down-

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ward by the foot treadle, the rockshaft 112 and the arm 114 are moved in the counterclockwise direction, thus moving the arm 110 and the rod 106 toward the left. Movement of the rod 106 toward the left moves the rod 80 toward the left to effect engagement of the clutch 70. A spring 120 surrounds the rod 106 and serves to bias the arm 110 and the rod 106 toward the right. Movement toward the left to effect engagement of the clutch is in opposition to the spring 120.

Secured to a transverse rockshaft 122 in the bracket 30 is a bell crank latch 124 which is biased for movement in the counterclockwise direction by a spring 126. One arm of the latch 124 extends toward the left and is provided with a notch adapted to receive a block 128 carried by the arm 110. As soon as the arm 110 and the rod 106 have been moved sufficiently to the left to engage the clutch, the latch 124 engages the block 128 to retain the parts in their clutch engaging positions.

Preferably, the rockshaft 122 carries an arm 130 at the front thereof which is adapted to be manually engaged for turning the rockshaft and releasing the latch to disengage the clutch. The arm 130 is not used during normal operation of the machine, and it is provided merely for emergency use or for use during preliminary set-up and adjustment of the machine.

Secured to a downward extension 132 on the slide 28 at the rear thereof is a longitudinal rod 134. This rod extends toward the right through a bearing aperture in the bracket 30, as shown in Fig. 4. As already stated, the vise 20 and the slide 28 are drawn toward the right by reason of the shortening of the brush resulting from the twisting of the wires. The rod 134 is movable with the slide 28 and the length of the rod is such that it engages the latch 124 to move it in the clockwise direction when the wires have been sufficiently twisted. As the latch 124 moves in the clockwise direction, it disengages the block 128, thus permitting the spring 120 to move the parts toward the right and disengage the clutch 70. Fig. 4 shows the parts in the position which they occupy immediately before the release of the latch 124 by reason of the engagement therewith of the rod 134.

Fig. 8 shows the brush and the various parts of the machine in the positions which they occupy upon the completion of the initial twisting operation, and it may be assumed that the clutch 70 has been automatically disengaged so that the chuck 22 is not rotating. It is necessary to supplementally twist the wires W at the end portions thereof and the present invention relates primarily to means for facilitating and controlling the supplemental twisting. In order to effect supplemental twisting of the end portions of the wires it is necessary to release the vise and the chuck from their engagement with the wires, as shown in Fig. 8, and to reengage them with the wires near the extreme ends thereof. Preferably and as shown, the chuck is first actuated to release and reengage the wires, and then the vise is actuated to release and reengage the wires. However, the invention is not necessarily limited to this sequence.

Secured to the said downward extension 132 on the slide 28 at the front thereof is a longitudinal rod 136. This rod extends toward the right through a bearing aperture in the bracket 30, as shown in Figs. 7, 8, 9, 10 and 11. A collar 138 is secured to the rod 136 at the right end

thereof, this collar serving as a stop in the manner to be explained.

Extending through suitable bearing apertures in the bracket 30 is a longitudinal rockshaft 140. This rockshaft is preferably extended at the left and it extends through a bearing aperture in a bracket 142 secured to the main slide 12. Secured to the rockshaft 140 is an upstanding arm 144 carrying a rearward projecting block 146, the said block being slotted to receive and embrace the rod 136 when the arm is in its rearward position, as shown in Fig. 3. An upstanding arm 148 is secured to the shaft 140 at the right end thereof and a tension coil spring 150 is connected with the arm 148, the said spring tending to bias the shaft 140 and all parts carried thereby in the clockwise direction as viewed in Fig. 3. The arm 144 preferably carries a knob 152 by means of which the arm can be manually swung forward in opposition to the spring 150. With the parts in the positions shown in Fig. 8 with the initial twisting completed, the arm 144 is in its rearward position with the block 146 interposed between a boss 154 on the bracket 30 and the said collar or stop 138 on the rod 136.

Assuming the parts to be in the position shown in Fig. 8, the operator first moves the hand lever 100 toward the right to disengage the chuck 22 from the wires. As soon as the chuck 22 disengages the wires, the slide 28 and the vise 20 and the brush are moved toward the left by the chain 48 and the weight until the stop 138 on the rod 136 engages the block 146 on the arm 144 as shown in Fig. 9. The right face of the interposed block 146 serves as an abutment in the path of movement of the stop 138 to prevent any further movement toward the left, the said block 146 constituting a spacer between the boss 154 and the stop 138. As soon as this movement has taken place the operator moves the lever 100 toward the left to reengage the chuck 22 with the wires, the wires being reengaged near the extreme right ends thereof.

With the parts in the positions shown in Fig. 9, the arm 144 is swung forward to withdraw the block or spacer 146 from its position between the boss 154 and the stop 138. The operator moves the lever 44 toward the right to disengage the vise 20 from the wires, the vise 20 then being moved toward the left by the chain and the weight until the stop 138 directly engages the boss 154, as shown in Fig. 10. The boss 154 serves as a second abutment for the movable stop 138. Then the lever 44 is moved toward the left to reengage the vise 20 with the wires, the wires being reengaged near the extreme left ends thereof. It will be apparent that as soon as the stop 138 has moved toward the left from the position shown in Fig. 9, the arm 144 may be released for rearward movement by the spring 150. The rear of the block 146 will engage the side of the stop 138 to limit rearward movement.

With the parts in the positions shown in Fig. 9, the arm 144 and the block 146 may be moved forward manually by engaging the knob 152. Preferably, however, means is provided for causing the arm 144 and the block 146 to be moved forward automatically upon movement of the lever 44 toward the right to disengage the vise. Secured to the rockshaft 140 near the left end thereof is an upstanding arm 156. Secured to the hand lever 44 is an arm 158 having a flange 160 which is positioned behind the arm 156 when the hand lever is in the position to effect engagement of the vise 20. The relationship of the

flange 160 with the arm 156 is clearly shown in Fig. 6, and also in Fig. 14. With the parts in the positions shown in Figs. 9 and 14 movement of the lever 44 toward the right causes the flange 160 on the arm 158 to move the arm 156 toward the front, thus rocking the shaft 140 and moving the arm 144 and block or spacer 146 forward. In this way the block or spacer 146 is automatically withdrawn from its interposed position between the abutment 154 and the stop 138 when the lever is moved to disengage the vise. When the lever 44 is again moved toward the left to effect reengagement of the vise, the arm 144 is permitted to move rearward until the rear of the block 146 engages the side of the stop 138.

When the parts have been moved to the positions shown in Fig. 10 with the chuck and the vise in engagement with the ends of the wires, the clutch 70 is again engaged by means of the foot treadle and the chuck 22 is rotated to twist the end portions of the wires. The latch 124 again engages the block 128 to hold the parts in clutch engaging positions.

The twisting of the end portions of the wires again shortens the brush and draws the vise 20 and the slide 28 toward the right to the positions shown in Fig. 11, the rod 134 again moving toward the right in unison with the movement of the vise and the slide. However, at the beginning of the said movement toward the right, the rod 134 is in the position shown in Fig. 10, which is toward the left from the position shown in Fig. 8, and the rod cannot directly engage the latch 124 to release it in the manner previously described. In order that the latch 124 may be again automatically moved by the rod 134 to again disengage the clutch 70, there is provided a mechanism which will be now described.

Mounted in suitable bearing apertures in the rear portion of the bracket 30 is a longitudinal rockshaft 162. Secured to the rockshaft 162 is an upstanding arm 164. A transverse link 166 is pivotally connected at its front end with the arm 148 on the rockshaft 140 and is pivotally connected at its rear end with the arm 164 on the rockshaft 162. By means of the connection described, the rockshaft 162 is rocked in unison with the rockshaft 140. Secured to the rockshaft 162 is an arm 168. Also mounted on the rockshaft 162 is an arm 170. The arm 170 is immediately adjacent the arm 168 and can freely turn relatively thereto within narrow limits. A spring 172 connected with a longitudinal pin 173 on the arm 168 serves to bias the arm 170 for movement in the counterclockwise direction with respect to the said arm 168.

Carried by the upper forward end of the arm 170 is a longitudinally movable pin or spacer 174, a spring 176 being provided for biasing the pin 174 toward the left. Preferably, the pin 174 comprises a main body with a screw 175 entered in a threaded opening therein, as shown in Fig. 10. By turning the screw, the effective length of the pin may be changed. The screw 175 is functionally a part of the pin, and further references to the pin 174 will be understood as including the screw.

When the arm 144 is in its rearward position, as shown in Fig. 3, the arms 168 and 170 are also in their rearward positions and the pin 174 is out of register with the rod 134 as shown in the rearward position in the said figure. However, when the arm 144 is moved to a forward position, as shown in Figs. 3 and 10, the arms 168 and 170 are also moved to forward positions so that the

pin 174 is or may be in register with the rod 134 as shown in Fig. 10. When the pin 174 is in register with the rod 134, it is interposed between the end of the said rod and the latch 124. As the rod 134 moves toward the right in accordance with the movement of the slide 28 resulting from the shortening of the brush during final twisting, the rod 134 moves the pin 174 longitudinally to push it against the latch 124, thus moving the latch in the clockwise direction and causing the disengagement of the clutch 70 in the manner already described. As the pin 174 moves, the spring 176 is compressed, and when the arm 170 and the pin are restored to their positions at the rear, the spring 176 moves the pin toward the left to its original position with respect to the arm, as shown in Fig. 11. The several parts are so adjusted that the clutch is disengaged after the required amount of final twisting has been effected.

When the arm 144 is first moved forward, the rod 134 is still approximately in the position shown in Fig. 9, or somewhat to the left thereof, the rod thus preventing the arm 170 and the pin 174 from moving to their completely forward positions as shown in Fig. 10. The interference of the rod 134 with the forward movement of the arm 170 is shown in Fig. 5, and it is evident that the spring 172 will yield so that the arm 170 does not move forward to the same extent as does the arm 168. However, as soon as the rod 134 has moved sufficiently toward the left, the spring 172 moves the arm 170 and the pin 174 to their fully forward positions, as shown in Fig. 10.

As has already been stated, the twisting of the end portions of the wires draws the vise 20 and the slide 28 toward the right from their extreme left positions as shown in Fig. 10 to an intermediate position as shown in Fig. 11. The movement of the slide toward the right effects disengagement of the clutch 70 at the proper time as already described, and it also moves the stop 138 toward the right to the position shown in Fig. 11.

Preferably, the block 146 carries a relatively narrow flange 178 which projects toward the rear and is immediately adjacent the abutment 154. The main body of the block constitutes a wide portion thereof and the flange 178 constitutes a narrow portion thereof. With the parts in the positions shown in Fig. 10, it is the flange or narrow portion 178 that engages the side of the stop 138 to prevent rearward movement of the block 146 and of the arm 144. This engagement is clearly shown in Fig. 12. However, as the stop 138 moves toward the right to the position shown in Fig. 11, the flange or narrow portion 178 no longer engages the side of the stop, and the block 146 and the arm 144 are swung rearward by the spring 150 to the position shown in Figs. 11 and 13. Further rearward movement is prevented by the engagement of the main rear face of the spacer with the side of the stop. It will be seen that with the parts in the intermediate positions shown in Figs. 11 and 13, the flange or narrow portion 178 is interposed between the stop 138 and the abutment 154. The flange 178 is in the path of movement of the stop 138 and constitutes a third abutment therefor.

The length of the pin 174 is such that the clutch is disengaged at or about the instant that the flange or narrow portion 178 is moved rearward between the stop 138 and the abutment 154, that is, when it is moved from the position shown in Fig. 12 to the position shown in Fig. 13. The rearward movement of the flange and of the arm

144 causes the arm 170 and the pin 174 to be moved rearward to the position shown in Fig. 11, the pin 174 then being out of register with the rod 134. When the clutch has been disengaged and the rotation of the chuck has been stopped, the stop 138 is slightly separated from the flange or third abutment 178, as shown in Fig. 11.

As soon as the final twisting has been completed and the parts have reached the position shown in Fig. 11, the operator moves the levers 44 and 100 toward the right to disengage the vise and the chuck from the wires. When the vise and the chuck are so disengaged the slide and the chuck are moved slightly toward the left by the chain and the weight from the position in Fig. 11. The movement toward the left is limited by the engagement of the stop 138 with the third abutment 178 on the block 146. This locates the vise 20 in the proper position for receiving the wires of the next following brush.

The completed brush is removed and the operations already described are repeated for the assembling and twisting of the next following brush. The twisting of the next following brush moves the vise 20 and the slide 28 toward the right to the positions shown in Figs. 1, 2 and 3 and as soon as the stop 138 moves far enough to clear the block 146, the said block is restored by the spring 150 to its position wherein the wide main body thereof is interposed between the abutment 154 and the stop 138, as shown in Fig. 8. At the same time the arm 170 and the pin 174 are returned to their rear positions as shown in Fig. 8.

As has been explained, mechanism is provided enabling the lever 44 for operating the vise 20 to withdraw the block or spacer 146 substantially simultaneously with the release of the wires by the vise. Specifically and with the parts in the positions shown in Fig. 9, the arm 144 and the block 146 are moved forward by reason of the engagement of the flange 160 on the lever 44 with the arm 156 on the rockshaft 140. This occurs when the arm 144 is moved to disengage the wires, with the vise in the position shown in Fig. 9. The relative positions of the said flange 160 and the said arm 156 are shown in Fig. 14. However, when the parts are moved to the positions shown in Fig. 11, the lever 44 must be again moved to disengage the wires so as to permit removal of the completed brush, and it is necessary to provide means for rendering the aforesaid mechanism inoperative so that the spacer will not be again withdrawn. If the flange 160 were to again engage and move the arm 156, the block 146 would be moved forward so as to withdraw the flange or second abutment 178 thereof from its position between the abutment 154 and the stop 138. This would permit the stop 138 to move into direct engagement with the abutment 154 and the vise 20 would be too far outward, or to the left, for the making of the next following brush.

In order that the block 146 may not be withdrawn when the lever 44 is moved with the parts in the position shown in Fig. 11, the said flange 160 is of such a length that it clears the arm 156 as shown in Fig. 15. It will be seen that when the flange 160 is in the position shown in Fig. 15, it is at the left of the arm 156. This permits the lever 44 to be moved for releasing the finished brush and for engaging the wires of the next following brush, without any engagement of the flange 160 with the arm 156.

The wires W may occasionally break during final twisting, and in such event the vise and

slide are not drawn toward the right so as to permit the flange 178 to enter between the stop 138 and the abutment 154. The clutch must be manually disengaged by means of the arm 130 and when the vise and chuck release the damaged brush the vise and slide and associated parts remain in the positions shown in Fig. 10. The vise 28 is too far to the left for proper initial engagement with the wires of the next following brush. A similar condition is encountered when the relative proportions of the brush being made are such that the shortening due to final twisting is insufficient to move the vise and slide to the positions shown in Fig. 11 with the flange or abutment 178 entered between the stop 138 and the abutment 154. For some brushes the flange or abutment 178 may be substantially thicker than that shown.

In order to insure the eventual movement of the parts to the positions shown in Fig. 11, the slide 28 may be provided with a roller 180 as shown in Figs. 1, 2, 14 and 15. A stationary cam plate 182 is provided, this being supported by means not shown on the base 10 of the machine. If, upon the completion of a cycle of operations, the vise and the slide are toward the left from the positions shown in Fig. 11, with the stop 138 directly engaging the abutment 154, the roller 180 will be in or near engagement with the cam plate 182. When the main slide 12 and the parts thereon move rearward for the making of the next following brush, the roller 180 travels along the edge of the cam plate 182. This engagement of the roller with the cam plate forces the slide 28 and the vise 20 toward the right so that the various parts are moved approximately to the relative positions shown in Fig. 11. Thus the parts are properly positioned for the making of the next following brush, even though the parts have not been moved to the position shown in Fig. 11 by the shortening of the brush due to twisting of the wires.

What we claim is:

1. In a brush making machine, the combination of two devices initially positioned for releasably gripping brush wires at positions spaced from the ends thereof one of which devices is bodily movable longitudinally, means biasing the bodily movable gripping device outward away from the other gripping device, means for effecting relative rotation between the gripping devices to cause primary twisting of the wires between the said positions of initial engagement, the twisting action causing the bodily movable gripping device to move inward in opposition to the biasing means, means for releasing one gripping device from the wires and for reengaging it therewith, means for limiting outward movement of the bodily movable gripping device at a predetermined position when the wires are released by the last aforesaid gripping device so that the said device reengages the wires near the corresponding ends thereof, means for releasing the second gripping device from the wires and for reengaging it therewith, and means for limiting additional outward movement of the bodily movable gripping device at a second predetermined position when the wires are released by the second aforesaid gripping device so that the said gripping device reengages the wires near the corresponding opposite ends thereof.

2. In a brush making machine, the combination of two devices initially positioned for releasably gripping brush wires at positions spaced from the ends thereof one of which devices is

bodily movable longitudinally, means biasing the bodily movable gripping device outward away from the other gripping device, means for effecting relative rotation between the gripping devices to cause primary twisting of the wires between the said positions of initial engagement, the twisting action causing the bodily movable gripping device to move inward in opposition to the biasing means, means for releasing one gripping device from the wires and for reengaging it therewith, a stop movable with the bodily movable gripping device, an abutment movable into and out of the path of movement of the stop, the said movable abutment when in the said path engaging the stop to limit outward movement of the bodily movable gripping device at a predetermined position when the wires are released by the last aforesaid gripping device so that the said device reengages the wires near the corresponding ends thereof, means for releasing the second gripping device from the wires and for reengaging it therewith, a stationary abutment in the path of movement of the stop, and means for moving the movable abutment out of the said path of stop movement to enable the stationary abutment to engage the stop and limit additional outward movement of the bodily movable gripping device at a second predetermined position when the wires are released by the second aforesaid gripping device so that the said gripping device reengages the wires near the corresponding opposite ends thereof.

3. A brush making machine as set forth in claim 2, including means operable by the second said releasing and reengaging means for moving the said movable abutment out of the path of the stop substantially simultaneously with the release of the corresponding gripping device.

4. In a brush making machine, the combination of two devices for gripping brush wires at positions spaced from the ends thereof one of which devices is a nonrotatable vise biased for longitudinal outward movement and the other of which devices is a rotatable chuck serving upon rotation to effect primary twisting of the wires between the said positions of engagement, a stop longitudinally movable with the vise, a stationary abutment engageable by the stop, a spacer initially interposed between the abutment and the stop, operating means for causing one of the wire gripping devices to release and reengage the wires, the vise upon release of the wires moving longitudinally until the stop engages the spacer so that reengagement of the wires is at a position closely adjacent the ends thereof, means for withdrawing the spacer from its interposed position after the said release and reengagement, operating means for causing the other wire gripping device to release and reengage the wires, the vise upon the last said release of the wires moving longitudinally until the stop engages the abutment so that the last said reengagement of the wires is at a position closely adjacent the ends thereof, and means operable after reengagement of the wires by both devices for rotating the chuck to effect twisting of the end portions of the wires.

5. A machine as set forth in claim 4, wherein the spacer is biased toward its interposed position so that upon the release thereof after movement out of such position it engages the side of the stop and so that upon inward movement of the vise and stop the spacer is returned to its interposed position.

6. A machine as set forth in claim 4, wherein

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means is provided enabling the second said operating means to also move the spacer out of its interposed position.

7. In a brush making machine, the combination of two devices for gripping brush wires at positions spaced from the ends thereof one of which devices is a non-rotatable vise biased for longitudinal outward movement and the other of which devices is a rotatable chuck serving upon rotation to effect primary twisting of the wires between the said positions of engagement, a stop longitudinally movable with the vise, a stationary abutment engageable by the stop, a spacer initially interposed between the abutment and the stop, an arm connected with the spacer for moving it, operating means for causing one of the wire gripping devices to release and reengage the wires, the vise upon release of the wires moving longitudinally until the stop engages the spacer so that reengagement of the wires is at a position closely adjacent the ends thereof, a lever movable in one direction to cause the other wire gripping device to release the wires and movable in the opposite direction to cause the said device to reengage the wires, means movable with the last said layer for engaging the said arm to withdraw the spacer from its interposed position substantially simultaneously with the last said release of the wires to enable the vise to move longitudinally until the stop engages the abutment so that the last said reengagement of the wires is at a position closely adjacent the ends thereof, the last said means disengaging the arm upon movement of the lever in the said opposite direction so as to permit the spacer to remain in its withdrawn position, and means operable after reengagement of the wires by both devices for rotating the chuck to effect twisting of the end portions of the wires.

8. A machine as set forth in claim 7, wherein means is provided for biasing the spacer toward its interposed position so that upon disengagement of the arm by the moving means therefor the spacer moves into engagement with the side of the stop and so that upon movement of the vise and stop in the inward direction the spacer is returned by its biasing means to its interposed position.

9. In a brush making machine, the combination of two devices for gripping brush wires at positions spaced from the ends thereof one of which devices is a nonrotatable vise biased for longitudinal outward movement and the other of which devices is a rotatable chuck serving upon rotation to effect primary twisting of the wires between the said positions of engagement, a stop longitudinally movable with the vise, a stationary abutment engageable by the stop, a spacer initially interposed between the abutment and the stop, operating means for causing one of the wire gripping devices to release and reengage the wires, the vise upon release of the wires moving longitudinally until the stop engages the spacer so that reengagement of the wires is at a position closely adjacent the ends thereof, operating means for causing the other wire gripping device to release and reengage the wires, mechanism enabling the last said operating means to withdraw the spacer from its interposed position substantially simultaneously with the last said release of the wires to permit the vise to move longitudinally until the stop engages the abutment so that the last said reengagement of the wires is at a position closely adjacent the ends thereof, the said mechanism being operable when

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the stop is in its said spacer engaging position, means operable after reengagement of the wires by both devices for rotating the chuck to effect twisting of the end portions of the wires, and means rendering the spacer withdrawing mechanism inoperative upon actuation of the second said operating means after the stop has been moved outward to a position beyond its said spacer engaging position.

10. In a brush making machine, the combination of two devices for gripping brush wires at positions spaced from the ends thereof one of which devices is a nonrotatable vise biased for longitudinal outward movement and the other of which devices is a rotatable chuck serving upon rotation to effect primary twisting of the wires between the said positions of engagement, a stop longitudinally movable with the vise, a stationary abutment engageable by the stop, a spacer initially interposed between the abutment and the stop, an arm connected with the spacer for moving it, operating means for causing the chuck to release and reengage the wires, the vise upon release of the wires by the chuck moving longitudinally until the stop engages the spacer so that reengagement of the wires by the chuck is at a position closely adjacent the ends thereof, a lever bodily movable with the vise for causing it to release and reengage the wires, a longitudinal flange carried by the lever for engaging the arm to withdraw the spacer from its interposed position substantially simultaneously with the release of the wires by the vise to enable the said vise to move longitudinally until the stop engages the abutment so that reengagement of the wires by the vise is at a position closely adjacent the ends thereof, the said flange being in position to engage the arm when the stop is in its said spacer engaging position and the said flange being out of arm engaging position when the vise and the lever have been moved outward so that the stop is in a position beyond its said spacer engaging position, and means operable after reengagement of the wires by both devices for rotating the chuck to effect twisting of the end portions of the wires.

11. In a brush making machine, the combination of two devices initially positioned for releasably gripping brush wires at positions spaced from the ends thereof one of which devices is bodily movable longitudinally, means biasing the bodily movable gripping device outward away from the other gripping device, means for effecting relative rotation between the gripping devices to cause primary twisting of the wires between the said positions of initial engagement, the twisting action causing the bodily movable gripping device to move inward in opposition to the biasing means, means for releasing one gripping device from the wires and for reengaging it therewith, means for limiting outward movement of the bodily movable gripping device at a predetermined position when the wires are released by the last aforesaid gripping device so that the said device reengages the wires near the corresponding ends thereof, means for releasing the second gripping device from the wires and for reengaging it therewith, means for limiting additional outward movement of the bodily movable gripping device at a second predetermined position when the wires are released by the second aforesaid gripping device so that the said gripping device reengages the wires near the corresponding opposite ends thereof, the two said movement limiting means relatively positioning the gripping de-

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vices and the wires for final twisting of the wires at the end portions thereof when relative rotation is again effected between the gripping devices which final twisting again causes the bodily movable gripping device to move inward in op-

position to the biasing means, and means for limiting outward movement of the bodily movable gripping device at a third predetermined position upon the release of either gripping device from the wires after final twisting.

12. In a brush making machine, the combination of two devices for gripping brush wires at positions spaced from the ends thereof one of which devices is a nonrotatable vise biased for longitudinal outward movement and the other of which devices is a rotatable chuck serving upon rotation to effect primary twisting of the wires between the said positions of engagement, operating means for causing one of the wire gripping devices to release and reengage the wires, means operable upon such release for stopping longitudinal movement of the vise at a predetermined position so that reengagement of the wires is at a position closely adjacent the ends thereof, operating means for causing the other wire gripping device to release and reengage the wires, means operable upon the last said release for stopping longitudinal movement of the vise at a second predetermined position so that the last said reengagement of the wires is at a position closely adjacent the ends thereof, means operable after reengagement of the wires by both devices for rotating the chuck to effect twisting of the end portions of the wires with resultant inward movement of the vise due to shortening of the effective length of the wires, and means for stopping movement of the vise at a third predetermined position upon release of the wires after the last said twisting.

13. In a brush making machine, the combination of two devices for gripping brush wires at positions spaced from the ends thereof one of which devices is a nonrotatable vise biased for longitudinal outward movement and the other of which devices is a rotatable chuck serving upon rotation to effect primary twisting of the wires between the said positions of engagement, a stop longitudinally movable with the vise, a stationary abutment engageable by the stop, a spacer having a wide position and having a narrow portion adjacent the abutment, the spacer being initially positioned with the wide portion thereof interposed between the abutment and the stop, operating means for causing one of the wire gripping devices to release and reengage the wires, the vise upon release of the wires moving longitudinally until the stop engages the wide portion of the spacer so that reengagement of the wires is at a position closely adjacent the ends thereof, means for fully withdrawing the spacer after the said release and reengagement so that neither portion thereof is interposed between the stop and the abutment, operating means for causing the other wire gripping device to release and reengage the wires, the vise upon the last said release of the wires moving longitudinally until the stop engages the abutment so that the last said reengagement of the wires is at a position closely adjacent the ends thereof, and means operable after reengagement of the wires by both devices for rotating the chuck to effect twisting of the end portions of the wires, the vise and stop being moved longitudinally inward during such twisting so that the spacer may be moved to an intermediate posi-

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tion with only the narrow portion thereof interposed between the stop and the abutment.

14. A machine as set forth in claim 13, wherein the spacer is biased toward its interposed position so that upon release thereof after it has been fully withdrawn the narrow portion thereof engages the side of the stop and so that after the said inward movement of the vise and the stop the wide portion of the spacer engages the side of the stop with the narrow portion thereof interposed between the stop and the abutment.

15. A machine as set forth in claim 13, wherein means is provided for biasing the spacer toward its interposed position, and wherein mechanism is provided enabling the second said operating means to act substantially simultaneously with the release of the wires to fully withdraw the spacer, the said mechanism upon reengagement of the wires permitting the spacer to be moved by its biasing means until the narrow portion thereof engages the side of the stop so that upon subsequent inward movement of the vise and stop the spacer is moved by its biasing means to a position wherein the main rear face thereof engages the side of the stop and wherein the said narrow portion thereof is interposed between the stop and the abutment.

16. In a brush making machine, the combination of two devices for gripping brush wires at positions spaced from the ends thereof one of which devices is a nonrotatable vise biased for longitudinal outward movement and the other of which devices is a rotatable chuck serving upon rotation to effect primary twisting of the wires between the said positions of engagement, a stop longitudinally movable with the vise, a stationary abutment engageable by the stop, a movable spacer having a wide portion and having a narrow portion adjacent the abutment, the spacer being initially positioned with the wide portion thereof interposed between the abutment and the stop, means for biasing the spacer toward its interposed position, operating means for causing one of the wire gripping devices to release and reengage the wires, the vise upon release of the wires moving longitudinally until the stop engages the wide portion of the spacer so that reengagement of the wires is at a position closely adjacent the ends thereof, operating means for causing the other wire gripping device to release and reengage the wires, mechanism enabling the last said operating means to act substantially simultaneously with the last said release of the wires to fully withdraw the spacer so that neither portion thereof is interposed between the stop and the abutment to thus permit the vise to move longitudinally until the stop engages the abutment with the result that the last said reengagement of the wires is at a position closely adjacent the ends thereof, said mechanism being operable when the stop is in its position of engagement with the wide portion of the spacer and the said mechanism releasing the spacer for movement by its biasing means upon reengagement of the wires by the last said gripping device, means operable after reengagement of the wires by both devices for rotating the chuck to effect twisting of the end portions of the wires, the vise and stop being moved longitudinally inward during such twisting so that the spacer may be moved by its biasing means to an intermediate position wherein only the narrow portion thereof is interposed between the stop and the abutment with the result that the stop engages the narrower portion of the spacer upon release of the wires after the last said

twisting, and means rendering the spacer withdrawing mechanism inoperable when the stop is in its position of engagement with the narrow portion of the spacer.

17. In a brush making machine, the combination of a main slide movable rearward and forward, the combination of two devices on the main slide for gripping brush wires at positions spaced from the ends thereof one of which devices is a nonrotatable vise biased for longitudinal outward movement and the other of which devices is a rotatable chuck serving upon rotation to effect primary twisting of the wires between the said positions of engagement, operating means for causing the wire gripping devices to release and reengage the wires, the vise upon release of the wires moving longitudinally so that the wires are reengaged closely adjacent the ends thereof with the result that upon further rotation of the chuck the end portions of the wires are twisted, and means dependent on the rearward movement of the main slide for moving the vise longitudinally inward from its extreme outward position.

18. A machine as set forth in claim 17, wherein means is provided for retaining the vise in the position to which it is moved by the said vise moving means.

19. A machine as set forth in claim 17, wherein the vise moving means comprises a stationary cam and a cam engaging element connected with the vise.

20. In a brush making machine, the combination of a main slide movable rearward and forward, the combination of two devices on the main slide for gripping brush wires at positions spaced from the ends thereof one of which devices is a nonrotatable vise biased for longitudinal outward movement and the other of which devices is a rotatable chuck serving upon rotation to effect primary twisting of the wires between the said positions of engagement, operating means for causing one of the wire gripping devices to release and reengage the wires, means operable upon such release for stopping longitudinal movement of the vise at a predetermined position so that reengagement of the wires is at a position closely adjacent the ends thereof, operating means for causing the other wire gripping device to release and reengage the wires, means operable upon the last said release for stopping longitudinal movement of the vise at a second predetermined position so that the last said reengagement of the wires is at a position closely adjacent the ends thereof, means operable after reengagement of the wires by both devices for rotating the chuck to effect twisting of the end portions of the wires with resultant inward movement of the vise due to shortening of the effective length of the wires, means for stopping movement of the vise at a third predetermined position upon release of the wires after the last said twisting, and means dependent on the rearward movement of the main slide for moving the vise longitudinally inward to the said third predetermined position in the event that it is not so moved as the result of the final twisting of the wires.

21. In a brush making machine, the combination of a main slide movable rearward and forward, the combination of two devices on the main slide for gripping brush wires at positions spaced from the ends thereof one of which devices is a nonrotatable vise biased for longitudinal outward movement and the other of which devices is a rotatable chuck serving upon rotation to effect primary twisting of the wires between the said

positions of engagement, a stop longitudinally movable with the vise, a stationary abutment engageable by the stop, a spacer having a wide position and having a narrow portion adjacent the abutment, the spacer being initially positioned with the wide portion thereof interposed between the abutment and the stop, means for biasing the spacer toward its interposed position, operating means for causing one of the wire gripping devices to release and reengage the wires, the vise upon release of the wires moving longitudinally until the stop engages the wide portion of the spacer so that reengagement of the wires is at a position closely adjacent the ends thereof, means for fully withdrawing the spacer after the said release and reengagement so that neither portion thereof is interposed between the stop and the abutment, operating means for causing the other wire gripping device to release and reengage the wires, the vise upon the last said release of the wires moving longitudinally until the stop engages the abutment so that the last said reengagement of the wires is at a position closely adjacent the ends thereof, means operable after reengagement of the wires by both devices for rotating the chuck to effect twisting of the end portions of the wires, and means dependent on the rearward movement of the main slide for moving the vise and stop longitudinally inward to an extent sufficient to permit the spacer to be moved by its biasing means to an intermediate position with only the narrow portion thereof interposed between the stop and the abutment.

22. In a brush making machine, the combination of two devices initially positioned for releasably gripping brush wires at positions spaced from the ends thereof one of which devices is bodily movable longitudinally, means biasing the bodily movable gripping device outward away from the other gripping device, means for effecting relative rotation between the gripping devices to cause primary twisting of the wires between the said initial positions of engagement, the primary twisting action causing the bodily movable gripping device to move inward in opposition to the biasing means, means dependent upon the said inward movement of the bodily movable gripping device for stopping the relative rotation between the gripping devices, means for releasing one gripping device from the wires and for reengaging it therewith, means for limiting outward movement of the bodily movable gripping device at a predetermined position when the wires are released by the last aforesaid gripping device so that the said device reengages the wires near the corresponding ends thereof, means for releasing the second gripping device from the wires and for reengaging it therewith, means for limiting additional outward movement of the bodily movable gripping device at a second predetermined position when the wires are released by the second aforesaid gripping device so that the said gripping device reengages the wires near the corresponding opposite ends thereof, the two said movement limiting means relatively positioning the gripping devices and the wires for final twisting of the wires at the end portions thereof when relative rotation is again effected between the gripping devices which final twisting again causes the bodily movable gripping device to move inward in opposition to the biasing means, and means dependent upon the last said inward movement of the bodily movable gripping device for stopping the relative rotation between the gripping devices.

23. In a brush making machine, the combination of two devices initially positioned for releasably gripping brush wires at positions spaced from the ends thereof one of which devices is bodily movable longitudinally, means biasing the bodily movable gripping device outward away from the other gripping device, means for effecting relative rotation between the gripping devices to cause primary twisting of the wires between the said initial positions of engagement, the primary twisting action causing the bodily movable gripping device to move inward in opposition to the biasing means, means for stopping relative rotation between the gripping devices, means including a member movable in unison with the bodily movable gripping device for actuating the said stopping means after a predetermined movement of the said gripping device during primary twisting, means for releasing the gripping devices from the wires and for reengaging them therewith, means for limiting outward movement of the bodily movable gripping device at a predetermined position when the wires are released and reengaged, the gripping devices then engaging the wires near the ends thereof for final twisting when relative rotation of the gripping devices is again effected and the final twisting action causing the bodily movable gripping device to again move inward in opposition to the biasing means, and a spacer movable to a position between the actuating member and the rotation stopping means, the said spacer enabling the actuating member to actuate the stopping means after a predetermined movement of the bodily movable gripping means during final twisting.

24. In a brush making machine, the combination of two devices for gripping brush wires at positions spaced from the ends thereof one of which devices is a nonrotatable vise biased for longitudinal outward movement and the other of which devices is a rotatable chuck serving upon rotation to effect primary twisting of the wires between the said positions of engagement, operating means for causing one of the wire gripping devices to release and reengage the wires, means operable upon such release for stopping longitudinal movement of the vise at a predetermined position so that reengagement of the wires is at a position closely adjacent the ends thereof, operating means for causing the other wire gripping device to release and reengage the wires, means operable upon the last said release for stopping longitudinal movement of the vise at a second predetermined position so that the last said reengagement of the wires is at a position closely adjacent the ends thereof, means operable after the first engagement of the wire gripping devices with the wires to rotate the chuck to effect primary twisting and operable after the aforesaid reengagement of the wires by both devices for rotating the chuck to effect twisting of the end portions of the wires, a longitudinal rod movable with the vise, means engageable by the rod for stopping the chuck rotating means upon movement of the vise and rod to a predetermined position during primary twisting, and a longitudinally movable pin adapted to be interposed between the rod and the chuck stopping means during twisting of the ends of the wires to enable the rod to operate the said chuck stopping means upon movement of the vise and rod to a second predetermined position.

25. A machine as set forth in claim 24, wherein the pin is carried by and longitudinally movable relatively to a pivoted arm, the arm being

movable to locate the pin in its interposed position or to remove it therefrom.

26. A machine as set forth in claim 24, wherein the pin comprises a longitudinal main body and a longitudinal screw adjustable with respect to the main body to change the effective length of the pin.

27. In a brush making machine, the combination of two devices for gripping brush wires at positions spaced from the ends thereof one of which devices is a nonrotatable vise biased for longitudinal outward movement and the other of which devices is a rotatable chuck serving upon rotation to effect primary twisting of the wires between the said positions of engagement, a stop longitudinally movable with the vise, a stationary abutment engageable by the stop, a spacer initially interposed between the abutment and the stop, an arm connected with the spacer for moving it, operating means for causing one of the wire gripping devices to release and reengage the wires, the vise upon release of the wires moving longitudinally until the stop engages the spacer so that reengagement of the wires is at a position closely adjacent the ends thereof, operating means for causing the other wire gripping device to release and reengage the wires, means enabling the last said operating means to withdraw the spacer from its interposed position substantially simultaneously with the last said release of the wires to enable the vise to move longitudinally until the stop engages the abutment so that the last said reengagement of the wires is at a position closely adjacent the ends thereof, means operable after the first engagement of the wire gripping devices with the wires to rotate the chuck to effect primary twisting and operable after the aforesaid reengagement of the wires by both devices for rotating the chuck to effect twisting of the end portions of the wires, mechanism automatically operable upon the longitudinal inward movement of the vise to a predetermined position during primary twisting for stopping the chuck rotating means, means automatically operable upon the longitudinal inward movement of the vise to a second predetermined position during twisting of the ends of the wires for operating the said chuck stopping mechanism, and mechanism for causing the last said means to be operative when the spacer is in its withdrawn position and inoperative when the spacer is in its interposed position.

28. In a brush making machine, the combination of two devices for gripping brush wires at positions spaced from the ends thereof one of which devices is a nonrotatable vise biased for longitudinal outward movement and the other of which devices is a rotatable chuck serving upon rotation to effect primary twisting of the wires between the said positions of engagement, a stop longitudinally movable with the vise, a stationary abutment engageable by the stop, a spacer initially interposed between the abutment and the stop, an arm connected with the spacer for moving it, operating means for causing one of the wire gripping devices to release and reengage the wires, the vise upon release of the wires moving longitudinally until the stop engages the spacer so that reengagement of the wires is at a position closely adjacent the ends thereof, operating means for causing the other wire gripping device to release and reengage the wires, means enabling the last said operating means to withdraw the spacer from its interposed

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position substantially simultaneously with the last said release of the wires to enable the vise to move longitudinally until the stop engages the abutment so that the last said reengagement of the wires is at a position closely adjacent the ends thereof, means operable after the first engagement of the wire gripping devices with the wires to rotate the chuck to effect primary twisting and operable after the aforesaid reengagement of the wires by both devices for rotating the chuck to effect twisting of the end portions of the wires, a longitudinal rod movable with the vise, means engageable by the rod for stopping the chuck rotating means upon movement of the vise and rod to a predetermined position during primary twisting, a longitudinally movable pin adapted to be interposed between the rod and the chuck stopping means during twisting of the ends of the wires to enable the rod to operate the said chuck stopping means upon movement of the vise and rod to a second predetermined position, and mechanism operable by the spacer withdrawing means for moving the

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said pin to its interposed position when the spacer is moved to its withdrawn position and for moving the said pin out of its interposed position when the spacer is moved to its interposed position.

29. A machine as set forth in claim 28, wherein the pin is resiliently supported so that it will yield when moved toward its interposed position with the rod in position to interfere with such movement.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,824,140	Hertzberg -----	Sept. 22, 1931
1,888,352	Lipps -----	Nov. 22, 1932
2,234,641	Baumgartner -----	Mar. 11, 1941