

May 20, 1930.

J. F. GAIL

1,759,050

METHOD OF AND MACHINE FOR ASSEMBLING SPRINGS

Filed May 31, 1927

18 Sheets-Sheet 1

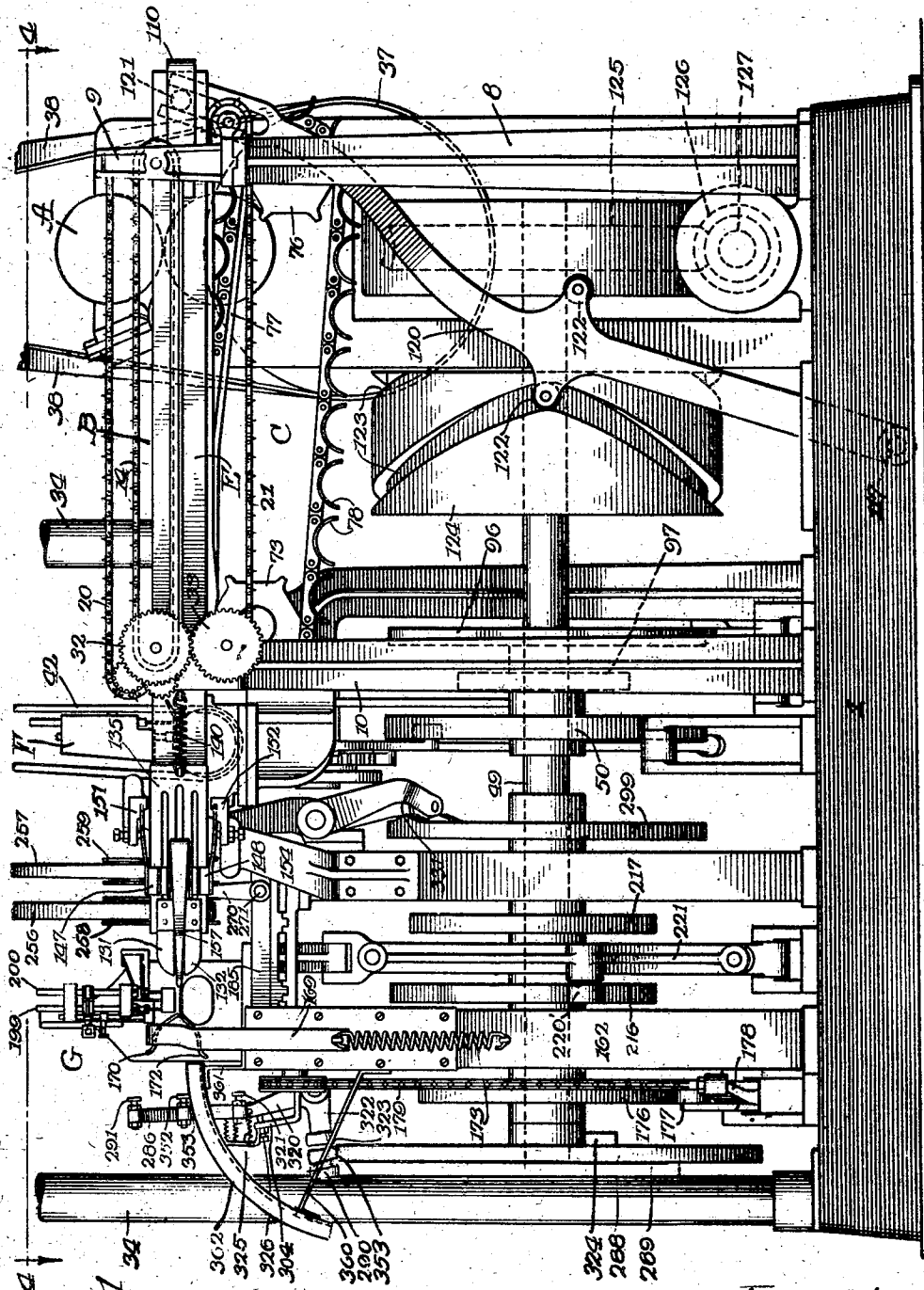


Fig. 1

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May 20, 1930.

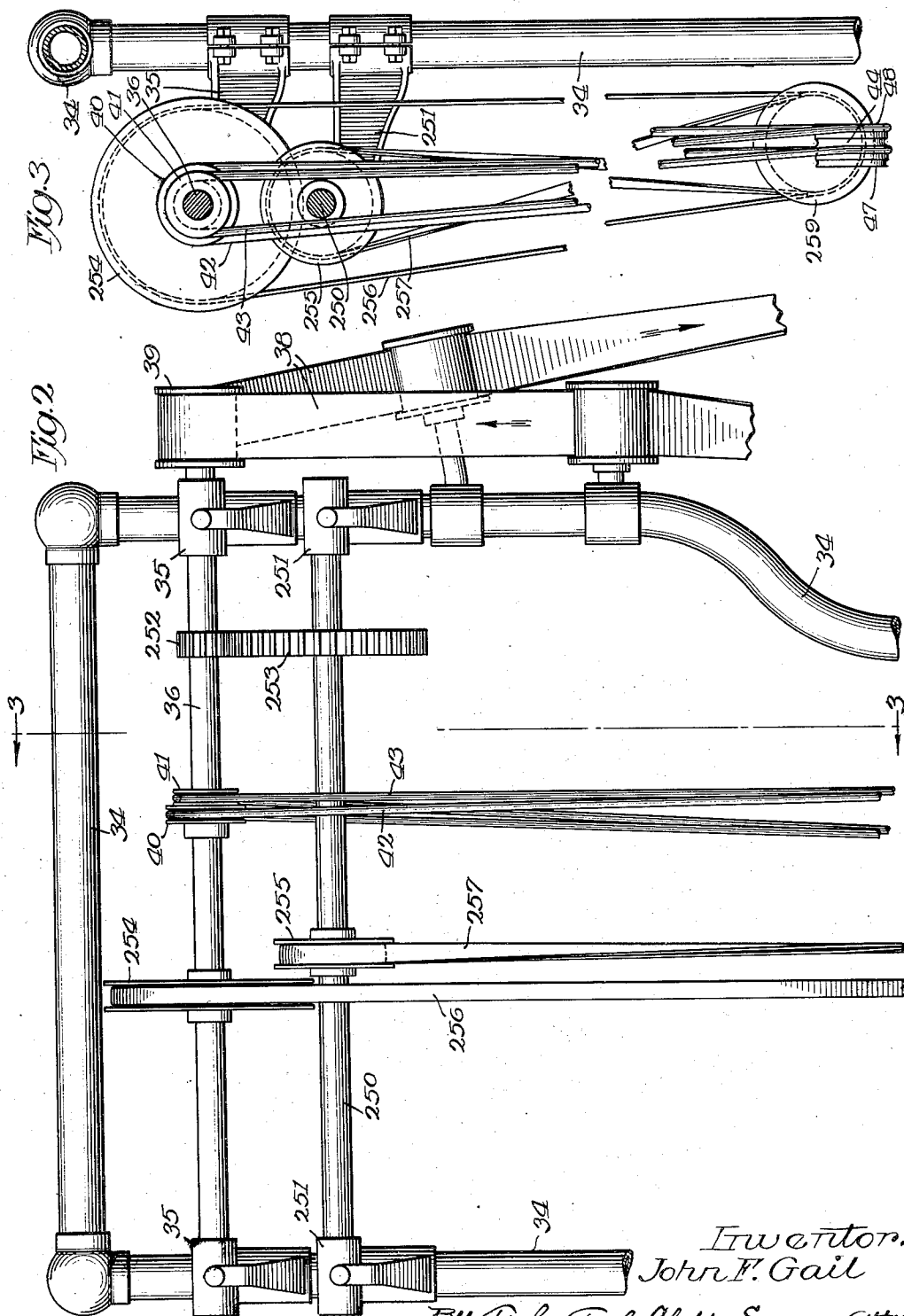
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18 Sheets-Sheet 2



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18 Sheets-Sheet 3

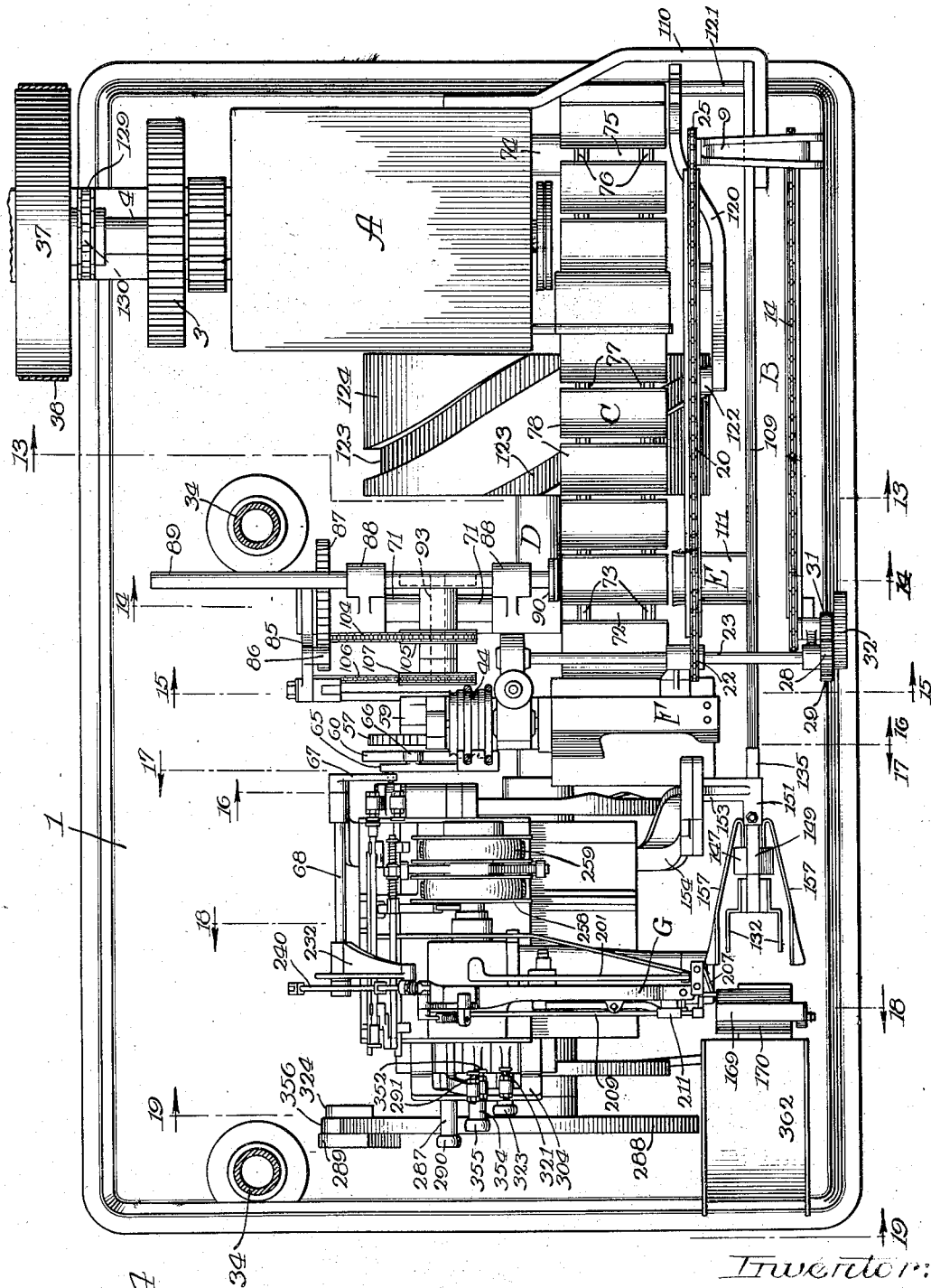


Fig. 4

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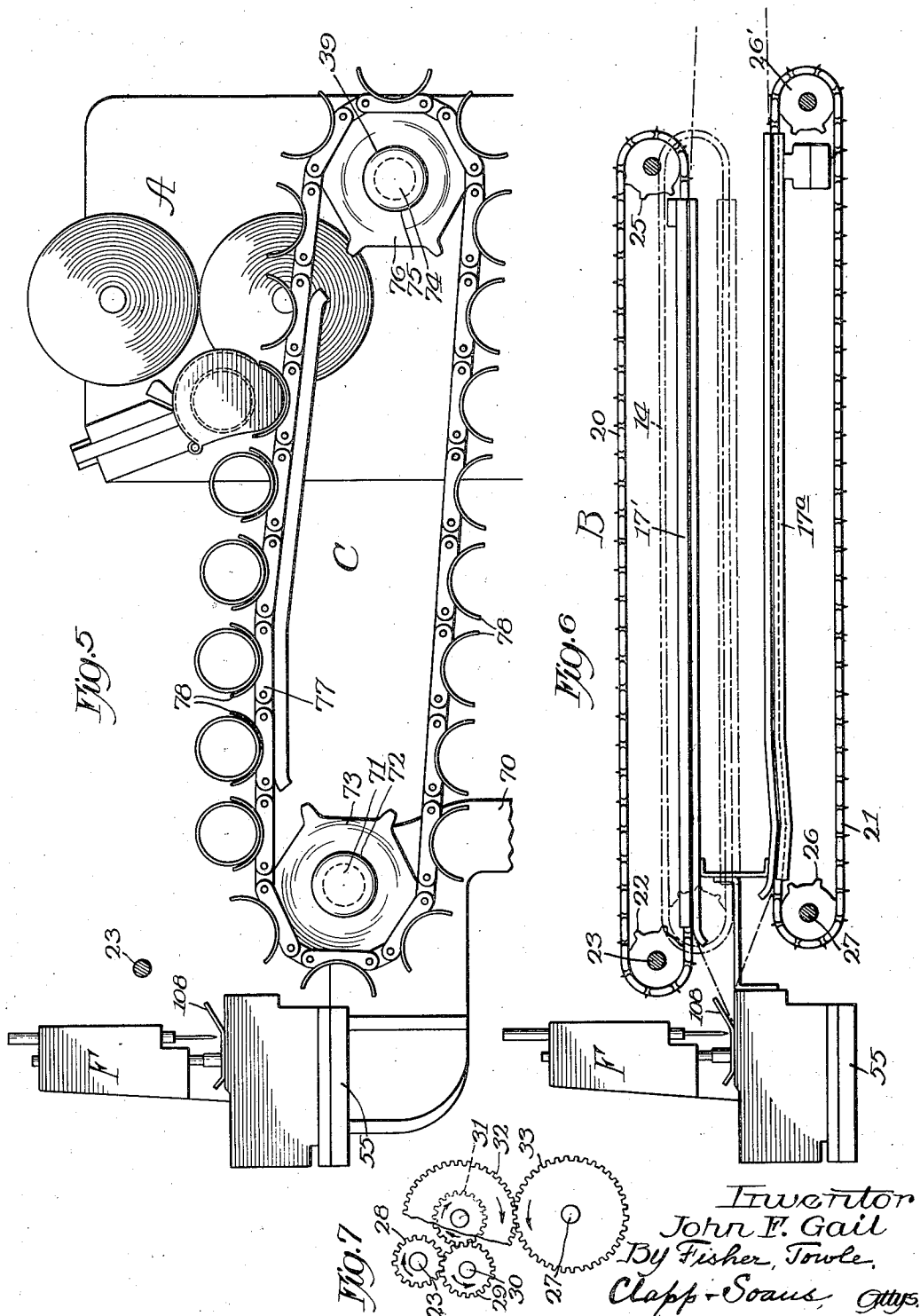
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18 Sheets-Sheet 4



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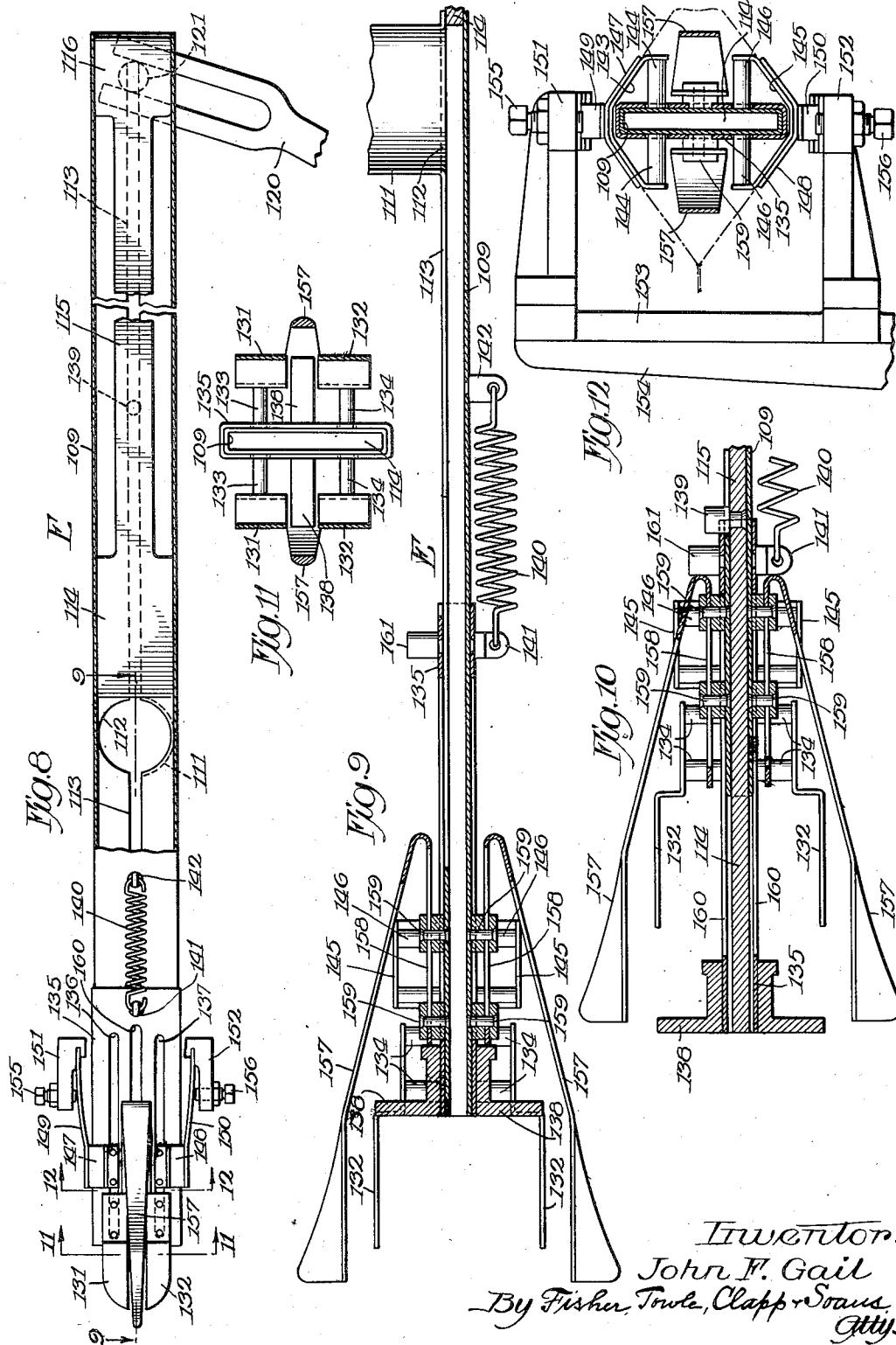
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METHOD OF AND MACHINE FOR ASSEMBLING SPRINGS

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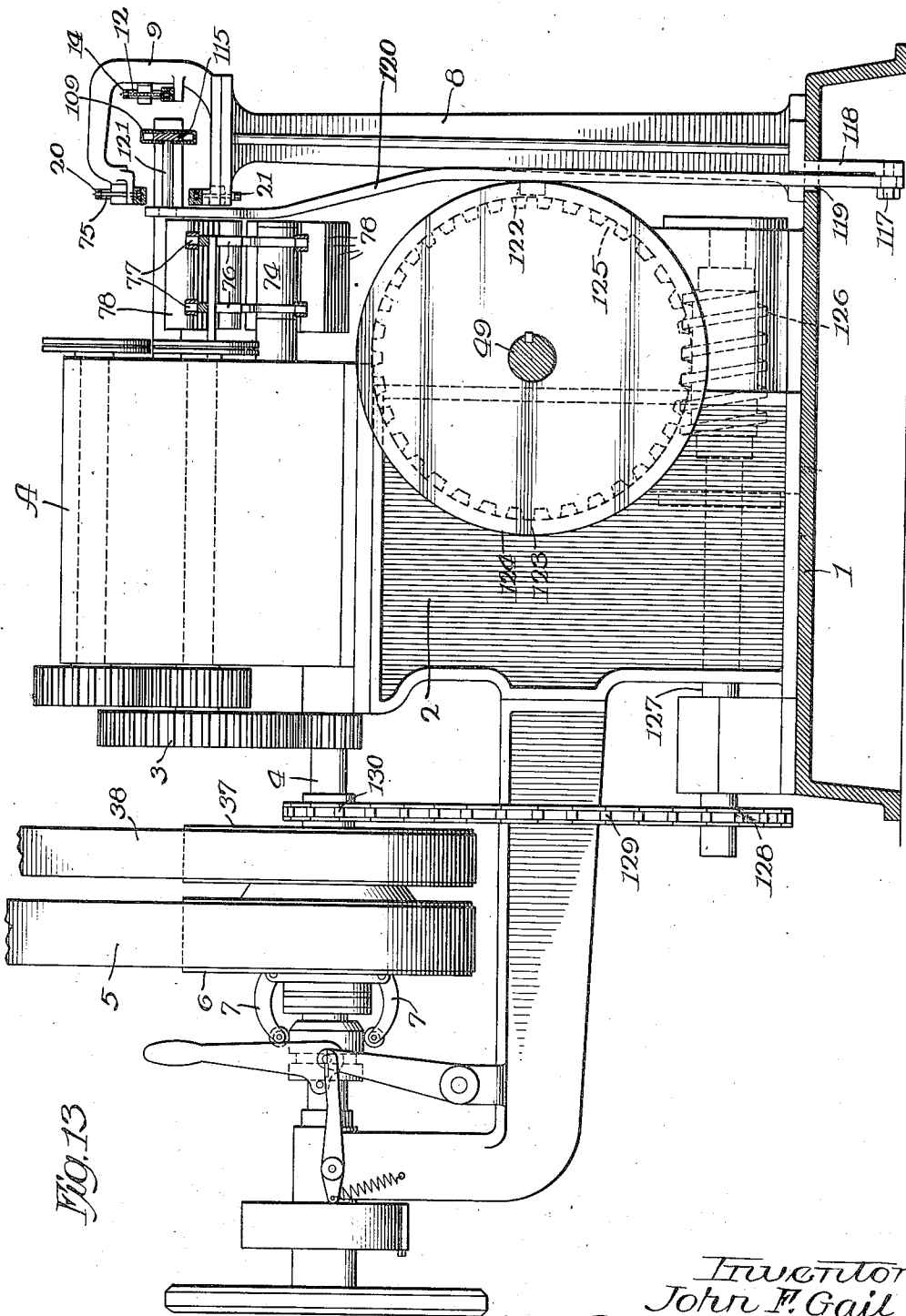


Fig. 13

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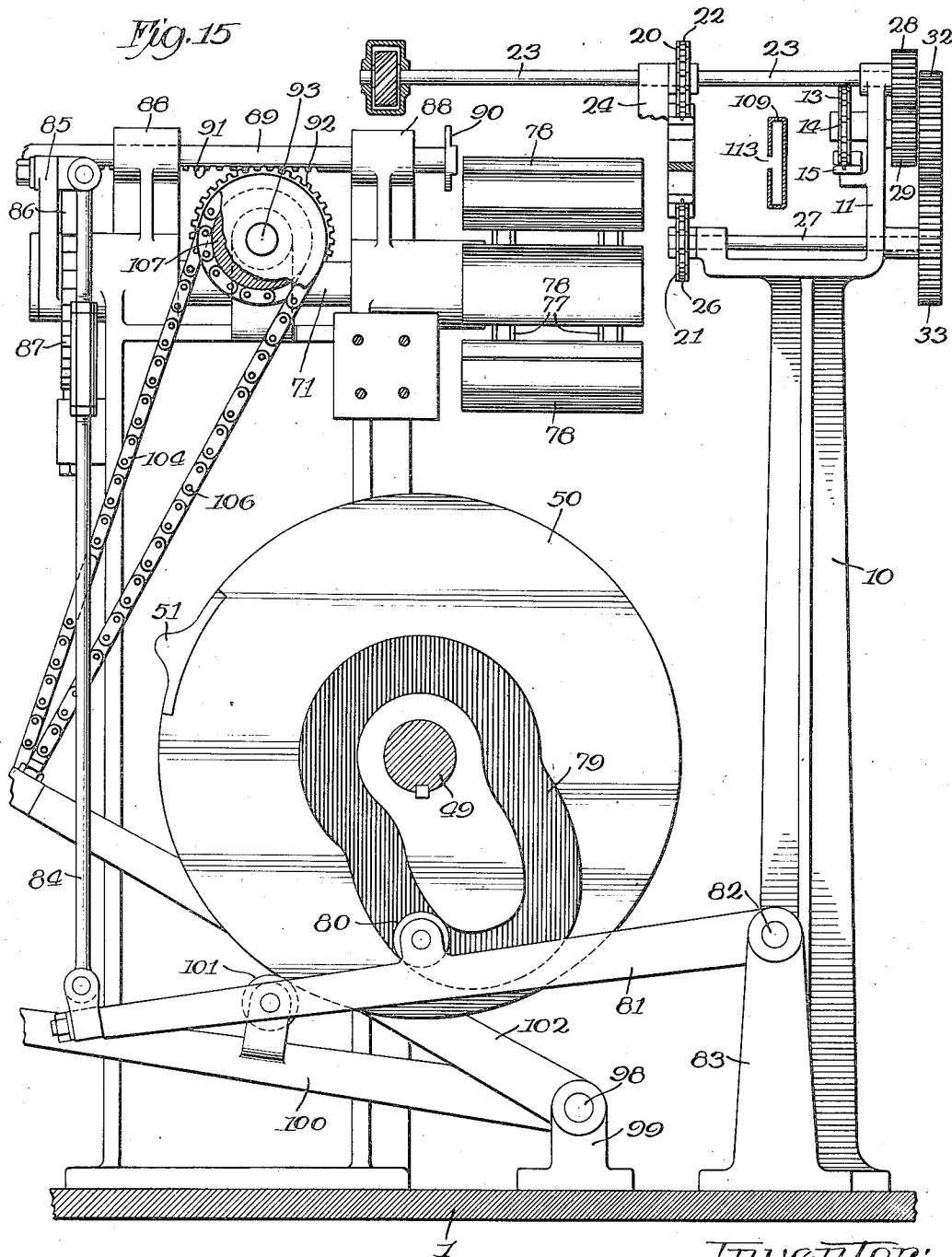
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18 Sheets-Sheet 8



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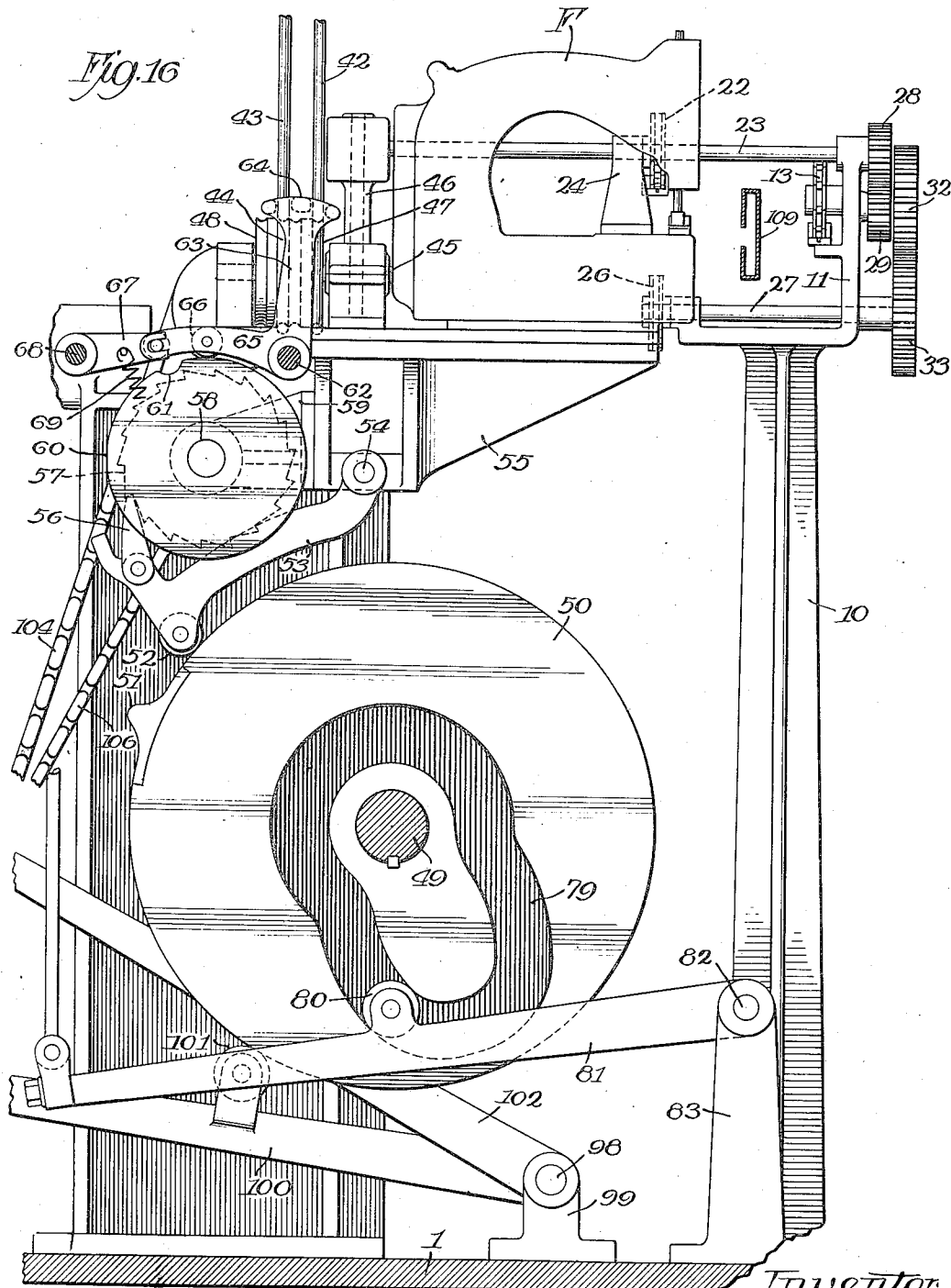
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18 Sheets-Sheet 9



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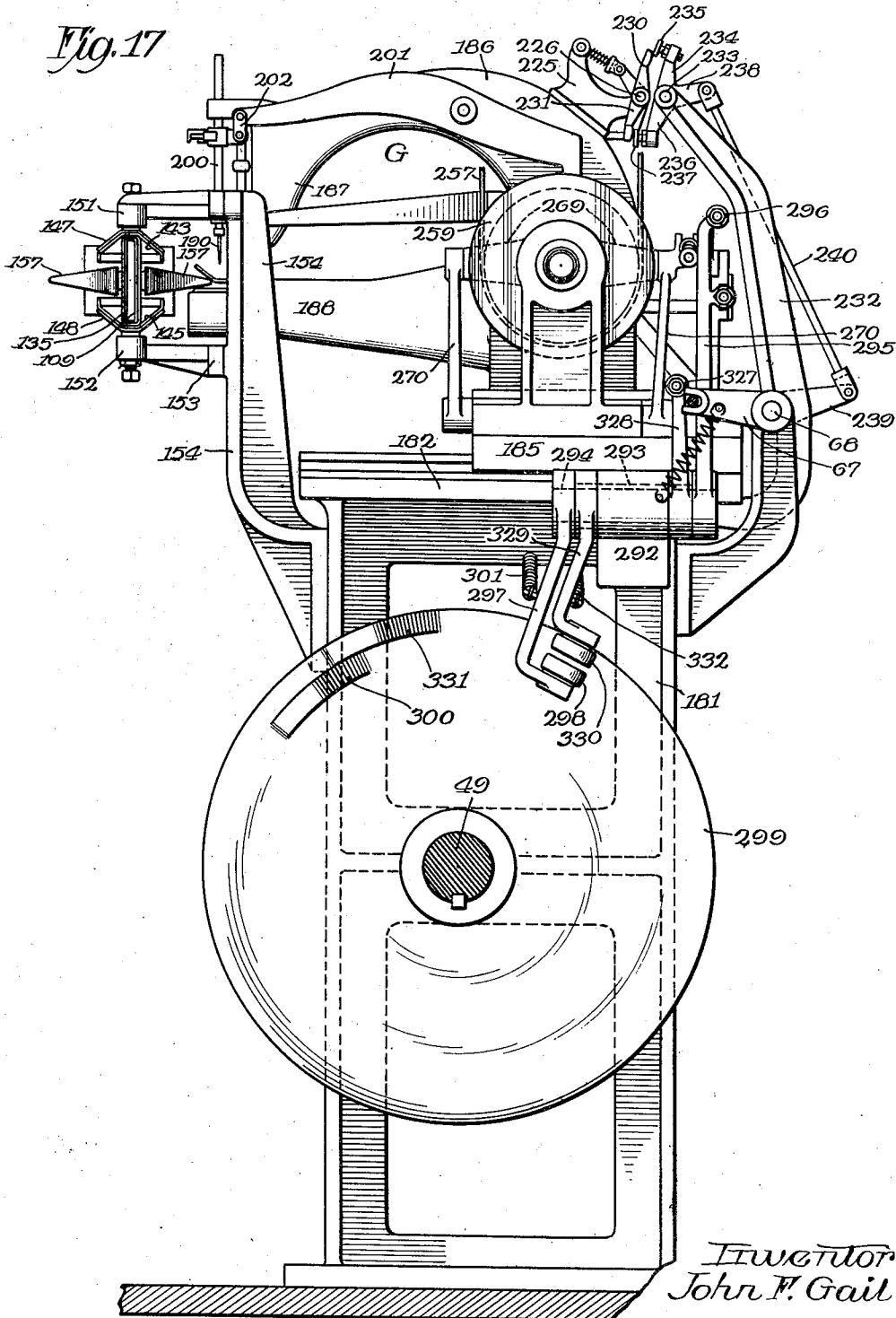
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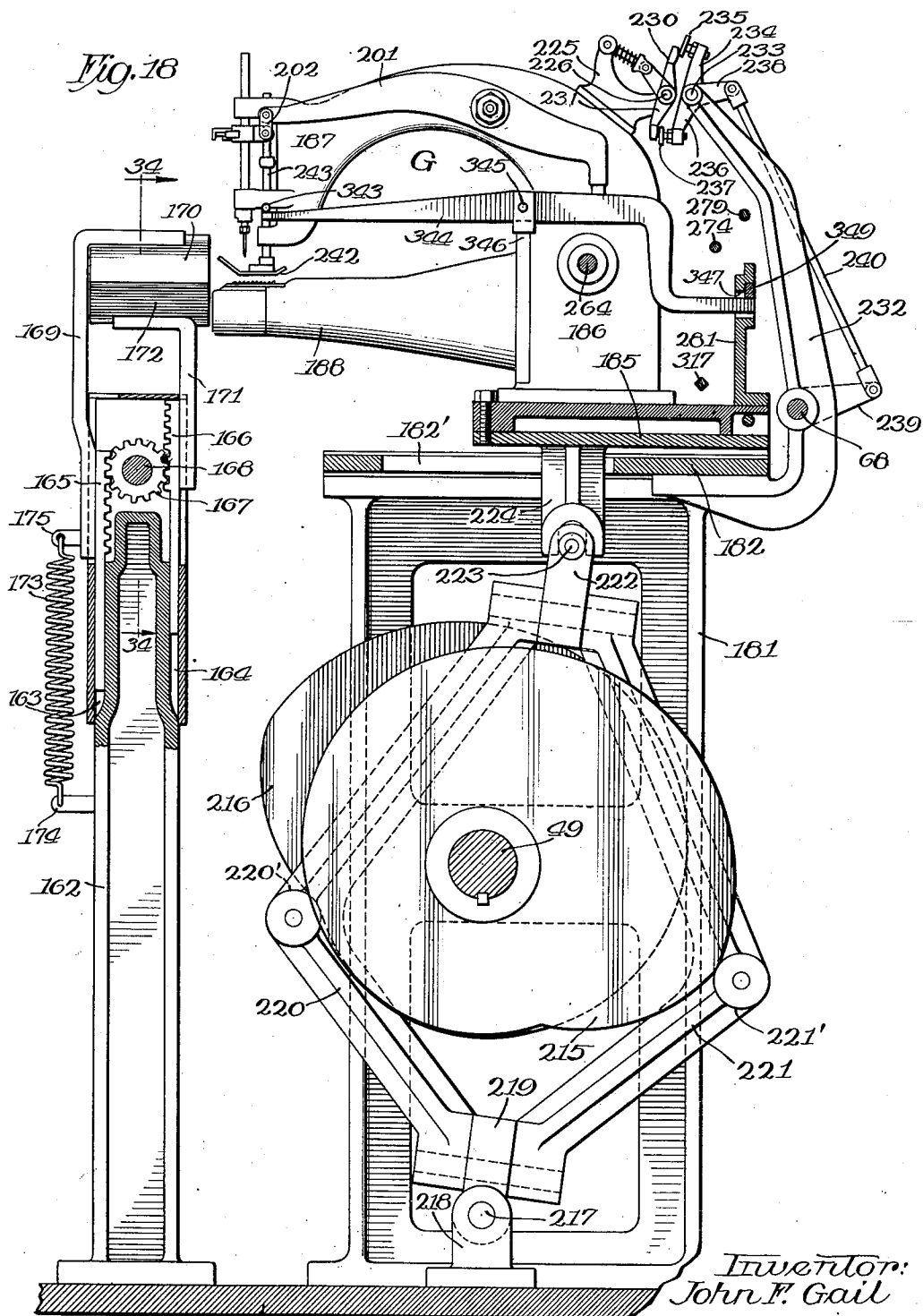
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METHOD OF AND MACHINE FOR ASSEMBLING SPRINGS

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18 Sheets-Sheet 11



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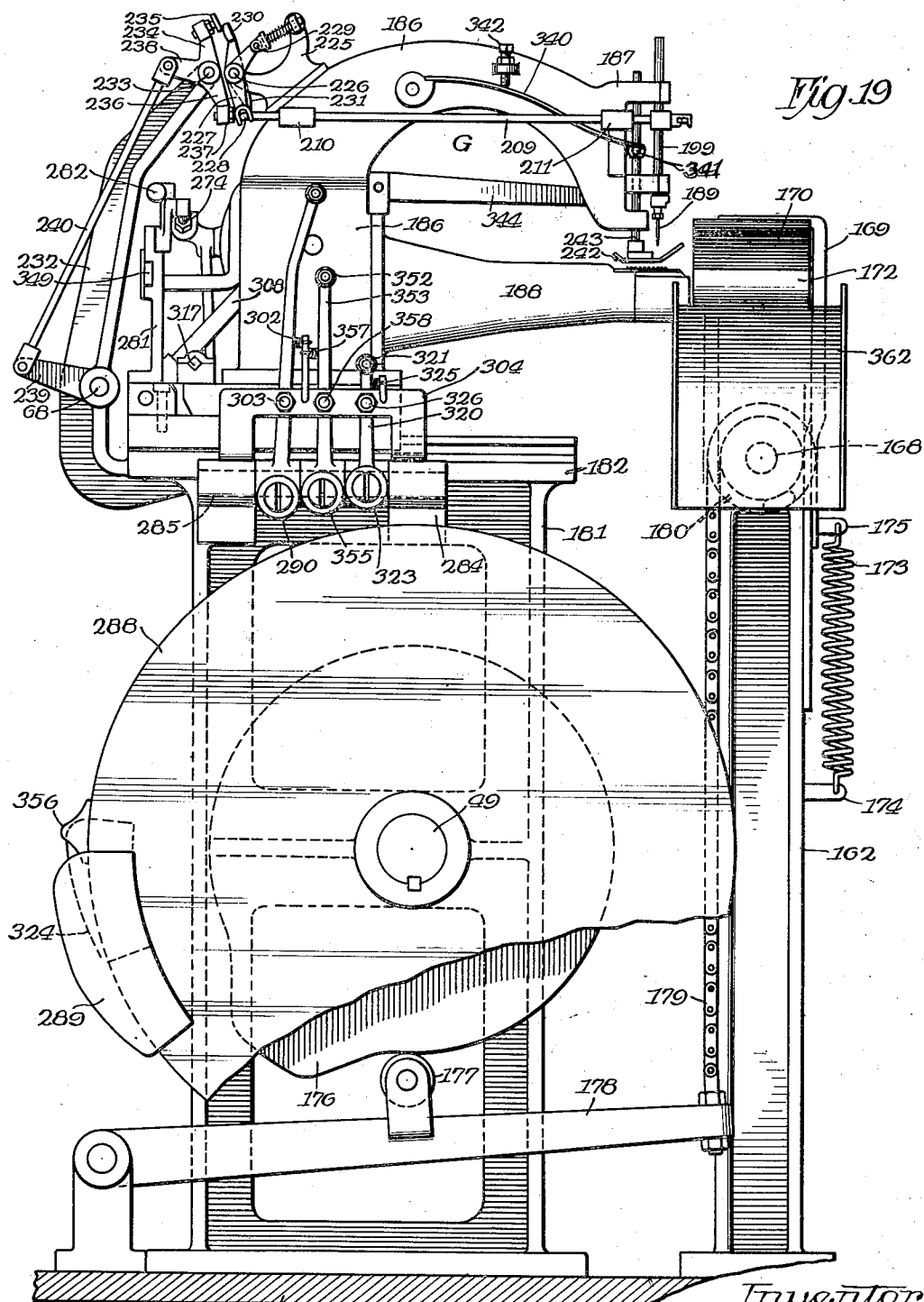
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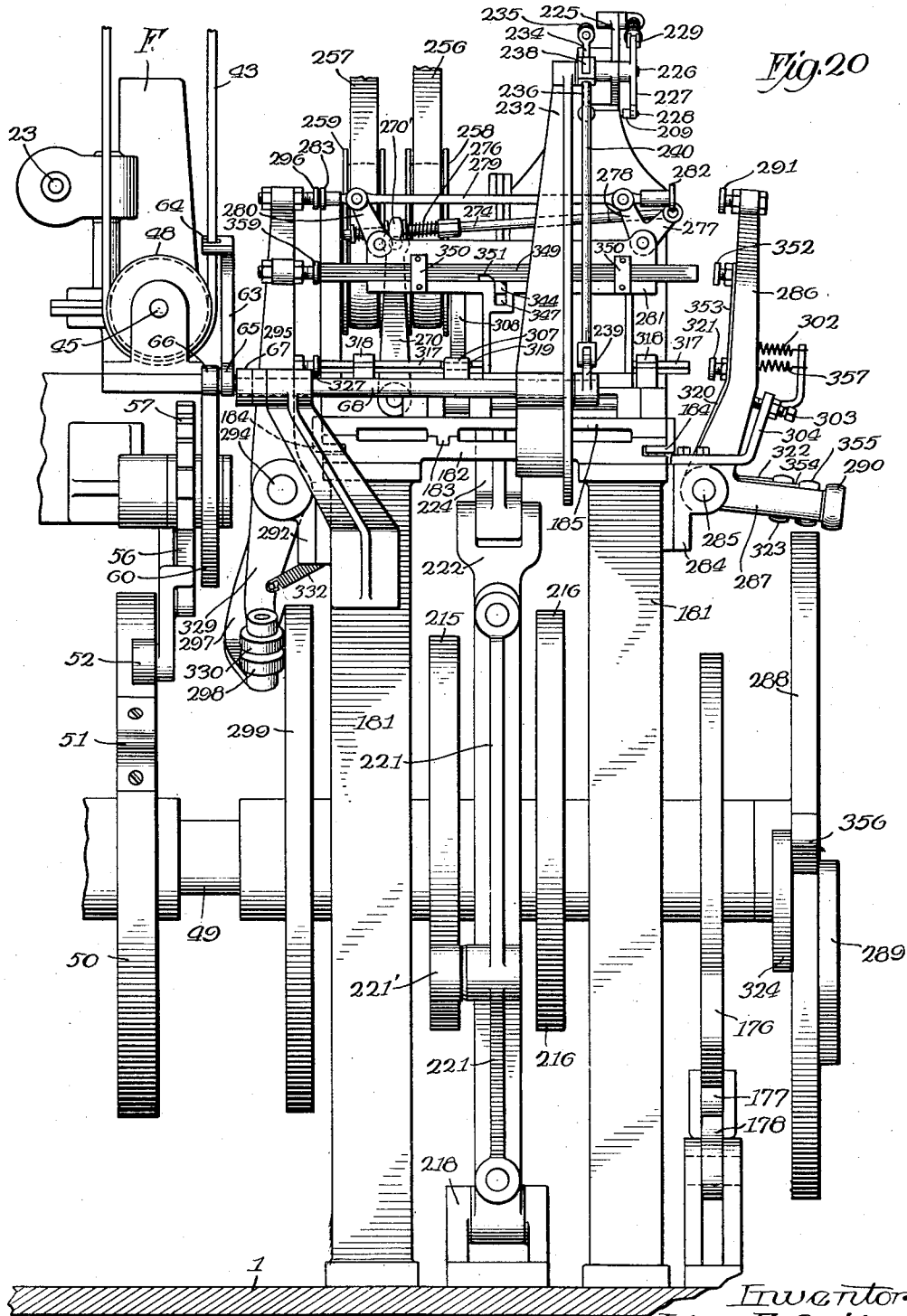


Fig. 20

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METHOD OF AND MACHINE FOR ASSEMBLING SPRINGS

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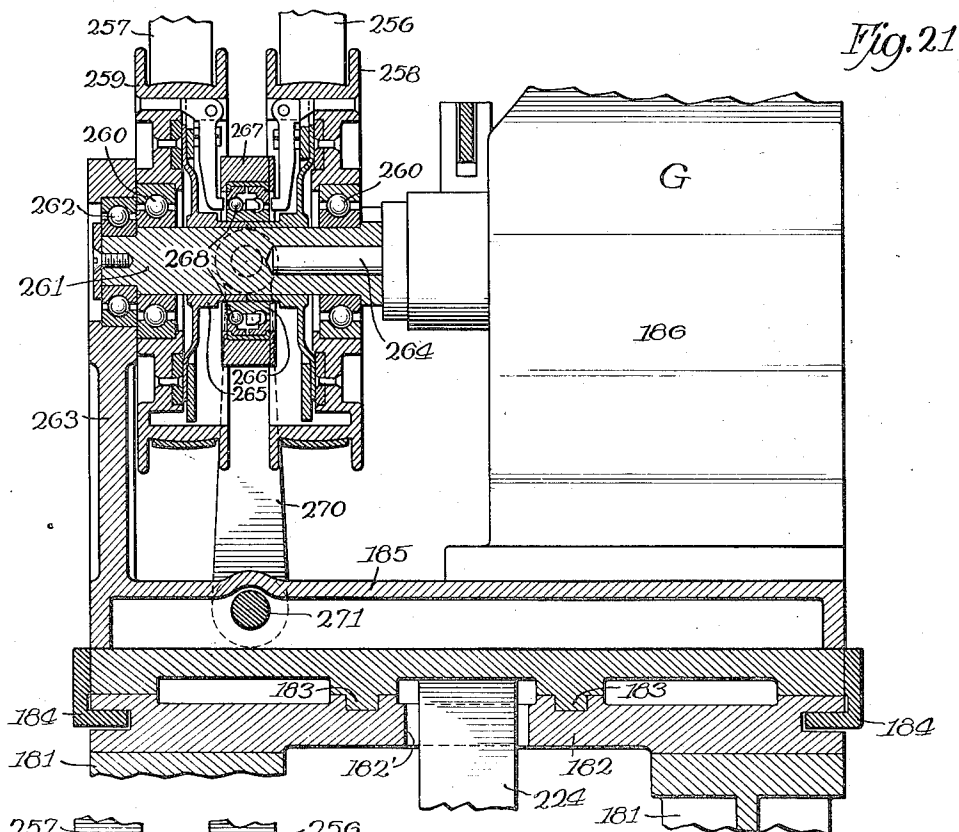


Fig. 21

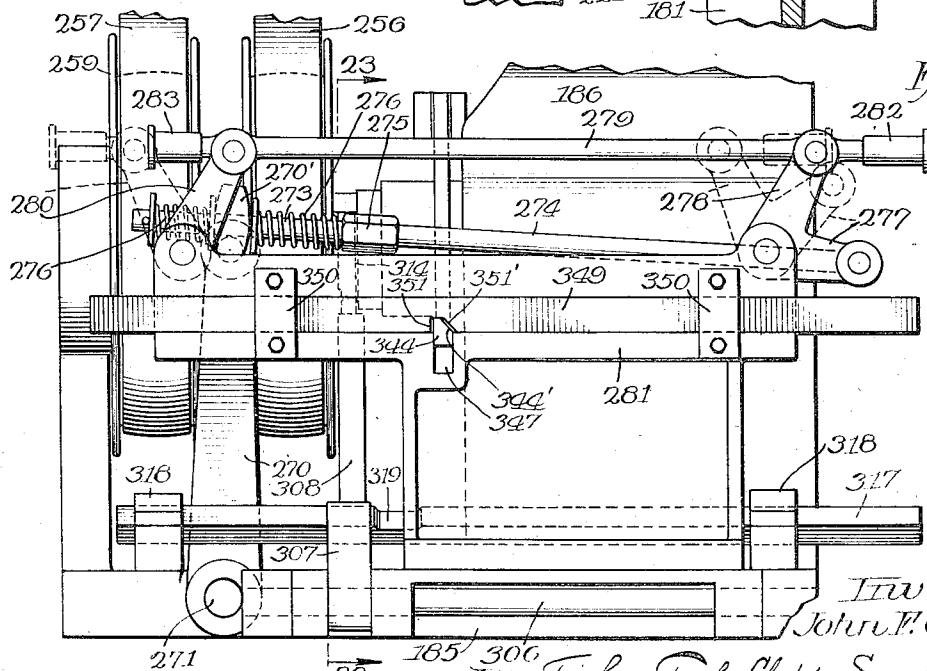


Fig. 22

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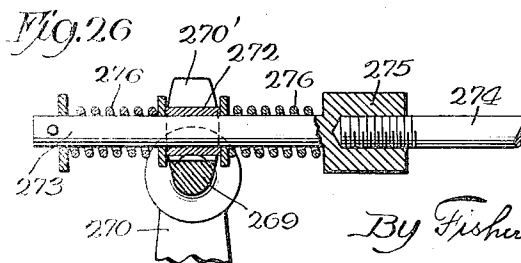
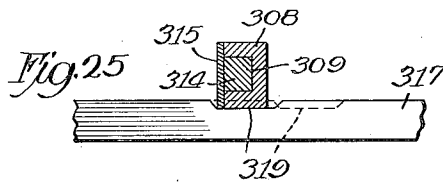
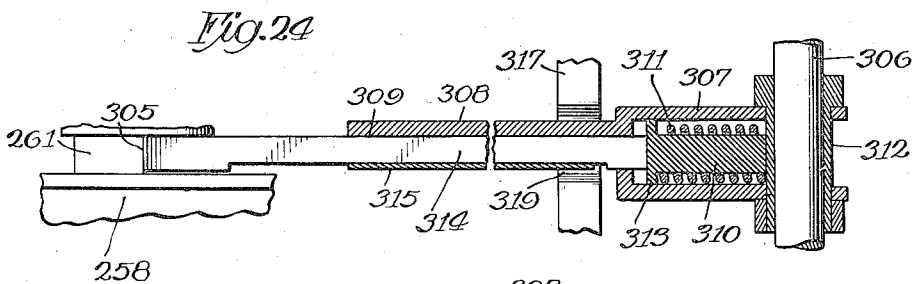
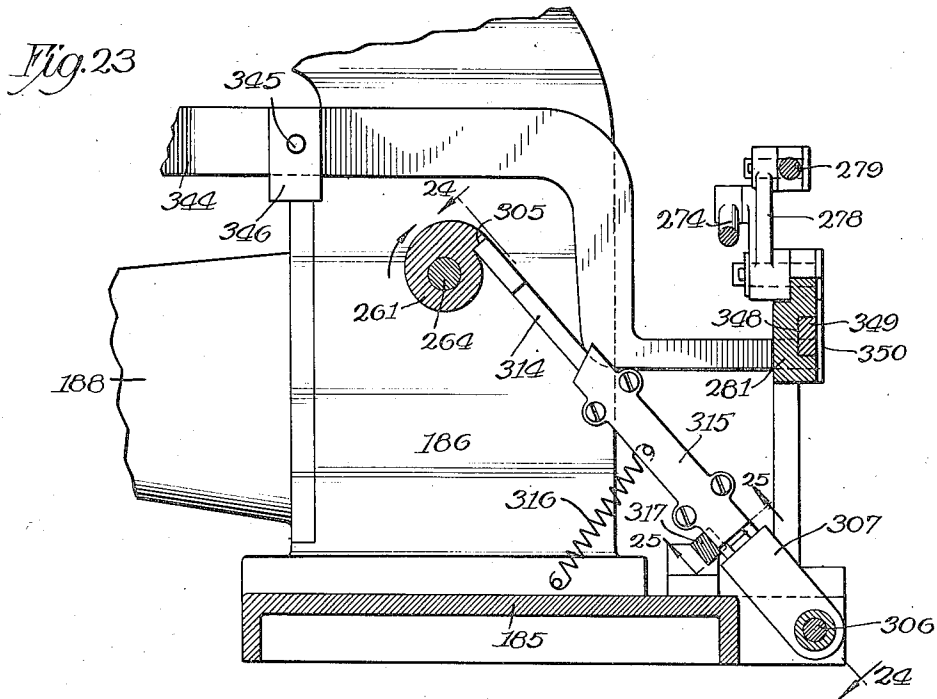
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METHOD OF AND MACHINE FOR ASSEMBLING SPRINGS

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18 Sheets-Sheet 15



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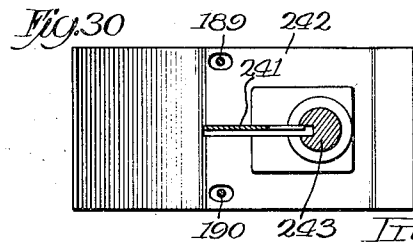
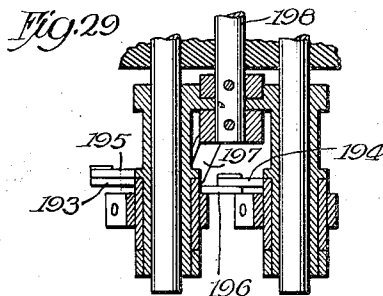
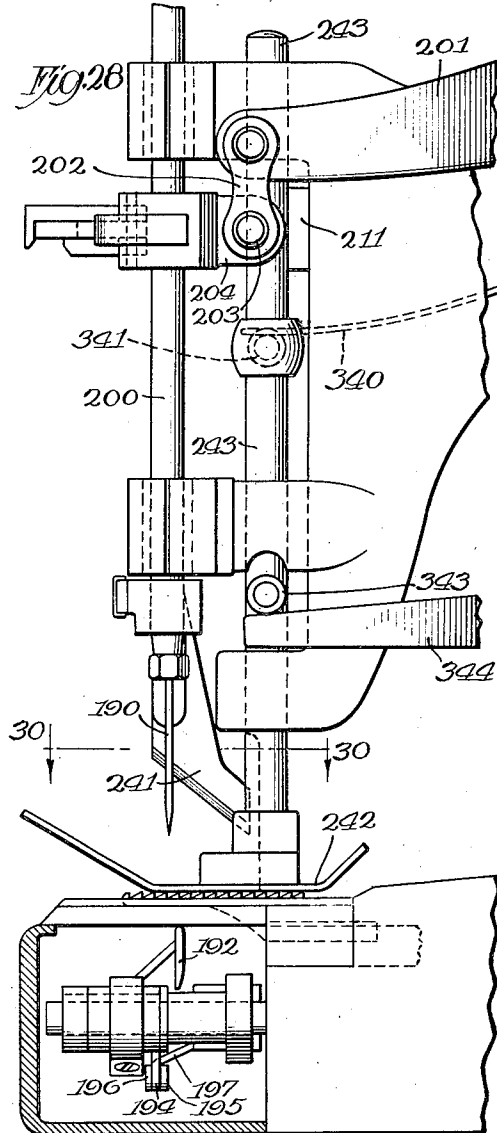
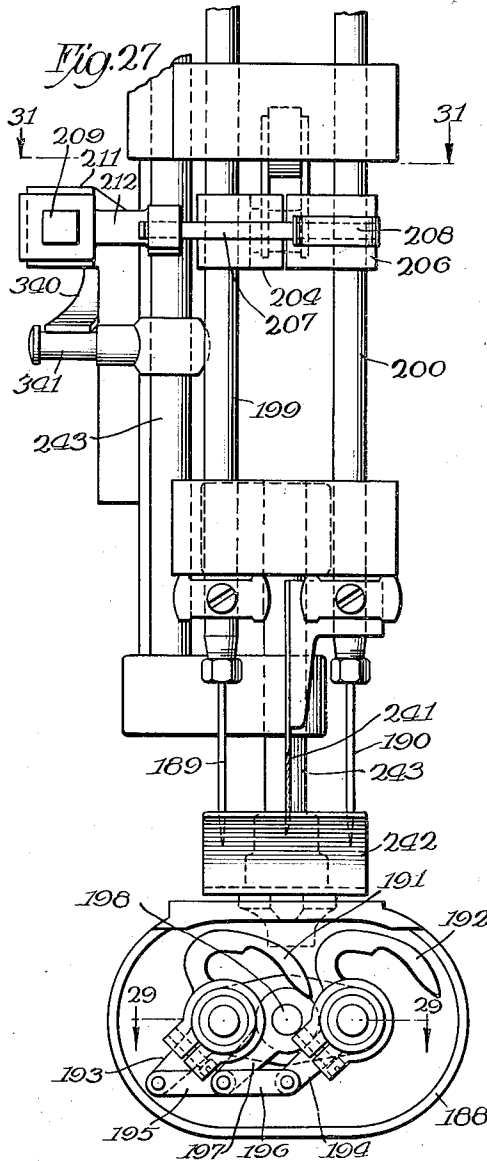
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18 Sheets-Sheet 16



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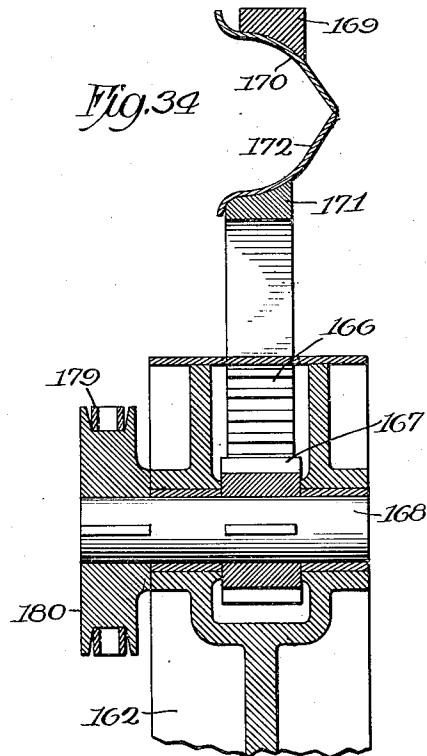
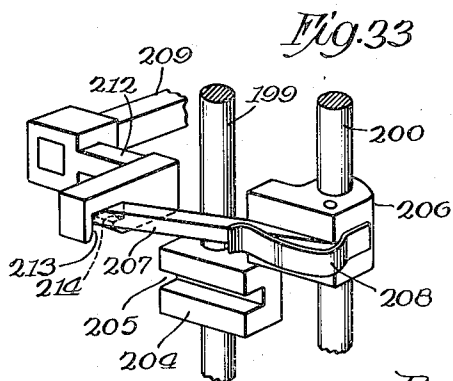
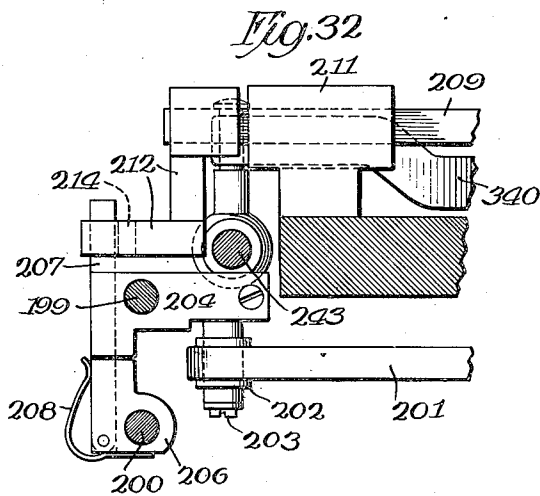
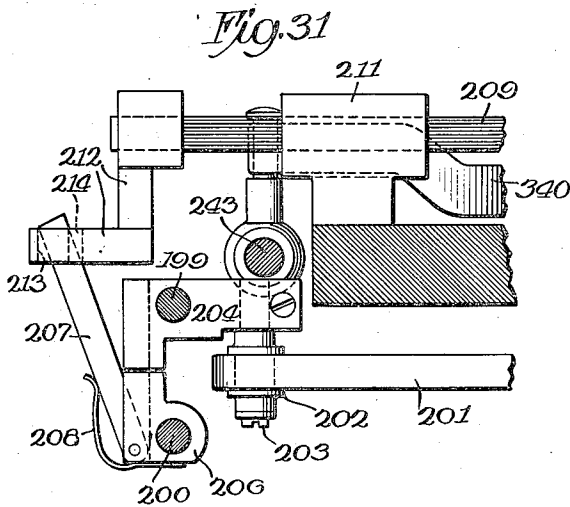
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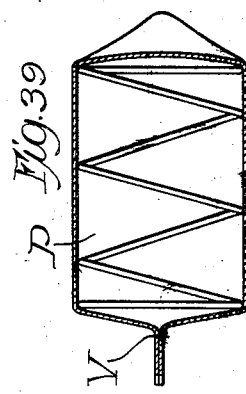
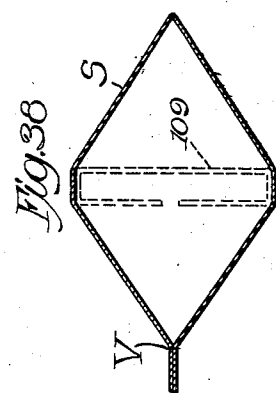
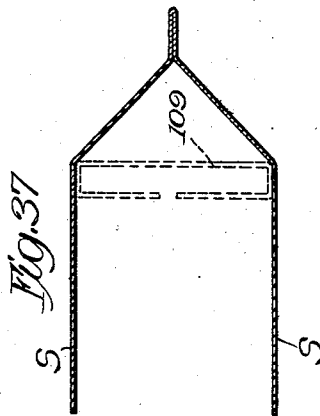
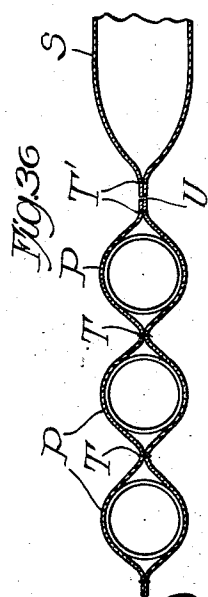
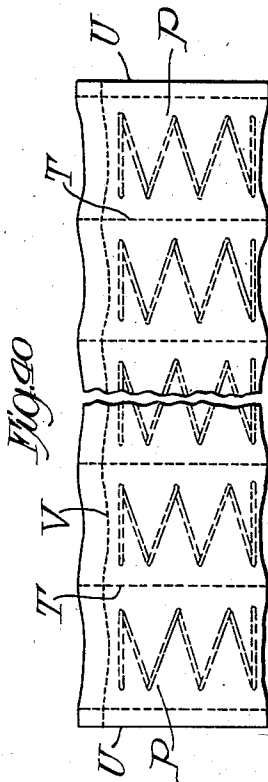
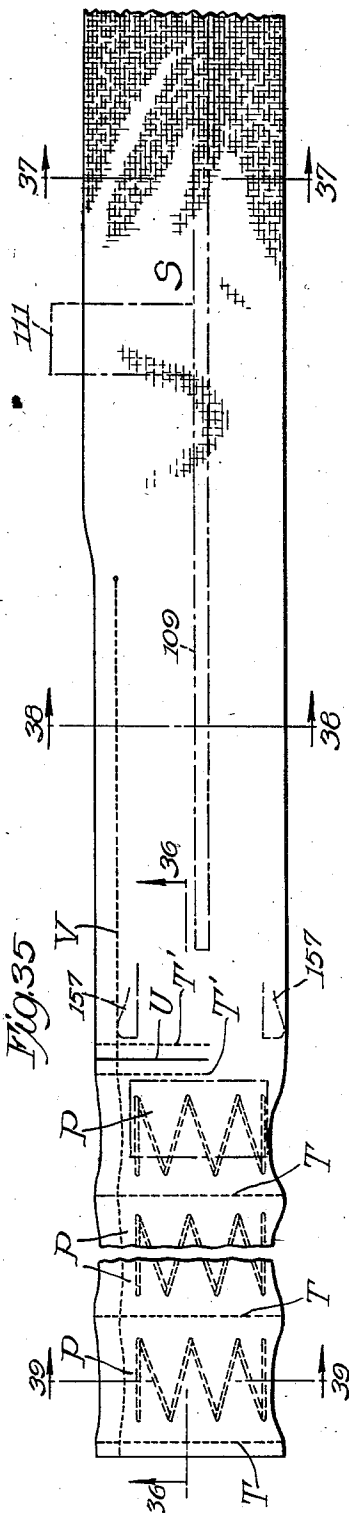
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METHOD OF AND MACHINE FOR ASSEMBLING SPRINGS

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18 Sheets-Sheet 18



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UNITED STATES PATENT OFFICE

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METHOD OF AND MACHINE FOR ASSEMBLING SPRINGS

Application filed May 31, 1927. Serial No. 195,405.

This invention relates to the art of spring assembling, and has reference more particularly to methods and machines employed in the manufacture of spring mattresses, cushions and the like, such, for instance, as the well known Marshall mattress disclosed in U. S. Letters Patent to James Marshall No. 685,160, October 22, 1901. Mattresses and cushions of this type comprise a plurality of two-ply strips of fabric that are stitched transversely at intervals to form pockets having closed ends, coil springs being housed in the pockets, and the rows of filled strips being arranged side by side and stitched together, and the whole enclosed in a suitable cover or casing.

In an application filed by me on the 26th day of February, 1926, Serial No. 90,892, I have disclosed an organized machine for the manufacture of such spring filled strips which includes mechanism for holding and conveying the two-ply fabric strip, forming the pockets therein, forming the springs and inserting the latter in the pockets, and completely closing the latter leaving the springs distended in operative position within the pockets. The machine of my present invention is of the same general character as the machine of my aforesaid application, but involves a number of changes, notably in the spring inserting mechanism and in the pocket stitching mechanism. In the machine of my aforesaid application the coil springs compressed into flattened form are inserted edgewise into the successive pockets with their axes transverse to the longitudinal axis of the pocket, and after the pockets have been completely closed the springs are operated upon by a mechanism which tilts them through a right angle so as to bring their axes parallel or coincident with the longitudinal axes of the pockets so as to permit the springs to expand the full length of the pockets.

One object of my present invention is to obviate the necessity of employing a spring tilting mechanism, and to that end my present invention employs a mechanism whereby the flattened springs are inserted into the pockets with their axes parallel or coincident

with the longitudinal axes of the pockets. In the machine of my aforesaid application the individual pockets of a single continuous strip are divided by a single line of stitching between adjacent pockets. For economy of operation the spring filled strips are manufactured in considerable lengths, and in the subsequent manufacture of the mattress or cushion each long strip is cut into several shorter strips of the required lengths. This necessitates the restitching of each shorter strip at one end. Another object of my present invention is to provide an improved stitching mechanism whereby a continuous long strip designed to be subsequently cut into a number of shorter strips may be double stitched by spaced parallel seams at points corresponding to the intended divisions between the short strip sections, whereby the long strip may be divided at points between the double seams, thus obviating the necessity of subsequently resewing one end of each shorter strip. In the accomplishment of the last-named object I employ a sewing machine equipped with a pair of laterally spaced needle bars and needles. One of these needles is operated at each travel of the machine across the strip, while the other is idle except at the intended points of division on the strip when it is coupled to the main needle bar and operates with the latter to form a double seam. Means are provided for securing an extra length of fabric between adjacent pockets at this point so as to afford room for the two parallel lines of stitching, and preferably also there is associated with the extra needle bar and needle a cutter which operates to sever the strip midway between the two lines of stitching.

Still other objects and attendant advantages of the invention will be apparent to persons skilled in the art as the same becomes better understood by reference to the following detailed description, taken in connection with the accompanying drawings wherein I have illustrated a practical and efficient embodiment of the principle of the invention, and in which—

Fig. 1 is a front elevation of the machine;
Fig. 2 is an enlarged side elevation of the

upper portion of the fast and slow drives of the fabric strip conveyor and the longitudinal stitcher and the fast and slow drives of the transverse stitcher;

5 Fig. 3 is a vertical transverse section on the line 3—3 of Fig. 2;

Fig. 4 is a sectional plan view of the machine, on the line 4—4 of Fig. 1;

10 Fig. 5 is a front elevation of the spring coiler and spring conveyor, and the longitudinal stitcher;

Fig. 6 is a front elevation of the fabric conveyor, and the longitudinal stitcher;

15 Fig. 7 is a detail elevation of the gear drive of the fabric conveyor, viewed from the right of Fig. 15;

Fig. 8 is a view partly in side elevation and partly in longitudinal section of the spring positioning mechanism;

20 Fig. 9 is a horizontal longitudinal section of the left hand half of the spring positioning mechanism shown in Fig. 8, on the line 9—9 of the latter figure;

25 Fig. 10 is a horizontal section through the head portion of the positioning mechanism, showing an advanced position of certain of the parts;

Fig. 11 is an enlarged vertical transverse section on the line 11—11 of Fig. 8;

30 Fig. 12 is an enlarged vertical transverse section on the line 12—12 of Fig. 8;

35 Figs. 13, 14, 15, 16, 17 and 18 are vertical transverse sections through the machine taken on the correspondingly numbered lines respectively of Fig. 4;

Fig. 14^a is an enlarged sectional detail of a portion of the fabric support and conveyor;

40 Fig. 19 is an end elevation viewed from the left of Fig. 4;

Fig. 20 is a rear elevation of the left hand portion of the machine;

45 Fig. 21 is a vertical section through the fast and slow drive pulleys of the transverse stitcher and the clutch controlling the same;

Fig. 22 is an enlarged view of a portion of Fig. 20, showing a different position of certain parts;

50 Fig. 23 is an elevation of a sewing machine stop mechanism, for arresting the sewing action at the completion of each transverse seam;

Fig. 24 is a longitudinal section on the line 24—24 of Fig. 23;

55 Fig. 25 is a transverse section on the line 25—25 of Fig. 23;

Fig. 26 is a detail, in longitudinal section, through the clutch shifter of the fast and slow sewing machine pulleys;

60 Fig. 27 is a front elevation of the twin needle sewing machine head and looper mechanism, showing also a cutter for severing the strip between the parallel seams;

65 Fig. 28 is a side elevation of Fig. 27, viewed from the right of the latter figure;

Fig. 29 is a horizontal section through the looper mechanism taken on the line 29—29 of Fig. 27;

Fig. 30 is a horizontal section taken on the line 30—30 of Fig. 28;

70 Fig. 31 is a top plan view of the needle bar clutch mechanism, showing the clutch disengaged taken on the line 31—31 of Fig. 27;

Fig. 32 is a view similar to Fig. 31 showing the clutch engaged;

75 Fig. 33 is a perspective elevation of the twin needle bars and the clutch and clutch-operating mechanism through which they are connected for simultaneous operation;

80 Fig. 34 is a vertical section, on the line 34—34 of Fig. 18, of a clamp which folds the opposite sides of the fabric around an inserted coil spring to hold the strip in position favorable for the cross-stitching of the plies alongside the spring;

85 Fig. 35 is a plan view of a portion of a partly filled and stitched strip, illustrating the single and double lines of stitching employed;

90 Fig. 36 is a longitudinal section through the left hand portion of Fig. 35 on the line 36—36 of said figure;

Fig. 37 is a transverse section through an open portion of the strip on the line 37—37 of Fig. 35;

95 Fig. 38 is a transverse section through a closed portion of the strip on the line 38—38 of Fig. 35;

100 Fig. 39 is a transverse section on the line 39—39 of Fig. 35, the same being a longitudinal section through a filled and closed pocket;

105 Fig. 40 is a plan, broken out between its ends, of a completed and severed short filled strip, representing the final product of the machine.

General organization

Referring first to Figures 1, 4, 5, 6, 8 and 9, I will first briefly identify the several principal cooperating mechanisms making up the complete machine, and I will then proceed to a description of these mechanisms in detail. 1 designates a flat rectangular base plate or platform, on one of the rear corners of which is mounted an automatic spring coiling machine designated as an entirety by A. Mounted on and extending lengthwise of the front of the platform 1 is a folded-fabric guide and carrier, designated as an entirety by B, the same including a continuously traveling group of sprocket chains cooperating with a corresponding group of supports which respectively engage with the folded edge and the free edges of the two-ply fabric strip and by means of pins carried by the chains advance the strip over the respective supports, maintaining the free edges of the strip suitably spaced for the insertion of coil springs therebetween. Back of the fabric guide and

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carrier and in front of the coiler is mounted an endless spring conveyor designated as an entirety by C, by which the springs as they are delivered from the coiler are conveyed into the field of action of a reciprocating spring inserter mechanism, designated as an entirety by D, by which the springs are pushed endwise between the spaced plies of the fabric, and into the field of action of a spring positioning mechanism designated as an entirety by E, the principal parts of which mechanism are located within and lengthwise of the folded fabric guide and carrier, and serve to advance flattened or compressed springs side-wise to their final positions in the strip. A longitudinal stitcher designated as an entirety by F located opposite the delivery end of the fabric guide and carrier unites the free edges of the two-ply strip; and a transverse stitcher, designated as an entirety by G located beyond the longitudinal stitcher cross-stitches the strip after each spring has been positioned therein, to complete the spring pocket. This cross-stitcher carries two needles spaced about an inch apart, one of which is continuously active, while the other is thrown into action at intervals to form a double seam between the successive short sections into which the loaded fabric strip is divided, this cross-stitcher also carrying a cutter operating between the two seams.

The spring coiler

With the specific structural features of the spring coiler A the present invention is not concerned. Any suitable or approved automatic spring coiling machine may be employed, preferably a machine of the type which delivers light coil springs of uniform diameter. As shown in Fig. 13, the coiler is mounted on a suitable frame structure 2 stepped on the base plate 1, and is driven by a gear train 3 from a drive shaft 4 operated from an overhead pulley (not shown) by a belt 5 and pulley 6, this latter being clutched to and unclutched from the shaft 4 by a clutch 7.

Folded fabric guide and carrier

On the front right hand corner of the base 1 is mounted a post 8 (Fig. 13) on the upper end of which is secured a C-frame 9; and approximately midway of the front edge of the base is mounted a similar post 10 (Figs. 15 and 16) terminating at its upper end in an L-frame 11. Journaled on the vertical limb of the C-frame 9 is a sprocket wheel 12, and similarly journaled on the vertical limb of the L-frame 11 is a sprocket wheel 13, and extending between these sprocket wheels is a sprocket chain 14. Beneath and parallel with the lower lap of the sprocket chain 14 is a chain guide and support consisting, as best shown in Figs. 14 and 14^a, of a flat strip 15

supported at its ends on lugs or brackets on the frame pieces 9 and 11 and formed with a central longitudinal channel 16, and an overlying inverted channel strip 17, the channel of which houses the lower lap of the chain 14. On the inner edge of this supporting structure is a slot 18 (Fig. 14^a) through which the folded edge of the two-ply fabric strip extends. On the outer sides of the links of the chain 14 at suitably spaced intervals are pins 19 which pierce the fabric and ride in the slot 16, thereby both advancing the folded edge of the fabric and locking it against edgewise escape.

The upper and lower free edges of the fabric strip are advanced and at the same time locked against edgewise escape by similar means, consisting of upper and lower sprocket chains 20 and 21 respectively, and cooperating chain guides and supports similar to that shown in Fig. 14^a. The inner end of the sprocket chain 20 travels over a sprocket wheel 22 (Fig. 15) fast on a conveyor drive shaft 23 that is journaled in the bracket 11 and in an auxiliary bracket 24, and the outer end of the chain 20 is trained over a sprocket wheel 25 journaled on the bracket 9. The inner end of the lower sprocket chain 21 is trained over a sprocket wheel 26 (Fig. 15) fast on a countershaft 27 journaled in the bracket 11, and the outer end of the sprocket chain 21 is trained over a sprocket wheel 26' journaled in the bracket 9. The chains 20 and 21 carry pins similar to the pins 19, and the lower limb of the upper chain 20 and the upper limb of the lower chain 21 are conducted through channel guides 17' and 17^a (Fig. 14) that are slotted on their inner edges for the passage of the free edges of the upper and lower plies of the fabric strip, as is indicated by dotted lines in Fig. 14. The mounting of the upper and lower conveyor chains 20 and 21 and the fabric and chain guides and supports is best illustrated in the detail view, Fig. 6. The countershaft 27 is driven from the drive shaft 23 through the gear train illustrated in Figs. 7, 15 and 16, and comprising a gear 28 fast on the drive shaft 23, meshing with an idler gear 29 on the stub shaft 30, a gear 31 fast on the shaft of the drive sprocket 13 of the outer chain 14 (whereby said chain 14 is driven in the same direction as the chains 20 and 21) and a gear 32 fast with the gear 31 meshing with a gear 33 fast on the countershaft 27. By the mechanism last described, the folded edge of the strip and the two free edges of the strip are positively advanced in parallel lines with the two plies of the strip separated or expanded for the insertion therebetween of the springs.

The drive shaft 23 of the fabric conveyor is operated by mechanism which affords two speeds,—one a normal speed, and the other a slightly increased speed for the purpose of

providing additional length of fabric between successive sections which are to be double seamed and severed. Referring first to Figs. 2 and 3, 34 designates as an entirety an inverted U-shaped upright frame, on the vertical limbs of which are mounted adjustable brackets 35 in which is journaled a horizontal shaft 36. This shaft is driven by a pulley 37 (Fig. 13) fast on the shaft 4, a belt 38, and a pulley 39 on one end of shaft 36. Fast on shaft 36 are two pulleys 40 and 41 of different diameters which, through belts 42 and 43, alternately drive a pulley 44 (Figs. 4 and 16) fast on the drive shaft 45 of the longitudinal seam stitcher F. A vertical transmission shaft 46 through spiral gears transmits the motion of the stitcher shaft 45 to the fabric carrier drive shaft 23. On either side of the drive pulley 44 are loose idler pulleys 47 and 48, onto which one of the belts 42 and 43 is shifted when the other is shifted onto the drive pulley 44. Describing the belt shifting mechanism, and referring to Fig. 16, 49 designates a main horizontal cam shaft journaled in suitable bearings and extending lengthwise of the machine. Keyed on shaft 49 is a cam disc 50, on the periphery of which is a cam lug 51. Once at each revolution of the cam disc 50 the cam lug 51, through a roller 52, raises an arm 53 that is pivoted at 54 to the lower side of a bracket 55 that supports the longitudinal seam stitcher F. The free end of arm 53 carries a spring-pressed pawl 56, the nose of which engages with a ratchet wheel 57 fast on a shaft 58 journaled in a bearing bracket 59 attached to the bracket 55. Also fast on the shaft 58 is a cam disc 60 the periphery of which is formed with a cam depression or notch 61. Pivoted at 62 on the bracket 55 is an elbow lever, the upwardly extending arm 63 of which carries a belt shifter 64 straddling the belts 42 and 43. The horizontally extending arm 65 of the elbow lever carries a roller 66 riding on the periphery of the cam disc 60. The free end of the arm 65 is loosely articulated to the free end of an arm 67 that is fast on a shaft 68, and the arm 67 is normally drawn down by a pull spring 69. The ratchet 57 has as many teeth as there are springs in each section of filled strip, and once during each rotation of the discs 60, the roller 66 drops into the notch 61 under the pull of the spring 69, which shifts the slower driving belt 43 to the idler 48 and the faster driving belt 42 to the driver 44, so as to temporarily speed up both the longitudinal seam stitcher F and the fabric strip driving mechanism for the purpose above mentioned. The ratchet 57 is changeable according to the number of springs in a section of strip, and the cam lug 51 may also be interchangeable for higher or lower lugs which will correspondingly vary the length of throw of the pawl 56.

Spring conveyor

In rear of and substantially parallel with the fabric guide and carrier last described is the endless conveyor C which transfers the springs successively from the delivery end of the coiler A to a point at which the springs are pushed endwise between the plies of the fabric strip and into a hollow guide chute through which the compressed and flattened springs are subsequently advanced sidewise to their final position in a partially formed pocket. Referring to Figs. 4, 5 and 14 in which the conveyor is best shown, 70 (Fig. 14) designates an upright frame on the base plate 1, in the upper end of which is journaled a horizontal shaft 71, keyed on the forward end of which shaft is a sleeve 72 carrying a pair of sprocket wheels 73. Journaled on a short shaft 74 projecting from the frame of the coiler A is a sleeve 75 fast on which are a pair of sprocket wheels 76. Trained over the sprocket wheels 73 and 76 are endless sprocket chains 77, the outer sides of the links of which are equipped with concave seats or saddles 78 for the springs. The drive shaft 71 of the spring conveyor is actuated to effect an intermittent or step-by-step travel of the conveyor through the mechanism best shown in Figs. 14 and 15, as follows. In one side of the cam disc 50 is a cam groove 79 engaged by a cam follower 80 on a lever 81 pivoted at 82 to a bracket 83 mounted on the base plate 1. The free end of the lever 81 is connected by a link 84 to an arm 85 pivoted on the rear end of the shaft 71, and the arm 85 carries a spring-pressed pawl 86, the nose of which cooperates with a ratchet wheel 87 fast on the shaft 71. Once during each revolution of the cam disc 50, the shaft 71 is thus given a partial rotation to advance the spring conveyor.

Spring inserter

The spring inserter consists essentially of a reciprocating plunger located behind and operating transversely of the spring conveyor to engage each spring endwise and force it between the spread plies of the fabric and compress it into the spring guide. This device and its operating mechanism are shown principally in Figs. 4, 14 and 15, and referring thereto, slidably mounted in a pair of spaced bearings 88 is a plunger stem 89 carrying at its forward end a plunger head 90, which latter is adapted to reciprocate with slight clearance over the conveyor saddles 78. On the under side of the plunger stem 89 is formed a rack 91 engaged by a pinion 92 fast on a cross-shaft 93. Keyed on the cam shaft 49 are a pair of cam discs 94 and 95, the former provided with a cam depression 96 and the latter with a cam swell or protuberance 97 synchronized with the depression 96. Pivoted at 98 to a bracket 99 on the base plate 1 is a lever 100 carrying a cam follower 101

riding on the periphery of the disc 94, and a similar lever 102 carrying a cam follower 103 riding on the periphery of the disc 95. To the free end of the lever 100 is connected a chain 104, the other end of which extends in one direction around and is secured to the periphery of a disc 105 (Fig. 4) fast on the shaft 93; and to the free end of the lever 102 is connected a similar chain 106, the other end of which extends in the opposite direction around and is secured to the periphery of a companion disc 107 (Fig. 4) fast on the shaft 93. The cams 96 and 97 effect a seesaw movement of the levers 100 and 102 and, through the described connections, produce uniform reciprocating movements of the plunger head 90 across the saddles of the spring conveyor; a complete movement occurring during the dwell in the travel of the conveyor.

The longitudinal seam stitcher

Located just beyond the spring inserter last described, with reference to the direction of travel, is the longitudinal seam stitcher F which operates to unite the two free edges of the fabric strip. As shown in Fig. 16, the stitcher F is mounted on the bracket 55, and its shaft 45 is driven at normal and accelerated speeds by the two belts 43 and 42, as previously described, the changes of speed occurring simultaneously with the changes of speed of the fabric feed mechanism. As indicated in Fig. 6, the free edge portions of the upper and lower plies of the strip passing off the fabric guides 17' and 17^a converge and meet in overlapping relation beneath the presser foot 108 of the stitcher.

The spring positioning mechanism

Located substantially midway between and parallel with the front and rear fabric guides and carriers is a hollow spring guide 109 of rectangular cross-section and of sufficient height and width to house a flattened spring. The member 109 is supported at one end, as shown in Fig. 4, by a bracket 110 attached to the frame of the coiler A, and it is additionally supported somewhat rearwardly of its other end by a concave plate 111 (Figs. 9 and 14) secured thereto and itself supported on the lower fabric guide 17^a; the plate 111 serving as a bridge to support the springs as they are entered by the inserter into the tubular guide 109. On the inner side of the guide 109 at a point registering with the bridge 111 is a hole 112 of a size to admit a spring. The structural details of this mechanism are shown mainly in Figs. 8 to 12 inclusive, from which it will be seen that the inner wall of the guide 109 is formed with a longitudinal slot 113 that intersects the opening 112. Slidably mounted in the guide 109 is a plunger 114 formed with a stem 115 that terminates in a widened rear end portion 116 slidably fitting the guide 109.

Referring to Figs. 1, 4 and 13, pivoted at 117 on a bracket 118 that extends through a slot 119 in the hollow base 1 is a long lever 120, the upper forked end of which (Fig. 1) straddles a laterally extending pin 121 on the widened rear end of the plunger stem. The lever 120 is equipped with cam followers 122 that travel in a pair of cam grooves 123 formed in the periphery of a cam drum 124 fast on the main cam shaft 49. As shown in Figs. 1 and 13, the cam shaft 49 is equipped at one end with a drive from the shaft 4, consisting of a worm wheel 125 fast on the cam shaft 49, a worm 126 on a cross-shaft 127, a sprocket wheel 128 on shaft 127, a sprocket chain 129, and a drive sprocket 130 fast on the hub of the pulley 37. With the plunger head 114 fully retracted to the position shown in Fig. 8, a spring is forced by the spring inserter through the hole 112 into the guide 109 just in advance of the plunger. Just before the inserter plunger 90 starts to back away, the plunger 114 begins its forward stroke pushing the flattened spring sideways through the portion of the guide 109 beyond the receiving opening 112. The stroke of the plunger 114 forces the spring out of the forward end of the guide 109, where the flattened spring expands endwise between upper and lower pairs of arms 131 and 132, the stems or shanks of which are mounted by studs 133 and 134 respectively on the forward end portion of the guide 109. The final portion of the stroke of the plunger 114 forces the expanded spring sideways from between the arms 131 and 132 into its final position between the plies of the fabric, through the following mechanism. Slidable on the forward portion of the guide 109 is a sleeve 135 formed with longitudinal slots 136 and 137 that straddle the studs 133 and 134. Mounted on the forward end of the sleeve 135 is a plunger head 138 in the form of a horizontal bar that plays between the upper and lower pairs of arms 131 and 132, and during the final advance movement serves to push the spring out from between said arms. This forward movement of the sleeve 135 is effected by means of a lateral stud 139 (Figs. 8 and 10) on the plunger stem 115 coming in contact with the rear end of the sleeve 135. A pull spring 140 connected to a lug 141 on the sleeve 135 and anchored to a lug 142 on the side of the guide 109 retracts the sleeve 135 to a position shown in Fig. 9 when the main plunger 114 backs away. The plunger head 138, acting through the spring itself against the previously formed and loaded pocket of the strip, operates to advance the strip one pocket width, and during this movement a light tension is imposed on both the upper and lower plies of the strip by the mechanism mainly illustrated in Fig. 12. Straddling the upper edge of the sleeve 135 is an arched clamp plate 143,

the lower edges of which are secured to the sides of the fixed guide 109 by pins 144 which extend through the slots 136 of the sleeve. Similarly straddling the lower edge of the sleeve 137 is an inverted arched clamp plate 145, the upper edges of which are similarly mounted on the guide 109 by pins 146 occupying the slots 137. The upper ply of the fabric is drawn over the clamp plate 143, and the lower ply is similarly drawn over the clamp plate 145. Light pressure is applied to the fabric on these clamp plates by spring-pressed clamp plates 147 and 148 respectively. The clamp plate 147 is mounted on the free end of a leaf spring 149 (Fig. 8) and the lower clamp plate 148 is similarly mounted on a leaf spring 150. The rear ends of the springs 149 and 150 are attached to a pair of arms 151 and 152 constituting parts of a bracket 153 that, as shown in Figs. 12 and 17, is itself secured to a bracket 154 attached to the supporting pedestal of the transverse stitcher hereinafter referred to. Adjusting screws 155 and 156 in the bracket arms 151 and 152 respectively bear on the springs 149 and 150 and regulate the tension of the latter.

Extending along the outer sides of the spring holding arms 131 and 132 are a pair of spreader fingers 157 formed with widened free ends, the function of which is to stretch the portion of the fabric into which the spring is forced by the plunger 138 in a direction lengthwise of the spring pocket to insure the full entrance of the spring sidewise into the pocket. These spreader fingers are formed with rearwardly bent stems or shanks 158 that are slidably mounted and guided on studs 159 attached to the sides of the fixed guide 109 and extending through central longitudinal slots 160 (Fig. 8) in the sleeve 135. At the time the plunger 138 is advanced to push the spring out of the holding arms 131 and 132, the fingers 157 are also advanced to distend the fabric in a direction lengthwise of the pocket and insure room for the spring. Before the plunger 138 reaches the limit of its forward movement, the lug 141 and a companion lug 161 on the other side of the sleeve 135 strike the heels of the fingers 157 and advance said fingers from the position shown in Fig. 9 to that shown in Fig. 10. The fingers 157 are retracted by the hub of the head 138 striking the shanks 158 of the fingers, as shown in Fig. 9. During the idle or return movement of the main plunger 114 the fabric feed mechanism and the longitudinal stitcher have accumulated slack between the longitudinal stitcher and the tension mechanism amounting to the length of fabric required for one pocket; and, as above stated, this slack is taken up by the next advance thrust of the plunger acting through the spring itself on the cross seam of the previously formed pocket.

After the spring has thus been laid in final

position, the upper and lower plies of the fabric are folded around the spring preliminary to the stitching of the next cross seam which completes the pocket by a mechanism illustrated mainly in Figs. 1, 4, 18, 19 and 34, wherein 162 designates a post mounted on the base plate 1 and formed on its front and rear sides with vertical slideways 163 and 164 (Fig. 18) in which slideways are mounted racks 165 and 166, respectively. These racks are moved simultaneously in opposite directions by a pinion 167 fast on a shaft 168 that is journaled in the post 162. Attached to the rack bar 165 is a vertical extension piece 169 to the upper end of which is attached a concave clamp plate 170 (Fig. 34); and to the rack bar 166 is secured a similar extension piece 171 to which is attached a mating concave clamp plate 172. By reference to Fig. 34 it will be observed that when the clamp plates 170 and 172 are closed around a spring, the lower edge of plate 170 and the upper edge of plate 172 are adapted to grip the fabric strip on a transverse line closely adjacent to the line on which the transverse seam which closes the pocket is formed. The clamp plates 170 and 172 are drawn together by a pull spring 173 anchored at one end to a lug 174 on the post 162 and at its other end to a lug 175 on the extension piece 169 which carries the upper clamp plate 170. The clamp plates are opened to permit the entrance of the next pocket length of fabric containing the next spring therebetween by a cam 176 (Fig. 19) fast on the cam shaft 49 operating through a cam follower 177 on a lever 178 and a pull chain 179 connecting the lever 178 with a sprocket wheel 180 fast on the pinion shaft 168. The cam 176 pulls the clamp plates apart through a sufficient interval of time to permit the spring pocket and spring to be displaced and replaced by the fabric and spring of the next adjacent spring pocket.

The transverse seam stitcher

Located just beyond the delivery end of the spring positioning mechanism last described with reference to the direction of travel is the transverse stitcher G which sews the side seams of the spring pockets after the spring has been placed in the pocket and the upper and lower plies of the fabric drawn together over the spring by the clamps 170 and 172. Referring mainly to Figs. 17, 18, 19 and 20, mounted on a pair of parallel pedestals 181 is a table 182 formed in its top and side edges with grooves to engage tongues 183 and gibs 184 on a reciprocating plate 185, on which latter is mounted a sewing machine of the well known type comprising a frame 186, head 187 and work support 188. In the present instance this sewing machine is preferably equipped with two needles spaced in a direction at right angles to the line of sew-

ing movement, one of the needles designated by 189 (Fig. 27) being continuously operative, and the other, designated by 190 being brought into action at intervals to form a double seam at points where the fabric strip is to be divided into sections of the desired length. Where the two needles are employed the machine is, of course, equipped with twin loopers 191 and 192 which, with their operating mechanism, are mounted in the work supporting arm 188 of the machine, and are operatively connected for simultaneous actuation by arms 193 and 194 and links 195, 196 connecting said arms to a common actuating arm 197 keyed to the oscillating looper operating shaft 198. The needles 189 and 190 are mounted in the lower ends of needle bars 199 and 200 respectively, and the needle bar 199 is reciprocated by the needle bar actuating lever 201 through a link 202 and a stud 203 (Figs. 31 and 32) mounted in a collar 204 fast on the continuously operating needle bar 199. As best shown in Fig. 33, the collar 204 is formed with a horizontal groove 205 in its front face, and fast on the extra needle bar 200 is a collar 206 formed with a similar groove in its front face in which is pivotally mounted at one end a clutch bar 207 normally pressed inwardly by a leaf spring 208. When the machine is operating to sew a single seam, the clutch bar 207 is disengaged from the clutch collar 204 as shown in Fig. 31. When the extra or spare needle 190 is to be brought into operation for the sewing of a double seam, the collars 204 and 206 are clutched together through the agency of the clutch bar 207 which is drawn into the groove 205. The clutch bar 207 is actuated in both directions from a slide bar 209 (Figs. 19, 31 and 32) mounted in bearings 210 and 211 on one side of the frame and head of the machine, the slide bar 209 carrying at its forward end a rectangular arm 212, in the lower edge of which is a notch 213 adapted to be entered by the free end of the clutch arm 207. The rear wall of the notch 213 is formed with a ledge 214 which serves to support the clutch arm 207 when the latter is in the disengaged oblique position shown in Figs. 31 and 33, but which permits the arm 207 to move out of the notch when said arm is in the clutched position shown in Fig. 32. At the conclusion of each cross seam operation, whether the machine has made a single seam or a double seam, the operation of the machine is arrested by a stop hereinafter described with both needles in fully raised position; and if the next seam is to be a double seam the bar 209 is actuated rearwardly to throw in the clutch, and if the next seam is to be a single seam immediately following a double seam, the bar 209 is shifted forwardly, on the return of the machine to starting position, to disengage the clutch. The mechanism for reciprocating the machine itself will next be described, and

this will be followed by a description of the automatic mechanism for shifting the clutch-operating bar 209.

Referring to Figs. 18 and 20, keyed on the shaft 49 are a pair of reversely disposed symmetrical cams 215 and 216. Horizontally journaled on a pivot shaft 217 mounted on a bracket 218 on the base plate 1 is a block 219 to which are bolted the lower ends of a pair of reversely bent arms 220 and 221. These arms embrace the shaft 49 midway between the cams 215, 216 and at their upper ends are bolted to a block 222. The block 222 is connected by a horizontal pivot bolt 223 to the lower end of an arm 224 rigid with the base plate 185 of the sewing machine and extending through a slot 182' in the table 182. The two arms 220, 221 bolted together at their upper and lower ends together constitute a yoke on which are mounted cam followers 220' and 221' cooperating with the cams 216 and 215 respectively. The active and passive portions of the respective cam discs 215 and 216 cooperate simultaneously to effect positive forward and rearward reciprocations of the sewing machine without any slack or overthrow.

Describing next the mechanism for shifting the needle clutch-operating bar 209, and referring to Figs. 17, 18, 19 and 20, mounted on the back of the sewing machine frame 186 is a bracket 225 in which is journaled a short rock shaft 226. Fast on one end of shaft 226 (see Fig. 19) is an elbow lever, the depending arm 227 of which has a forked lower end straddling a pin 228 in the clutch-shifting bar 209. The upper arm 229 of said lever forms an element of an ordinary over-the-center spring toggle that yieldably locks the shaft 226 in either of two shifted positions. Fast on the other end of shaft 226 (see Figs. 17 and 18) are a pair of upwardly and downwardly extending striker arms 230 and 231 respectively. Attached at its lower end to one of the table-supporting frames 181 on the rear side of the machine is an upwardly extending bracket arm 232, in an intermediate portion of which is formed one of the bearings of the rock shaft 68. In the upper end of the bracket arm 232 is journaled a rock shaft 233 lying parallel with and slightly in rear of the rock shaft 226. Fast on rock shaft 233 is a three-arm lever comprising an upwardly extending arm 234 equipped with an adjustable stop 235, a downwardly extending arm 236 equipped with an adjustable stop 237 and a rearwardly extending arm 238. The stop 235 is located directly in rear of the upper end of the striker arm 230, and the stop 237 is located directly in rear of the lower end of the striker arm 231. Fast on the rock shaft 68 is a rearwardly extending arm 239 that is connected by a link 240 to the arm 238.

With the parts in the relative position

shown in Figs. 17, 18 and 19, the needle clutch is disconnected, and the needle 189 only is operated. When the machine has completed the sewing of the last single seam preceding a double seam, the cam follower 66 (Fig. 16) drops into the cam recess 61, which permits the spring 69 acting through the arm 67 to rock the shaft 68 in a clockwise direction viewing Fig. 19. This, through arm 239, link 240 and arm 238 rocks the shaft 233, and swings the stop 235 forwardly, and the stop 237 rearwardly, from the position shown, so that on the next back travel of the sewing machine the upper striker arm 230 strikes the stop 235 and thereby rocks the shaft 226 in a direction to swing the arm 227 rearwardly, thereby drawing the clutch bar 209 rearwardly and coupling the clutch. At the same time that the rock shaft 233 is thus shifted, through the mechanism previously described the accelerated speed drive of the fabric conveyor and of the longitudinal stitcher is thrown in. The two needles having been connected, the next forward travel of the sewing machine sews a double seam, and at the same time the strip is cut between the seams by a knife 241 (Figs. 27 and 28) that is attached to the extra needle bar 200 between the needles 189 and 190 and reciprocates with the extra needle 190. The machine is equipped with the usual presser foot 242 mounted on the presser foot lifting bar 243, and the presser foot and its lifting bar are suitably slotted, as indicated in Figs. 28 and 30, to permit the reciprocation of the cutter 241 therethrough. At the completion of the sewing of the double seam, the reciprocation of the needles is arrested, by a stop mechanism later described, with both needles in their highest position, and simultaneously therewith the cam follower 66 rides out of the cam seat 61, thereby shifting the drive of the fabric conveyor and the longitudinal stitcher from accelerated speed to normal speed and at the same time shifting the stops 235 and 237 back to the position shown, so that on the return travel of the sewing machine the lower striker arm 231 strikes the stop 237, and, through the rock shaft 226 and arm 227 the clutch shifter bar 209 is returned to the position shown, disconnecting the clutch, so that on the next working movement of the sewing machine the needle 189 alone operates.

From the foregoing it will be seen that just before the fabric strip reaches a point at which it is to be severed, the accelerated speed of the fabric conveyor and of the longitudinal stitcher is automatically thrown in to provide the additional length of fabric required by the double seam, and at the same time the clutch-controlling mechanism last described is automatically set to couple the needle clutch on the next return movement of the transverse stitcher; while, when the

double seam is completed, the accelerated speed of the fabric conveyor and longitudinal stitcher is restored to normal, and the clutch-controlling mechanism is again automatically set to uncouple the needle clutch on the next return movement of the transverse stitcher.

The transverse stitcher G is driven by belts from overhead shafts and pulleys. During the actual stitching the machine is driven at high speed (approximately 2,000 R. P. M.). When each seam is completed, the operation of the machine is arrested; but since it is impractical to suddenly arrest such a high speed movement, I provide means whereby the high speed movement is first changed to a much slower speed (about one-tenth), and this slow speed movement is then arrested by a positive stop during the return travel of the machine to a fresh unstitched portion of the fabric. Referring to Figs. 2 and 3, the shaft 36 is the high speed overhead pulley shaft mounted and driven as already described. A countershaft 250, below and parallel with the shaft 36 is journaled at its ends in bearing brackets 251 mounted on the vertical limbs of the frame 34. A pinion 252 on the shaft 36 meshing with a gear 253 on the countershaft 250 drives the latter in a reverse direction at a greatly reduced speed. On shafts 36 and 250 are relatively large and small pulleys 254 and 255 that, through belts 256 and 257, drive the high and low speed pulleys 258 and 259 (Fig. 20) of the sewing machine. By reference to Fig. 21 it will be observed that the two sewing machine drive pulleys 258 and 259 are loosely journaled by anti-friction bearings 260 on a short drive shaft 261 that is journaled at one end in an anti-friction bearing 262 mounted in an upright frame piece 263 on the cross-slide 185, and at its other end is coupled to the sewing machine drive shaft 264. The high and low speed pulleys 258 and 259 are alternately drivingly connected to the shaft 261 through a sliding clutch sleeve 265 splined on the shaft 261, and co-operating friction clutch mechanism within the pulleys, the details of which, since they form no part of the present invention and are well known, need not herein be described. The clutch sleeve 265 is shifted by means of an inner ring 266 encircling the sleeve 265 and fitted to an annular recess in the latter, an outer ring 267 encircling and connected to the inner ring by an anti-friction bearing 268, a pair of lateral arms 269 (Fig. 17) on the ring 267, and a clutch shifter yoke 270 fulcrumed at its lower end on a pivot pin 271 (Fig. 21) in the cross-slide 185 and with its arms pivotally connected to the ends of the arms 269. One of the arms of the yoke 270 is extended above the pivot 269 as shown at 270' (Figs. 22 and 26) and apertured to receive a bushing sleeve 272, in which sleeve

is slidably mounted an actuating rod made in two sections 273 and 274 united by a threaded coupling 275 so as to make the length of the rod adjustable. The thrust of the rod on the clutch shifter arm 270 is cushioned in both directions by coil springs 276 mounted on the rod section 273 in the manner clearly shown in Fig. 26. When the rod 274 is shifted to the left viewing Figs. 20 and 22, the slow speed pulley 259 is clutched to the sewing machine shaft; and when said rod is shifted in the reverse direction, the high speed pulley 258 is clutched to the sewing machine shaft.

Cam-actuated strikers are employed to effect the positive shifting movements of the clutch-shifting rod 274. Referring to Figs. 20 and 22, the outer end of the rod 274 is pivoted to the lower arm 277 of a vertically disposed bell crank lever, the upper arm 278 of which is pivoted to a rod 279, the other end of which is similarly pivoted to an upwardly extending arm 280. The elbow lever 277, 278 and the arm 280 are both pivoted at their lower ends on a bracket 281 that is mounted on the rear of the cross-slide 185. The ends of the rod 279 are equipped with heads 282 and 283 that lie in the paths of strikers which operate to shift the rod 279 endwise.

Describing next the cam-actuated mechanism for effecting the slow speed throw of the rods 279 and 274, on the side of the outer frame piece 181 is mounted a bracket 284 in which is journaled a short shaft 285, loose on which is an elbow lever comprising an upwardly extending arm 286 and an outwardly extending arm 287. Fast on the cam shaft 49 is a disc 288, on the front face of which is mounted a cam block 289 which, once at each revolution of the disc 288, liftingly engages the arm 287 through a cam follower 290, thereby swinging the arm 286 to the left, viewing Fig. 20, whereby an adjustable striker 291 mounted in the upper end of the arm 286 through engagement with the head 282 shifts the rod 279 and the clutch-shifting rod 274 from the position shown by full lines in Fig. 22 to the position shown by dotted lines in said figure and by full lines in Fig. 20, throwing in the slow speed drive. This occurs simultaneously with the completion of a transverse seam. As soon as the sewing machine has returned to starting position, the fast speed drive is thrown in by a similar mechanism which shifts the rod 279 in the reverse direction. Referring to Figs. 17 and 20, in a bearing bracket 292 attached to the inner frame piece 181 is journaled a sleeve shaft 293, within which is journaled a shaft 294 the ends of which project beyond the ends of the sleeve shaft 293. Secured to one end of the shaft 294 is an upwardly extending lever arm 295, the upper end of which carries an adjustable striker 296 lying oppo-

site the head 283 of the rod 279. Fast on the other end of shaft 294 is a depending lever arm 297 carrying a cam follower 298. Keyed on the shaft 49 is a disc 299, on the face of which is a cam 300 that, once during each revolution of the disc 299, engages the follower 298 and rocks the arm 295 in a direction to shift the rod 279 to the right, viewing Figs. 20 and 22 from the position shown in Fig. 20 to the full line position shown in Fig. 22, thereby throwing in the high speed drive. The lever arm 297 is caused to hug the cam disc 299 by a pull spring 301; and similarly the cam follower 290 is maintained in the path of the cam 289 by a pull spring 302 (Fig. 20), the length of the return stroke of the arm 286 being regulated by an adjusting screw 303 mounted in a bracket 304.

Sewing machine stop

Immediately following the throwing in of the low speed as above described, the sewing movement of the machine is momentarily arrested (the low speed friction clutch slipping to permit the same), and the machine is held idle until it has returned to starting position. Referring to Figs. 23, 24 and 25, on the sewing machine drive shaft 261 just outside the pulley bearing 260, is formed a radial stop shoulder 305. Pivoted on a shaft 306 mounted in lugs on the cross-slide 185 is a plunger cylinder 307 formed with a relatively long stem 308, in which latter is formed a rectangular groove or channel 309. Within the cylinder 307 is a plunger 310, encircling which is a compression spring 311 footed at its lower end against a wear sleeve 312 encircling the pivot shaft 306 and at its upper end abutting against an annular flange 313 on the plunger 310 that slidingly engages the internal wall of the cylinder. The plunger is formed with a rectangular stem 314 that fits the channel 309 in the cylinder stem and is secured therein by a cover plate 315. The plunger stem 314 projects beyond the upper end of the cylinder stem 308 and lies crosswise of the shaft 261 in the transverse plane of the stop shoulder 305. The plunger stem or stop rod 314 is drawn down to engaging position relatively to the stop shoulder 305 by a pull spring 316. It is normally held out of engagement with the stop shoulder 305 by a square rod 317, which rod, as best shown in Figs. 20 and 22, lies in rear of the sewing machine and is slidingly supported in bearings 318 mounted on the cross-slide 185. In the side of the rod 317 that lies adjacent to the stop rod 314 is formed a cam recess or notch 319. While the sewing machine is operating on the fabric strip, the slide rod 317 is in a position wherein the cam notch 319 lies to the right of the stop rod, viewing Fig. 22, and the stop rod is held thereby in idle position wherein its free end is out of the path of the shoulder 305. When the slide rod

317 is moved to the left, viewing Fig. 22, the cam notch 319 is brought into register with the stop rod, as shown in Fig. 20, and the spring 316 instantly pulls the latter down to a position wherein its free end is engaged by the stop shoulder 305 of the sewing machine shaft, thereby arresting the latter under a cushioned impact afforded by the spring 311.

Describing the actuating mechanism of the slide rod 317, which is generally similar to the actuating mechanism of the rod 279, and referring to Figs. 1, 17, 19 and 20, pivoted on the shaft 285 is an elbow lever formed with an upwardly extending arm 320 carrying at its upper end an adjustable striker 321 located opposite one end of the rod 317, and with an outwardly extending arm 322 carrying a cam follower 323, which latter lies in the path of travel of a cam block 324 mounted on the inner side of the cam disc 288 slightly in rear of the cam block 289. Just after the slow speed drive of the sewing machine has been thrown in, the cam 324 actuates the elbow lever 320, 322, causing the striker 321 to shift the rod 317 to the left and throw in the sewing machine stop just described. The follower 323 is held in position to be engaged by the cam 324 through a pull spring 325 connected to and normally drawing the lever arm 320 rearwardly against an adjustable stop 326.

The sewing machine stop having been automatically thrown in by the mechanism last described, the machine is idle until it is returned to starting position, at which point the slide rod 317 is shifted in the reverse direction to disengage the stop by a striker 327 on the upper end of an arm 328 (Fig. 17) fast on one end of the sleeve shaft 293, said arm being rocked through the agency of a depending arm 329 fast on the other end of said sleeve shaft and a cam follower 330 on said arm that is engaged by a cam 331 on the face of the disc 299; the follower 330 being caused to hug the disc by a pull spring 332.

The presser foot 242 of the sewing machine is normally held down on the work by a leaf spring 340 (Figs. 19, 27 and 28) supported at one end on the frame of the sewing machine and at its other end bearing upon a lateral stud 341 carried by the presser foot lifting bar 243, the spring being tensioned by an adjusting screw 342. Upon the completion of each transverse seam the presser foot of the machine is automatically raised to clear the fabric on the return travel. Referring to Figs. 18 and 28, attached to the presser foot lifting bar 243 is a laterally projecting stud 343 that is liftingly engaged by the forward end of a lever 344 pivoted at 345 to a bracket 346 on one side of the sewing machine frame. The rearwardly extending downwardly bent arm of said lever 344 extends through a transverse slot 347 (Figs. 20 and 22) in the bracket

281. In the outer side of said bracket is a horizontal channel 348 (Fig. 23) in which is slidably mounted a flat bar 349 confined by retaining strips 350. The tail end of the lever 344 that projects into the slot 347 is formed with a beveled cam edge 344', as best shown in Fig. 22, and in the lower edge of the slide bar 349 is a notch 351 formed with a cooperating beveled cam edge 351'. Manifestly, an endwise movement of the slide bar 349 to the left viewing Figs. 20 and 22, will depress the tail piece of the lever into the lower portion of the slot 347 below the lower edge of the slide bar 349, thereby elevating the presser foot; and the lower edge of the slide bar will hold the presser foot raised until the slide bar is returned to a position in which the notch 347 registers with the notch 351, whereupon the lever is returned to normal working position by the presser foot spring 340. The slide bar 349 is actuated in a direction to raise the presser foot by an adjustable striker 352 mounted in the upper end of the upwardly extending arm 353 of an elbow lever pivoted on the shaft 285 (Figs. 19 and 20), the outwardly extending arm 354 (Fig. 4) of said elbow lever carrying a cam follower 355 riding on the periphery of the cam disc 288 and lifted once at each revolution of the latter by a cam 356 on the periphery of said disc. The cam follower is caused to hug the periphery of the cam disc by a pull spring 357 (Fig. 19), similar to the pull springs 302 and 325, and the outward movement of the lever arm 353 is limited by an adjustable stop 358 similar to the stops 303 and 326. The opposite movement of the slide bar 349 is effected by an adjustable striker 359 (Fig. 20) mounted on the lever arm 295. This shifts the slide bar 349 to the right from the position shown in Fig. 20 to that shown in Fig. 22, and permits the presser foot to descend. The cams are so timed that this lowering of the presser foot occurs slightly after the sewing machine stop has been thrown out and substantially simultaneously with the throwing in of the high speed.

Referring to Figs. 1, 4 and 19, mounted on the upright 162 by bracket arms 360 and 361 is a downwardly and forwardly curved delivery chute 362, over which the filled strip sections slide onto the floor or into any suitable receptacle, for subsequent assembly in a mattress or seat cushion spring.

The mechanism for effecting the reciprocations of the transverse stitcher, the two speed drive of the transverse stitcher, the automatic mechanism for alternately shifting the drive between low and high speeds, the machine stop and its controlling mechanism, and the presser foot raising and lowering mechanism are all substantially similar to corresponding mechanisms disclosed and claimed in an earlier application filed by me on the 26th day of February, 1926, Serial No. 90,892 for improvements in machines for and

methods of assembling springs, and no claims to such mechanisms, per se, are made herein. An important feature of the present invention resides in the manner and means hereinabove described for inserting the springs into the fabric pockets, and for completing and closing the pockets successively by transverse seams after the springs have been placed therein. The means whereby at regular predetermined intervals a double transverse seam is sewed, and the fabric strip is severed between the two members of the double seam constitutes another novel and important feature of the present invention, since this enables the machine to deliver separate individual filled strips of predetermined length which are complete and require no further stitching.

Figures 35 to 40 of the drawings illustrate various stages in the manufacture of the completed product by the machine. Fig. 35 illustrates in plan view an advance section of the two-ply fabric strip S, in the forward portion of which several springs have been deposited and housed in completed pockets P, these latter being separated by individual transverse seams T. At T', T' is shown one of the double seams, and at U is indicated the line of cut between the seams T', T', marking the division between two sections. At V is shown the longitudinal seam which closes the open ends of the pockets P, and it will be observed that this longitudinal seam V is maintained some distance in advance of the cross-seams T and T', thus forming a tubular portion of the strip through which the springs are successively pushed sidewise by the main and auxiliary plungers 114 and 138. At the time each spring is laid in its final position in its pocket, the thrust of the spring-advancing plunger acting through the spring itself on the previously loaded and completed pocket advances the portion of the strip beyond the strip conveyor by the length of one pocket, thus taking up the slack previously formed during the preceding return stroke of the plunger. At intervals when a double seam is to be made, the fabric conveyor and the longitudinal stitcher are speeded up to draw into the slack sufficient additional length to provide for the double seam. As the fabric strip is pushed forward by the thrust of the plunger acting through the last inserted spring, the forward travel of both plies of the fabric is frictionally retarded by the fabric clamps which put a sufficient drag on the fabric to avoid slack in the pockets themselves; and just before each cross-seam is formed, the spring clamps 170 and 172 closing on the spring serve to center the latter and also draw the inner sides of the fabric plies together and clamp them in position to be permanently united by the stitcher. Fig. 36 shows in vertical cross-section a group of three filled and completed

pockets with a double seam between the latter and the next section to be filled. Fig. 37 illustrates in cross-section the position of the fabric strip at a point in advance of the longitudinal stitcher, where the upper and lower plies are held in spaced position for the lateral insertion of a spring into the spring guide; and Fig. 38 illustrates in cross-section the position of the plies at a point where their free edges have been united by the longitudinal stitcher. Fig. 39 is a longitudinal section through a completed and filled pocket; and Fig. 40 is a plan view, broken out between its ends, of a completed section of filled strip.

I claim:—

1. In the art of spring assembling, the combination of a support for a two-ply fabric strip, mechanism for flattening and simultaneously inserting coil springs between the plies of said strip, and mechanism for advancing the inserted springs lengthwise of said strip.

2. In the art of spring assembling, the combination of a support for a two-ply fabric strip, mechanism for flattening and simultaneously inserting coil springs between the plies of said strip, mechanism for advancing the inserted springs lengthwise of said strip, and means for maintaining the springs in flattened condition during the advancing movement thereof.

3. In the art of spring assembling, the combination of a support for a two-ply fabric strip, mechanism for inserting coil springs between the plies of said strip with the axes of said springs disposed crosswise of the strip, and mechanism for advancing the inserted springs sidewise through said strip.

4. In the art of spring assembling, the combination of a support for a two-ply fabric strip, mechanism for inserting coil springs in flattened condition between the plies of said strip with the axes of said springs disposed crosswise of the strip, and mechanism for pushing the inserted springs sidewise through said strip.

5. In the art of spring assembling, the combination of a support for a two-ply fabric strip, mechanism for flattening and simultaneously inserting coil springs between the plies of said strip with the axes of said springs disposed crosswise of the strip, mechanism for advancing the inserted springs sidewise through said strip, and means for maintaining the springs in flattened condition during the advancing movement thereof.

6. In the art of spring assembling, the combination of a support for a two-ply fabric strip, mechanism for inserting coil springs in flattened condition between the plies of said strip with the axes of said springs disposed crosswise of the strip, mechanism for advancing the inserted springs sidewise through said strip, means for maintaining the springs in

flattened condition during the advancing movement thereof, means beyond said last-named means for limiting the expanding movements of said springs, and means for pushing the springs out of said limiting means.

7. In the art of spring assembling, the combination of a support for a two-ply fabric strip, mechanism for inserting springs between the plies of said strip, means for advancing the springs successively lengthwise of said strip, and means for forming a closed pocket around each spring at the end of the advance movement.

8. In the art of spring assembling, the combination of a support for a two-ply fabric strip, mechanism for inserting coil springs between the plies of said strip with the axes of said springs disposed crosswise of the strip, means for advancing the springs sidewise successively lengthwise of said strip, and means for forming a closed pocket around each spring at the end of the advance movement.

9. In the art of spring assembling, the combination of a support for a two-ply fabric strip, mechanism for inserting coil springs between the plies of said strip with the axes of said springs disposed crosswise of the strip, mechanism for advancing the inserted springs lengthwise of said strip, and means for forming a closed pocket around each spring at the conclusion of the advance movement.

10. In the art of spring assembling, the combination of a support for a folded two-ply fabric strip, mechanism for inserting coil springs between the plies of said strip with the axes of said springs disposed crosswise of the strip, means for uniting the free longitudinal edges of said folded strip, mechanism for advancing the inserted springs sidewise through said strip, and means for uniting the plies of said strip crosswise behind each spring at the end of the advance movement of the latter.

11. In a spring cushion assembling machine, the combination of a support for a two-ply fabric strip, a guide tube disposed within and lengthwise of said support, means for inserting coil springs into said tube, and a plunger in said tube operating to advance the springs through the latter.

12. In a spring cushion assembling machine, the combination of a support for a two-ply fabric strip, a guide tube disposed within and lengthwise of said support formed with a lateral opening, means for inserting coil springs into said tube through said opening, and a plunger in said tube operating to advance the springs through the latter.

13. In a spring cushion assembling machine, the combination of a support for a two-ply fabric strip, a guide tube disposed within and lengthwise of said support, means for inserting coil springs in flattened condition into said tube, a plunger in said tube operat-

ing to advance the springs through the latter, a holder for the expanded springs on the end of said guide tube, and an auxiliary plunger operating to push the expanded springs out of said holder.

14. In a spring cushion assembling machine, the combination of a support for a two-ply fabric strip, a guide tube disposed within and lengthwise of said support, means for inserting coil springs into said guide tube, a plunger in said guide tube, and a fabric expander located opposite the discharge end of said guide tube.

15. In a spring cushion assembling machine, the combination of a support for a two-ply fabric strip, a guide tube disposed within and lengthwise of said support, means for inserting coil springs in flattened condition into said guide tube, a plunger in said guide tube, a holder for the expanded springs on the end of said guide tube, an auxiliary plunger operating to push the expanded springs out of said holder, and a fabric expander located laterally opposite said holder.

16. In a spring cushion assembling machine, the combination of a support for a two-ply fabric strip, a guide tube disposed within and lengthwise of said support, means for inserting coil springs in flattened condition into said guide tube, a plunger in said guide tube, a holder for the expanded springs on the end of said guide tube, an auxiliary plunger for pushing the expanded springs out of said holder slidably mounted on said guide tube, and a pair of fabric expanding fingers slidably mounted on said guide tube and disposed laterally opposite said holder.

17. In a spring cushion assembling machine, the combination of a support for a two-ply fabric strip, a guide tube disposed within and lengthwise of said support, means for inserting coil springs in flattened condition into said guide tube, a plunger in said guide tube, a holder for the expanded springs on the end of said guide tube, an auxiliary plunger for pushing the expanded springs out of said holder slidably mounted on said guide tube, a pair of fabric fingers slidably mounted on said guide tube and disposed laterally opposite said holder, means actuated by said first-named plunger for advancing said auxiliary plunger and said guide fingers, and a spring for retracting said auxiliary plunger and said fingers during the return movement of said first-named plunger.

18. In a spring cushion assembling machine, the combination of a support for a two-ply fabric strip, mechanism for inserting springs between the plies of said strip, means for advancing the springs successively lengthwise of said strip, said spring-advancing means also operating through the spring to advance the fabric strip, means for tensioning said strip, and means for forming

a closed pocket around each spring at the end of the advance movement.

19. In a spring cushion assembling machine, the combination of a support for a two-ply fabric strip, mechanism for inserting springs between the plies of said strip, means for advancing the springs successively lengthwise of said strip, said spring-advancing means also operating through the spring to advance the fabric strip, friction clamps through which the plies of the strip are drawn during the advance movement thereof, and means for forming a closed pocket around each spring at the end of the advance movement.

20. In a spring cushion assembling machine, the combination of means for positioning coil springs between the plies of a two-ply fabric strip with the axes of the springs disposed crosswise of said strip, means for drawing the two plies of the strip together around the sides of said springs, and means for uniting said plies between adjacent springs.

21. In a spring cushion assembling machine, the combination of means for positioning coil springs between the plies of a two-ply fabric strip with the axes of the spring disposed crosswise of said strip, co-operating clamps operative to fold the plies of the strip around the sides of said springs, and means for stitching said strips together opposite the meeting edges of said clamps.

22. In a machine of the character described, a conveyor for a two-ply fabric strip comprising supports for the edge portions of the strip, and endless conveyor elements movable over said supports equipped with pins adapted to pierce the fabric.

23. In a machine of the character described, a conveyor for a two-ply fabric strip comprising longitudinally channeled supports for the edge portions of the strip, and endless conveyor elements movable over said supports equipped with pins adapted to pierce the fabric and travel through the channels of said supports.

24. In a machine of the character described, a conveyor for a folded two-ply fabric strip comprising a support for the folded edge of the strip, spaced supports for the free edges of the strip, and endless chains movable over the respective supports equipped with pins adapted to pierce the fabric.

25. In a machine of the character described, a conveyor for a folded two-ply fabric strip comprising a longitudinally channeled support for the folded edge of the strip, spaced longitudinally channeled supports for the free edges of the strip, and endless chains movable over said supports equipped with pins adapted to pierce the fabric and travel through the channels of said supports.

26. In a machine of the character de-

scribed, the combination of a support for a folded two-ply fabric strip, means maintaining the free edges of the plies spaced apart, means beyond said spacing means for uniting said free edges to form a fabric tube, means for inserting coil springs between said free edges, and means for pushing the inserted springs into said tube.

27. In a machine of the character described, the combination of a support for a folded two-ply fabric strip, means maintaining the free edges of the plies spaced apart, means beyond said spacing means for uniting said free edges to form a fabric tube, means for inserting coil springs endwise between said free edges, means for successively pushing said springs sidewise into said tube, and means for cross-stitching said tube between adjacent springs to form individual pockets around said springs.

28. In a machine of the character described, the combination of a conveyor for a two-ply fabric strip operative to maintain the plies spaced apart at one edge of the strip, a spring conveyor opposite the spaced edge of said strip and means operating to successively force the springs from said conveyor between the plies of said strip.

29. In a machine of the character described, the combination of a conveyor for a two-ply fabric strip operative to hold the plies spaced apart at one edge of the strip, a spring conveyor opposite the spaced edge of said strip carrying saddles to receive springs and a reciprocating plunger operating to successively push the springs endwise off said saddles and between the plies of said strip.

30. In a machine of the character described, the combination of a conveyor for a two-ply fabric strip operative to hold the plies spaced apart at one edge of the strip, a spring guide disposed lengthwise of and between the longitudinal margins of said conveyor, a spring conveyor opposite the spaced edge of said strip, a plunger operating to successively force the springs from said spring conveyor into said guide, and a plunger operative to force the springs through said guide.

31. In a machine of the character described, the combination of a conveyor for a folded two-ply fabric strip operative to maintain the free edges of the plies spaced apart, a spring guide disposed lengthwise of and between the longitudinal margins of said conveyor, a spring conveyor opposite the free edges of said strip, a stitcher operative to unite the free edges of said strip beyond said spring conveyor, a plunger operating to successively force the springs endwise from said spring conveyor into said guide, and means operative to force the springs through said guide and deposit them between the plies of said strip.

32. In a machine of the character described, the combination of a conveyor for a folded

two-ply fabric strip operative to hold the free edges of the plies spaced apart, a tubular spring guide disposed lengthwise of and between the longitudinal margins of said conveyor, a spring conveyor opposite the free edges of said strip, a stitcher operative to unite the free edges of said strip beyond said spring conveyor, a plunger operating to successively compress and force the springs from said spring conveyor into said guide, means operative to force the springs through said guide and deposit them between the plies of said strip, and means for cross-stitching the strip behind the deposited springs.

33. In the art of spring assembling, the combination of a support for a two-ply fabric strip, means for inserting springs between the plies of said strips, means for forming single cross-seams between adjacent springs, and means for forming double cross-seams at predetermined intervals between adjacent springs.

34. In the art of spring assembling, the combination of a support for a two-ply fabric strip, means for inserting springs between the plies of said strip, means for forming single cross-seams between adjacent springs, means for forming double cross-seams at predetermined intervals between adjacent springs, and means for severing the strip between the individual seams of said double cross-seams.

35. In a machine for making spring-filled fabric strips, the combination of a support for a two-ply fabric strip, means for inserting springs side by side between the plies of said strip, a sewing machine mounted to reciprocate crosswise of said strip, said sewing machine being equipped with a pair of spaced needles, means for advancing said strip past said sewing machine, means for operating one of said needles at each travel of said sewing machine, and means for operating the other needle at predetermined intervals whereby to form a double seam.

36. In a machine for making spring-filled fabric strips, the combination of a support for a two-ply fabric strip, means for inserting springs side by side between the plies of said strip, a sewing machine and means for reciprocating the same crosswise of said strip, said sewing machine being equipped with a continuously operating needle and a spare needle, means for advancing said strip past said sewing machine, and means for coupling said spare needle to said continuously operating needle at predetermined intervals whereby to form a double seam.

37. In a machine for making spring-filled fabric strips, the combination of a support for a two-ply fabric strip, means for inserting springs side by side between the plies of said strip, a sewing machine and means for reciprocating the same crosswise of said strip, said sewing machine being equipped

with a continuously operating needle and a spare needle, means for advancing said strip past said sewing machine, and automatic means for coupling said spare needle to, and uncoupling it from, said continuously operating needle at predetermined intervals whereby to form a double seam.

38. In a machine for making spring-filled fabric strips, the combination of a conveyor for a two-ply fabric strip, means for inserting springs between the plies of said strip, means for successively advancing said springs lengthwise of the strip to final position in the latter, said spring-advancing means also operating to advance the portion of the strip extending beyond said strip conveyor, means for cross-stitching the strip between adjacent springs including means for forming double cross-seams at intervals, and a fabric strip conveyor drive including means for accelerating the speed of said drive at intervals corresponding to the formation of said double cross-seams whereby to provide the extra length of fabric required for said double cross-seams.

39. In a machine for making spring-filled fabric strips, the combination of a conveyor for a folded two-ply fabric strip, means for inserting springs between the plies of said strip, a longitudinal stitcher beyond said conveyor and spring inserting means for uniting the free edges of the strip, means for successively advancing the springs through the closed portion of said strip to final position in the latter, said spring-advancing means also operating to advance the portion of the strip extending beyond said strip conveyor, a cross-stitcher for forming seams between adjacent springs including means for forming double seams at intervals, and driving means for said conveyor and said longitudinal stitcher including means for accelerating the speed of said driving means at intervals corresponding to the formation of said double seams whereby to provide the extra length of fabric required for said double seams.

40. A method of producing a spring cushion strip, which consists in inserting springs successively between the plies of a tubular fabric strip, pushing said springs successively through said strip to final position therein, and cross-stitching said strip behind each spring.

41. A method of producing a spring cushion strip, which consists in inserting coil springs successively between the plies of a tubular fabric strip with the axes of said springs disposed crosswise of the strip, pushing said springs sidewise successively through said strip to final position therein, and cross-stitching said strip behind each spring prior to the deposit of the next spring.

42. A method of producing a spring cushion strip, which consists in advancing a fold-

ed two-ply fabric strip endwise with its free margins spaced apart, inserting springs through said spaced margins between the plies of the strip, uniting said margins beyond the point at which the springs are inserted to form a tubular portion, pushing said springs through said tubular portion to final position therein, and cross-stitching said tubular portion between adjacent springs.

43. A method of producing a spring cushion strip, which consists in advancing a folded two-ply fabric strip endwise with its free margins spaced apart, inserting coil springs successively through said spaced margins between the plies of the strip, uniting said margins beyond the point at which the springs are inserted to form a tubular portion, pushing said springs successively through said tubular portion to final position therein, and cross-stitching said tubular portion behind each spring prior to the deposit of the next spring.

44. The herein described method of producing spring cushion strips, which consists in inserting springs successively between the plies of a relatively long tubular fabric strip, pushing said springs successively through said strip to final position therein, uniting the plies of the strip by a single cross-seam behind each spring, and at uniform intervals uniting the plies of the strip by a double cross-seam in lieu of a single seam.

45. The herein described method of producing spring cushion strips, which consists in inserting coil springs successively between the plies of a relatively long tubular fabric strip with the axes of said springs disposed crosswise of the strip, pushing said springs sidewise successively through said strip to final position therein, uniting the plies of the strip by a single cross-seam behind each spring, and at uniform intervals uniting the plies of the strip by a double cross-seam in lieu of a single seam and simultaneously severing the strip between the individual seams of said double cross-seam.

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