Jan. 20, 1953 E. L. BRONSTIEN ET AL 2,625,962

SPRING ASSEMBLING MACHINE

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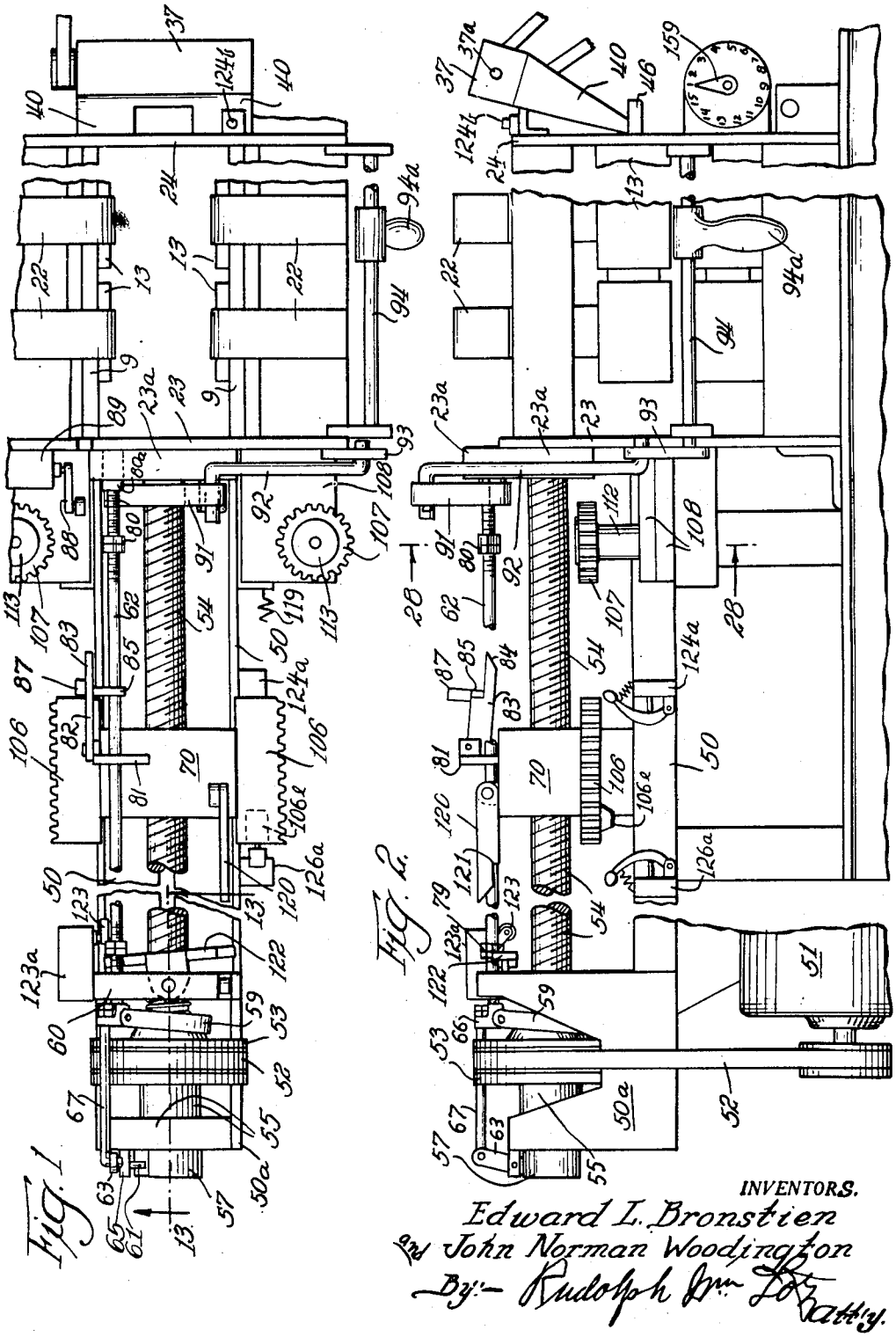


Fig. 1

Fig. 2

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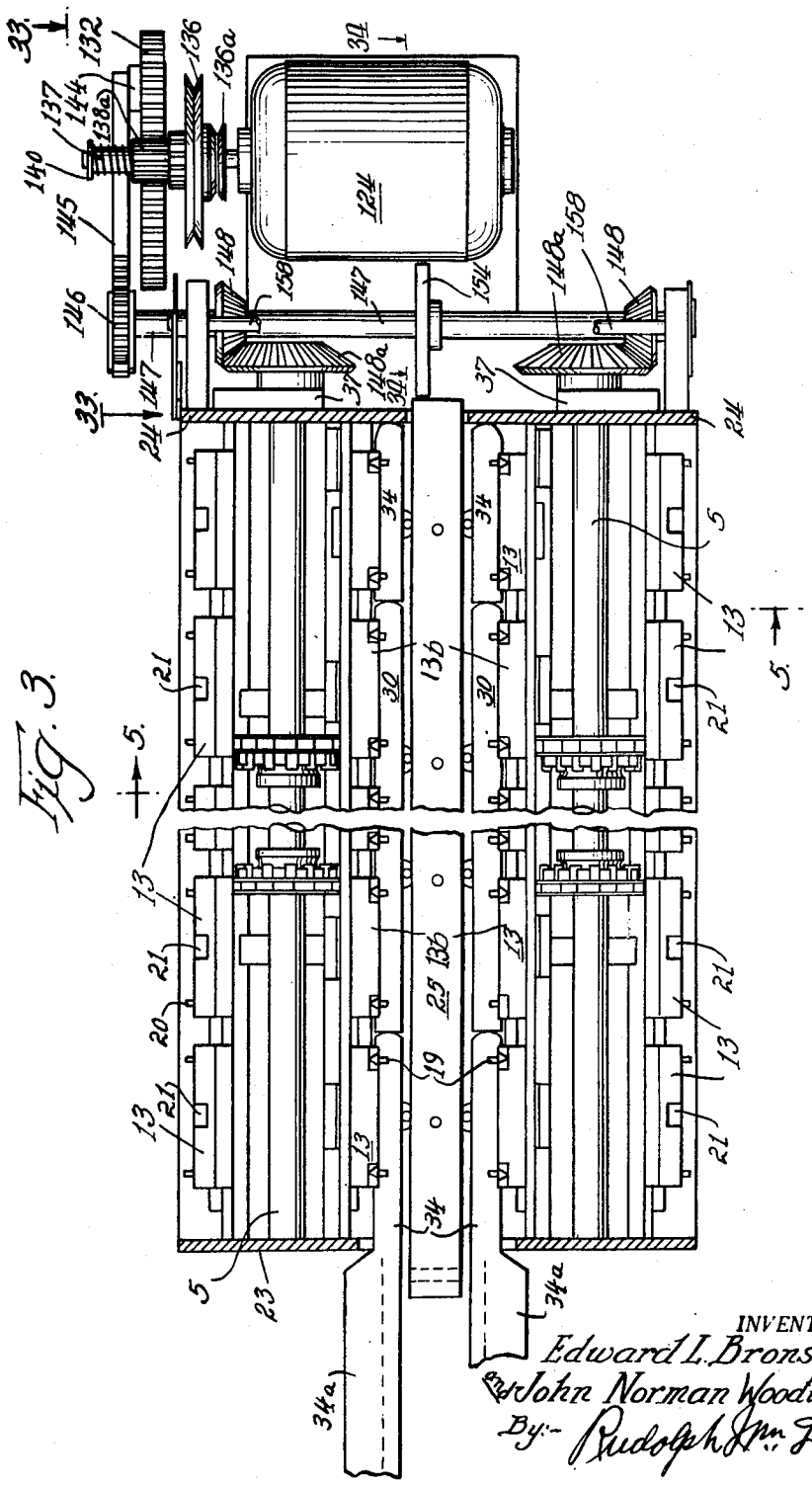


Fig. 3.

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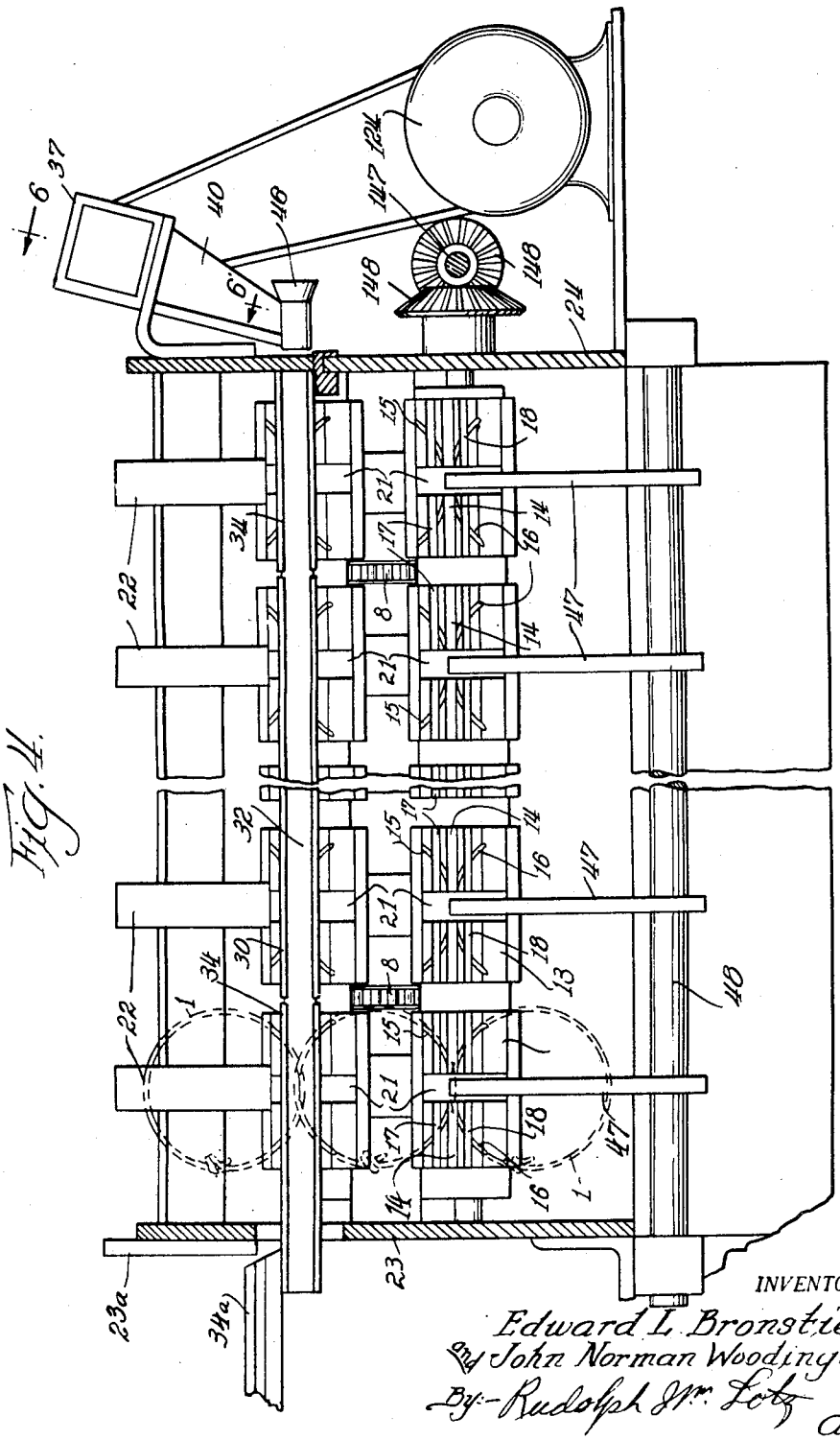


Fig. 4.

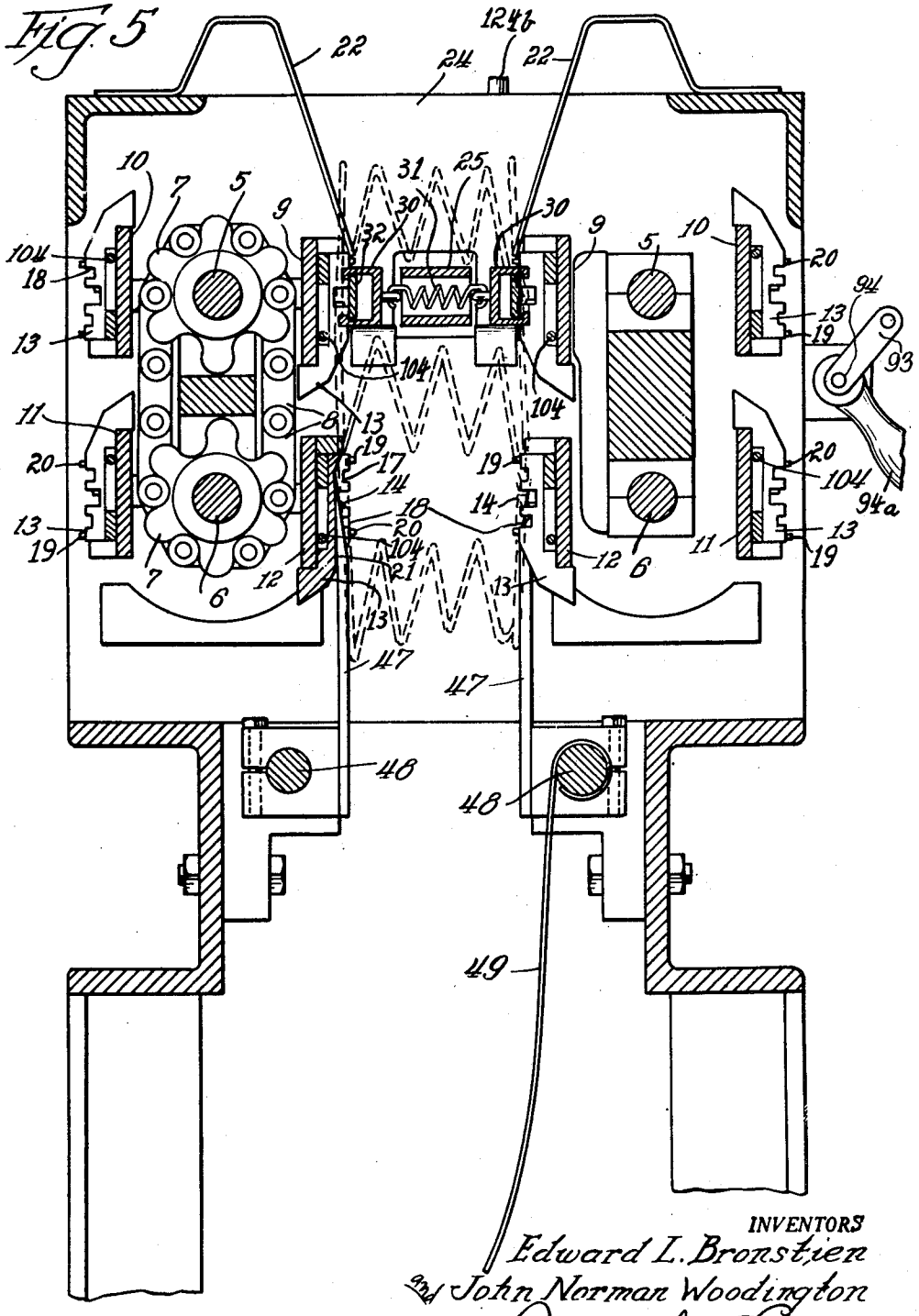
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Fig. 5



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Fig. 8.

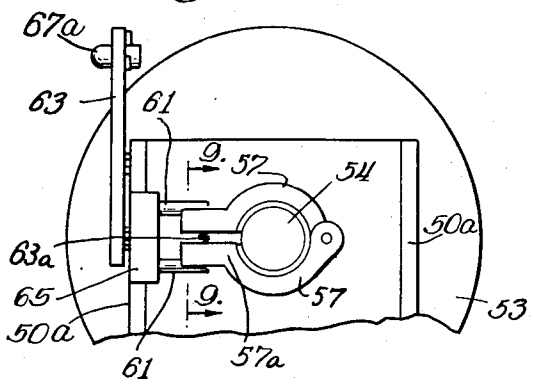
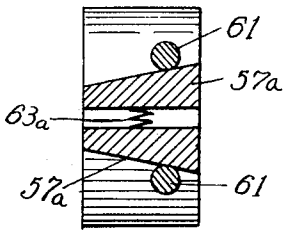


Fig. 9.



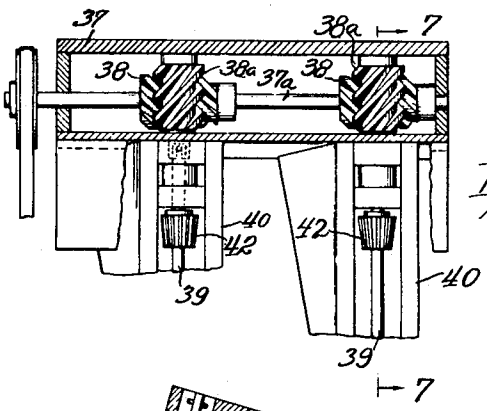


Fig. 6

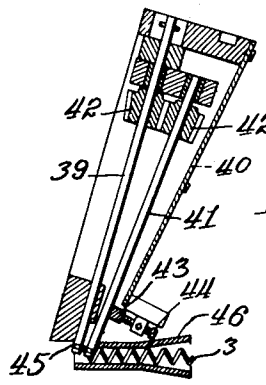


Fig. 7.

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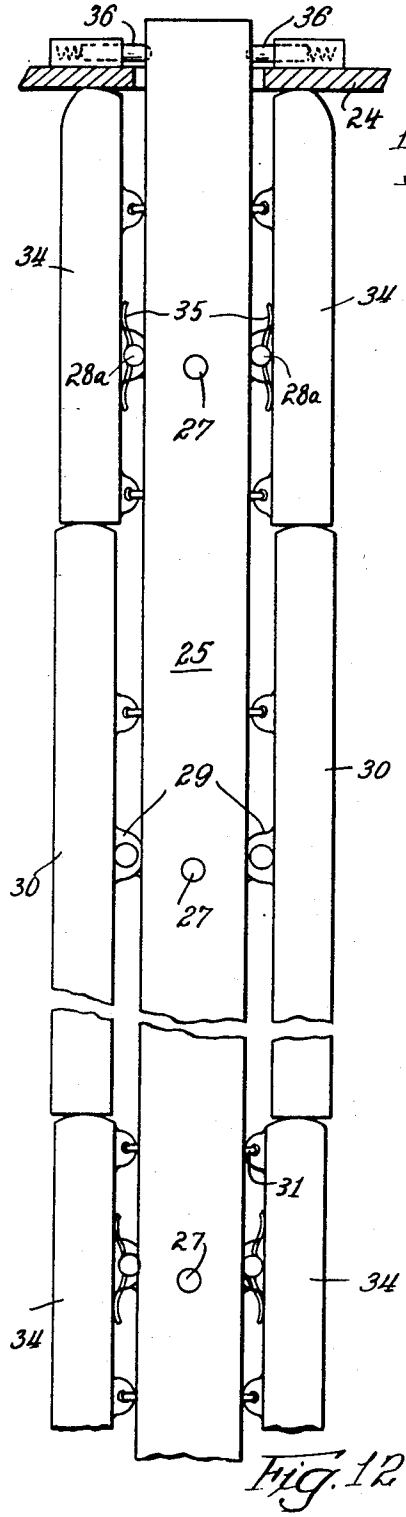


Fig. 12

Fig. 10

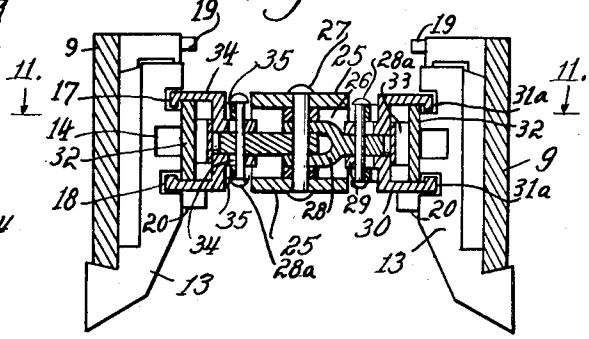
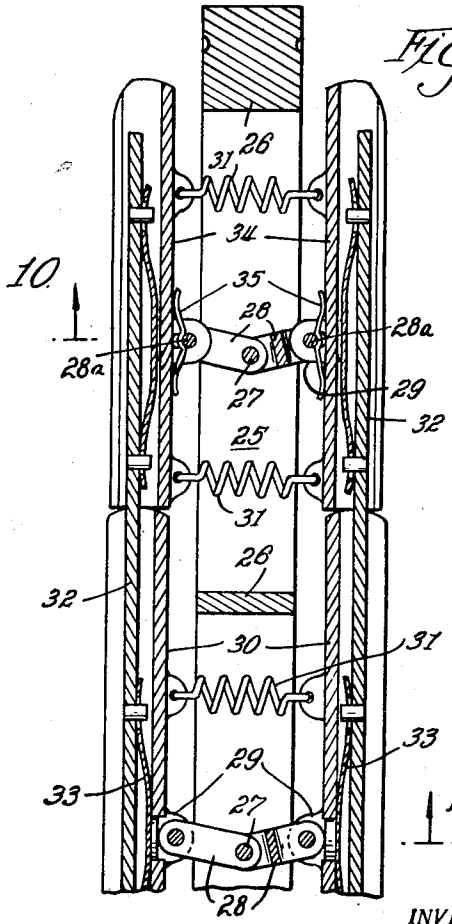


Fig. 11



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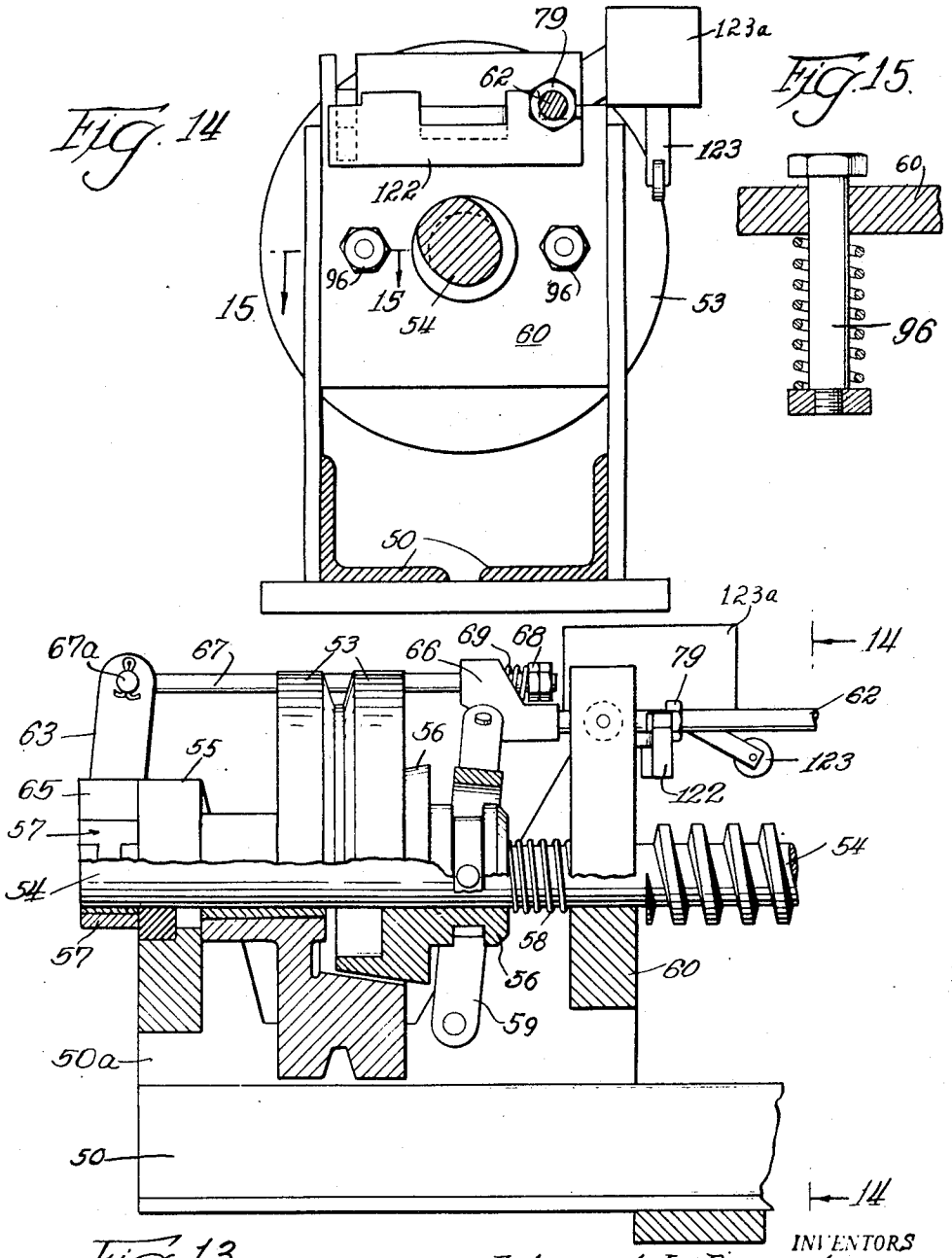


FIG. 14

FIG. 13

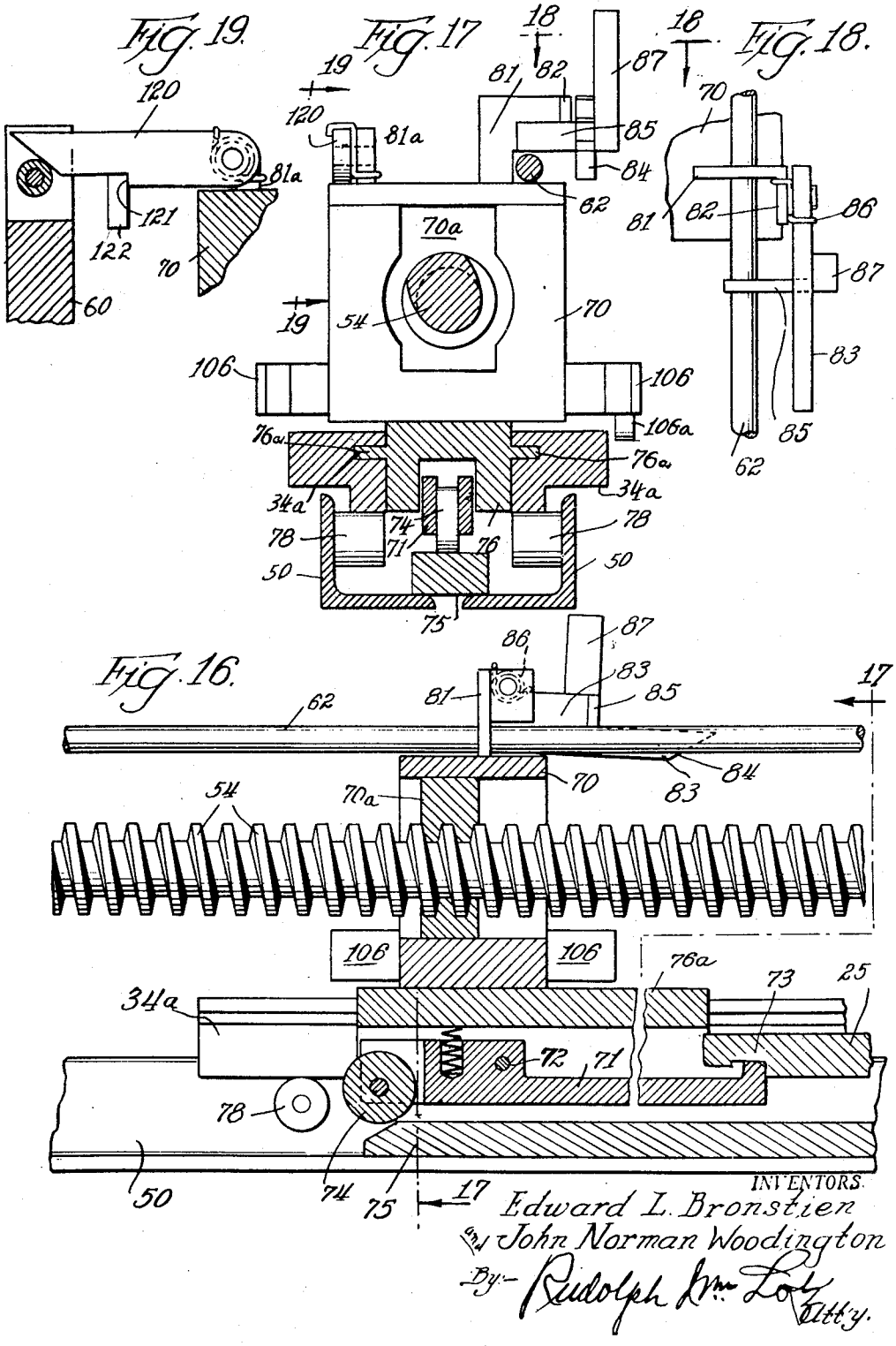
FIG. 15

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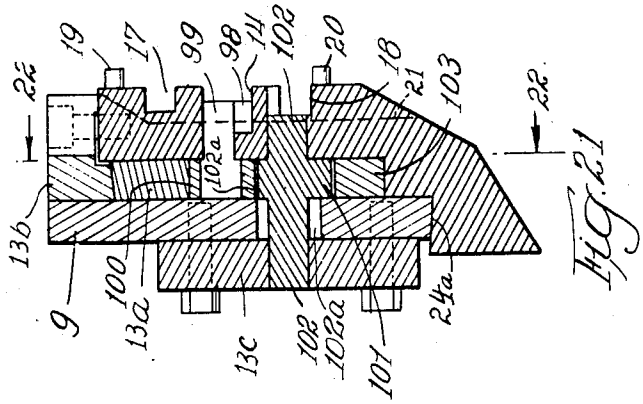


FIG. 21

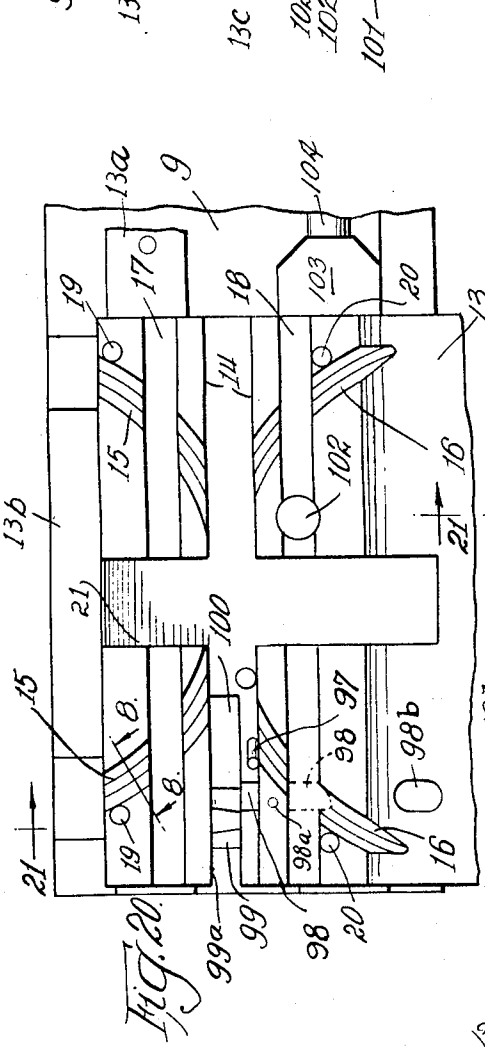


FIG. 20

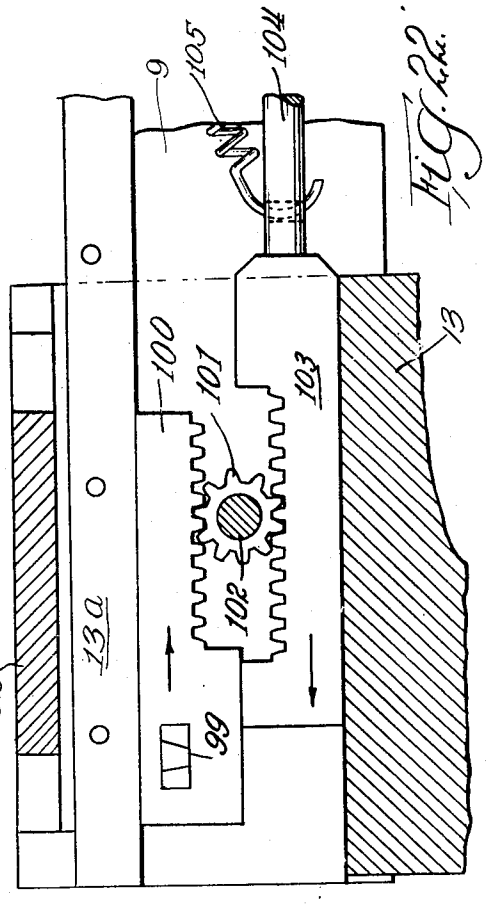


FIG. 22

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FIG. 23.

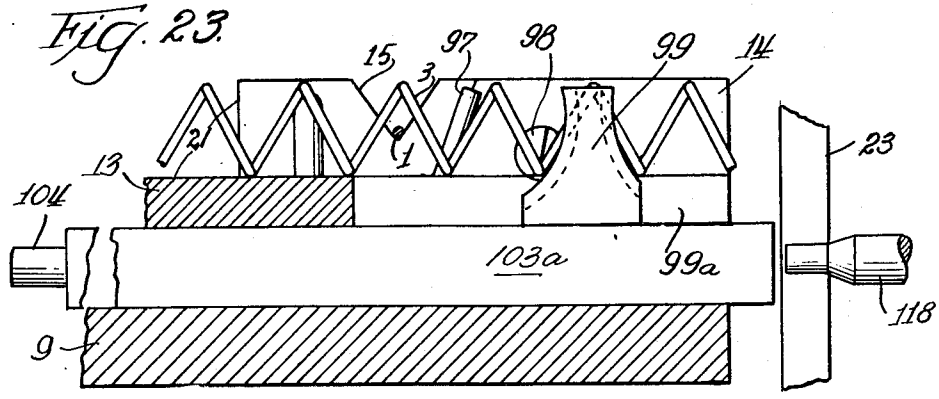


FIG. 24.

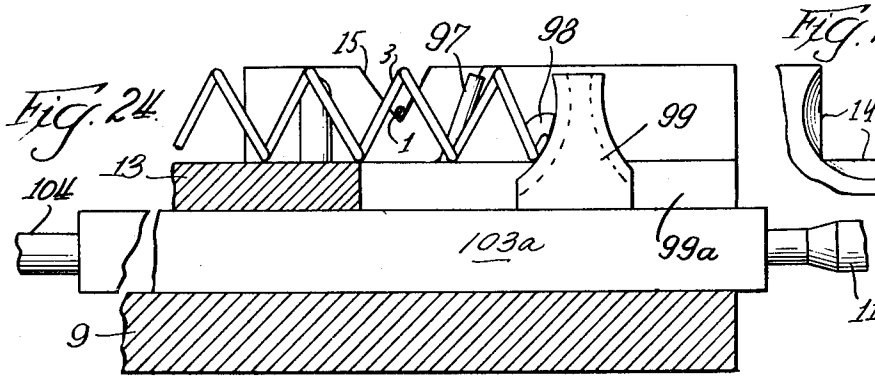


FIG. 26.

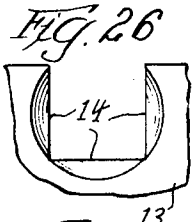


FIG. 25.

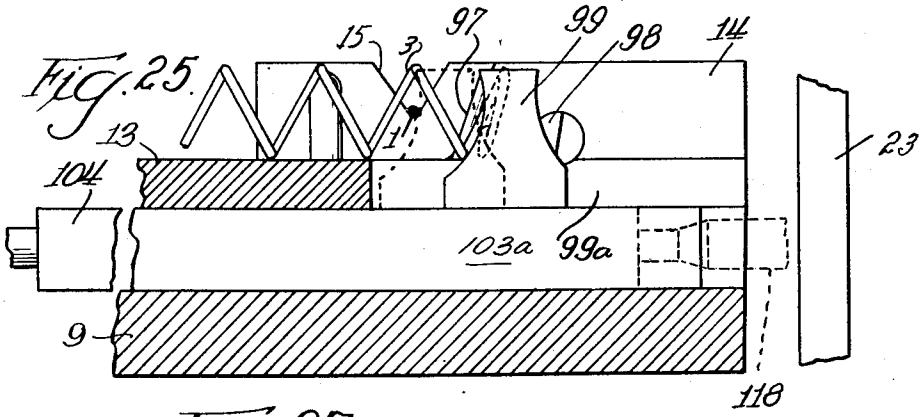
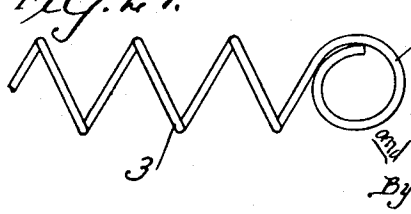


FIG. 27.



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FIG. 28

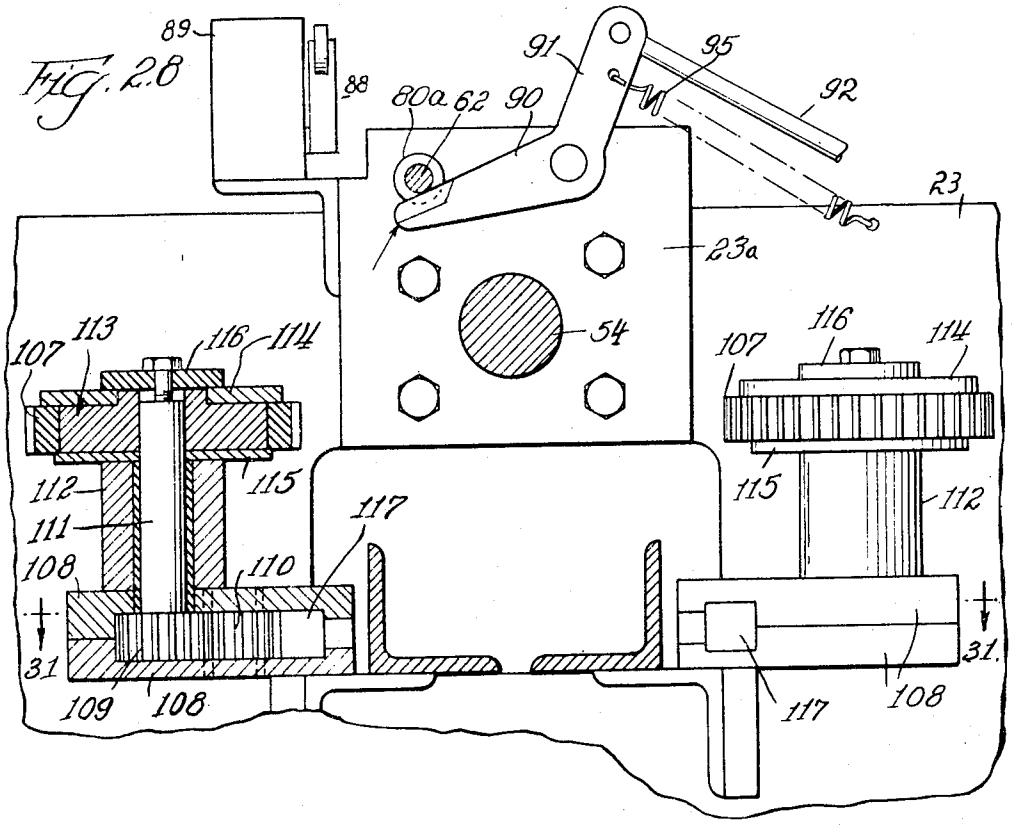


FIG. 29

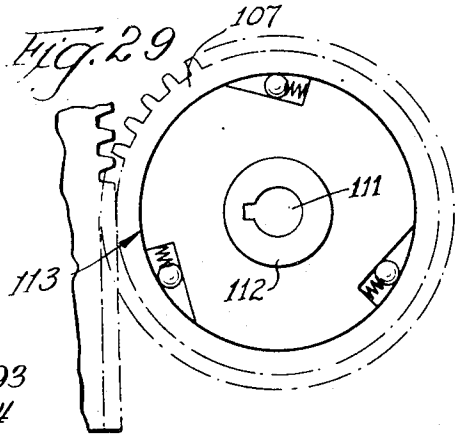
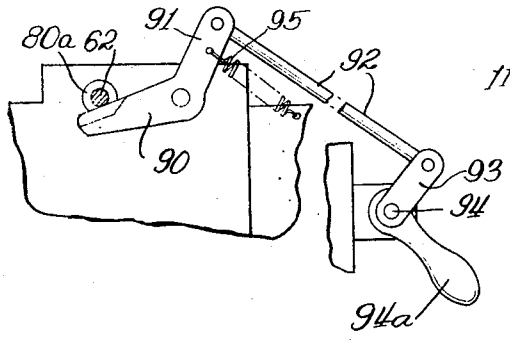


FIG. 30



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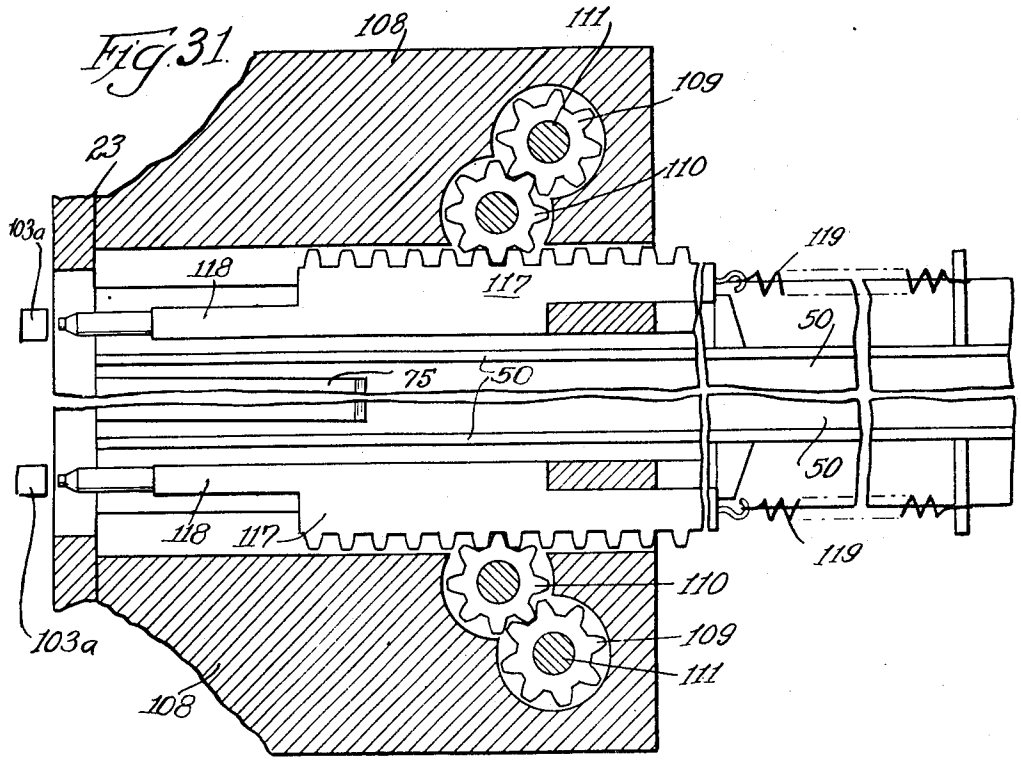
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Fig. 31.



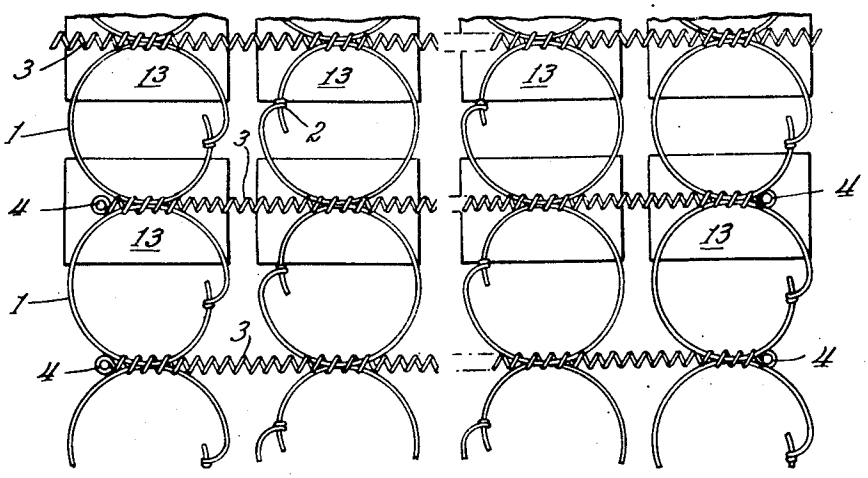


Fig. 32.

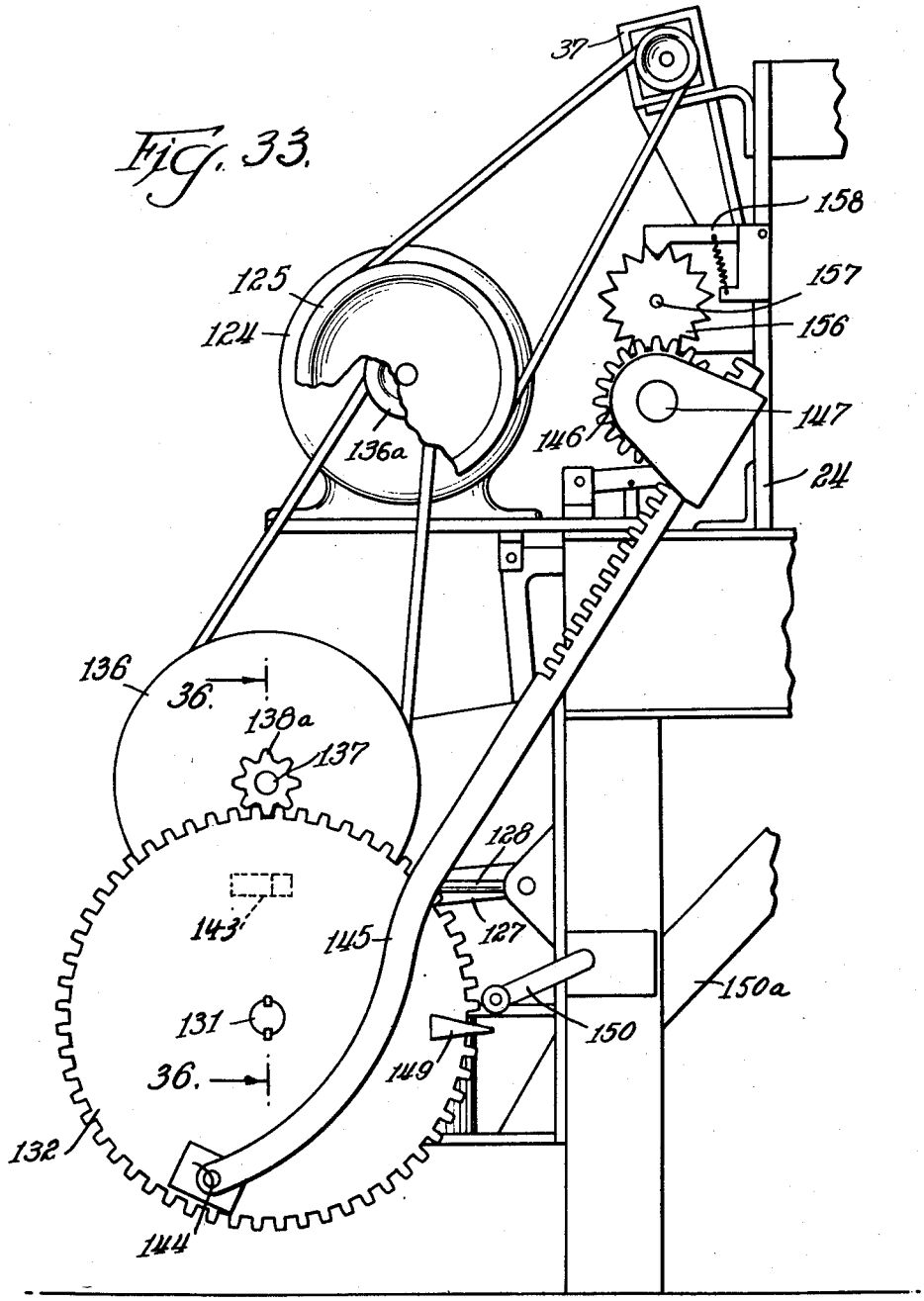
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SPRING ASSEMBLING MACHINE

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Fig. 33.



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Fig. 35.

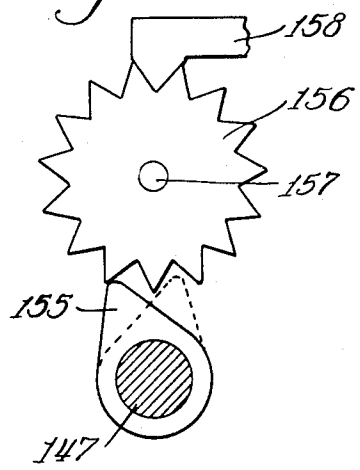
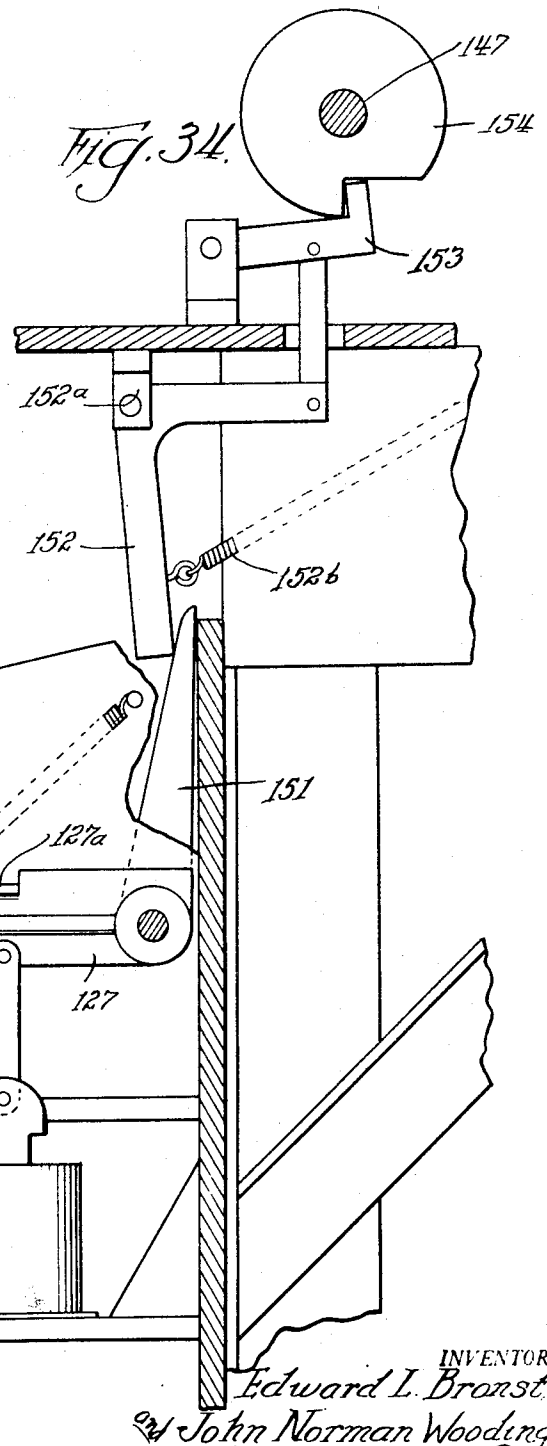


Fig. 34.



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Fig. 37.

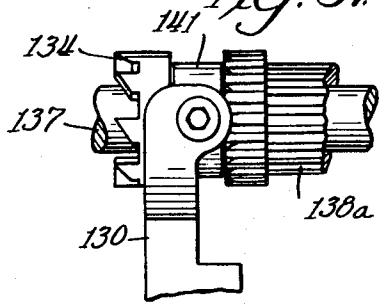


Fig. 36.

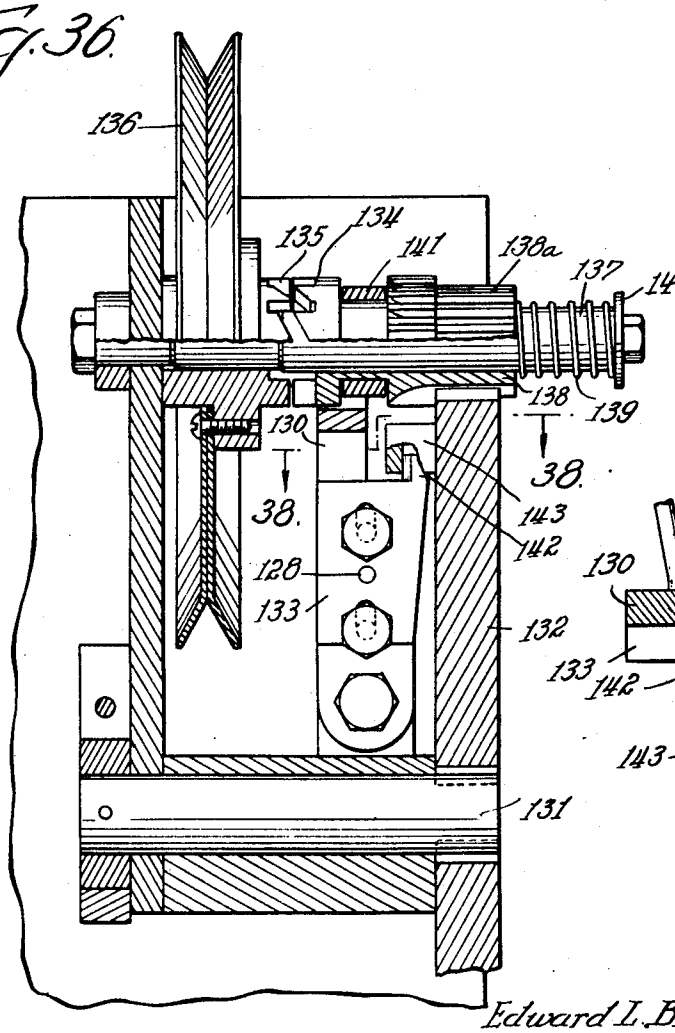
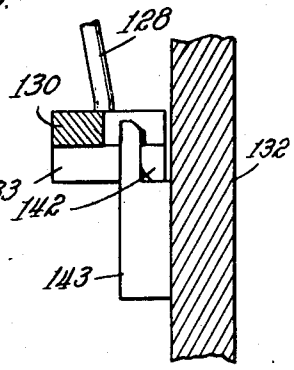


Fig. 38.



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Patented Jan. 20, 1953

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UNITED STATES PATENT OFFICE

2,625,962

SPRING ASSEMBLING MACHINE

Edward L. Bronstien, St. Paul, Minn., and John Norman Woodington, Chicago, Ill., assignors to United States Bedding Co., St. Paul, Minn., a corporation of Minnesota

Application January 24, 1949, Serial No. 72,282

16 Claims. (Cl. 140—92.7)

1

This invention relates to improvements in the machine described and claimed in and by Letters Patent No. 2,351,659, dated June 20, 1944, and has for its object to convert said machine, which is manually operated, into a semi-automatic, power actuated machine, and to equip the same with automatically actuated tie-wire trimming mechanisms, and otherwise improve the same, as pointed out hereinafter, thereby effecting substantial increase in production per man hour of spring assemblies of the same type as are produced by the machine of the aforesaid patent, and eliminate a great number of the manual operations incident to effecting the trimming of both ends of each tie-wire included in the assemblies delivered by the machine of said patent.

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

Fig. 1 is a fragmentary plan view of the machine on a small scale.

Fig. 2 is a fragmentary side elevation of the same on the same scale as Fig. 1.

Fig. 3 is a top plan view of a portion of the machine on a larger scale than Figs. 1 and 2.

Fig. 4 is a central vertical longitudinal sectional view of the portion of the machine shown in Fig. 3 a part of the lower frame portion being omitted.

Fig. 5 is a fragmentary vertical transverse sectional view of the same taken on the line 5—5 of Fig. 3.

Fig. 6 is a fragmentary, substantially vertical transverse sectional view, on an enlarged scale, taken on the line 6—6 of Fig. 4.

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 6.

Fig. 8 is a fragmentary detail end elevation of the machine, on a larger scale than Fig. 1, looking at the left-hand end of Fig. 1.

Fig. 9 is a fragmentary detail sectional view taken on the line 9—9 of Fig. 8.

Fig. 10 is a vertical transverse sectional view, on an enlarged scale, taken on the line 10—10 of Fig. 11.

Fig. 11 is a plan sectional view, taken on the line 11—11 of Fig. 10, the upholstery spring engaging blocks of Fig. 10 being omitted.

Fig. 12 is a fragmentary plan view of the structure shown in Figs. 10 and 11 and includes a fragmentary plan sectional view of the right-hand end frame plate of the machine and parts mounted upon the same.

Fig. 13 is a fragmentary detail vertical longitudinal sectional view of the left-hand end portion of the machine taken on the line 13—13 of Fig. 1.

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Fig. 14 is a sectional view taken on the line 14—14 of Fig. 13.

Fig. 15 is a fragmentary detail sectional view taken on the line 15—15 of Fig. 14.

Fig. 16 is a continuation of Fig. 13 but shows the carriage, which is reciprocated by the screw shaft, disposed farther to the right than in Figs. 1 and 2.

Fig. 17 is a vertical transverse sectional view taken on the line 17—17 of Fig. 16.

Fig. 18 is a fragmentary plan view of Fig. 17, as indicated by the line 18—18 of Fig. 17.

Fig. 19 is a fragmentary detail vertical longitudinal sectional view taken on the line 19—19 of Fig. 17, with the plane of said line extending in part through the right-hand frame plate of Fig. 13.

Fig. 20 is a face view of one of the upholstery spring engaging blocks of the machine which is equipped with a tie-wire severing and terminal loop forming mechanism.

Fig. 21 is a vertical transverse sectional view of the same taken on the line 21—21 of Fig. 20.

Fig. 22 is a vertical longitudinal sectional view taken on the line 22—22 of Fig. 21.

Fig. 23 is a fragmentary longitudinal plan sectional view, on an enlarged scale, showing the tie-wire severing and terminal loop forming mechanism of another of the blocks shown in Fig. 20.

Figs. 24 and 25 are similar to Fig. 23, showing the movable member of the mechanism in different progressive positions.

Fig. 26 is a fragmentary end elevation of the tie-wire receiving end of an upholstery spring engaging block of the machine.

Fig. 27 is a fragmentary view of an end portion of a tie-wire after the same has been trimmed by the mechanisms of Figs. 23–25.

Fig. 28 is a vertical transverse sectional view partly in elevation and on an enlarged scale, taken on the line 28—28 of Fig. 2.

Fig. 29 is a fragmentary detail plan view of the rack bars and spur gear wheels shown in Figs. 1, 2 and 28.

Fig. 30 is a view in elevation, on a reduced scale, of the mechanism shown in part at the top of Fig. 28.

Fig. 31 is a plan sectional view, partly broken away, taken on the line 31—31 of Fig. 28.

Fig. 32 is a fragmentary plan view of the type of spring assembly produced by the machine.

Fig. 33 is a view in side elevation, on an en-

larged scale, of a mechanism which effects shifting of upholstery spring carriers of the machine a collar and spring being omitted.

Fig. 34 is a fragmentary vertical longitudinal sectional view showing other parts of the shifting mechanism and taken on the line 34—34 of Fig. 3, the motor being omitted.

Fig. 35 is a view in side elevation, partly in section, showing the indexing mechanism of the machine.

Fig. 36 is a vertical transverse sectional view taken on the line 36—36 of Fig. 33.

Fig. 37 is a fragmentary detail side elevation of the clutch of Fig. 36.

Fig. 38 is a fragmentary detail sectional view taken on the line 38—38 of Fig. 36 on a larger scale.

SECTION 1

Brief general description

Sheets 1–5 and 17

The machine is designed for the production of spring assemblies composed of the knotted type of hour glass upholstery springs 1 which are disposed in parallel rows, both longitudinally and transversely, as shown in Fig. 32, the springs of the longitudinal rows being spaced apart and the knots 2 thereof disposed substantially midway between the uppermost and lowermost portions of the terminal coils of the springs. Successive transverse rows of the springs 1 are partially overlapped and coupled with each other by means of helical tie-wires 3, which encircle the overlapped portions of the same.

Said tie-wires 3 are first cut to a length greater than shown in Fig. 32 before they are engaged with the springs 1, the surplus lengths thereof being cut off and the then remaining terminal coils, of the thus shortened tie-wires, are then bent to form closed loops 4, which prevent the tie-wires from becoming disengaged from the springs 1 as shown in Figs. 27 and 32.

The tie-wire cut-off and loop forming operations aforesaid are known to those skilled in the art, as tie-wire trimming operations which are most commonly performed manually by means of suitable pneumatically actuated hand tools after a spring assembly has been delivered from the machine, as in the case of the machine of said Patent No. 2,351,659.

The machine, as shown in Fig. 5, comprises, in part, a suitable main frame portion, not described in detail, which is equipped with suitable bearings for two pairs of parallel horizontal shafts. Each pair thereof comprises an upper shaft 5 and a lower shaft 6, the axes of the shafts of each pair lying in spaced apart parallel vertical planes. Each of said pairs of shafts carries pairs of spaced apart sprocket wheels 7. Sprocket chains 8 are trained over these sprocket wheels, as shown at the left-hand side of Fig. 5 but omitted from the right-hand side as not necessary to be shown there.

Mounted rigidly upon links of each pair of sprocket chains 8 is a set of four equally spaced apart bars 9, 10, 11 and 12, respectively. Mounted adjustably upon each of said bars is a set of blocks 13, one of which is shown in detail in Figs. 20, 21 and 22, and which are spaced apart in harmony with the predetermined spacing apart of the vertical rows of springs 1, shown in Fig. 32.

The blocks 13 of each of said bars at the left-hand side become opposed to the blocks 13 at the right-hand side during intermittent operations of the shafts 5 and 6 in unison in opposite directions.

The space between faces of opposed blocks 13 is usually about sixty percent of the length of the springs 1.

As shown in Fig. 20, each block 13 is provided in its face with a guide channel 14 for a tie-wire 3, and also with substantially arcuate grooves 15 and 16 respectively, the groove 15 being shaped to correspond substantially with the contour of the lower portions of the knotted terminal coils of the springs 1, shown in Fig. 32, while the groove 16 is shaped to correspond substantially with the contour of the upper portions of the springs 1, the intermediate coils of which are of smaller diametric dimensions than the knotted end-coils thereof. These arcuate grooves 15 and 16 are so nearly similar in radial dimensions as to be substantial duplicates of each other. In instances wherein the said end-coils are not substantially circular, the grooves 15 and 16 will be of contours corresponding with those of the spring end-coil portions to be received therein.

Both grooves 15 and 16 are flared, being substantially V-shaped in radial section and are provided, preferably, which arcuate bottoms of radius equal, substantially, to that of the largest gauge (diameter) of wire of which the springs 1 may be composed.

The groove 15 is of less depth than the groove 16 to an extent substantially equal to the gauge (diameter) of the wire of which the springs 1 are made. The bottoms of the grooves 15 and 16 lie in spaced apart planes parallel with the face of the block 13. A vertical plane of the axis of the guide channel 14 is coincident with the plane of overlap of the springs within the guide channel 14, which is square in cross-section and of slightly larger diameter than the tie-wire 3, as is true, also, of the blocks 21 of the said patented machine.

Parallel with and spaced equally from the guide channel 14 are two channels 17 and 18, the channel 17 being preferably of equal but of no less depth than the groove 15, and channel 18 being similarly of no less depth than the groove 16. The channels 17 and 18 receive flanges of a channel bar element of a clamping bar structure (shown in Figs. 10, 11 and 12 and described hereinafter) which acts to clamp the portions of the spring 1 engaged in the arcuate grooves 15 and 16 against the arcuate bottoms of the latter and the channels 17 and 18. This is true, also, of the clamping bar structure of the patented machine.

The spring end-coil portions lying within said grooves 15 and 16 thus are positioned accurately with respect to the guide channel 14 so that only predetermined portions of said end-coils of springs 1 become overlapped within said channel 14 and become disposed, also, out of the path of the front extremity of the tie-wire 3 to prevent obstruction to free travel of the latter.

In order to bring about this encircling of the overlapped pairs of spring portions of two rows thereof by the helical tie-wires with an equal number of coils of the latter disposed about each pair, the blocks 13 must be adjusted longitudinally of the bars 9, 10, 11 and 12 relative to each other by trial and error before the machine is ready for continuous operation. Such adjustment is required because the path of the front extremity of the tie-wires is almost as

accurate as a thread cut into the interior of a tube. These adjustments are very slight, of course.

Mounted tangentially of the upper groove **15** are two stop or giude pins **19**, and, similarly disposed relative to the groove **16**, are similar pins **20**, the latter being also disposed tangentially of the lower wall of the lower channel **18**.

Midway between the side edges of the block **13** is a wide vertical groove **21** which is of depth equal to or slightly greater than the channel **14**, except at its upper end where its bottom wall is sloped, as shown in Fig. 20. This groove is referred to hereinafter as the "stripper groove" (shown in Fig. 4).

Upon the top of the machine frame there are mounted flat or leaf springs **22** of inverted substantially U-shaped type (Figs. 3, 4 and 5). One arm of each of these springs is rigid with the machine frame. The other arm is disposed so that its lower end portion bears upon the upper edge portion of a block **13** over the stripper groove **21**, there being one spring **22** for each block **13** of a row thereof.

The terminal blocks **13** of each row thereof (the block of Figs. 20 and 21 being one of same) are equipped with the aforesaid trimming mechanisms and are described in detail later herein.

The bars **9**—**12** are disposed between flat vertical end plates **23** and **24**, of the main frame of the machine, with one end of each bar preferably in contact with the right-hand end plate **24** (Fig. 3). The right-hand end blocks of each bar (the block of Figs. 20–22 being one of them) are disposed as closely proximate to the plate **24** as is possible to prevent undue waste of tie-wires **3**.

Said plate **24** acts as a stop to prevent longitudinal movements of the bars **9**—**12**, for reasons explained later, and acts also, as a stop for parts of the clamping bar structure, as also explained later herein.

Each block **13** is equipped at its lower end with a tapered surface portion of greater thickness than its grooved and channeled portion and presents a slightly tapered shoulder **24***a* which is engaged with a correspondingly tapered lower edge of the bar **9**—**12** upon which the block **13** is mounted (Fig. 21).

Mounted upon each of the said bars **9**—**12** is a bar **13***a* and a bearing block **13***c*. The lower edge of said bar **13***a* is spaced from the tapered edge of the bar **9**—**12** upon which it is mounted and is equipped with a tapered upper edge. The clamping bar **13***b* is secured by screws to the top edge of each block **13** and is equipped with a flange provided with a tapered edge which bears upon the tapered edge of the bar **13***a* when said screws are tightened and thus clamps the block **13** against all movement relative to the bar **9**—**12** upon which it is mounted (Figs. 20–22).

Each block **13** of every row is provided with a back channel, which is closed by the bar **9**—**12**, and thus forms a rectangular tube.

These tubes and the lower skirt portions of the blocks **13** differentiate the latter from the blocks **21** of the aforesaid patented machine.

Note that Figs. 3, 4 and 5 are substantial duplicates of Figs. 3, 4 and 5 of said Patent No. 2,351,659.

Note also that the blocks of Figs. 15 and 16 of said patent are exactly the same, substantially, as those of the instant machine insofar as the channels and arcuate grooves of the latter are concerned.

SECTION 2

The tie-wire feed mechanism

This mechanism comprises a casing **37** equipped with bearings for the shaft **37***a*, driven by a motor **124** (Figs. 3, 4 and 33) and which carries the gear pinions **38** meshed with pinions **38***a* which drive spindles **39**.

Each spindle **39** passes through a casing **40** equipped with bearings for the upper and lower ends of said spindles **39**.

Each of the latter is geared to a companion spindle **41** by means of the spur-gear wheels **42**. The spindle **41** is journalled adjacent its lower end in a bearing **43** which is adjustable by means of the set screw **44** relative to the lower bearing of the spindle **39**.

The lower end portions of the spindles **39** and **41** are provided with annular grooves **45** in which a tie-wire **3** inserted by the operator into the feed tube **46** is engaged and caused to be rotated and thus advanced through the guide channels **14** of the two rows of blocks **13** on the bars with which the channel bar sections **30** and **34** are then engaged, each of the feed tubes **46** being aligned with the guide channel **14** of the block **13** nearest adjacent to the frame plate **24**.

A reversible electric motor **124** disposed to the right of the frame plate **24** (Figs. 3 and 4) operates the shaft of the above described mechanism.

The above described structure is not novel and is merely exemplary of a suitable tie-wire feed mechanism.

SECTION 3

Detailed description of the clamping bar structure

Sheet 6

Fig. 10 shows a pair of opposed blocks **13** mounted upon bars **9** of Fig. 5, the clamping bar structure being shown in vertical transverse section on a smaller scale than Figs. 20 and 21. That structure comprises a plunger **25** composed of parallel horizontal flat strips secured to each other in spaced apart relation by means of spacing members **26** (Figs. 10 and 11), by welding or otherwise, to provide long slots in said plunger.

Midway between the ends of each slot, a vertical pivot pin **27** is mounted in the plunger and upon each pin **27** a pair of toggle links **28** is mounted pivotally. Each link **28** is pivotally connected at its other end with a pair of projections **29** of a channel bar **30**. The latter is equipped with side flanges which enter the grooves or channels **17** and **18** parallel with the guide channels **14** of the blocks **13** when the channel bars are disposed at the outer limits of their lateral movement relative to the plunger **25**. Each channel bar **30** includes terminal sections **34** movable laterally relative thereto.

Tension springs **31** pass through the slots of the plunger **25** and are connected at their ends with the channel bars **30** and **34** and operate to maintain the latter normally at the inner limit of their said lateral movement in contact with the plunger **25**.

The flanges of the channel bar differ in depth to accord with the difference in depth of the channels **17** and **18** of the blocks **13** and are equipped with inturned flanges equipped with stop shoulders **31***a*.

Passing through all channel bars **30**—**34** are closure bars **32** for the tie-wire guide channels **14** of all of the blocks **13** of a row. Bowed flat springs **33** maintain the bars **32** engaged normally with said stop shoulders **31***a*. When the flanges

of sections 30 and 34 enter the channels 17 and 18 of the blocks 13 and bear upon the portions of the springs 1 which pass over the bottom walls of the said channels 17 and 18; the bars 32 bear upon the faces of the blocks 13 and become spaced from the said stop shoulders 31a (see Fig. 10).

The end sections 34 (Figs. 11 and 12) are adapted to enter the channels 17 and 18 of only the terminal blocks 13 of each row in order to permit the use of heavier gauge marginal springs 1 of the ultimate assembly, than the remaining springs of each transverse row, as is common practice in the industry.

The pairs of toggle links 28 connecting the pins 27 with the terminal channel bar sections 34, are somewhat shorter than the links 28 which connect the pins 27 with the middle section 30. The pivot pins 28a are of such length that they project beyond the side faces of the said flanges 29 through longitudinal slots 29a of which they pass, said slots being so short as to be impossible of clear illustration.

Bowed springs 35 are interposed between the outer end portions of the pins 28a and the webs of the sections 34 and serve to maintain said pins 28a disposed normally at the outer ends of the last mentioned slots. The difference between the movements of the sections 34 and the middle sections 30 is never more than a few thousandths of an inch.

The sections 34 abut the main section 30 at one end each and, in operation, as the plunger 25 has neared the inner limit of its movement, the other ends of the sections 34, at the inner end of the structure, abut the end plate 24 of the machine frame while the plunger 25 continues its movement, and thus all of the toggle links are caused to operate to move the channel bars 30 and 34 to the outer limit of their lateral movement against the action of the tension springs 31 to the position of Fig. 10. The left-hand sections 34 are equipped with extensions 34a, shown in Figs. 3 and 4 and also in Figs. 16 and 17.

The plunger 25 is projected along its innermost end portion through an opening in the plate 24 and is engaged between a pair of spring held brake members 36, mounted upon said plate 24, which operate in a well-known manner to prevent the tension springs 31 from drawing the channel bar sections 30 and 34 back to the inner limit of their lateral movement relative to the plunger 25 and thus prevent any retraction of the plunger 25.

During reciprocation of the channel bar structure, the lower flanges of the channel bar sections 30 and 34 ride upon the pins 20 (Figs. 10, 20 and 21) of the blocks 13 to which they are opposed.

SECTION 4

Mechanism for actuating the clamping bar structure

Sheets 1 and 7

Description of this mechanism and its operation is limited, in this section, to the parts thereof which effect movement of the clamping bar structure from the left-hand to the inner (right-hand) limit of its movement, after the operator has inserted a row of springs into the machine, and its action respecting other parts of the machine during this direction of travel. Description of what occurs during reverse movement of this mechanism and the clamping bar structure, and the parts which are actuated during said reverse movement, are described in another section.

As shown in Figs. 1 and 2, a pair of horizontally disposed angle bars 50 are secured at their right-hand ends to the main frame of the machine.

A reversible electric motor 51 (Fig. 2) is disposed below the outer end portions of the bars 50 and is connected by a belt 52 with a sheave 53 mounted rotatably upon the unthreaded end portion of the screw shaft 54. Said unthreaded portion is journalled in the bearing 55, and in the frame plate 60. The right-hand extremity of said screw shaft 54 is journalled in a bearing of the frame plate 23a (Figs. 1 and 2).

A brake 57 (Figs. 1, 8 and 9) is disposed for engagement with the outermost end portion of the screw shaft 54.

The sheave 53 constitutes a friction clutch member for co-operation with the sliding clutch member 56, keyed to the screw shaft 54, and which is held normally engaged with the sheave 53 by the compression spring 58. The latter is interposed between the clutch member 56 and the frame plate 60 (Fig. 13, Sheet 7).

The clutch member 56 is reciprocated by a conventional lever 59 which is pivotally connected with a rigid frame part and also with the reciprocable rod 62, as described hereinbelow. The latter is also connected with the brake lever 63.

The brake of Figs. 8 and 9 (Sheet 5) is of a conventional type and comprises brake shoes 57 pivotally engaged with a pin mounted upon a cross bar integral with the bearing 55. The brake shoes are equipped with beveled flanges 57a between which a compression spring 63a is interposed, and upon the outer faces of which a pair of arms 64 ride. The latter are rigid with a reciprocable member 65 operatively engaged with the brake lever 63.

The lever 63 is secured pivotally, between its ends, to a side plate 50a, rigid with one of the angle bars 50, and is connected, suitably, at its lower end with the member 65, and at its upper end with a rod 67 by means of a member 67a.

The rod 67 (Fig. 13) passes slidably through a member 66 and is equipped, at its right-hand end, with lock nuts 68. A powerful compression spring 69 is interposed between the nuts 68 and the member 66 to control the degree of pressure exerted upon the screw shaft 54 by the brake shoes 57.

The member 65 is connected rigidly with the left-hand end of the rod 62.

No patentable novelty is claimed for the above described brake, per se.

The screw shaft 54 is equipped, preferably, with a very long pitch thread, such as the triple thread shown in Figs. 1 and 2 or an equally long pitch single thread for reasons set forth hereinbelow. In other figures, a standard single thread is shown for convenience only.

As shown in Figs. 1 and 2 and also in Figs. 16 and 17, the screw shaft reciprocates a carriage 70. Said carriage is equipped with a removable nut 70a suitably secured rigidly thereto and with which the screw shaft 54 is engaged.

Said carriage is connected detachably with the plunger 25 of the clamping bar structure by means of the spring held latch lever 71 (Fig. 16, Sheet 8) which is pivotally secured between its ends within the channeled base member 76 of the carriage 70, by means of the pivot pin 72, and is equipped at one end with the projection 73 which engages normally in a recess in the plunger 25. Said lever 71 is equipped at its other end with a roller 74 which rides upon a cam block 75, mounted upon the angle bars 50, to effect release of the projection 73 from the recess in the plunger 25

at a given point in the travel of the carriage 70 in the direction to move the clamping bar structure to the right-hand limit of its movement, the remainder of said movement of the clamping bar structure being effected by momentum.

A compression spring (Fig. 16) maintains the latch lever 71 normally engaged with the plunger 25.

The length of travel of the carriage 70 is greater than that of the clamping bar structure, so that, after the latter has attained the inner right-hand limit of its movement, the carriage moves onto its right-hand limit of movement relative to the plunger 25.

The base plate of the carriage 70 is equipped with side flanges 76a which engage in the grooves of the arms 34a of the left-hand channel bar sections 34 of the clamping bar structure shown in Figs. 3 and 4 and which constitute extensions of the latter which spread apart without being disengaged from the flanges 76a as the plunger 25 attains the inner limit of its movement. Said arms 34a do not pass through the opening in the frame plate 23. Said arms 34a ride upon a series of rollers 78 mounted upon studs secured to the vertical flanges of the angle bars 50 (Fig. 16).

The rod 62 is slidable, at its end portions, in bearings in the frame plates 60 and 23a, respectively, and is equipped with an adjustable collar 79 and nuts 80 adjacent said end portions, the nuts 80 being spaced from a collar 80a on said rod, as shown in Figs. 1 and 28.

The clutch spring 58 maintains the rod 62 normally at the left-hand limit of its movement, with brake shoes 57 released from the screw shaft 54 during periods of rotation of the latter by throw-in of the clutch member 56.

As the carriage 70 nears either limit of its travel, said rod 62 must be shifted to clutch throw-out and brake setting position, this being accomplished by mechanisms mounted upon the said carriage 70. Said mechanisms also operate to actuate a pair of electrically associated switches which control the circuits of the motor 51 to open one and close the other thereof each time that the rod 62 attains the right-hand limit of its movement.

Since this section of the specification deals only with all that is accomplished by the carriage 70 during its travel to the right, only one of the said mechanisms on said carriage is described next below.

Said mechanism comprises a post 81 (Figs. 1, 2, 16 and 17 and 18, Sheet 8) which is of inverted L-shape and is equipped with a flange 82 to which a lever 83, having an inclined cam edge 84, is secured pivotally at one end. Secured rigidly to said lever 83 between the ends thereof, is another L-shaped member which comprises a horizontal arm 85 which bears normally upon the rod 62, and an upright arm 87. A spring 86 is engaged with the flange 82 and the lever 83 to hold the latter normally in the position of Fig. 16.

The collar 80 of the rod 62 (Fig. 1) is disposed in the path of the arm 85, and as the carriage 70 approaches the frame plate 23a, the collar 80 is engaged by said arm 85 and throws the rod 62 to its right-hand limit, and thereby causes the collar 80a on said rod to pass over the beveled edge portion of the arm 90 of the spring-held bell crank trip lever 91 (Figs. 1, 28 and 30). The rod 62 is thus maintained at the right-hand limit of its movement against the action of the spring 58 until said trip lever is actuated to release the collar 80a.

The lever 88 of the switch 89 (Fig. 28) is disposed in the path of the arm 87. The lower wall of a corner recess of the plate 23a is disposed in the path of the cam edge 84 of the lever 83. Below the plate 23a is the opening in the plate 23 through which the clamping bar structure passes.

A tension spring 95 (Figs. 28 and 30) maintains the said bell-crank lever normally engaged with said rod 62.

At about the instant that the collar 80a has passed over the said arm 90, the cam edge 84 of the lever 83 will have raised the arm 85 above the level of the collar 80 and at about the same instant that this occurs, the arm 87 actuates the switch lever 88 to position to open the circuit of the motor 51, theretofore closed, and to close the other circuit of said motor 51 preparatory to actuating the crank shaft 94 to release the collar 80a, cause the rod 62 to be moved to clutch throw-in position and thus cause the carriage 70 to travel to the left, said shaft 94 being equipped with hand levers 94a for use of the operator (Fig. 30).

The momentum of the carriage 70, which travels at high speed, is sufficient to overcome the brake resistance to rotation of the screw shaft 54, to permit the carriage to move to its switch lever 88 actuating position after the brake 57 has been set and said clutch 56 thrown out. The carriage 70 is then disposed at the right-hand limit of its movement and remains there until the operator has inserted a pair of tie-wires 3 and has thereafter actuated the crank shaft 94.

One switch 124a of a pair of the same type as the switch 89 that controls a circuit of the motor 124, as shown in Figs. 3, 4 and 33, diagrammatically, is mounted upon an angle bar 50 (Figs. 1 and 2). The lever of said switch is shown as disposed in the path of a projection 106a of a rack bar 106 mounted upon the carriage 70 and is moved thereby to position to close, and maintain closed, a circuit of the said motor 124 before the carriage 70 has attained the right-hand limit of its movement, thereby causing actuation of the tie-wire feed mechanism in the direction required to effect insertion of tie-wires 3 into the tube 46 and thus through guide channels 14, until said circuit is reopened by actuation of a companion switch as described hereinafter.

A button switch 124b (Figs. 1 and 5) is provided, as in the patented machine, to be depressed by the operator to reverse the rotation of the motor 124 in the event that the tie-wire 3 does not pass full length through a guide channel 14 and needs to be withdrawn and another tie-wire inserted in place thereof.

Travel of the carriage 70 to the left, after actuation of the shaft 94, does not affect the switch 124a which closes the circuit of the motor 124.

SECTION 5

The tie-wire trimming mechanism

One of these mechanisms is incorporated into each of the terminal blocks of each row thereof, the block 13 of Figs. 20, 21 and 22 being one thereof disposed next adjacent the frame plate 24 of the machine.

The other terminal block of each row is shown in section in Figs. 23, 24 and 25 on an enlarged

scale, said block being disposed closely adjacent to the frame plate 23.

By turning Fig. 20 through an arc of 180°, it constitutes a face view, as to the grooved and channeled face portion thereof, of the block of Figs. 23–25, and when so turned, Figs. 23–25 will constitute a bottom plan sectional view taken on the plane of the lower wall of the channel 14 of said block, the latter being disposed in a vertical plane.

Each of the said mechanisms comprises a stop shoulder 97 (Figs. 20, 23–25) which is inclined to an angle approximating the pitch of the tie-wire 3 and projects inwardly from one wall of the channel 14 of the block 13 a distance somewhat greater than equal to the diameter of the wire of which the tie-wire 3 is composed. Said stop shoulder 97 is also equipped with a substantially semicylindrical face throughout its length and it is located about midway between the stripper groove 21 of the block 13 (Figs. 20 and 21) and an end thereof, namely, the left end of the block 13 of Fig. 20 and the right-hand end of the block 13 of Figs. 23–25.

Spaced from said stop shoulder 97 a distance equal to or to very slightly greater than the length of one coil of the tie-wire 3, is a rigid shearing member 98. The shearing edge of the latter is spaced from the same wall of the channel 14 from which the stop shoulder 97 projects. The shearing edge of the reciprocable shear member 99 is disposed in a plane parallel with the side walls of the channel 14. Said plane is spaced from the similar plane which is tangential to the stop shoulder 97, said shearing edge of the member 98 being disposed a distance slightly greater than equal to the diameter of the wire of which the tie-wires 3 are composed, from the said plane of the stop shoulder 97 (Figs. 20, 23–25).

The reciprocable shear member 99 is equipped at its lower end with a cutting edge and is disposed normally approximately the same distance, longitudinally, from the member 98 as the latter is spaced from the shoulder 97. The upper end portion of the member 99 cooperates with the member 97, as it passes the latter, to form a closed terminal loop 4 in the tie-wire (Fig. 27). Said cutting edge cooperates with that of the member 98 to cut the tie-wire 3.

All three of these members are disposed normally out of the path of travel of the front extremity of the tie-wire 3, which enters the left-hand end of the channel 14 of the block 13, shown in Fig. 20, and also the left-hand end of the block 13 shown in Figs. 23–25. Each member 98 is inserted into place through an opening 98b in the block 20 and is lodged in the wall of the block between the channels 14 and 18 thereof with one end disposed flush with the lower surface of said wall (Fig. 20) and is secured rigidly in place in any suitable manner, as by means of a pin 98a, its innermost surface portion being disposed inwardly of the bottom surfaces of the said channels 14 and 18 (Figs. 23–25). The tie-wire entry ends of the guide channels 14, of the blocks 13 of each row, are reamed out as shown in Fig. 26.

The member 99 of Figs. 20 and 21 is rigid with a reciprocable rock-bar 100 mounted in a channel in the back of and common to all blocks 13 (Fig. 21), and passes through the slot 99a in the bottom wall of the channel 14 (Figs. 20, 23–25).

As best shown in Fig. 22, the rack-bar 100 meshes with a spur gear pinion 101 rigid with the shaft 102 which is journalled at one end in the block 13 and has its extremity disposed flush with the bottom of the channel 18 of said block (see Fig. 21).

The rack-bar 100 meshes with a rack-bar 103 (Fig. 22) and the latter is connected with the bar 103a of Figs. 23–25 by a rod 104 which passes through the back channels of all blocks 13 interposed between the terminal blocks 13. The bar 103a of Figs. 23–25 carries the reciprocable shear member 99 which is a duplicate of the reciprocable shear member 99 of Figs. 20–22, and performs the same function in the same way as the latter.

A tension spring 105 (Fig. 22) connects the rod 104 with the bar 9 at a point not shown, and serves to maintain the rack-bars 100, 103 and bar 103a in the respective positions of Figs. 22 and 23.

One end portion of each shaft 102 passes through a short longitudinal slot 102a in each bar 9—12 and is journalled in a bearing in a plate 13c suitably mounted for longitudinal adjustment along each bar 9—12, this being necessary to permit the terminal blocks 13, of each row next adjacent the frame plate 24, to be adjusted in position relative to next adjacent blocks 13 along the bars 9—12.

The normal outer limit of movement of each reciprocable shear member 99 is shown in Fig. 23 and the inner limit of its movement is shown in dotted lines in Fig. 25.

Figs. 23–25 illustrate the progressive movements of the bar 103a responsively to actuation thereof by reciprocable plungers 118 of Fig. 31, as next described.

SECTION 6

Mechanism which actuates the trimming mechanisms

Mounted upon the carriage 70 is a pair of rack bars 106 (Figs. 1, 2, 16 and 17) which mesh with the spur gear wheels 107 as the carriage 20 approaches the right-hand limit of its movement and during the corresponding portion of its movement in the opposite direction (Figs. 1, 2, 28 and 29).

Each spur gear wheel 107 constitutes a free wheeling clutch element of the mechanism shown in Fig. 28 which comprises a pair of plates 108 (shown also in Fig. 31) mounted upon brackets rigid with the frame bars 50.

Said plates 108 are equipped with recesses (Figs. 28 and 31) containing pairs of intermeshed spur gear pinions 109 and 110. The pinions 109 are rigid with a shaft 111, journalled in a bearing 112, and which is also rigid with the free wheeling clutch member 113 lying within the spur gear wheel 106 (Fig. 28). The latter is interposed between washers 114 and 115, the former of which is supported upon the bearing 112, both said washers being held in place by the plate 116 secured to the shaft 111.

Each clutch member 113 (Fig. 29) is equipped with a plurality of peripheral recesses each having a radial wall. Each of said recesses contains a roller and a compression spring engaged with said radial wall to urge said roller into engagement with the wheel 107, so that when the clutch member wheel 107 is rotated anti-clockwise (Fig. 29), as when the carriage 70 travels to the left, it will cause the clutch member 113 and shaft 111 to rotate with it, said wheel 107 being free to rotate relative to the member 113

in the opposite direction. The above described type of clutch is old and well-known.

The two wheels 107 (Figs. 1 and 28) rotate in respectively opposite directions to effect rotation of the shafts 111 during travel of the carriage 70 to its left-hand limit of movement.

The rack bars 106 become engaged with the spur gear wheels 107 at substantially the instant that the projection 73 of the latch lever 71 (Fig. 16) leaves the recess in the plunger 25 during travel to the right.

The point in the travel of the carriage 70 at which this disengagement of the latch lever 71 from the plunger 25 occurs, is fixed by the distance that the beveled end of the cam block 75 is spaced from the frame plate.

During the travel of the carriage 70 to its right-hand limit, the shafts 111 are not actuated, and while the carriage 70 remains at said limit of its movement, the operator feeds a pair of tie-wires 3 into the machine.

As soon as said insertion of the wires has been effected, the operator actuates the rock shaft 94 and thus causes the rod 62 to be returned to the left-hand limit of its movement. Thus the brake 57 is released, the clutch member 56 is thrown in and the screw shaft 54 is rotated in the direction to cause the carriage 70 to be returned to the left-hand limit of its movement. During the initial part of this travel of the carriage 70 and while the clamping bar structure remains at the right-hand limit of its movement, the rack bars 106, and spur gear wheels 107, cause the shafts 111 to be rotated in the direction to cause the plungers 118 (Fig. 31) to be actuated to move the bars 103*a*, rack bars 100 and plungers 99 against the action of the springs 105, from their normal positions to the inner limits of their respective movement, as shown in dotted lines in Fig. 25.

As shown in Fig. 31, which should be read in conjunction with Fig. 22, each pinion 110 meshes with a reciprocable rack bar 117, rigid with a plunger 118, which enters the opposed back channel of a terminal block 13, to engage an end of a bar 103*a* to effect actuation of the companion rack bar 103 of the other terminal block 13 of the same row, said rack bars 117 being held normally at the outer limits of their movement by the springs 119 and are thus returned to normal position.

An instant after the tie-wire trimming mechanisms have thus been actuated and the rack bars 106 have become disengaged from the wheels 107, the latch lever 71, mounted upon the carriage 70, becomes re-engaged with the plunger 25 and thus the clamping bar structure is caused to travel with the carriage 70 to the left-hand limit of its movement.

One of said rack bars 106 is equipped with a projection 106*a* (Figs. 2 and 17), which actuates the lever of a switch 126*a* to close the circuit of a solenoid 126 (Figs. 33 and 34) momentarily during travel of the carriage to the left, which causes actuation of the shifting mechanism of the machine by the motor 124, as described fully in the next section of this specification.

Closing of the solenoid circuit occurs when the clamping bar structure is entirely out of the path of the row of springs 1 last inserted into the machine because the shifting of the bars 9—12 follows instantly after closure of said solenoid circuit. The carriage 70 is now very near to the left-hand limit of its travel.

Mounted upon the top of the carriage 70 is another post 81*a* to which one end of a lever 120 is secured pivotally. Said lever is equipped with a beveled end surface and with a shoulder 121 (Figs. 2, 16, 17 and 19) between its ends.

A lever 122 is pivotally secured between its ends to the plate 60 (Figs. 1 and 13) and is disposed at one end in the path of the collar 79 of the rod 62. The other end of said lever is disposed in the path of said shoulder 121 of the lever 120. The first-named end of the lever 122 is thus caused to engage the collar 79 and throw the rod 62 to the right-hand limit of its movement for re-engagement of collar 80*a* with the arm 90 of the bell crank lever 91 (Fig. 29). The beveled end of the lever 120 rides upon a roller (Fig. 19) to throw the shoulder 121 out of the path of said lever 122 after the latter has actuated the rod 62. Thus the clutch member 56 is thrown out and the brake 57 is set.

The lever 123 of the switch 123*a* on the plate 60 lies in the path of the carriage 70 and is actuated an instant before the rod 62 has been restored to the right-hand limit of its movement. Thus the circuit of the motor 51 again is reversed so that, upon next actuation of the crank shaft 94, the carriage 70 will be caused to travel to its right-hand limit.

Prior to actuating the shaft 94 again after the carriage 70 has attained the left-hand limit of its movement, the operator inserts another row of springs 1 into the machine.

Shock absorbing members 96 are mounted in the plate 60 in the path of the carriage 70 for obvious reasons (Figs. 14 and 15).

The foregoing operations are repeated, of course, after each insertion of a row of springs 1 into the machine.

SECTION 7

The shifting and indexing mechanisms

The motor 124 effects shifting of bars 9—12 automatically after the solenoid circuit control switch 126*a* has been closed momentarily. Said motor thus performs two functions, one being to actuate the tie-wire feed mechanism.

In the instant machine, the motor 124 is belt connected, by means of its sheave 125 with the shaft of the casing 37, and its small sheave 136*a* is belt connected with the sheave 136 rotatably mounted on a shaft 137, which carries a spur gear pinion 138*a* that meshes with the spur gear wheel 132 (Figs. 33 and 36).

A tooth clutch member 135 is rigid with the sheave 136 and a companion clutch member 134 is integral with a sleeve on the shaft 137 with which the pinion 138*a* is also integral.

A sleeve 141 is mounted rotatably upon the said sleeve and is held against rotation by the forked arm of a rocking lever 130 (Figs. 36 and 37) described herebelow.

A compression spring 139 is interposed between the pinion 138*a* and the collar 140 on the right-hand end of the shaft 137, which operates to throw in the clutch member 134 and swing the lever 130, when a companion rocking lever 133, mounted upon the lever 130, permits.

The lever 130 is mounted pivotally, at its lower end, upon the bearing of the shaft 131, keyed to the wheel 132. The latter is equipped with a cam projection 143, shown in dotted lines in Fig. 33, and in full lines in Figs. 36 and 38.

Mounted slidably, for longitudinal movement, upon the lever 130, is the member 133 (Figs.

34, 36 and 38) which is equipped at its upper end with a projection 142 which is normally engaged with the said projection 143 on the wheel 132.

The armature of the solenoid 126 is connected with a rocking arm 127 equipped with a flange 127a, pivotally connected with a frame plate of the machine, and which is swung downwardly when the solenoid circuit is closed, thereby to cause the arm 128, also pivotally connected with the machine frame, to be swung downwardly against the action of the tension spring 129 (Fig. 34). Said arm 128 is connected with member 133 and passes through a longitudinal slot in the lever 130.

Thus the member 130 is moved downwardly to withdraw the projection 142 out of the path of travel of the projection 143 for an instant and thus permits the clutch members 134 and 135 to become inter-engaged responsively to the action of the compression spring 139. This causes the wheel 132 to make a complete revolution which is controlled by re-engagement of the projection 142 with said projection 143 (Figs. 33, 34, 36 and 38) responsively to the spring 129.

The wheel 132 is equipped with a crank pin 144 with which the lower end of a rack-bar 145 is connected. The latter meshes with the spur gear wheel 146 of a free wheeling clutch, such as is shown in Fig. 29, and operates to rotate the shaft 147, during the up-stroke of the rack-bar 145, through a complete revolution, the down-stroke of said rack-bar 145 being free.

The shaft 147 (Fig. 3) is equipped with bevel gear wheels 148 which mesh with bevel gear wheels 148a mounted upon the shafts 6 (Fig. 3) and turn the latter a half revolution in respectively opposite directions to shift the bars 9–12.

A projection 149 on the wheel 132 (Fig. 33) actuates the lever 150 of the switch 150a. The latter functions electrically to effect operation of the switch 124a to open the circuit of the motor 124 before the wheel 132 has completed its revolution, the remainder of which is effected by momentum.

To stop the rotation of the wheel 132 at the completion of said revolution, the arm 127 (Fig. 34), which is rigid with an upwardly projecting arm 151, causes actuation of a bell crank lever 152.

An arm of bell crank lever 152, which is secured pivotally at its elbow to the projection 152a (Fig. 34), is disposed in the path of the arm 151, and is actuated against the action of the tension spring 152b (Fig. 34), to draw the upper arm of the L-shaped lever 153 out of the path of the cam wheel 154. The latter is mounted rigidly upon the shaft 147.

Said wheel 154 rotates with shaft 147, a full revolution, the lever 153 being restored to the position of Fig. 34 the instant that the wheel 154 has completed a revolution.

Mounted upon the shaft 147 is an arm 155 (Fig. 35) which operates to turn the toothed wheel 156, on the shaft 157, tooth by tooth against the action of the spring-held detent 158 (Figs. 3 and 35). The index wheel 159 (Fig. 2) is thus rotated to indicate the number of pairs of tie-wires 3 and, thus also, the number of rows of springs 1 that have been inserted into the machine.

An alarm means, such as an electric bell or lamp, not shown, may be provided to advise the operator that a spring assembly has been completed.

The operator then actuates the shaft 94 to cause the completed assembly to be discharged, and when this has been done, the said indicating hand will register with the numeral "0" of said index wheel or disk 159 to indicate that the first row of springs 1 for the next assembly must be inserted into the machine.

No patentable novelty, per se, is claimed for the subject matter described in this section 7 of the specification, in view of the disclosures of Patent No. 2,351,659.

This application is a continuation-in-part of our prior application Serial No. 625,698, filed October 31, 1945, and now abandoned.

We claim as our invention:

1. In a spring assembling machine, including spring end-coil engaging and positioning devices equipped with tie-wire guide channels, tie-wire feed mechanism, and a reciprocable clamping bar structure cooperating with said devices, a screw shaft for actuating said clamping bar structure, a reversible electric motor for actuating the screw shaft, a clutch for connecting the screw shaft with said motor, motor circuit control switches, a carrier movable longitudinally along said screw shaft for effecting operation of one of said switches to close one motor circuit to effect reverse rotation of said motor as the clamping bar structure attains a given point in its movement and at the same time opening the previously closed circuit, and means actuated by the screw shaft for automatically operating said clutch to disconnect the screw shaft from the motor as said clamping bar structure attains predetermined points in its travel, and manually operable means for effecting movement of said clutch to connect the screw shaft with the motor.

2. A structure, according to claim 1, wherein the clamping bar structure is associated detachably with the screw shaft, means for effecting disassociation of the same automatically from the screw shaft as the clamping bar approaches one limit of its movement and reassociating it automatically with the screw shaft at a given point in the reverse rotation of the latter.

3. A spring assembling machine including a frame pairs of intermittently movable carriers equipped with pairs of bars disposed in parallel opposed relation to each other, a row of blocks mounted upon each of said bars for adjustment relative to each other along said bars, the opposed faces of said blocks being equipped with formations for the reception of predetermined end-coil portions of two rows of compressed springs and with a tie-wire guide channel into which predetermined end-coil portions of said springs are caused to project for encirclement by a helical tie-wire, each of said blocks being equipped with a back channel, a pair of reciprocable rack bars both meshing with a spur gear pinion mounted within the channels of each of one of the terminal blocks of each row, a single reciprocable rack bar mounted in the other terminal blocks of each row, the last-named rack bars and one of said rack bars of each pair being equipped with a shearing member projecting into the guide channels of said blocks through slots in the bottom walls of the guide channels thereof, a rod connecting the reciprocable rack bars of one pair of said terminal blocks with the rack bar of the other which is devoid of the shearing member, and mechanism operable to actuate one of the reciprocable rack bars equipped with a shear

member to effect movement of the said rack bar of the other terminal block carrying a shearing member in the opposite direction via said spur gear pinion.

4. A spring assembling machine including intermittently movable spring engaging and carrying elements, power actuated mechanism for actuating the same, reversible power actuated mechanism for holding springs engaged with said elements while the springs carried thereby are inter-connected with each other between intervals of movement of said members, means disposed for automatic control by the last-named mechanism for causing actuation of the first-named mechanism during movement of said second-named mechanism in one direction and for effecting automatic stopping of both said mechanisms as the same attain predetermined points in their respective movements, a member constituting a part of said spring engaging and carrying elements and disposed at one end thereof, said member having a tie-wire receiving channel and spring engaging grooves formed therein, a rigid shear member mounted within one end portion of said channel, a rigid stop shoulder within said channel and spaced from said rigid shear member, a shear member reciprocable longitudinally of and within said channel, said shear member being normally spaced from the rigid shear member and stop shoulder and movable toward said fixed shear member to sever the tie-wire, said stop shoulder and reciprocable shear member being equipped with formations cooperating to deform the remaining terminal of the tie-wire to form a closed loop in one end thereof as said reciprocable shear member passes said shoulder, a rod connected at one end to said shear member and extending at a right angle to the direction of movement of said carriers, a reciprocable member connected to said rod for movement therewith, and crimping means associated with said reciprocable member to form a closed loop at the other end of the tie-wire.

5. In a spring assembly machine, a pair of carriers spaced apart and having portions in parallel relationship, blocks mounted on said carriers and disposed thereon in rows and having arcuate grooves for receiving the end turns of the springs to be assembled, said springs being inserted between said carriers with the end turns of adjacent rows of the springs abutting in said arcuate grooves, a tie-wire guide channel formed in said blocks, means to feed helical tie-wires into said guide channels to secure together said adjacent rows of springs at their abutting portions, movable mechanism including clamping bars engageable with said blocks to close said guide channels, electric motor drive for the tie-wire feeding means, electric circuit controlling the motor drive, cooperating means on said movable mechanism and a relatively stationary part of the machine including a switch in said circuit whereby said switch is operated to actuate said drive as the clamping bars move toward and are in substantially operable position, rotatable shafts supporting said carriers, gearing for rotating said shafts, means driven by said gearing to indicate the number of completed rows of springs, electrical means connecting said motor drive to said gearing, a circuit for said electrical means, and cooperating means on said movable mechanism and a relatively stationary part of the machine including a switch in said last named circuit whereby said last named switch is operated when said clamping members are moving away from and are substantially withdrawn from between said carriers.

6. In a spring assembly machine, a pair of carriers spaced apart and having portions in parallel relationship, blocks mounted on said carriers and disposed thereon in rows and having arcuate grooves for receiving the end turns of the springs to be assembled, said springs being inserted between said carriers with the end turns of adjacent rows of the springs abutting in said arcuate grooves, a tie-wire guide channel formed in said blocks, means to feed helical tie-wires into said guide channels to secure together said adjacent rows of springs at their abutting portions, clamping members movable into engagement with said blocks to close said guide channels, electrically actuated means to move said clamping members between said carriers and into engagement with said blocks, an electric motor to operate said feed means, a circuit for said motor, cooperating means on a part movable with said clamping bars and a relatively stationary part of the machine including a switch in said circuit whereby said switch is closed to cause said motor to operate said feeding means when said clamping members are in position to close said guide channels, shearing and crimping means for said tie wires located at least at one end of one of said rows, cooperating means on a part movable with said clamping bars and a stationary part of the machine for initiating movement of said shearing and crimping means, rotatable shafts supporting said carriers, and gearing for rotating said shafts, electrical means connecting said motor to said gearing, a circuit for said electrical means and cooperating means movable with said clamping bars and a relatively stationary part of the machine including a switch in said last named circuit whereby said last named switch is operated when said clamping members are moving away from and are substantially withdrawn from between said carriers.

7. In a spring assembly machine, a pair of carriers spaced apart and having portions in parallel relationship, blocks mounted on said carriers and disposed thereon in rows and having arcuate grooves for receiving the end turns of the springs to be assembled, said springs being inserted between said carriers with the end turns of adjacent rows of the springs abutting in said arcuate grooves, a tie-wire guide channel formed in said blocks, means to feed a helical tie-wire into said guide channels, movable mechanism including clamping bars engageable with said blocks to close said guide channels, electric motor drive for the tie-wire feeding means, electric circuit controlling the motor, cooperating means on said movable mechanism and a relatively stationary part of said machine including a switch in said circuit whereby said switch is operated as the clamping bars move toward and are substantially in their operable position to actuate said circuit and initiate feed of said tie-wires, rotatable shafts supporting said carriers, gearing for rotating said shafts, said shafts being rotated to move the rows of springs through the machine, a second electrical circuit to control the application of power to said gearing, and cooperating means on said movable mechanism and a relatively stationary part of the machine including a switch in said second circuit whereby said last named switch is operated as the clamping bars are moving away and removed from operable position.

8. In a spring assembly machine, a pair of carriers spaced apart and having portions in

parallel relationship, blocks mounted on said carriers and disposed thereon in rows and having arcuate grooves for receiving the end turns of the springs to be assembled, said springs being inserted between said carriers with the end turns of adjacent rows of the springs abutting in the arcuate grooves, means to feed helical tie-wires between said carriers and parallel to the rows of blocks and through guide channels formed therein to secure together said adjacent rows of springs at their abutting portions, movable mechanism including clamping members and a plunger, said clamping members and plungers being movable between said blocks, said clamping members having flanges which are adapted to set within channels formed in said blocks parallel to said guide channels, said plunger being disposed between said clamping members, a stop member disposed at one end of the machine and arranged to stop movement of said clamping members but not to impede movement of said plunger, spreading means associated with said clamping members and plunger, said clamping members moving into engagement with said blocks to close said guide channels when said clamping members strike said stop member and while said plunger continues its movement, electric motor drive for the means to feed helical tie-wires, a circuit for said motor drive, cooperating means on said movable mechanism and a relatively stationary part of the machine including a switch in said circuit to energize said electric motor drive to feed helical tie-wires when said clamping members are in position to close said guide channels, switch means operable to effect withdrawal of said plunger and clamping members from between said blocks, rotatable shafts supporting said carriers, gearing for rotating said shafts, electrical means to rotate said shafts a predetermined amount, a second circuit for said last named means, and cooperating means on said movable mechanism and a relatively stationary part of the machine including a switch in said second circuit to actuate said last named means when said clamping members are withdrawn from between said carriers.

9. In a spring assembly machine, a pair of carriers spaced apart and having portions in parallel relationship, blocks mounted on said carriers and disposed thereon in rows and having arcuate grooves for receiving the end turns of the springs to be assembled, said springs being inserted between said carriers with the end turns of adjacent rows of the springs abutting in said arcuate grooves, a tie-wire guide channel formed in said blocks, means to feed helical tie-wires into said guide channels to secure together said adjacent rows of springs at their abutting portions, clamping members movable into engagement with said blocks to close said guide channels, a plunger disposed between said clamping members and connected thereto, means to move said plunger and clamping bars, said plunger and said clamping members being movable longitudinally from one end of the rows of blocks into and out of the space between said carriers, a stop member disposed at the other end of the rows of blocks and arranged to stop movement of said clamping members but not to impede movement of said plunger, link members associated with said clamping members and plunger, said clamping members moving into engagement with said blocks to close said guide channels when said clamping members strike said stop member and while said plunger continues movement, an electrical motor to operate said feed means, a circuit controlling said motor, cooperating means on a part movable with said clamping bars and a relatively stationary part of the machine including a switch in said circuit whereby said switch is closed when said clamping members are in operable position between said carriers, rotatable shafts supporting said carriers, gearing for rotating said shafts, said shafts being rotated to move the rows of springs through the machine, an electrical circuit to control the application of power to said gearing, and cooperating means on a part movable with said clamping bars and a relatively stationary part of the machine including a switch in said last named circuit whereby said last named switch is operated when said clamping bars are moving away from and are substantially withdrawn from between said carriers.

10. A spring assembling machine including a frame, a pair of intermittently movable carriers equipped with pairs of bars disposed in parallel opposed relation to each other, a row of blocks mounted upon each of said bars, the opposed faces of said blocks being equipped with formations for the reception of predetermined end-coil portions of rows of springs and with a tie-wire guide channel into which predetermined end-coil portions of said spring are caused to project for encirclement by a helical tie-wire, means to feed tie-wires through said guide channels, a shaft mounted in the terminal block at one end of a row, a gear mounted on said shaft, a first rack member engaging said gear, a second rack member engaging said gear, a rack bar mounted on the terminal block at the other end of the row, a rod extending along the row and connecting said rack bar to one of said rack members, a plunger operable to move said rack bar, gear and rod, said plunger being movably mounted on said frame of said machine at one end of said rows, reciprocable members mounted on said rack bar and on one of said rack members, and cooperating means mounted on said terminal blocks for crimping the ends of said helical tie-wires when said reciprocable members move relative to said cooperating means.

11. A spring assembling machine including a frame, a pair of intermittently movable carriers equipped with pairs of bars disposed in parallel opposed relation to each other, a row of blocks mounted upon each of said bars, the opposed faces of said blocks being equipped with formations for the reception of predetermined end-coil portions of rows of springs and with a tie-wire guide channel into which predetermined end-coil portions of said spring are caused to project for encirclement by a helical tie-wire, means to feed tie-wires through said guide channels, a shaft mounted in the terminal block at one end of a row, a gear mounted on said shaft, a first rack member engaging said gear, a second rack member engaging said gear, a rack bar mounted on the terminal block at the other end of the row, a rod extending along the row and connecting said rack bar to one of said rack members, a plunger operable to move said rack bar, gear, and rod, said plunger being movably mounted on said frame of said machine at one end of said rows, reciprocable members mounted on said rack bar and on one of said rack members, a stop member disposed within the guide channel of the terminal blocks of said row, and a rigid shearing member mounted in the terminal blocks at said other end of said row, said reciprocable members

being moved in response to movement of said plunger to close the ends of said helical tie-wire to prevent said tie-wire from unwinding from the springs.

12. A spring assembling machine including a frame, a pair of intermittently movable carriers equipped with pairs of bars disposed in parallel opposed relation to each other, a row of blocks mounted upon each of said bars, the opposed faces of said blocks being equipped with formations for the reception of predetermined end-coil portions of rows of springs and with a tie-wire guide channel into which predetermined end-coil portions of said spring are caused to project for encirclement by a helical tie-wire, movable mechanisms including clamping bars adapted to move between said carriers to close said tie-wire guide channels, means to feed tie-wires through said guide channels, a shaft mounted in the terminal block at one end of a row, a gear mounted on said shaft, a first rack member engaging said gear, a second rack member engaging said gear, a rack bar mounted on the terminal block at the other end of the row, a rod extending along the row and connecting said rack bar to one of said rack members, a plunger operable to move said rack bar, gear, and rod, said plunger being movably mounted on said frame of said machine at one end of said rows, means to cause said movable mechanism to move said plunger when said clamping bars are in a predetermined position, a reciprocable member mounted on said rack bar and on one of said rack members, and cooperating means mounted on said terminal blocks for crimping the ends of said helical tie-wires when said reciprocable members move relative to said cooperating means.

13. A spring assembling machine including a frame, a pair of intermittently movable carriers equipped with pairs of bars disposed in parallel opposed relation to each other, a row of blocks mounted upon each of said bars, the opposed faces of said blocks being equipped with formations for the reception of predetermined end-coil portions of rows of springs and with a tie-wire guide channel into which predetermined end-coil portions of said spring are caused to project for encirclement by a helical tie-wire, means to feed said tie-wire through said guide channels, each of said rows of blocks having associated therewith the following elements; a shaft mounted in the terminal block at one end of the row, a gear mounted on said shaft, a first rack member engaging said gear, a second rack member engaging said gear, said rack members being mounted in the terminal blocks at said one end, a rack bar mounted in the terminal block at the other end of the row, a rod extending along the row and connecting said rack bar to one of said rack members, a reciprocable member mounted on said rack bar and on one of said rack members and extending into the tie-wire guide channels of the terminal blocks, cooperating means mounted in said tie-wire guide channels of said terminal blocks for crimping the ends of said tie-wires when said reciprocable member is moved, all of the elements associated with each row of blocks being carried by and movable with said carriers; and a pair of plungers disposed at one end of the rows of blocks in position to be aligned with a pair of said rows of blocks, said rack members, reciprocable members, gear, rod, and rack bar of a row of blocks on each carrier being moved by one of the plungers to crimp the ends of the tie-wires after the feeding means has encircled the end portions of the rows of springs with the tie-wires.

14. A spring assembling machine including a frame, a pair of intermittently movable carriers equipped with pairs of bars disposed in parallel opposed relation to each other, a row of blocks mounted upon each of said bars, the opposed faces of said blocks being equipped with formations for the reception of predetermined end-coil portions of rows of springs and with a tie-wire guide channel into which the predetermined end-coil portions of said spring are caused to project for encirclement by a helical tie-wire, movable mechanism including clamping bars adapted to move between said carriers and to close said guide channels, means to feed said tie-wire through said guide channels, each of said rows of blocks having associated therewith the following elements; a shaft mounted in the terminal block at one end of the row, a gear mounted on said shaft, a first rack member engaging said gear, a second rack member engaging said gear, said rack members being mounted in the terminal blocks at said one end, a rack bar mounted in the terminal blocks at the other end of the row, a rod extending along the row and connecting said rack bar to one of said rack members, reciprocable members mounted on said rack bar and on one of said rack members and extending into the tie-wire guide channels of the terminal blocks, cooperating means mounted in said tie-wire guide channels of said terminal blocks for crimping the ends of said tie-wires when said reciprocable member is moved, all of the elements associated with each row of blocks being carried by and movable with said carriers; a pair of plungers disposed at one end of the rows of blocks in horizontal alignment with a pair of said rows of blocks, said rack members, reciprocable members, gear, rod, and rack bar of a row of blocks on each carrier being moved by one of the plungers to crimp the ends of the tie-wires after the feeding means has encircled the end portions of the rows of springs with the tie-wires, and means to cause said movable mechanism to actuate said plunger when said clamping bars are in a predetermined position.

15. A spring assembling machine including a frame, a pair of intermittently movable carriers equipped with pairs of bars disposed in parallel opposed relation to each other, a row of blocks mounted upon each of said bars, the opposed faces of said blocks being equipped with formations for the reception of predetermined end-coil portions of rows of springs and with a tie-wire guide channel into which predetermined end-coil portions of said spring are caused to project for encirclement by a helical tie-wire, means to feed tie-wires through said guide channels, a shaft mounted in the terminal block at one end of a row, a gear mounted on said shaft, a first rack member engaging said gear, a second rack member engaging said gear, a rack bar mounted on the terminal block at the other end of the row, a rod extending along the row and connecting said rack bar to one of said rack members, a plunger operable to move said rack bar, gear and rod, said plunger being movably mounted on said frame of said machine at one end of said rows, a reciprocable member mounted on said rack bar and on one of said rack members, cooperating means mounted on said terminal blocks for crimping the ends of said helical tie-wires when said reciprocable members move relative

to said cooperating means, and resilient means urging said reciprocable members away from said cooperating means and yieldingly resisting the force exerted by said plunger.

16. In a machine of the type specified which includes a reversible electric motor, a reciprocable carriage driven by said motor, clamping bars, a member operatively connected between said carriage and motor, a spring-held clutch releasably connecting said member with said motor, a second member connected with said clutch and adapted to release the clutch, a pair of interassociated switches controlling the direction of rotation of said motor, cooperating devices on said carriage and the machine frame for actuating said clutch connected second member and switches in a predetermined order of succession to effect release of said clutch and reversal of said motor as said carriage approaches the respective limits of its movement, a spring-held trip lever mechanism associated with said second member connected with said clutch to retain the latter in clutch release position after each actuation thereof until said trip lever mechanism is actuated manually to release the same, a carrier for holding the springs to be assembled, a carrier shifting mechanism for moving the carrier and springs through the machine, a tie-wire feed mechanism to feed tie-wires to the machine

to connect the springs being assembled, a motor for actuating said carrier shifting mechanism and said tie-wire feed mechanism, a clutch interposed between said last-named motor and said shifting mechanism, and cooperating devices on the machine frame and said carriage operatively controlling the last-named clutch to cause said shifting mechanism to operate after the clamping bar structure is withdrawn from the path of the springs last inserted into the machine following the insertion of tie-wires into the machine to connect the springs.

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