Jan. 20, 1953 E. L. BRONSTIEN ET AL 2,625,963

SPRING ASSEMBLING MACHINE

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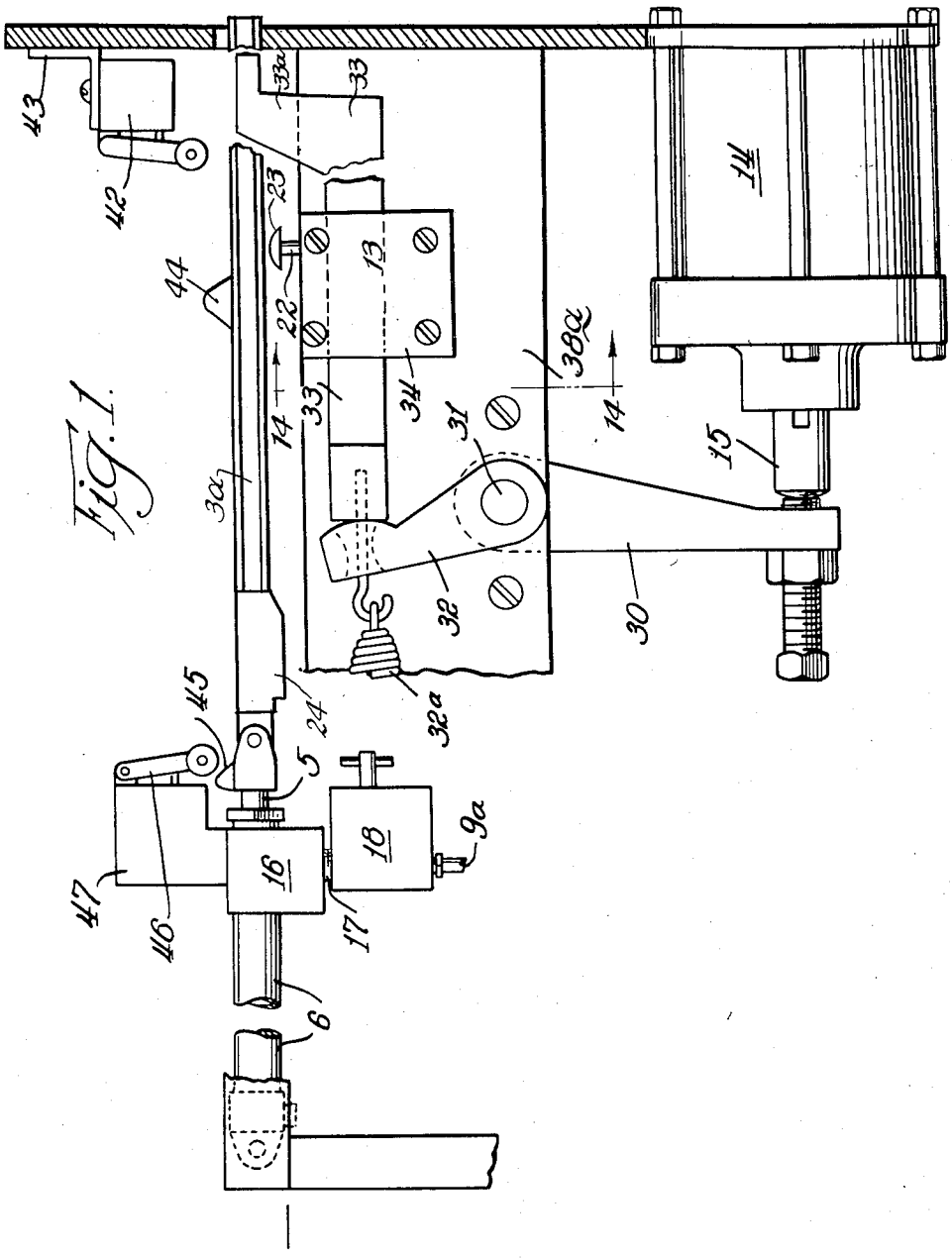


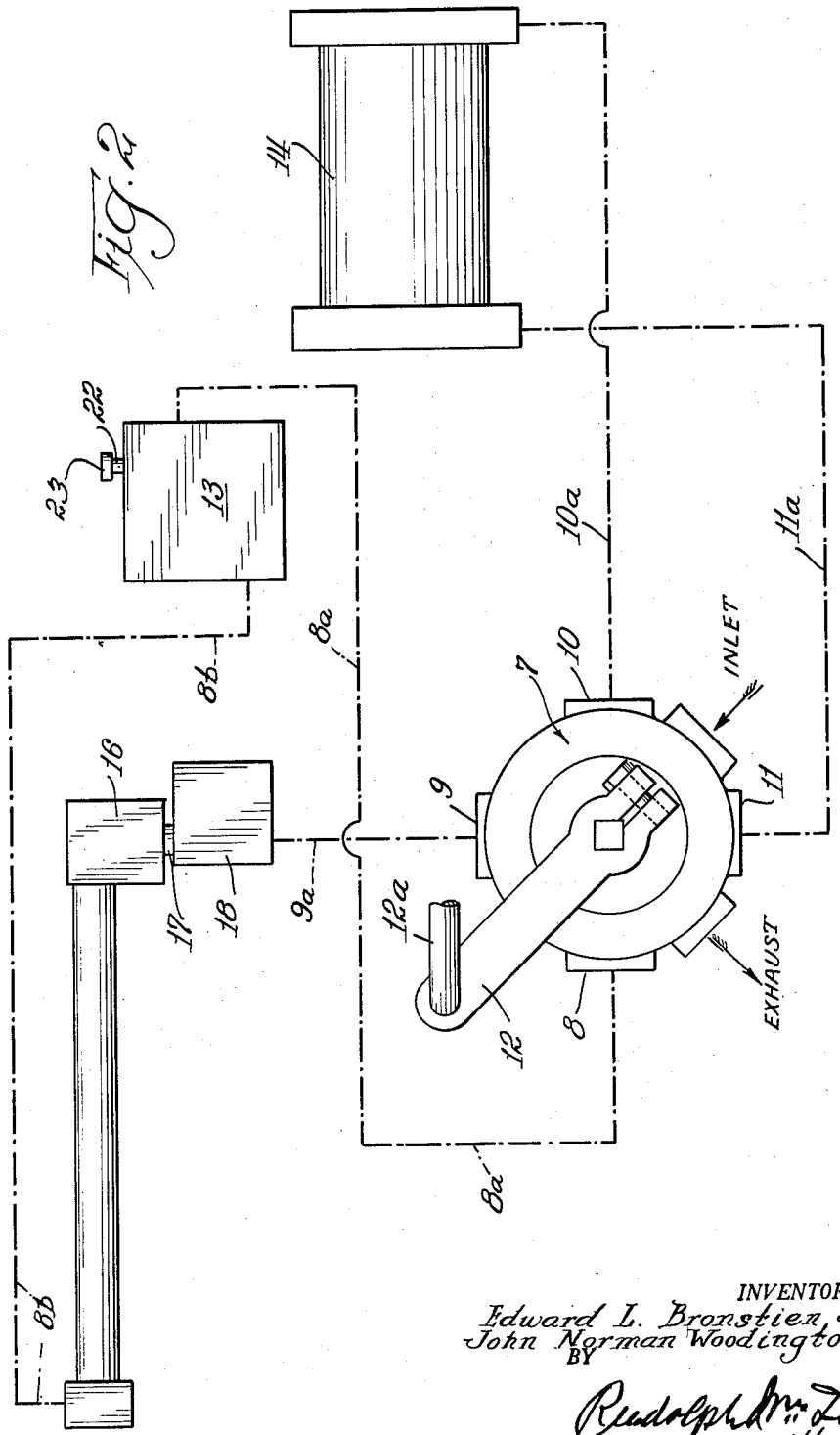
Fig. 1.

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SPRING ASSEMBLING MACHINE

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SPRING ASSEMBLING MACHINE

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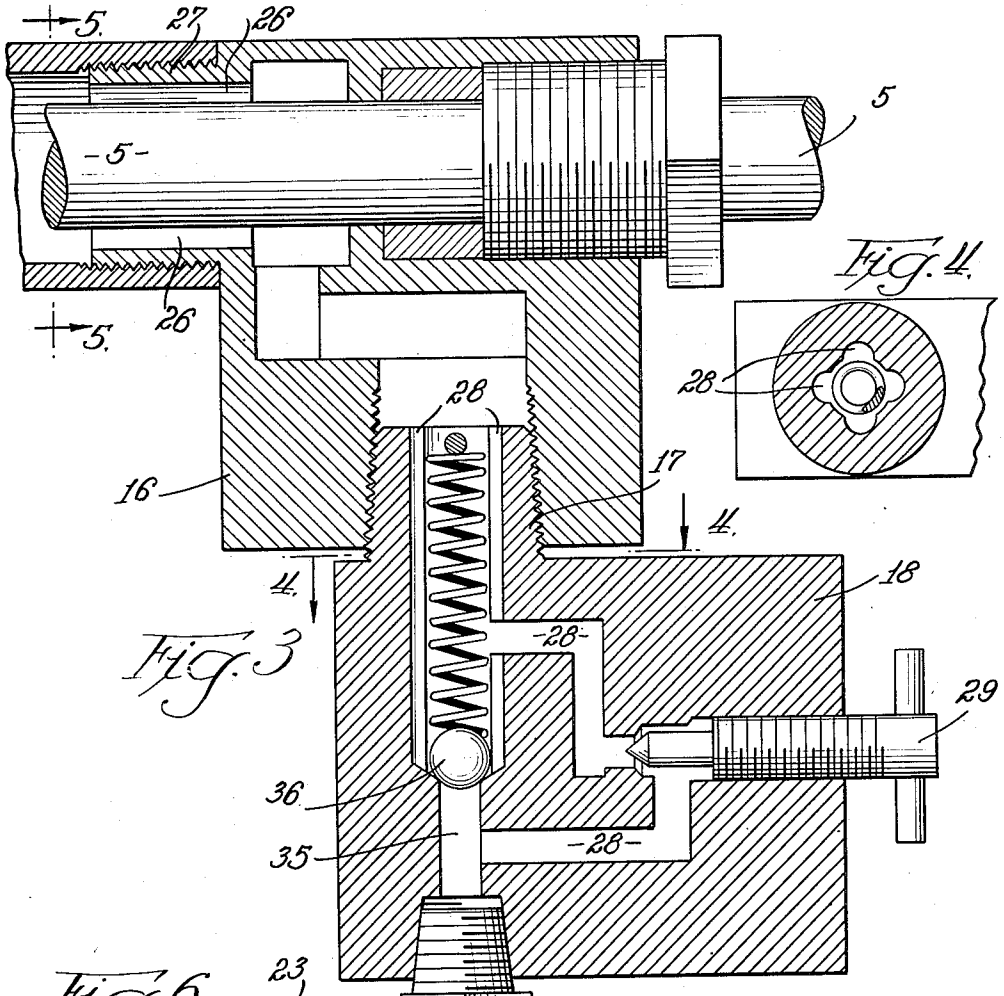


Fig. 3

Fig. 4.

Fig. 6.

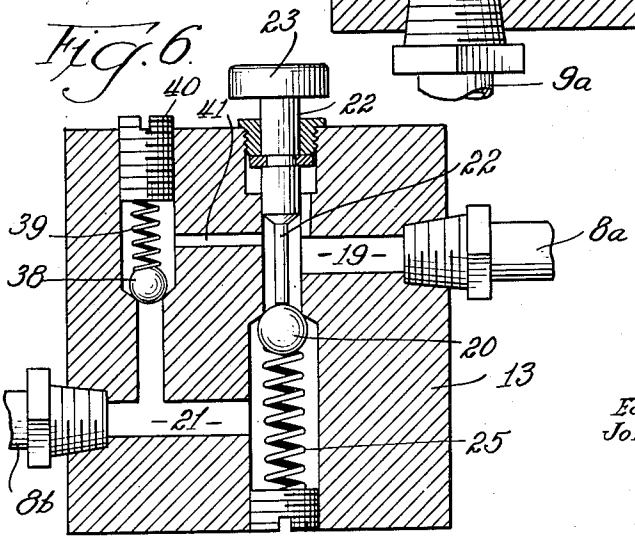
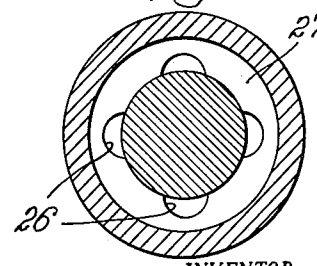


Fig. 5.



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SPRING ASSEMBLING MACHINE

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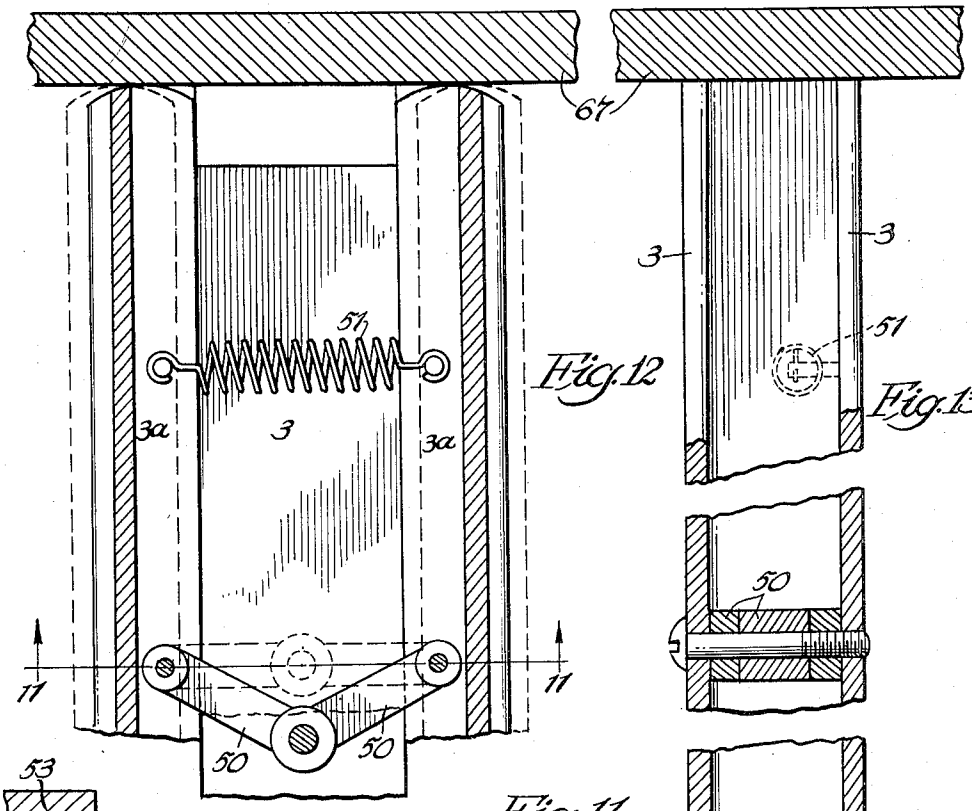
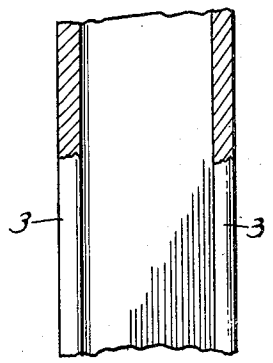


Fig. 12

Fig. 13



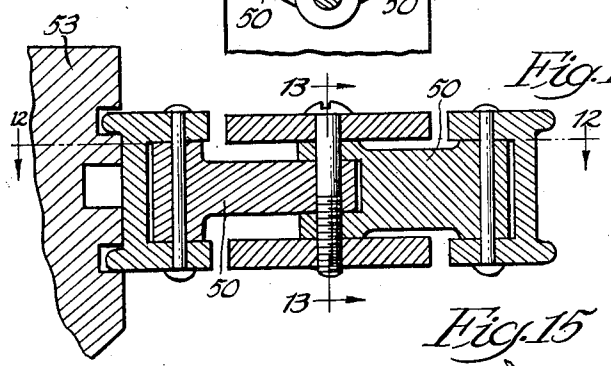
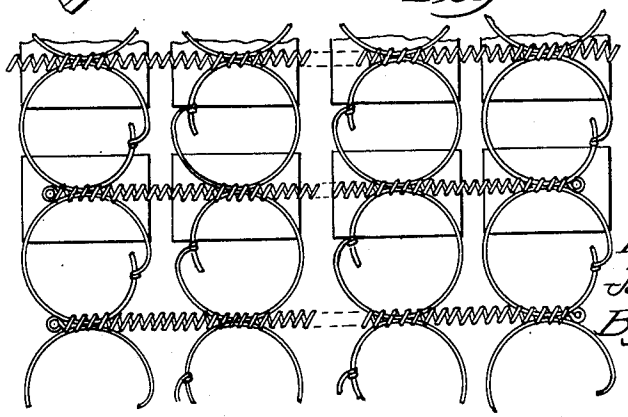


Fig. 11

Fig. 15



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SPRING ASSEMBLING MACHINE

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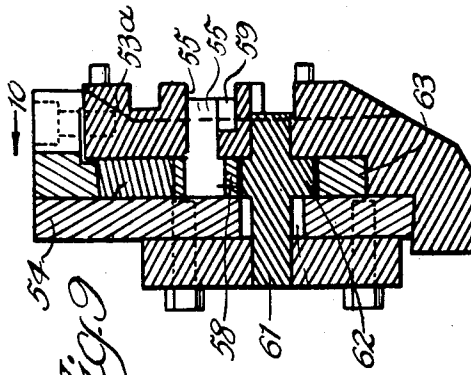


Fig. 9

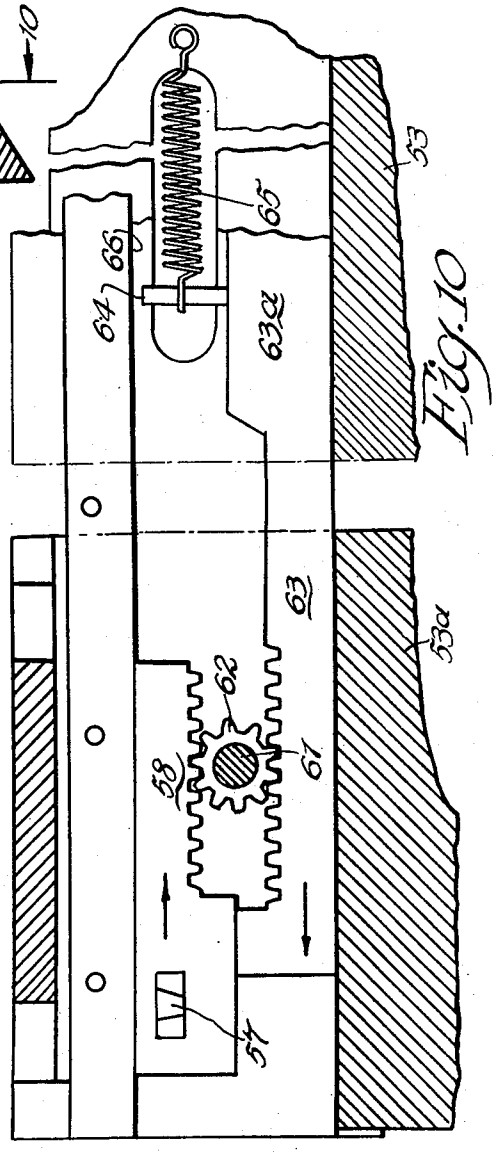


Fig. 10

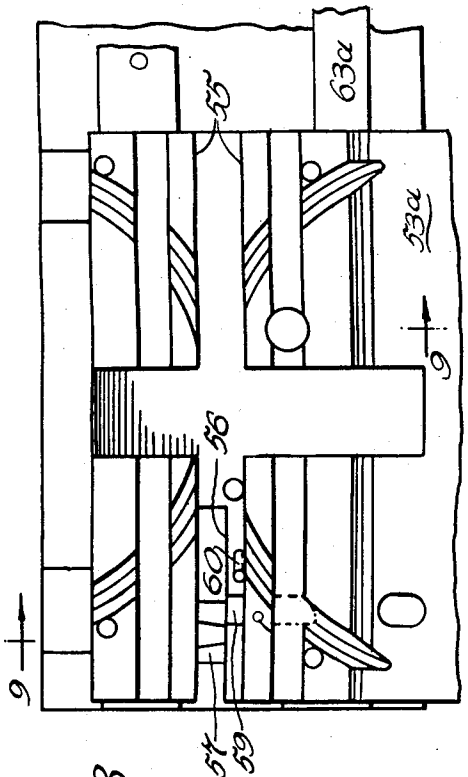


Fig. 8

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Fig. 7

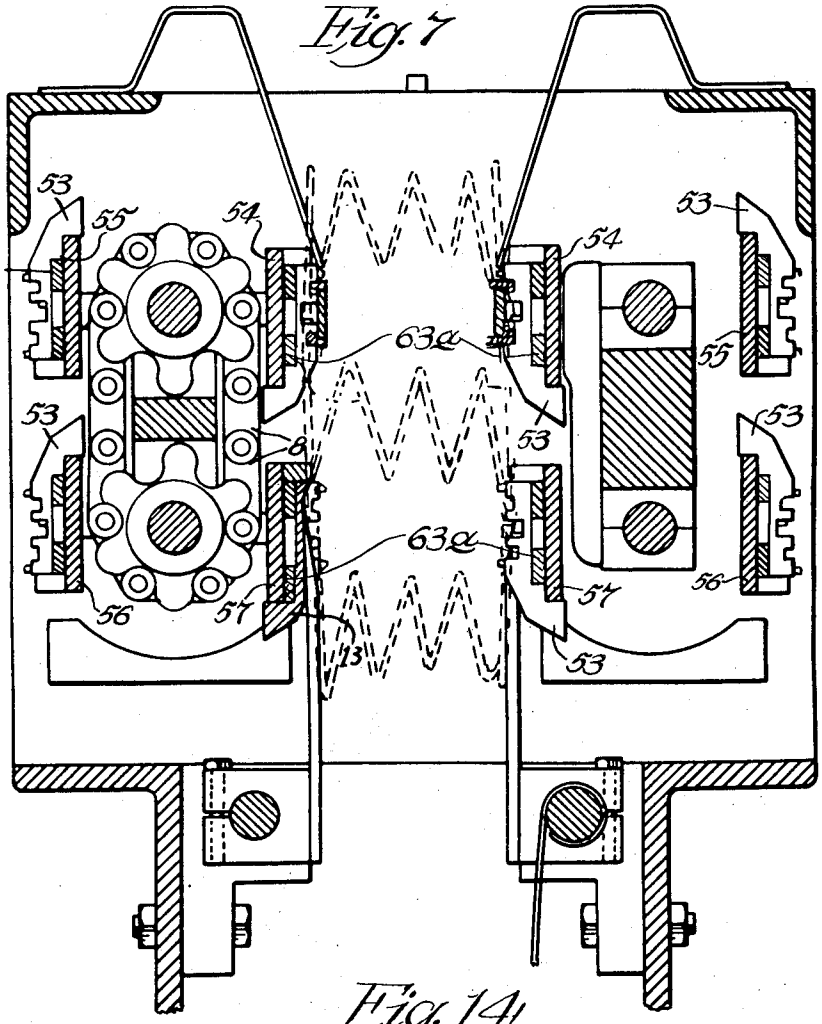
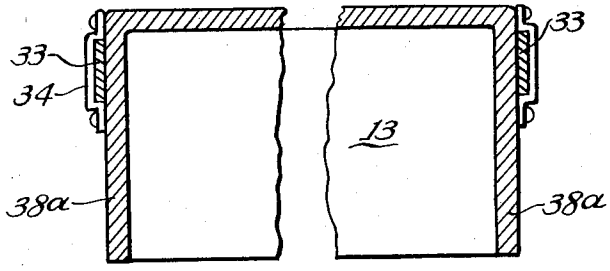


Fig. 14



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Patented Jan. 20, 1953 2,625,963

UNITED STATES PATENT OFFICE

2,625,963

SPRING ASSEMBLING MACHINE

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Application May 16, 1950, Serial No. 162,252

7 Claims. (Cl. 140—92.7)

1

This invention relates to improvements in the machine described and claimed in Letters Patent of the U. S. No. 2,351,659, dated June 20, 1944; and in part to improvement in the machine described and claimed in our pending application, Serial No. 72,282 filed January 24, 1949, the subject matter of which relates to first improvements of the machine of the aforesaid patent, which consist of the substitution of electric motor actuation for the manually operated part of the left-hand end portion of the patented machine; thereby to speed up operation of the same, as more fully pointed out hereinafter, and in including in the right-hand end portion thereof, tie-wire trimming mechanisms which are automatically actuated by the aforesaid manually operated part of the original machine.

In the instant application, the electric motor actuated part of the machine of application, Serial No. 72,282, is replaced by a far more simple and efficient pneumatically actuated mechanism, which performs the same functions as said motor actuated mechanisms of the pending application but in an entirely different manner.

A suitable embodiment of the present invention is illustrated in the accompanying drawings wherein:

Fig. 1 is a fragmentary side elevation of the end portion of the machine of said pending application showing the pneumatic substitute for the previous electrically actuated means for actuating the clamping bar structure also shown and the tie-wire trimming mechanisms not shown.

Fig. 2 is a diagrammatic view showing parts of said substitute pneumatically actuated mechanism in elevation, and the piping system thereof in dot and dash lines.

Fig. 3 is a fragmentary enlarged detail, vertical, longitudinal, sectional view taken in the vertical plane of the axis of the top cylinder of the actuating mechanism, the piston of which actuates the clamping bar structure; and also illustrating the valve controlled ducts associated with the said cylinder and another cylinder shown in Figs. 1 and 2.

Fig. 4 is a fragmentary detail view, partly in section, taken on the line 4—4 of Fig. 3.

Fig. 5 is a detail sectional view taken on the line 5—5 of Fig. 3.

Fig. 6 is a vertical, longitudinal, sectional view, on an enlarged scale, through the valve casing which is connected with the left-hand end portion of cylinder mentioned in the brief description of Fig. 3.

Fig. 7 is a cross-sectional view of the right-

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hand end portion of the machine, which corresponds, in part, with Fig. 5 of Patent No. 2,351,659, and is a substantial duplicate of Fig. 5 of the aforesaid pending application except as to omission of some parts and except as to reference characters applied.

Fig. 8 is a face view of one of the terminal spring end-coil engaging blocks of the machine of application No. 72,282, except as to reference characters applied, and is a duplicate of Fig. 20 of the latter.

Fig. 9 is a cross-sectional view taken on the line 9—9 of Fig. 8, and is a duplicate of Fig. 8, and is a duplicate of Fig. 21 of application No. 72,282.

Fig. 10 is a sectional view taken on the line 10—10 of Fig. 9 and is a duplicate, in part, of Fig. 22 of application No. 72,282.

Fig. 11 is a fragmentary, detail, vertical, transverse, cross-sectional view, similar to Fig. 7, through the uppermost pair of opposed spring carriers of the same, including a cross-sectional view of a clamping bar structure engaged with said carriers.

Fig. 12 is a fragmentary plan sectional view of the clamping bar structure only, taken on the line 12—12 of Fig. 11.

Fig. 13 is a fragmentary, central, vertical, longitudinal, sectional view taken on the line 13—13 of Fig. 11.

Fig. 14 is a fragmentary, vertical, cross-sectional view, on an enlarged scale, taken on the line 14—14 of Fig. 1.

Fig. 15 is a fragmentary plan view of a spring assembly.

Reference is made hereinafter to several figures of the drawings of Patent No. 2,351,659 instead of including similar figures of the drawings of application No. 72,282, as the reader hereof must study said patent in order to understand fully the machine of the instant invention, the duplicates of figures of the drawings of application No. 72,282 included in the instant application being only those which are needed for full understanding of the instant invention.

One of the advances in the art embodied in the machine of application No. 72,282 lies in equipping the machine of the patent with tie-wire trimming mechanisms, and in effecting operation of the latter automatically at a given point in the cycle of operations by the power actuated means of the instant machine or that of the machine of application No. 72,282, since automatic trimming operations eliminate two manual trimming operations for each tie-wire. The smallest

number of tie-wires included in a spring assembly of standard length is thirty-four, and the automatic trimming of the ends of all thereof by power actuated means thus not only saves sixty-eight manual operations, but also eliminates added handling of the assembly after the same is discharged from the machine.

No patentable novelty over either the machine of Patent No. 2,351,659, nor that of the disclosure of application, Serial No. 72,282, is claimed for anything illustrated in Figs. 7 to 15 of the instant drawings except as to corrective matter included in Figs. 1 and 11 to 13 inclusive.

Having studied Patent No. 2,351,659, the reader hereof will note at once that the carrier bars and blocks mounted thereupon differ from those of said machine, the only important difference being that the said blocks, shown in Figs. 7 to 11 of the instant drawings, are equipped with channels in their rear faces.

The terminal blocks of each row, in the instant machine, are equipped with mechanisms which cut off surplus end portions of the tie-wires and thereafter convert the remaining terminal coils of the latter into closed loops, as shown in Fig. 15, and explained briefly hereinafter.

As the instant invention relates only to the improvements over the machine of said pending application and resides in substituting the pneumatically actuated mechanism of Figs. 1 to 6 of the instant drawings for the complex power mechanism of the pending application, former will be first described in connection with certain structural details of parts actuated thereby.

In Fig. 1 of the instant drawings, only the left-hand end plate 1 of the right-hand end portion of the machine is shown, the latter being provided with the opening through which the clamping bar structure 3–*a* moves into and out of its operative positions, as in the patented machine.

In the instant machine, the laterally movable channeled members 3*a* are connected with a plunger 3, disposed between them, by means of pairs of toggle links 50 and tension springs 51 (Figs. 11–13) as later described.

The left-hand end of the plunger 3 is secured rigidly to the outer end of the piston rod 5 of the cylinder 6 (Fig. 1), the said plunger 3 being equipped with a short downwardly projecting longitudinal rib 24, the purpose of which is described hereinafter.

The cylinder 6, and other parts of the pneumatically actuated mechanism, are suitably mounted upon parts of the frame of the machine, as described later herein, the casing 7 of a plural-way rotatable valve, operable by the lever 12 and rod 12*a*, being one of said parts.

The valve casing 7 is equipped with an inlet port suitably connected with a source of supply of compressed fluid, an exhaust port, both as indicated in Fig. 2; and with ports 8, 9, 10 and 11, respectively, which are connected, directly or indirectly, with the cylinders 6 and 14, respectively, as next described herebelow. The cylinders 6 and 14 are fluid cylinders having ports opening into the cylinders on each side of the pistons disposed therein.

The cycles of operations of the two earlier, and the instant machine, are substantially alike, because in each of them the clamping bar structure is disposed initially at the left-hand limit of its movement and a pair of opposed spring carriers are then disposed in spring receiving position.

The first operation in each instance is the manual insertion, by the operator, of a row of springs into the machine.

Next the operator causes the clamping bar structure to be moved into operative position at the right-hand limit of its movement, and while it remains in that position, the operator inserts a pair of tie-wires into the tie-wire feed mechanisms of the machine, which are actuated by a reversible electric motor at the right-hand end of the machine.

Next, the operator causes the clamping bar structure to be returned to the left-hand limit of its movement, and in the case of the patented machine, throws in a clutch which connects the last-named electric motor with the shifting mechanism of the machine and thus completes the cycle.

The operator may be required to reverse the electric motor before the clamping bar structure begins travel to the left in the event that a tie-wire shall not have been projected throughout its length into the machine.

To do this, she merely presses and holds down the spring-held push button of an electric switch which causes reverse rotation of the motor shaft so long as said button remains depressed.

In the instant machine, each cycle of operations begins with having the lever 12 of the valve 7 in the position of Fig. 2, the clamping structure 3—3*a* being then disposed at the left-hand limit of its movement, as shown in Fig. 1.

While the above named parts remain in said last-named position, the port 9 is connected with the compressed air inlet port, and via pipe 9*a* and valve casing 13 (Fig. 3) compressed air remains in the right-hand end of cylinder 6 to hold the piston rod 5 at the left-hand limit of its movement, together with the clamping bar structure 3—3*a* (Fig. 1).

The plunger 22 of valve casing 13 is at the upper limit of its movement, the right-hand end of cylinder 6 is connected with port 8 and the exhaust port of casing 7.

Also, the port 10 of casing 7 is now connected with the exhaust port and, via pipe 10*a*, with the right-hand end of cylinder 14; port 11 being then connected with the inlet port, and, via pipe 11*a*, with the left-hand end of cylinder 14, and thus maintains the piston of the latter at the left-hand limit of its movement.

While the piston rod 5 is moving to the left, the air from the left-hand end of cylinder 13 is flowing through the valve casing 13 past the check-valve 38, and thus through pipe 8*a* to exhaust port of casing 7 (Fig. 6).

The duct 41 of casing 13 is of far smaller cross-sectional area than the duct 35 of casing 13 which duct is open due to the opening of valve 36 when the piston rod is being moved to the left (Fig. 3) and thus exhaust of air from the left-hand end of cylinder 6 is far slower than entry of compressed air into the right-hand end of cylinder 6, particularly because the flow of exhaust air into said duct 41 is resisted by the valve 38. Thus a counter-pressure of air in left-hand end of cylinder 6 is built up progressively to an increasing degree to decrease the speed of travel of the structure 3—3*a* to its left-hand limit.

In the machine of the pending application, Serial No. 72,282, the reversible electric motor which actuates the tie-wire feed mechanisms, is connectible via a clutch with the shifting mechanisms, said clutch being thrown in automatically by a solenoid to cause the shifting mech-

anism to be actuated, and in the instant machine, this is done similarly by the closure, for an instant, of the circuit through said solenoid, via actuation of the lever 46 of the switch 47 (Fig. 1) by means of a projection of suitable type mounted upon the right-hand end portion of the piston rod 5 of cylinder 6.

The manner or means whereby this automatic actuation of the shifting mechanism is effected, is not shown, because, per se, no patentable novelty is claimed therefor.

The motor of the patented machine operates continuously during period of operation of the machine, but in the instant machine, as also in that of the pending application, the said motor (not shown) is caused automatically to operate only during a portion of each complete cycle of operations by closing the circuit thereof in the instant machine via the switch 42 by means of the projection 44 on the plunger 3, as the latter moves to the right and, as in the machine of the pending application, effecting opening of the motor circuit automatically at the instant that the shifting of the carriers has been effected, said last-mentioned means being omitted from illustration because, per se, it lacks patentable novelty.

After the operator has inserted another row of springs into the machine, the lever 12 is turned clockwise to vertical position, and thus the port 9 becomes connected with the exhaust port of casing 7; port 8 becomes connected with the inlet port, and then compressed air passes through valve casing 13 from right to left around the valve 20, which is forced off of its seat by the pressure, and via pipe 8b into left-hand end portion of cylinder 6, to cause the piston rod 5 and clamping bar structure to move to the right.

The plunger 3 is equipped at its left-hand end with a rib 24, which may be of any desired length, and as said plunger 3 attains the right-hand limit of its movement, said rib 24 rides upon the plunger 22 of valve casing 13 and thus the check-valve 20 is, which was previously unseated by the source pressure, will be held open until the plunger 3 is moved to the left.

During movement of piston rod 5 to the right, air in the right-hand end portion of cylinder 6 is forced through the valve casing 18, via the duct 28, the latter being choked between its ends by the needle valve 29 to limit speed of travel of the piston rod 5 and structure 3—3a to a predetermined degree throughout the length of their travel to the right.

Next, the operator inserts another pair of tie-wires into the machine, and then swings lever 12 clockwise through an arc of 45° and leaves it in that position for only a fraction of a second, during which the port 10 is connected with the inlet port of casing 7, and port 11 is connected with the exhaust port. Then the piston rod 15 is moved to the left with the result that the tie-wire trimming mechanisms (Figs. 8, 9 and 10) are actuated as hereinafter more fully described.

The operator returns the lever 12 to the position of Fig. 2, and thus compressed air from port 9 of casing 7 again flows into the right-hand end of cylinder 6 through valve 36, which has been opened by the pressure differential developed across needle valve 39, and through duct 28 to cause the structure 3—3a to travel to the left and causes air in the left-hand end of cylinder 6 to flow freely around valve 20 and through duct 21 of casing 13 and thence to exhaust until the rib 24 has passed the head 23 of plunger 22 to effect reseating of the valve 20, whereupon the compressed air continues to pass through valve casing 13 via duct 41 and around valve 38, which is opened by the pressure built up in the left-hand end of the cylinder 6; and during this initial part of its stroke to the left, the structure 3—3a moves swiftly, and thereafter progressively more slowly, as explained hereinabove, to its left-hand limit. As it has almost attained that limit, the projection 45 on the piston rod (Fig. 1) closes the circuit of the aforesaid solenoid for an instant, and thus causes the shifting mechanism to be actuated; the machine being then ready for another cycle of operations. Also when the operator returns the lever 12 to the position shown in Fig. 2, the port 10 is connected with the exhaust port and the port 11 is connected with the inlet port to move the piston 15 in cylinder 14 to the right so that the piston 15 and cylinder 14 will be in the proper position for the next cycle of operation.

Extending to the left of the frame plate 1 (Fig. 1) is an inverted channel member 38a upon which a rock shaft 31 is suitable mounted. A depending lever 30 is rigid with the middle portion of said shaft 31 upon the projecting end portions of which a pair of arms 32 are rigidly mounted, the upper end portions of the latter being opposed to the outer ends of a pair of reciprocable plungers 33 which are held by tension springs 32a at the outer limit of their movement. The tension springs 32a move the reciprocable plungers 33 to the left when the lever 12 is in the position shown in Fig. 2 and the piston 15 is in its right-hand position. The force applied to the reciprocable plungers 33 from the piston 15, when the lever 12 is swung to its extreme right-hand position, as previously explained, is sufficient to overcome the forces of springs 32a and move the reciprocable plungers to the right. Guide members 34 for said plungers 33 are mounted upon the frame member 38.

The formation 33a at the right-hand end of each plunger 33 operates a plunger of one pair of the tie-wire trimming mechanisms of the machine when said plunger is moved to the right by the said arm 30 when the piston rod 15 of cylinder 14 is projected to the left.

The said member 38a extends to and is connected at its left-hand end with post 38b (Fig. 1), which rests upon the floor, and to which the left-hand end portion of cylinder 6 is secured; the right-hand head 16 of the latter, the valve casings 18, 7 and 13, being suitably secured to and supported upon the member 38a, it being obvious that the cylinder 14 may also be suitably secured to the latter or to a part of the machine frame below the right-hand end portion thereof.

In Fig. 7, the spring end-coil engaging blocks 53, including terminal blocks 53a (Figs. 8–10), are mounted upon the carrier bars 54—57, the block 53a of Fig. 8 being the one mounted upon the right-hand bar 54 of Fig. 7 at the far end of the same.

Each block 53a is equipped with a tie-wire trimming mechanism in one end portion thereof.

Each block 53a of every one of said carrier bars shown in Fig. 8, is disposed next adjacent to right-hand end plate of machine frame (to the right of the frame plate 1 of Fig. 1).

As shown in Fig. 8, in the left-hand end portion of the tie-wire guide channel 55 of the block 53a, there is a longitudinal slot 56, through which projects a member 57 which is rigidly mounted

upon a reciprocable rack bar 58 (Fig. 9) disposed in the back channel of said block.

Rigidly mounted in the lower wall of the said guide channel 55, flush at its upper end with a wall of the slot 56, is a shear member 59, and to the right of the latter and also mounted rigidly in the lower wall of channel 55, is a stop member 60 for a coil of a tie-wire disposed in said channel.

The member 57 is equipped along its lower end with a shear edge, which, when said member moves to the right, cooperates with the shear member 59 to cut a tie-wire, and then, as it passes the member 60, it cooperates with the stop member 60 to form a terminal loop in the tie-wire.

As shown in Fig. 10, the rack bar 57 meshes with a gear pinion 61 on a shaft 62, the latter being also shown clearly in Fig. 9, as being journalled, in part, in the block 53*a* and, in part, in a block 53*b*, which is mounted upon the back face of the carrier bar 54—57, for longitudinal adjustment thereupon.

Pinion 61 meshes with the rack bar 63, which constitutes one end portion of a bar or connecting rod 63*a*, which extends through all of the back channels of the blocks 53 interposed between the terminal blocks 53*a* of each row.

The portion 63*a* of the rack bar 63, disposed within the back channel of the other terminal block 53*a*, is just a plain bar, quadrangular in cross-section, which carries a member 57 projecting through a slot in the terminal block next adjacent the frame plate 1 of Fig. 1 and is directly opposed to the terminal of one of the plungers 33 (Fig. 1).

The member 57, last mentioned, is associated, of course, with a rigid shear member 59 and a stop member 60, so that when the same is moved to the right by a plunger 33, the left-hand end portion of a tie-wire will be trimmed in unison with trimming of the right-hand end of same by the member 57 mounted upon the rack bar 58.

The tie-wire trimming mechanisms above described briefly, are more fully illustrated in drawings of the pending application and described in greater detail, but since said trimming mechanisms, per se, cannot be made subject-matter of any claim of this application, the illustration and brief description included herein is deemed sufficient to meet requirements.

Fig. 10 of the instant drawings includes a fragmentary view of the block 53 next adjacent to the block 53*a* and indicates that the portion 63*a* of the rack bar 63 is rectangular in cross section and integral with the latter, and also that the same is equipped with a projection 64 connected with one end of a tension spring 65. The latter is disposed, in part, in a longitudinal slot 66 in the carrier bar, the other end of said spring being secured to the bar at one end of said slot 66.

Check valve 20 of casing 13 (Fig. 6) is held seated by the compression spring 25, and valve 38 is held seated by spring 39, the pressure of which is adjustable via the screw plug 40, the spring 25 being adjustable by a similar plug.

As shown in Figs. 3 and 5, the piston rod 5 passes through a bearing member 26 in the right-hand end portion of cylinder 6, said member being provided with small air ducts 27 which limit the volume of air capable of passing into and out of said cylinder under a given pressure and time period.

Similar ducts 28 also border the inner end portion of the needle valve 29 between the seat for same and the threaded end portion thereof (Fig. 5).

As shown in Fig. 12, the channel bars 3*a* are held in contact with side edges of the plunger 3 by the springs 51, until the right-hand ends of the bars 3*a* abut the right-hand end plate 67 of the machine, while the plunger 3 completes its movement to the said end plate 67 to cause the toggle links 50 to move the bars 3*a* to the outer limits of their movement into channels of the spring carriers 53 and 53*a*. A plurality of spaced apart pairs of toggle links 50, alternated with springs 51, are provided.

From the foregoing description it should be apparent that the operational sequence of the spring assembly machine herein disclosed is as follows. Assuming two rows of springs have been inserted in the spring carriers, the operator first swings lever 12 from the position shown in Fig. 2 to a vertical position. This moves the piston rod 5 and channel members 3*a* to the right. As the channel members move to their clamping position projection 44 closes switch 42 to operate the tie-wire feeding mechanism to feed tie-wires into the machine. At this point the operator inserts another row of springs into the machine. The operator then swings lever 12 to the right for an instant and returns it to the vertical position. The right-hand movement of lever 12 moves cylinder 15 to operate the tie-wire trimming mechanism, which trims the ends of the helical tie-wires. The lever 12 is then moved to the position shown in Fig. 2 and this causes the piston 5 and channels 3*a* to move to the left. When the channels are being withdrawn the projection 45 closes switch 47 to operate the shifting mechanism and move the spring carriers.

This application is a continuation-in-part of our prior application Serial No. 775,346, filed September 20, 1947 and now abandoned.

We claim as our invention:

1. Pneumatic actuating mechanism for use with a spring assembly machine having clamping bars and a tie-wire trimming mechanism, which pneumatic actuating mechanism operates the clamping bars and tie-wire trimming mechanism, said pneumatic actuating mechanism comprising a first cylinder equipped with a reciprocable first piston connected with one end of the clamping bars, a manually operated plural way valve having an exhaust port and connected with a source of supply of compressed fluid and with the ends of said first cylinder, a first valve casing connected between said plural way valve and one end of said first cylinder, a first check valve in said first casing adapted to be opened when pressure is supplied to said first casing from said plural way valve, a needle valve disposed within a first duct paralleling said first check valve, said needle valve being open at all times, a second valve casing connected between said plural way valve and the other end of said first cylinder, a second check valve in said second casing adapted to be opened when pressure is supplied to said second casing from said plural way valve, a third check valve disposed within a second duct paralleling said second check valve, said third check valve being adapted to be opened when the pressure in said other end of said first cylinder is greater than the pressure in the connection of said plural way valve to said second casing, a plunger disposed in said second casing and engaging said second check valve, a rib movable with said clamping bars and

adapted to engage said plunger to hold said second check valve open when said clamping bars and said first piston are moved to substantially the limit of their movement toward said one end of said first cylinder, a second cylinder having a second piston engaged to operate the tie-wire trimming mechanism, a spring maintaining said tie-wire trimming mechanism and said second piston normally in inoperative position, a pipe connecting said second cylinder with said plural way valve to permit actuation of said second piston of said second cylinder while said clamping bars are maintained by said first piston of said first cylinder at one limit of its movement.

2. Pneumatic actuating mechanism according to claim 1, wherein said second duct is of a smaller area than the effective fluid passing area of said first check valve when said first check valve is held open by pressure supplied to said first casing from said plural way valve, said second duct operating to resist flow of fluid out of said other end of said first cylinder, and said first check valve operating to permit flow of fluid more rapidly into said one end of said cylinder than contained fluid can be forced to flow through said second duct.

3. In a control mechanism for operating clamping bars and tie-wire trimming mechanisms of a spring assembly machine, a first horizontally disposed cylinder, a piston-rod slidable within said first cylinder, said piston being connected to said clamping bars and movable therewith, said clamping bars being adapted to move horizontally between spring carriers and into engagement with the carriers to hold the springs to be assembled on said carriers, a second cylinder, a second piston-rod slidable in said second cylinder, linking members connecting said second cylinder to the tie-wire trimming mechanisms, said tie-wire trimming mechanisms being disposed within the carriers and operable to form the ends of the helical tie-wires into closed loops in response to a force applied to the tie-wire trimming mechanisms, resilient means urging said linking members to one position, said trimming mechanisms having applied thereto a force when said second piston moves said linking members out of said one position, valve means associated with each of said cylinders, conduits connecting said cylinders to said valve means, a source of pressure connected to said valve means, and means to actuate said valve means in sequence to move said clamping bars into their clamping position by admitting pressure from said source to one end of said cylinder and to open the other end thereof to a lower pressure than said source, to actuate said tie-wire trimming mechanisms by admitting pressure from said source to one end of said second cylinder and opening the other end thereof to a lower pressure than said source, and to remove said clamping bars from their clamping position by admitting pressure from said source to said other end of said first cylinder and opening said one end of said first cylinder to a lower pressure than said source.

4. In control mechanisms for operating clamping bars, tie-wire feeding means, and tie-wire trimming mechanisms of a spring assembly machine having a frame supporting the aforementioned means, mechanisms and bars, a first cylinder mounted on the frame of the machine, a first piston-rod slidable in said first cylinder, said piston being connected to said clamping bars and movable therewith, said clamping bars being adapted to move horizontally between spring carriers and into engagement with the carriers to hold the springs to be assembled on said carriers, a second cylinder mounted on the machine frame, a second piston slidable within said second cylinder, linking members connecting said second piston to the tie-wire trimming mechanisms, said tie-wire trimming mechanisms being disposed within the carriers to form the ends of the helical tie-wires into closed loops in response to a force applied to said tie-wire trimming mechanisms, resilient means urging said linking members to one position, said trimming mechanisms having applied thereto a force when said second piston moves said linking members out of said one position, valve means associated with each of said cylinders, conduits connecting said cylinders to said valve means, a source of pressure connected to said valve means, means to actuate said valve means in sequence to move said clamping bars into their clamping position by admitting pressure from said source to one end of said first cylinder and to open the other end thereof to a lower pressure than said source, to actuate said tie-wire trimming mechanisms by admitting pressure from said source to one end of said second cylinder and opening the other end thereof to a lower pressure than said source, and to remove said clamping bars from their clamping position by admitting pressure from said source to said other end of said first cylinder and opening said one end of said first cylinder to a lower pressure than said source, a switch mounted on the frame of the machine, a cam member movable with the clamping bars and aligned with said switch, said switch being actuated by said cam member to operate the tie-wire feeding mechanism when the clamping bars are moved into their clamping position.

5. In control mechanisms for operating clamping bars, tie-wire trimming mechanisms, and means to move the spring carriers of a spring assembly machine having a frame supporting the aforementioned means, mechanisms, and bars, a first cylinder mounted on the frame of the machine, a first piston rod slidable in said first cylinder, said piston being connected to said clamping bars and movable therewith, said clamping bars being adapted to move horizontally between spring carriers and into engagement with the carriers to hold the springs to be assembled on said carriers, a second cylinder mounted on the machine frame, a second piston slidable within said second cylinder, linking members connecting said second piston to the tie-wire trimming mechanisms, said tie-wire trimming mechanisms being disposed within the carriers to form the ends of the helical tie-wires into closed loops in response to a force applied to said to tie-wire trimming mechanisms, resilient means urging said linking members to one position, said trimming mechanism having applied thereto a force when said second piston moves said linking members out of said one position, valve means associated with each of said cylinders, conduits connecting said cylinders to said valve means, a source of pressure connected to said valve means, means to actuate said valve means in sequence to move said clamping bars into their clamping position by admitting pressure from said source to one end of said first cylinder and to open the other end thereof to a lower pressure than said source, to actuate said tie-wire trimming mechanisms by admitting pressure from said source to one end of said sec-

ond cylinder and opening the other end thereof to a lower pressure than said source, and to remove said clamping bars from their clamping position by admitting pressure from said source to said other end of said first cylinder and opening said one end of said first cylinder to a lower pressure than said source, a switch supported by the machine frame, a cam member movable with the clamping bars, said switch being operated by said cam member to actuate said means to move the spring carriers when the clamping bars are removed from between the spring carriers.

6. In control mechanisms for operating clamping bars, tie-wire feeding means, tie-wire trimming mechanisms, and means to move the spring carriers of a spring assembly machine having a frame supporting the aforementioned means, mechanisms and bars, a first cylinder mounted on the frame of the machine, a first piston rod slidable in said first cylinder, said first piston being connected to said clamping bars and movable therewith, said clamping bars being adapted to move horizontally between spring carriers and into engagement with the carriers to hold the springs to be assembled on said carriers, a second cylinder mounted on the machine frame, a second piston slidable within said second cylinder, linking members connecting said second pistons to the tire-wire trimming mechanisms, said tie-wire trimming mechanisms being disposed within the carriers to form the ends of the helical tie-wires into closed loops in response to a force applied to said tie-wire trimming mechanisms, resilient means urging said linking members to one position, said trimming mechanism having applied thereto a force when said second piston moves said linking members out of said one position, valve means associated with each of said cylinders, conduits connecting said cylinders to said valve means, a source of pressure connected to said valve means, means to actuate said valve means in sequence to move said clamping bars into their clamping position by admitting pressure from said source to one end of said first cylinder and to open the other end thereof to a lower pressure than said source, to actuate said tie-wire trimming mechanisms by admitting pressure from said source to one end of said second cylinder and opening the other end thereof to a lower pressure than said source, and to remove said clamping bars from their clamping position by admitting pressure from said source to said other end of said first cylinder and opening said one end of said first cylinder to a lower pressure than said source, a first switch mounted on the frame of the machine, a first cam member movable with the clamping bars and aligned with said switch, said first switch being actuated by said first cam member to operate the tie-wire feeding mechanisms when the clamping bars are moved into their clamping position, a second switch supported by the machine frame, a second cam member movable with the clamping bars and aligned with said second switch, said second switch being operated by said second cam member to actuate said means to move the spring carriers when the clamping bars are removed from between the spring carriers.

7. In control mechanisms for operating clamping bars, tie-wire feeding means, tie-wire trimming mechanisms, and means to move the spring carriers of a spring assembly machine having a frame supporting the aforementioned means, mechanisms and bars, a first cylinder mounted on the frame of the machine, a first piston rod slidable in said first cylinder, said piston being connected to said clamping bars and movable therewith, said clamping bars being adapted to move horizontally between spring carriers and into engagement with the carriers to hold the springs to be assembled on said carriers, a second cylinder mounted on the machine frame, a second piston slidable within said second cylinder, a shaft rotatably mounted on said machine frame, a lever secured to said shaft and adapted to engage said second piston to be moved thereby, a pair of arms secured to said shaft, a pair of reciprocable plungers each engaging one of said arms and aligned to bear against a portion of said tie-wire trimming mechanisms, said tie-wire trimming mechanisms being disposed within the carriers to form the ends of the helical tie-wires into closed loops in response to a force applied to said tie-wire trimming mechanisms, resilient means urging said plungers to one position, said trimming mechanism having applied thereto a force when said second piston moves said plungers out of said one position, valve means associated with each of said cylinders, conduits connecting said cylinders to said valve means, a source of pressure connected to said valve means, means to actuate said valve means in sequence to move said clamping bars into their clamping position by admitting pressure from said source to one end of said first cylinder and to open the other end thereof to a lower pressure than said source, to actuate said tie-wire trimming mechanisms by admitting pressure from said source to one end of said second cylinder and opening the other end thereof to a lower pressure than said source, and to remove said clamping bars from their clamping position by admitting pressure from said source to said other end of said first cylinder and opening said one end of said first cylinder to a lower pressure than said source, a switch mounted on the frame of the machine, a cam member movable with the clamping bars and aligned with said switch, said switch being actuated by said cam member to operate the tie-wire feeding mechanism when the clamping bars are moved into their clamping position.

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