June 20, 1944. E. L. BRONSTIEN ET AL 2,351,659

MACHINE FOR FABRICATING UPHOLSTERY SPRINGS

Filed Aug. 4, 1941 6 Sheets-Sheet 1

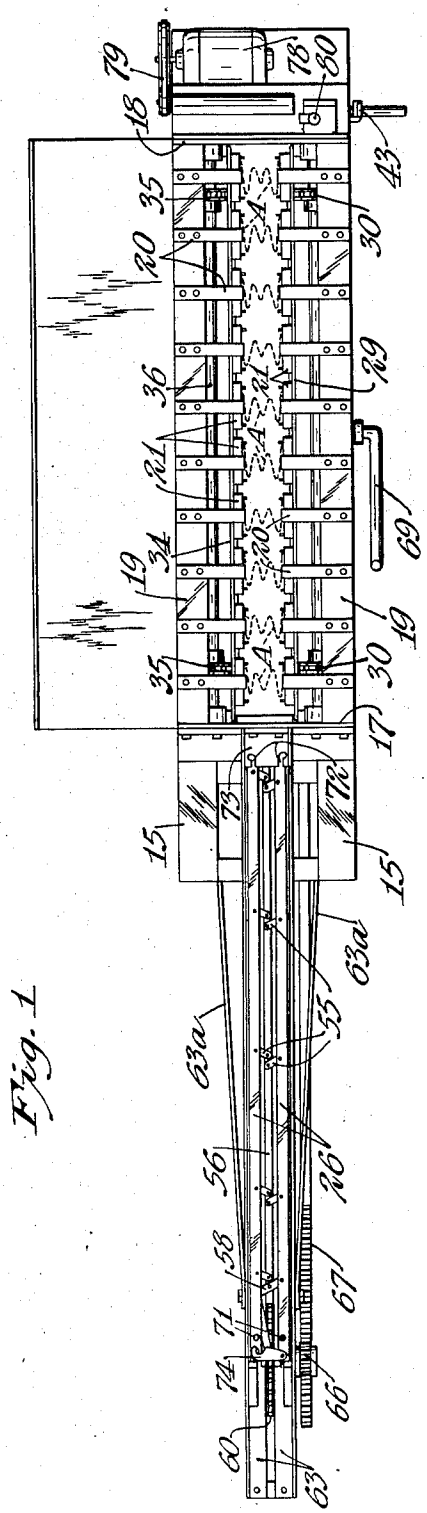


Fig. 1

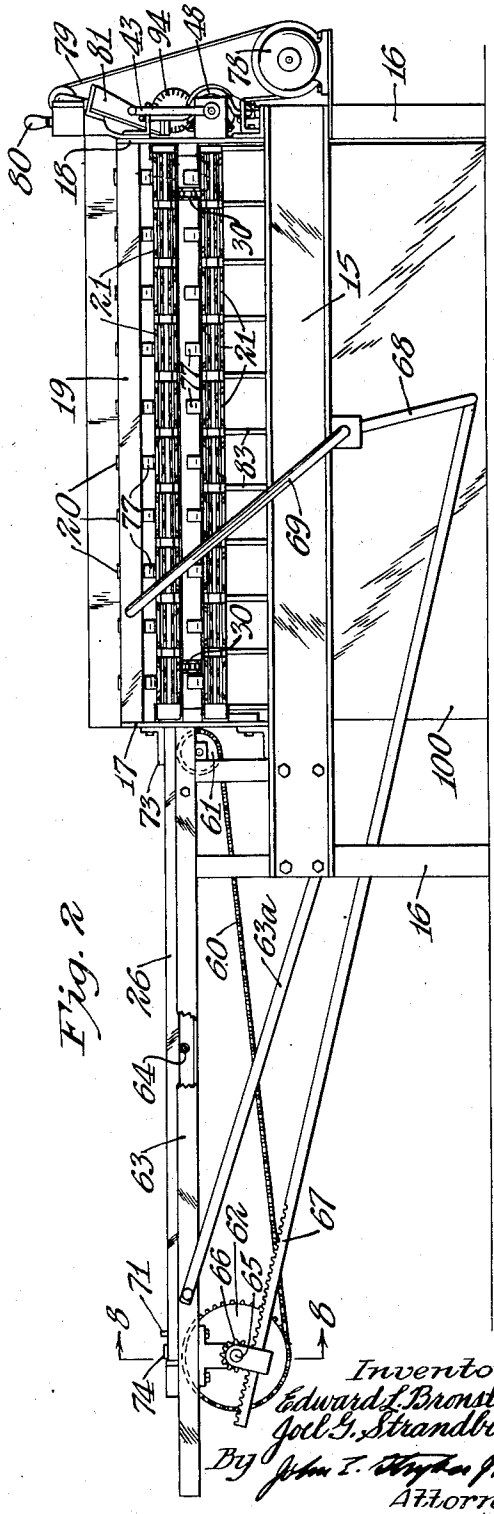


Fig. 2

Inventor
Edward L. Bronstien
Joel G. Strandberg
By John F. Hayden Jr.
Attorney

June 20, 1944. E. L. BRONSTIEN ET AL 2,351,659

MACHINE FOR FABRICATING UPHOLSTERY SPRINGS

Filed Aug. 4, 1941 6 Sheets-Sheet 2

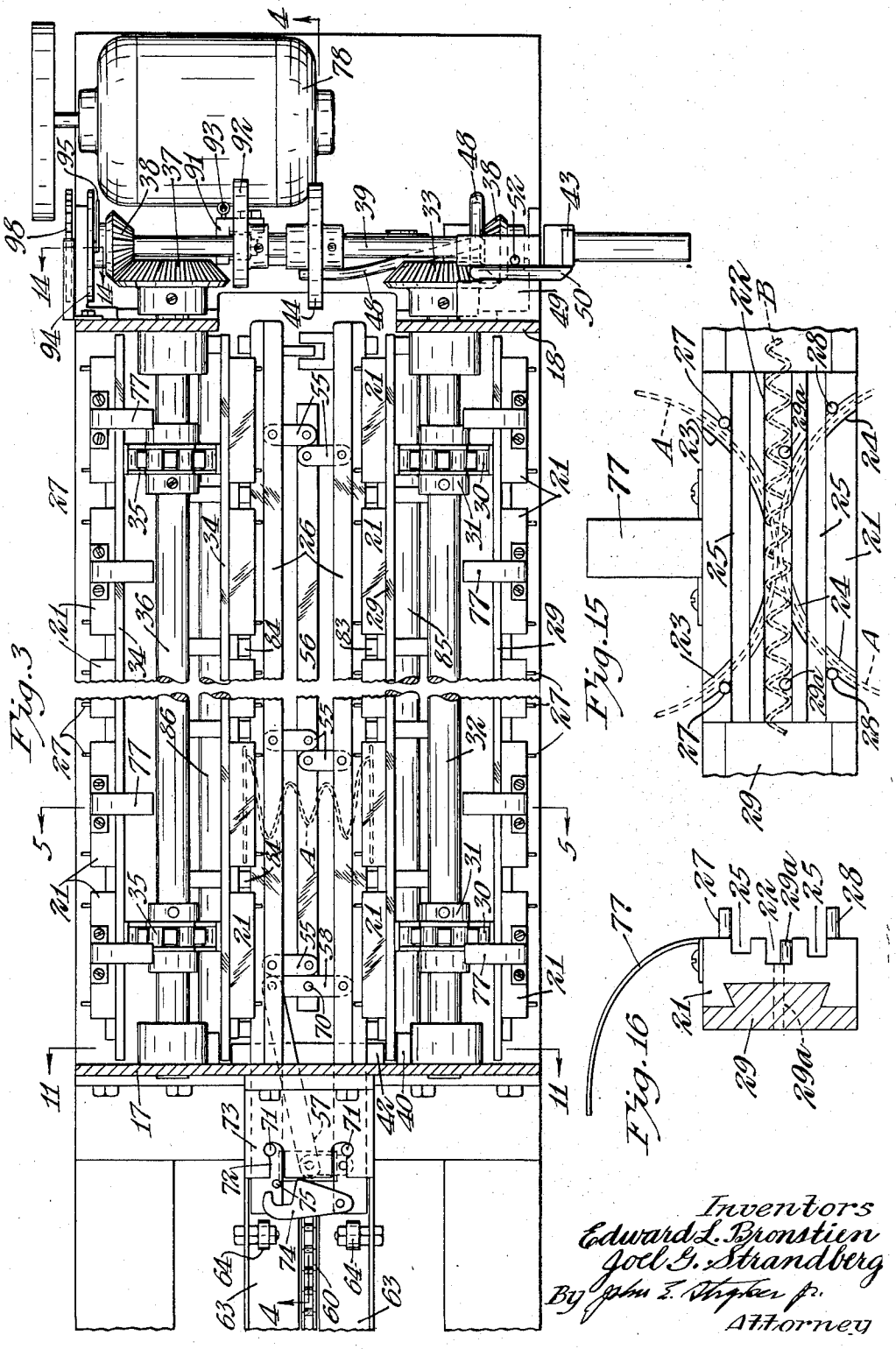


Fig. 3

Fig. 15

Fig. 16

Inventors
Edward L. Bronstien
Joel G. Strandberg
By John Z. Stryker Jr.
Attorney

June 20, 1944. E. L. BRONSTIEN ET AL 2,351,659

MACHINE FOR FABRICATING UPHOLSTERY SPRINGS

Filed Aug. 4, 1941 6 Sheets-Sheet 3

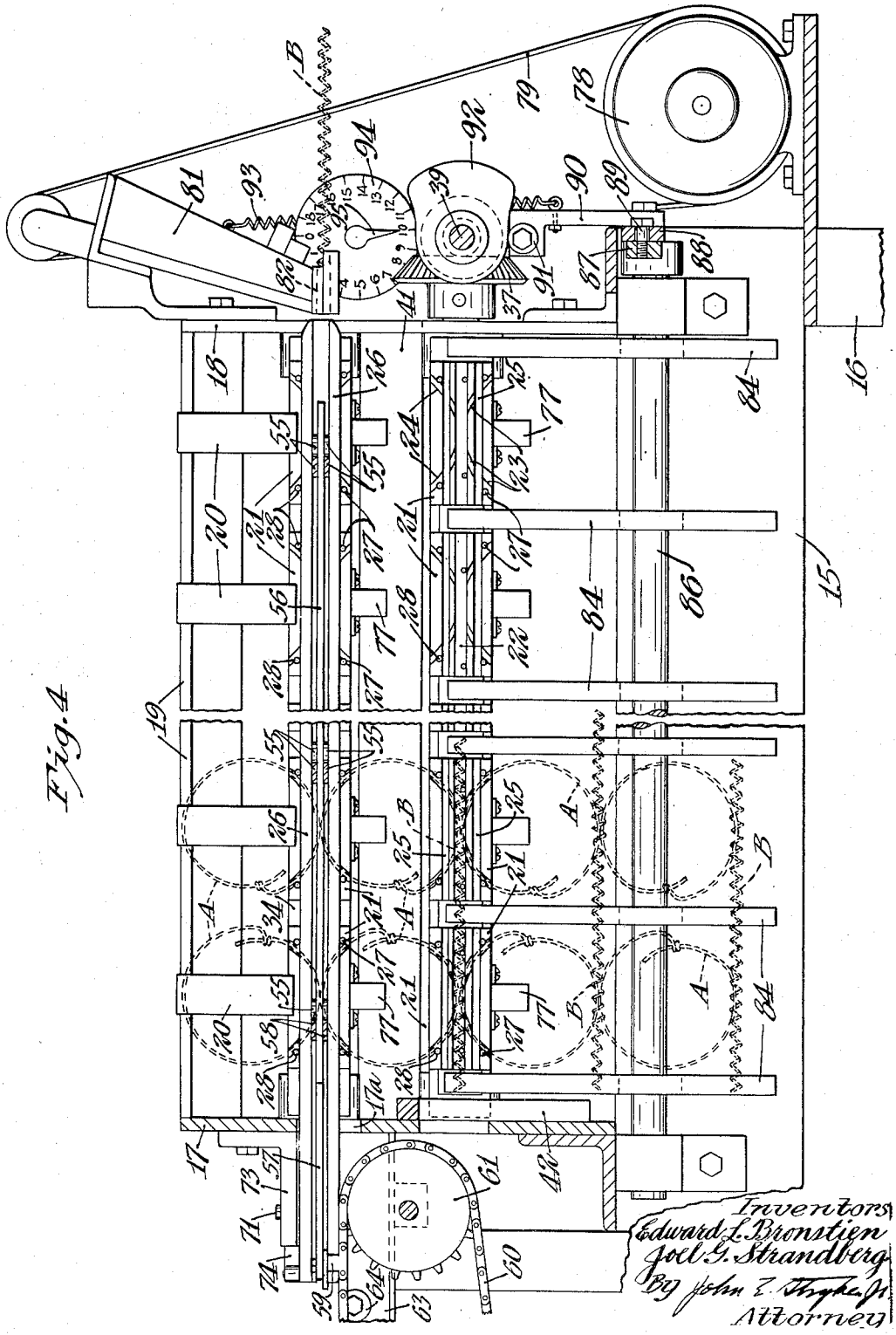


Fig. 4

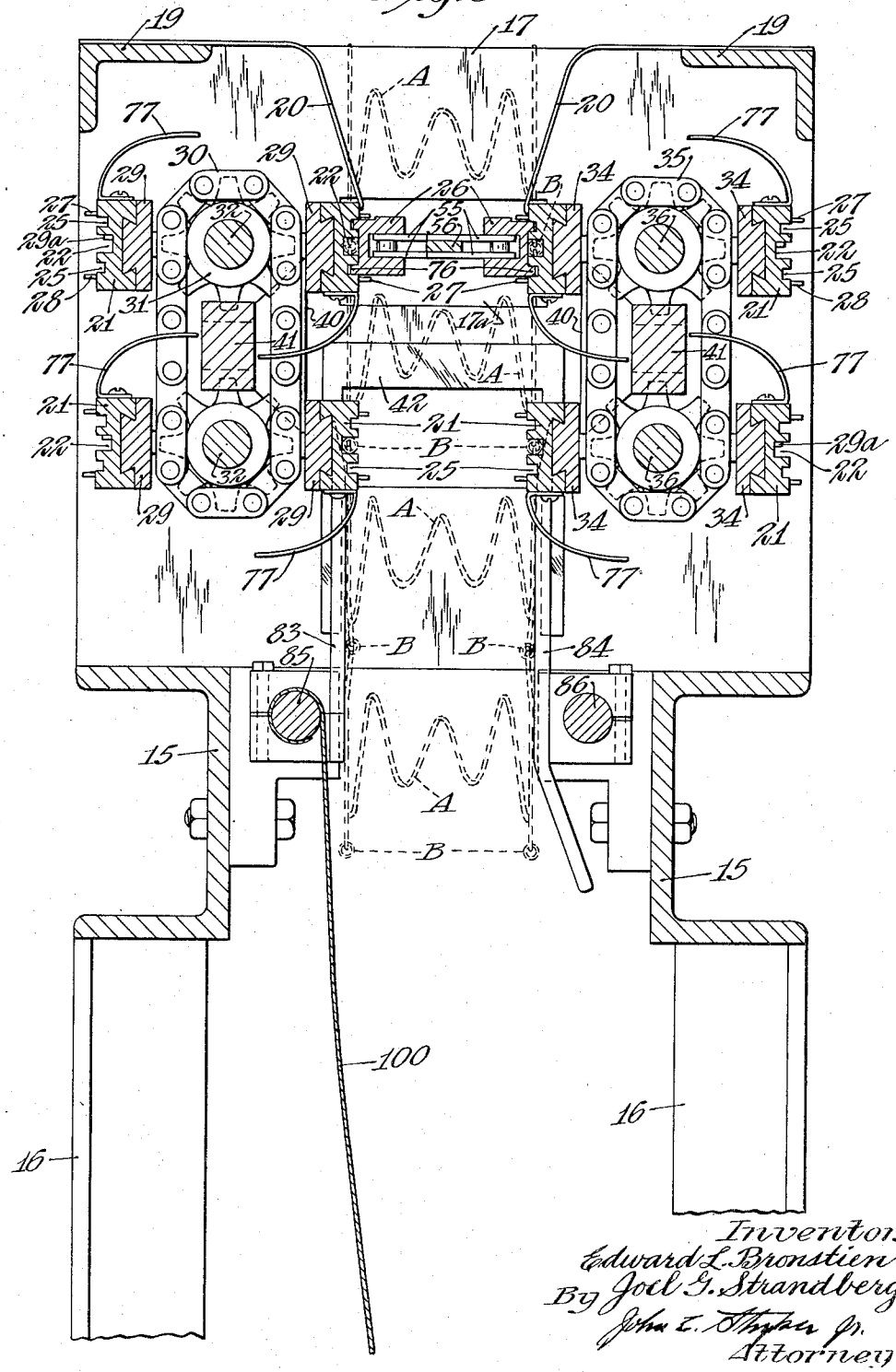
Inventors
Edward L. Bronstien
Joel G. Strandberg
By John Z. Hughes Jr
Attorney

June 20, 1944. E. L. BRONSTIEN ET AL 2,351,659

MACHINE FOR FABRICATING UPHOLSTERY SPRINGS

Filed Aug. 4, 1941 6 Sheets-Sheet 4

Fig. 5



Inventors
Edward L. Bronstien
By Joel G. Strandberg
John E. Hughes Jr.
Attorney

June 20, 1944. E. L. BRONSTIEN ET AL 2,351,659

MACHINE FOR FABRICATING UPHOLSTERY SPRINGS

Filed Aug. 4, 1941 6 Sheets-Sheet 5

Fig. 6

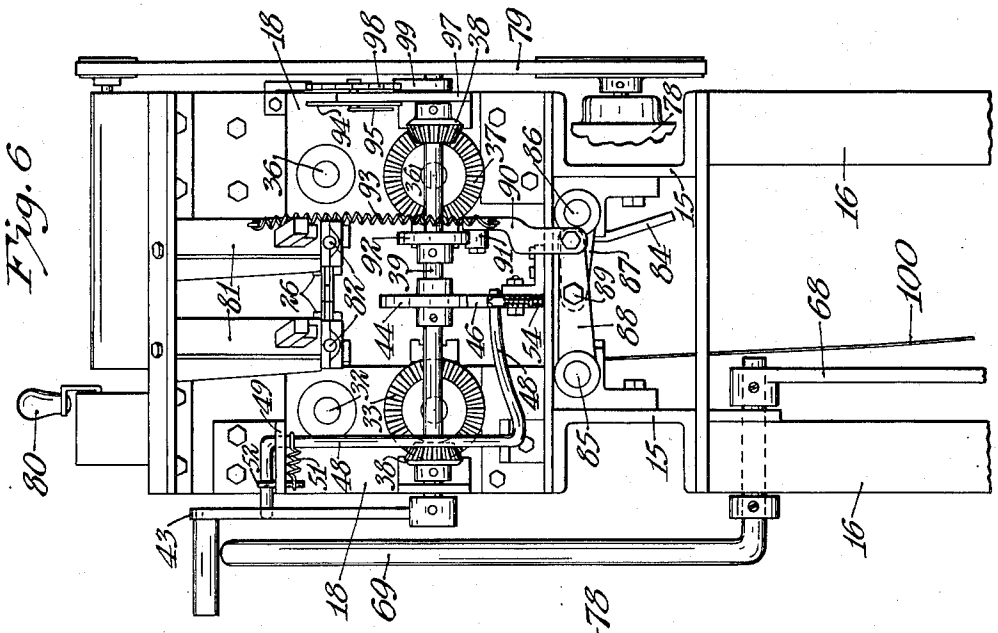


Fig. 7

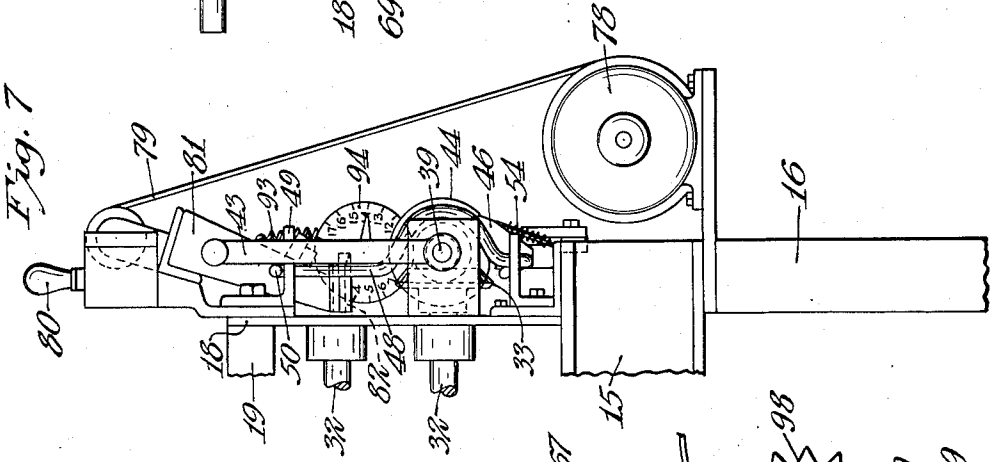


Fig. 8

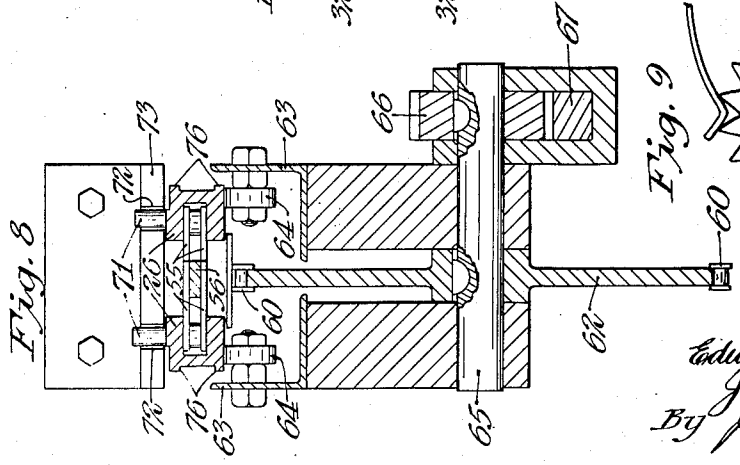
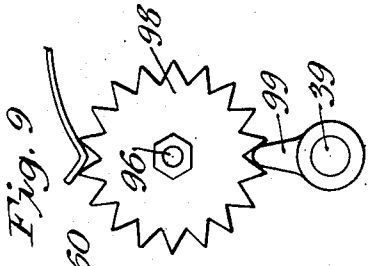


Fig. 9



Inventors
Edward L. Bronstien
Joel G. Strandberg
By John T. Hayden Jr.
Attorney

June 20, 1944. E. L. BRONSTIEN ET AL 2,351,659

MACHINE FOR FABRICATING UPHOLSTERY SPRINGS

Filed Aug. 4, 1941 6 Sheets-Sheet 6

Fig. 10

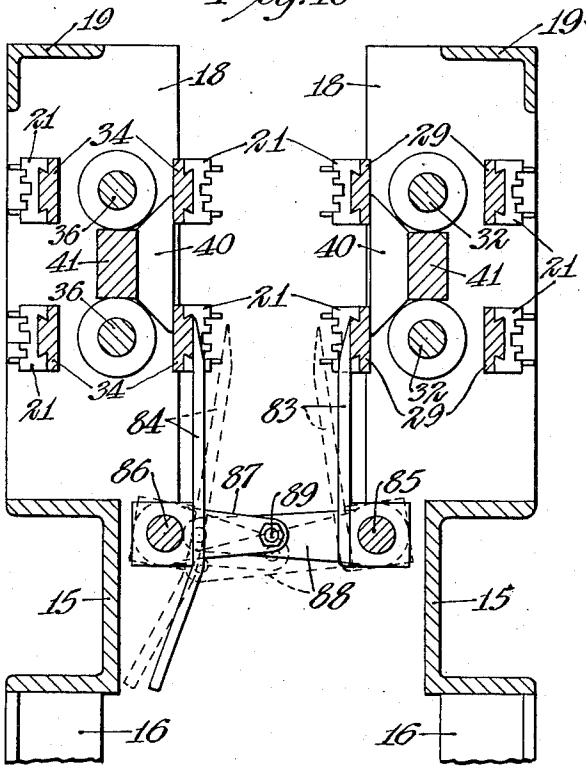


Fig. 11

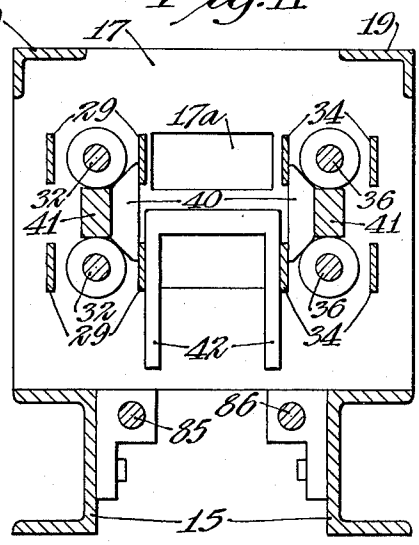


Fig. 14

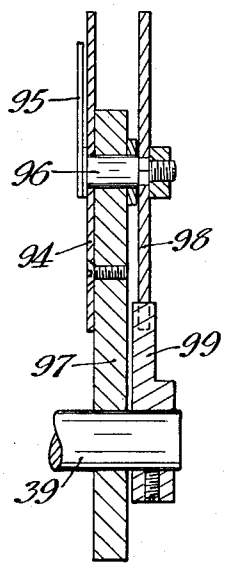


Fig. 12

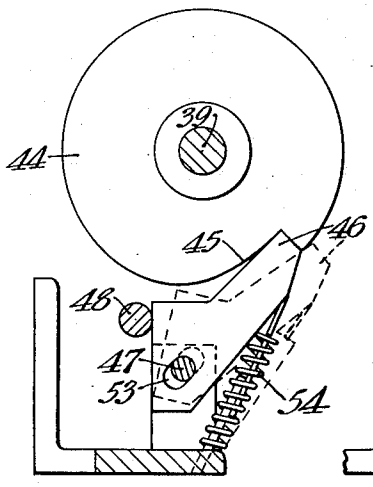
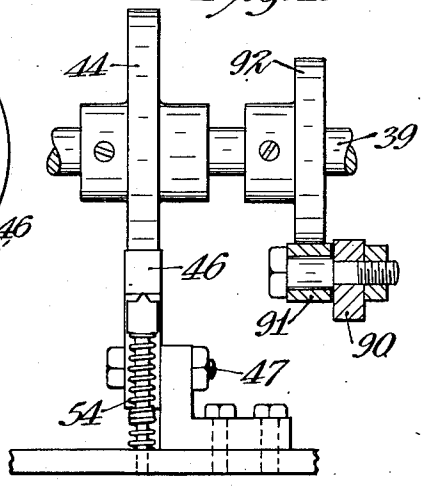


Fig. 13



Inventors
Edward L. Bronstien
By Joel G. Strandberg
John I. Snyder Jr.
Attorney

Patented June 20, 1944 2,351,659

UNITED STATES PATENT OFFICE

2,351,659

MACHINE FOR FABRICATING UPHOLSTERY SPRINGS

Edward L. Bronstien and Joel G. Strandberg, St. Paul, Minn., assignors, by direct and mesne assignments, to The United States Bedding Company, St. Paul, Minn., a corporation of Minnesota

Application August 4, 1941, Serial No. 405,380

48 Claims. (Cl. 140—3)

This invention relates to improvements in machines for fabricating spring assemblies for upholstery, and has for its main object to provide a machine of that type which reverses in the main the practices or mode of operation of prior art machines and is far more efficient than the latter, and which requires attendance and operation by only a single practically unskilled operator and a minimum of physical exertion on the part of said operator.

A further object of the invention is to provide a machine of the type aforesaid, which can be safely operated by an unskilled operator and the operation of which can be effected with appreciable speed by a girl, after only brief instruction and few hours of practice.

Other specific objects and advantages of the invention appear in and will be readily understood from the following specification:

In the drawings which illustrate one form of our improved machine:

Figure 1 is a plan view of the machine;

Fig. 2 is a front side elevation of the same;

Fig. 3 is a fragmentary plan view on a larger scale, with the top frame members and helical wire feeders removed to show parts otherwise concealed;

Fig. 4 is a vertical, longitudinal section taken on the line 4—4 of Fig. 3;

Fig. 5 is a cross section taken on the line 5—5 of Fig. 3;

Fig. 6 is an end elevation showing the controls and mechanism at the right end of the machine;

Fig. 7 is an enlarged front elevation of certain of the mechanism illustrated in Fig. 6;

Fig. 8 is a section taken on the line 8—8 of Fig. 2;

Fig. 9 is a rear elevation showing details of the row counting mechanism;

Fig. 10 is a schematic, vertical cross section illustrating certain details of the spring ejector mechanism;

Fig. 11 is a cross section taken on the line 11—11 of Fig. 3;

Fig. 12 is a front elevation showing details of the latch for the spring holders;

Fig. 13 is an end view showing said latch and the ejector cam;

Fig. 14 is a fragmentary vertical section taken on the line 14—14 of Fig. 3, showing details of the row counting mechanism;

Fig. 15 is an enlarged front elevation showing one of the spring holder dies together with a part of the supporting bar, in inverted relation to the spring-engaging or operative position of the die, and

Fig. 16 is an end view of the same inverted as in Fig. 15 and with the supporting bar shown in section.

Our machine has a main frame comprising longitudinally extending channel members 15 supported on legs 16, the members 15 supporting an upright plate 17 near one end and a pair of upright plates 18 near the other end. The top of the plate 17 is connected to the upper ends of the plates 18 by spaced, parallel angle members 19. As best shown in Figs. 1 and 5, upholstery springs A are inserted, with their axes horizontal, one row at a time in the top of the machine, and are slightly compressed between pairs of downwardly converging guides 20 as they are inserted. One end of each of the guides 20 is secured to one of the frame members 19 and the other end resiliently engages the inner faces of a series of spring holding dies 21. The lower periphery of each spring A passes into engagement with grooves formed in one of the dies 21, as more fully hereinafter described.

The several dies 21 are alike and the details of one of them are shown in Figs. 15 and 16. Each has a central, longitudinally extending groove or channel 22, to receive and guide a helical tie-wire B for fastening the upholstery springs together, and arcuate grooves 23 and 24 which intersect the groove 22 to receive the adjoining upholstery springs A of the successive rows to be joined together by the wire B. Additional grooves 25, one above and one below the groove 22 and extending parallel to the latter are formed in each die 21 to receive flanges of clamping bars 26 of a reciprocable plunger hereinafter described. Pairs of pins 27 and 28 project from each die 21 adjacent to the grooves 23 and 24 respectively, the pins 28 constituting stops and guides for the springs as they are inserted so that they register with the arcuate grooves and the pins 27 constituting supports for the clamping bars 26 during their movement to and from clamping position.

A horizontal row of the dies 21 is mounted on each of four bars 29 which are fastened to a pair of endless chains 30. These chains are operated on sprocket wheels 31 which are fixed on parallel shafts 32, one of these shafts being mounted directly above the other. The lower of the shafts 32 projects at the outer face of one of the end plates 18 and has a beveled gear 33 fixed thereon (Figs. 3, 4 and 6). The bars 29 are equally spaced on the chains 30 and the center to center

spacing is equal to the desired spacing of the helical wires B in the spring assembly wherein such wires encircle predetermined portions of the terminal coils of adjoining upholstery springs which overlap each other within the channel 22. Said portions of the springs are substantially arcuate in the instance illustrated, although the said grooves 22 and 24 may be shaped to correspond with portions of spring end coils of other shapes intended to be received in said grooves. Horizontal rows of dies 21 are also mounted on a second series of four bars 34 mounted on a pair of endless chains 35, arranged like the chains 30, to be operated on sprocket wheels and shafts 36. The rows of dies 21 on the bars 34 are disposed directly opposite those on the bars 29, as best shown in Fig. 5. A shaft 36 for operating the chains 35 has a beveled driving gear 37 at an end of the machine and two of the sprocket wheels are fixed to this shaft to drive the chains 35. Beveled pinions 38, one meshing with the gear 37 and the other with the gear 33 are fixed on a shaft 39 for operating the chains 30 and 35 in unison. The bars 29 and 34 have dovetail connections with the several dies 21 and, as shown in Figs. 15 and 16, each die is fixed on its supporting bar by pins 29*a*, one of which projects into the central groove 25 near a side wall thereof to perform the further function of engaging the helical wires B between the convolutions thereof to assist in advancing the helicals longitudinally as they are rotated about their axes.

Extending parallel to the inner reaches of the chains 30 and 35 are series of guide plates 40 (Figs. 10 and 11). The vertical faces of these plates engage the bars 29 and 34 between the dies 21 and at the ends of the bars as the latter move downward to thereby prevent either tilting movement or movement of the dies away from the springs that are held thereby. Movement of the bars 29 and 34 away from the shafts 32 and 36 is prevented by providing fixed vertical guides 42 on the end frame member 17, as shown in Figs. 3 and 11. Rigid frame members 41 extend parallel to the shafts 32 and 36 and the guide plates 40 are fixed on these members 41 which are supported at their ends on the frame plates 17 and 18. Journal bearings for the several shafts 32 and 36 project inward from the end frame plates 17 and 18. The gearing between the driving shaft 39 and the chains 30 and 35 is such that one revolution of the shaft 39 advances the chains one-quarter of their length and carries a row of holding dies on a bar 29 and another row on a bar 34 from a spring receiving position downward to a holding position (see Fig. 5) while other rows of dies are moved in from above to receive another row of upholstery springs from the top of the machine.

At the front of the machine the shaft 39 projects and has a manually operable crank 43 mounted thereon for turning the shaft and operating the chains 30 and 35. Mechanism is provided for stopping the shaft 39 after each revolution with the dies in proper position. This mechanism comprises the latch best shown in Figs. 6, 7, 12 and 13. Fixed on the shaft 39 is a wheel 44 having a notch 45 to receive a dog 46 supported on a pin 47 and arranged to be actuated by a rod 48 and spring 54. The rod 48 has an offset to clear the shaft 39 and extends upward through and above a guide plate 49 which is slotted to permit movement of the rod to and from the crank 43 (Fig. 3). A beveled end 50 of the rod 48 is adapted to be engaged by the crank 43 to move the rod out of the path of the crank as the latter is returned to its upright position at the end of a revolution. A spring 51 (Fig. 6) is arranged to urge the rod toward its projecting position, one end of the spring being connected to the rod 48 and the other end to a pin 52. This pin is fixed in the guide plate 49 and projects from the top thereof where it engages the rod 48 to prevent swiveling movement of the latter in the plate 49 when the end 50 is struck by the crank 43 in a clockwise direction as seen in Fig. 7.

To free the dog 46 from the notch 45 in the wheel 44 the handle of crank 43 is moved slightly in a counter-clockwise direction from the upright position shown in Fig. 7. This turns the rod 48 in the bracket 49 away from the pin 52 and causes the lower end portion of said rod to disengage the dog 46 from the notch 45. An elongated slot 53 (Fig. 12) is formed in the dog 46 to engage the pin 47 and allow limited movement of the dog tangentially relative to the wheel 44. The spring 54 is arranged to urge the dog 46 toward the periphery of the wheel 44 and to raise the dog to the dotted line position shown in Fig. 12 when not in engagement with the notch 45. By this arrangement the dog 46 is prevented from re-entering the notch 45 immediately after the rod 48 has disengaged it from the notch. When the operator has freed the shaft 39 by slight backward movement of the crank 43, this crank is turned clockwise one complete revolution to thereby advance the rows of spring holding dies 21 one step in the cycle of operation. The movement is stopped with precision by the dog 46 entering the notch 45 as the end of the rod 48 is sprung out of the path of the crank by engagement of the crank with the beveled end 50 of said rod. The chains 30 and 35 remain stationary with one row of dies 21 on the chain 30 directly opposite a row of like dies on the chain 35 and in registry with horizontally extending clamping bars 26.

The bars 26 clamp successive rows of the upholstery springs in pairs of the dies 21 while successive pairs of the helical springs B are spun or woven into position to connect the springs. These clamping bars 26 extend in parallel relation to each other for the entire length of the rows of upholstery springs to be joined together and are moved longitudinally to and from clamping position through an opening 17*a* in the end plate 17 (Figs. 4 and 11). Provison is made for actuating the bars 26 to and from the dies 21. For this purpose pairs of toggle links 55 connect the bars 26 to a reciprocable bar or plunger 56 movable midway between the uppermost pair of opposed rows of dies 21 assembly of clamping bars and bar 56 is movable by a link 57 and levers 58 longitudinally to and from operative position (Figs. 3, 4, 5 and 8). The link 57 is joined at its outer end to a lug 59 projecting from an endless chain 60 and this chain is operated on sprocket wheels 61 and 62 so that its upper reach extends horizontally between frame members 63 which extend horizontally from the end frame plate 17, being supported by oblique bracket bars 63*a*. Pairs of rollers 64 (Fig. 8) are mounted on the frame members 63 to support the clamping bars 26. The sprocket wheel 62 is fixed on a shaft 65 and a pinion 66 for turning the shaft is also fixed thereon and arranged to be rotated by a toothed rack 67 having a long extension pivotally connected to a crank arm 68. This crank arm is connected to a manually operable lever 69 at the

front of the machine. By oscillating this lever in one direction the clamping bars 26 are moved from their retracted position illustrated in Figs. 1 and 2 to their clamping position shown in Figs. 3, 4 and 5.

The pull of the chain 60 is transmitted from the link 57 to one end of the levers 58 which are identical with each other and mounted one above and the other below the central bar or plunger 56. A pin 70 (Fig. 3) connects the levers 58 to the bar 56 and the ends of the levers remote from the link 57 are pivotally connected to one of the clamping bars 26. A pin 71 projects upward from each of the bars 26 to engage a cam slot 72 formed in a horizontally extending bracket 73 which is mounted on the outer face of the end frame member 17. The inner ends of the cam slots 72 act as stops to limit longitudinal inward movement of the clamping bars and cause the bars 26 to be separated by action of the toggle links 55 responsively to further inward movement of the plunger 56 sufficiently to perform their clamping function upon reaching the end of the stroke toward the right as seen in Figs. 1, 2 and 4. A latch member 74 is pivotally mounted on the top of one of the bars 26 and is arranged to engage a pin 75 projecting from the other bar to hold these clamping bars in laterally retracted positions during the greater part of the stroke to and from operative position. The latch member 74 is arranged to strike the end of the bracket 73 to disengage the pin 75 as the bars 26 approach the inward limit of their movement and before they attain their clamping position. One or more springs connecting the bars 26 crosswise and tending to draw them together may be substituted for the latch members 74 and 75.

As best shown in Figs. 5 and 8, each of the bars 26 is formed with a pair of longitudinal flanges 76 which fit into the longitudinal grooves 25 in the holding dies 21 to clamp the upholstery springs in the intersecting grooves 23 and 24. Projecting from the leading edge of each of the holding dies 21 is a spring finger 77 which is curved forward and toward the chain to pass out from the lower end of the aligned guide 20 and to form a continuation of the latter in guiding the upper peripheries of the successive upholstery springs A into the arcuate grooves 23 of the die 21 on which the finger 77 is mounted. These spring fingers 77 prevent the upholstery springs from catching on or engaging improperly with the leading edges of the dies.

Power driven mechanism of any conventional type may be provided for feeding the helical wires B longitudinally and rotating them about their axis to cause them to embrace the adjoining or overlapped portions of their end coils of the upholstery springs projecting into the channels 22. The machine illustrated has mechanism of this character driven by an electric motor 78 and belt 79 under control of an electric switch having a handle 80 conveniently located within easy reach of the machine operator. Two of the feeding mechanisms are driven from the motor 78, the housings 81 of these mechanisms having openings 82 to receive the helical wires respectively. The openings 82 are disposed in horizontal alignment with the rows of grooves 22 in the opposed dies 21 when the latter are in their positions for clamping engagement with the bars 26.

To eject the rows of upholstery springs from the lower rows of dies 21, series of arms 83 and 84 are arranged as best shown in Figs. 4, 5 and 10. The arms 83 project upward from and are fixed on a shaft 85 and the arms 84 are similarly arranged and supported on a shaft 86. The upper ends of the several arms are disposed between and at the ends of the dies 21, the inner smooth faces constituting guides for downward movement of the spring assembly. A crank arm 87 projects from the shaft 86 and another and somewhat longer arm 88 is fixed on the shaft 85. These arms are connected together for limited movement in unison by a bolt 89 (Figs. 4, 6 and 10). Fastened to an end of the arm 88 and extending upward, is an arm 90 having a roller 91 mounted on its upper end portion for engagement with the periphery of a cam 92 which is fixed on the shaft 39. The roller 91 is held against the cam by a spring 93 connecting the arm 90 to the frame of the machine. When the shaft 39 is rotated the cam 92 and spring 93, through the connections just described, actuate the ejector arms 83 and 84 from the full line position to the dotted line position shown in Fig. 10 and back to the full line position. The arms 83 and 84 are thus caused to compress the successive rows of upholstery springs and to free them from the die grooves and pins 27 and 28 of the lower rows of dies as the latter are moved downward and away from the springs. The spring assembly continues downward and is discharged from the bottom of the machine upon an apron 100.

To keep the operator informed of the number of rows of springs that have been assembled for a unit, the counting mechanism best illustrated in Figs. 4, 9 and 14 is provided. This counting mechanism has a dial 94 and indicator hand 95, the latter being fixed on a shaft 96 which is revoluble in a supporting bracket 97. At the back of the bracket a star wheel 98 is mounted on the shaft 96 to be turned by a finger 99 fixed on an end of the shaft 39. The star wheel 98 has notches equal in number to the numbered division marks on the dial 94 and this corresponds to the maximum number of rows of springs which are to be fabricated as a unit.

Summary of operation

To assemble a group of the upholstery springs A, the operation is started with the clamping bars 26 withdrawn to the position indicated in Figs. 1 and 2, leaving the space between the rows of dies 21 open and the parts of the machine stationary. The operator inserts the first row of springs A by thrusting them down between the guides 20 until the lower arcuate portions of their end coils snap into the arcuate grooves 24 of the several dies 21 at both ends of each spring (Figs. 4 and 5). The stop pins 28 facilitate this operation because they are disposed substantially tangentially of said grooves and thus guide the predetermined end coil portions of the springs thereinto. When a complete row has been inserted, the operator swings the lever 69 to the right as seen in Fig. 2. This moves the clamping bars 26 to their position indicated in Figs. 3, 4 and 5, the bars being spread apart and seated in the dies 21 by the action of the toggle links 55 and pins 71 entering the cam slots 72 while the latch member 74 is disengaged from the pin 95 to permit separation of the bars 26. At the end of this operation the ribs 76 on the bars 26 securely clamp the lower peripheries of the several springs A in the die grooves 24 with uniform segments of the peripheries projecting into the longitudinal grooves 22 in the dies, the several grooves

22 of each row of dies being aligned from end to end of the machine with one of the openings 82 in the helical wire feeding mechanism. The operator now inserts an end of a helical wire B in one of the openings 82 and then starts the motor 78 by actuating the switch handle 80. The feeding mechanism drives the wire B longitudinally of its axis and also rotates it about its axis in the appropriate direction to cause the convolutions of the wire to embrace the segments of the springs A in each of the grooves 22 with a uniform number of turns. It will be understood that the wires B have been cut previously to uniform lengths approximately equal to the length of the rows of upholstery springs. The feeding mechanism releases the wire as soon as it has been fed into engagement with all of the coils of the row and then a second helical wire is fed in similar manner through the opening 82 at the opposite side of the row. This binds the lower peripheries of the upholstery springs of the first row together for both the top and bottom margins of the spring unit to be assembled.

The next operation is to withdraw the plunger comprising the clamping bars 26 by swinging the lever 69 back to the left as shown in Fig. 2. This lever, acting through the crank 68, toothed rack 67 and pinion 66 on the shaft 65, operates the chain 60, and the latter being connected by the lug 59, link 57 and lever 58 to the plunger 56, first withdraws the pins 71 from the cam slots 72 while the toggle links 55 actuated by the center bar 56 withdraw the clamping bars 26 from all of the oppositely disposed dies 21. Continued movement of the chain 60 removes the plunger assembly to the retracted position on the frame members 63 illustrated in Figs. 1 and 2. Now the crank 43 is turned one complete revolution and is locked in its upright position to thereby carry the first row of upholstery springs from the initial position downward one step while a second pair of rows of the dies 21 is carried inward from above by the chains 30 and 35 to bring these rows of dies into registry with the clamping bars 26. As this second series of dies is moved into position the upper peripheries of the first row of upholstery springs are caught in the arcuate grooves 23 of the several dies, being guided by the fingers 77 and confined by pins 27. This occurs as the second set of dies come to rest. Now a second row of springs A is placed between the guides 20, each spring being pressed down to snap into an arcuate groove 24. The lower peripheries of the springs of the second row abut against the upper peripheries of those of the preceding row in the grooves 22, as indicated in Figs. 4 and 15. As the next step, the clamping bars 26 are again moved to their operative position by actuating the lever 69 and then a second pair of helical wires B is fed through the openings 82 to connect the lower peripheries of the springs of the second row to each other and to the upper peripheries of the springs of the first row. The clamping bars 26 are again withdrawn, and the crank 43 is again operated to advance the assembled springs another step downward. The operations above described are repeated until a complete spring unit has been fabricated and is finally discharged downward over the apron 100, shown in Figs. 2 and 5.

During each revolution of the crank 39 the ejector arms 83 and 84 are operated to disengage the springs and their connecting helicals from the lower rows of dies 21 and the counter mechanism operates to advance the hand 95 one division on the dial 94. Where the number of divisions is equal to the number of rows of springs required for a unit plus one, the hand 95 reaches its zero indicating position automatically for the commencement of the operations for each succeeding spring unit assembly.

It will be observed, of course, that the upholstery springs employed are of the conventional hour-glass knotted type, the terminal coils of which are of appreciably larger diameter than the intermediate coils. It is this difference in diameter that allows ample space for the passage of the plunger 56 and clamping bars 26 into free spaces between the intermediate coils of the springs of a pair of rows thereof, that have their terminals engaged in the grooves of the dies of the uppermost row of the latter.

Because of the accurate positioning of the predetermined spring end portions projecting to the guide channels 22, the number of coils of the tie-wires encircling said portions is rendered uniform and thus the axes of the upholstery springs of the assembly become quite accurately aligned with each other both longitudinally and transversely of the same.

Having described our invention, what we claim as new and desire to protect by Letters Patent is:

1. A machine for fabricating upholstery springs comprising, two series of parallel rows of spring holding dies, the dies of one series being disposed opposite those of the other series to engage opposite end coils respectively, of the springs, means for moving both rows of dies to and from a spring receiving position, clamping means movable between the opposing rows of dies to grip the springs therein, guides for spring connecting members in alignment with portions of the end coils of the springs engaged in said dies and means for feeding spring coupling members through said guides to couple said portions of the springs engaged by said dies and clamping means.

2. The machine according to claim 1 in which said guides comprise passages formed in the dies and having mouths opposed and adapted to be closed by the clamping means.

3. The machine according to claim 1 in which each die is formed with arcuate grooves arranged to receive arcuate portions of adjoining end coils of a pair of springs.

4. The machine according to claim 1 in which each die is formed with arcuate grooves arranged to receive segments of the adjoining spring peripheries and a straight groove intersecting said arcuate grooves and constituting a portion of a guide for one of the spring connecting members.

5. The machine according to claim 1 in which each die has a pair of arcuate grooves each arranged to receive and confine a portion of a spring end coil and spaced members projecting from said die adjacent to said groove for engagement with the said portions of the springs for guiding the said end-coil portions into said grooves.

6. The machine according to claim 1 in which said clamping means comprise parallel bars and means for separating said bars to grip the springs in the dies.

7. The machine according to claim 1 in which the several dies are formed with recesses and said clamping means comprise separable members each formed with projections to grip the springs in said recesses.

8. A machine for fabricating upholstery springs comprising, two series of parallel rows of spring holding dies, the dies of one series being disposed

opposite those of the other series to engage opposite ends respectively of the springs and each die being adapted to confine portions of end coils of two adjoining springs, means for moving both rows of dies to and from a spring receiving position, clamping means movable between the opposing rows of dies to grip the springs therein, guides for spring connecting members in registry with the adjoining end-coil portions of springs in said dies, and means for feeding spring connecting members through said guides to couple said portions of pairs of the springs held by said dies and clamping means.

9. The machine according to claim 8 in which said guides comprise passages formed in the dies and having mouths opposed to and adapted to be closed by the clamping means.

10. The machine according to claim 8 in which said clamping means comprise a pair of parallel bars movable in direction parallel with the said guides to and from clamping position between the rows of springs in said dies, and means for separating said bars to cause the same to grip the springs in said dies.

11. A machine for fabricating upholstery springs comprising, two series of parallel rows of spring holding dies, the dies of one series being disposed opposite those of the other series to engage opposite end-coils respectively, of the springs, rotary means supporting each series of said dies, clamping means movable between the opposed rows of dies to grip the springs therein, guides for helical wires in registry with the adjoining portions of end-coils of springs engaged in said dies, means for feeding helical wires through said guides to couple end-coil portions of the springs engaged by said dies and clamping means, and means for operating said rotary means simultaneously to present rows of dies successively into registry with said clamping means.

12. The machine according to claim 11 in which said rotary means each includes a pair of parallel, horizontal shafts, one mounted above the other and extending parallel to the rows of dies.

13. A machine for fabricating upholstery springs comprising, two series of parallel rows of spring holding dies, the dies of one series being disposed opposite those of the other series to engage opposite ends respectively of the springs, conveyors supporting the respective series of dies, clamping means movable between the opposing rows of dies and in parallel relation thereto to grip the springs therein, guides for helical wires in alignment with the peripheries of springs in said dies, means for feeding helical wires through said guides to couple portions of the end-coils of the springs held by said dies and clamping means, and means for operating said conveyors simultaneously to present rows of dies successively in registry with said clamping means.

14. The machine according to claim 13 in which the rows of dies extend horizontally, the conveyors supporting the same are movable to carry the springs in engagement with the dies downward and the springs are insertable between the dies at the top of the machine.

15. The machine according to claim 13 in which each of the conveyors comprises endless chains having mounted thereon a series of parallel bars for supporting the respective rows of dies and wherein the respective conveyors have spaced parallel links arranged to present successively a plurality of rows of dies in spring carrying positions.

16. The machine according to claim 13 in which means are provided for stopping said conveyors with rows of dies in registry with said clamping means and wherein said clamping means are operable between end coil portions of springs in said dies while said conveyors are at rest in coordinate clamping position with respect to said clamping means.

17. The machine according to claim 13 in which the rows of dies extend horizontally, the conveyors supporting the same are movable to carry the springs in engagement with the dies step by step downward from a spring receiving position at the top of the machine to a spring discharging position at the bottom thereof, the separate springs being insertable between the dies at the top of the machine and the means for operating the spring clamping means and helical wire feeding means are operable while the conveyors are stationary between steps in the operation thereof.

18. A machine for fabricating upholstery spring assemblies comprising, spaced, parallel conveyors each supporting a plurality of parallel bars, a row of spring engaging dies on each bar, the bars on one conveyor being disposed opposite those on the other and both conveyors being operable to move the bars edgewise, clamping means movable between opposing rows of dies to grip the springs therein, guides for helical tie wires in alignment with portions of the end-coils of springs held in said dies by said clamping means, means for feeding helical tie wires through said guides to couple the said portions of springs held by said dies and clamping means, means for operating said conveyors simultaneously and intermittently to present rows of dies successively in registry with said clamping means, and means for disengaging the coupled springs from said dies.

19. A machine for fabricating upholstery spring-assemblies comprising, a pair of horizontally spaced, endless conveyors each supporting a plurality of parallel horizontal bars for vertical movement, edgewise, said conveyors including interconnected links disposed in spaced parallel, vertical planes, a row of spring-engaging dies mounted on each bar, the dies on one conveyor being disposed opposite those on the other conveyor to engage opposite ends of the springs and the dies being spaced apart horizontally along each conveyor equally and at center to center vertical distances approximately equal to the diameters of the spring ends to be coupled, each die being formed with grooves to receive portions of end-coils of adjoining springs and being formed with guides for helical wires in alignment with portions of the springs engaged in the die grooves, means for feeding helical tie wires through said guides to couple springs held between opposing rows of dies, spring clamping bars movable longitudinally between uppermost opposed rows of dies, means for separating said bars to grip the springs in said dies, means for operating said conveyors to move the rows of dies downward simultaneously to present successively in registry with said clamping bars, and means for disengaging the coupled springs from said dies at a given point in their downward travel.

20. The machine according to claim 19 in which means are provided for stopping said conveyors with rows of dies in registry with said clamping bars and means are provided for moving said clamping bars to and from clamping

position between rows of springs in said dies while said conveyors are stationary.

21. A machine for fabricating upholstery springs comprising spaced parallel conveyors, each having a plurality of parallel bars, a row of spring-engaging dies on each bar, the bars of one conveyor being disposed opposite those on the other and each die being formed to receive arcuate segments of springs of adjoining rows, means for operating the conveyors in unison to move the bars, dies and springs, step by step, transversely of the rows distances equal to the upholstery spring spacing with dwell periods between the steps, means for clamping adjoining rows of upholstery springs in said dies and means for feeding helical wires into engagement with the springs in said dies during the dwell period.

22. A machine for fabricating upholstery springs comprising two series of parallel rows of spring holding dies, the dies of one series being disposed opposite those of the other series to engage opposite ends respectively of the springs, each die being formed with a groove arranged to receive a segment of a spring periphery, spaced stop members projecting adjacent to the outer periphery of each of said grooves to facilitate manual feeding of a spring segment into the groove, means for clamping segments of springs in opposed rows of said dies, guides for helical wires, and means for feeding spring connecting members through said guides to connect rows of springs held by said dies and clamping means.

23. A machine for fabricating upholstery springs comprising two series of parallel rows of spring holding dies, the dies of one series having grooved faces disposed opposite and parallel to those of the other series to engage opposite ends respectively of the springs, each die being formed with a groove arranged to receive a segment of a spring periphery, spaced stop members projecting from said faces adjacent to the outer periphery of each of said grooves, a guide finger extending laterally of each die face and midway between the stop members thereon to coact with said stop members in directing a segment of a spring into the adjacent groove, means for clamping segments of springs in opposed rows of said dies, and means for feeding spring-connecting members to connect rows of springs held by said dies and clamping means.

24. A means for positioning the terminal coils at one end of a pair of springs for coupling thereof by a helical tie wire, which comprises a single flat-faced member equipped with a guide channel for a helical tie wire and with a pair of opposed arcuate grooves disposed upon opposite sides of said channel and communicating with the latter, each of said grooves adapted to receive an arcuate portion of a terminal coil of one of said springs, a clamping means operable to force and said last-named coil portions into said grooves thereby to position said coil portions so that parts thereof are disposed within said channel and in the path of a tie wire advanced through said channel by rotation.

25. A means for positioning the terminal coils at one end of a pair of springs for coupling thereof by a helical tie wire, which comprises a single flat-faced member equipped with opposed arcuate grooves adapted to receive and position predetermined portions of said terminal coils into predetermined relation with respect to each other and a helical tie wire guide channel in said member to cause a helical tie wire when rotated and advanced through said channel to encircle said predetermined coil portions, and a clamping means operable to force said coil portions into and hold same firmly within said grooves.

26. A means for positioning and holding upholstery springs for coupling by means of a helical tie wire, comprising a bar equipped at spaced-apart points with pairs of oposed arcuate grooves and with a guide channel for a tie wire disposed midway between said grooves, the latter adapted to receive portions of terminal coils of springs of two parallel rows and arranged to cause a portion of the terminal coil of each spring engaged therein to project into said channel, and a spring clamping device associated with said bar and operable to force into and hold within said grooves predetermined portions of said terminal coils and thereby flex the same to fit said grooves while a helical tie wire is advanced through said channel into an encircling relation to the spring portions projecting into the said channel.

27. A structure as defined in claim 26, wherein the arcuate grooves are of greater depth than the thickness of the wire of which the springs are composed and are provided with flared mouths.

28. A structure of the type defined in claim 26, wherein the arcuate grooves are intersected by channels in the bar extending parallel with said guide channel and wherein the spring clamping bar is equipped with flanges engageable in said last-named channels.

29. A structure as defined by claim 26, wherein the arcuate grooves are provided with flared mouth portions and are of greater depth than the diameter of the wire of which the springs are composed and wherein the said grooves are intersected by channels parallel with said guide channel and of the same depth as said grooves and the clamping means equipped with projections adapted to engage and force spring portions disposed within said grooves to the bottoms of the latter and said last-named channels.

30. A structure as defined in claim 26, wherein the clamping means when engaged with spring portions disposed within said grooves constitutes a closure for the guide channel associated with each pair of opposed grooves of the series.

31. A structure of the type specified comprising a pair of parallel spaced-apart bars having opposed face portions provided with tie wire guide channels and a spaced-apart series of arcuate grooves disposed upon opposite sides of said channel and communicating therewith for the reception of predetermined portions of terminal coils at both ends of upholstery springs of two rows of the latter interposed between said bars, and a means for forcing said spring portions into and holding the same engaged in said grooves while a tie wire is passed through said channel into encircling relation to predetermined portions of said springs projecting into said channel, said means being adapted to be moved longitudinally of said bars and over said channels to and from operative position.

32. A structure as defined in claim 31, wherein bars are spaced apart a distance less than the axial height of the springs to be received therebetween.

33. A structure of the type defined in claim 31, wherein the said arcuate grooves are provided with flared mouths and said bars are equipped with guide devices adjacent the said grooves

for causing the said terminal coil portions of inserted spring to be initially disposed over said grooves.

34. A structure of the type specified comprising a bar equipped with flat-faced portions spaced from each other and each said portion provided with a pair of opposed grooves corresponding in shape substantially with those of predetermined portions of terminal coils of upholstery springs of two parallel rows of the latter, said grooves having flared mouth portions and each thereof communicating at two points with tie-wire guide channel of each said flat-faced portion extending parallel with said rows of springs, and clamping means operatively associated with said bar for engaging and forcing into said grooves said predetermined spring portions and there holding the same while a tie wire is passed into encircling relation to spring portions projecting from said grooves into said guide channels.

35. A structure as defined in claim 34, wherein the said flat-faced bar portions are equipped with guide devices adjacent said grooves for primarily positioning the said terminal coil portions over or within said grooves.

36. A structure of the type specified in claim 34, wherein the said grooves are intersected by grooves extending parallel with said guide channel and said clamping means include formations to engage in said intersecting channels for engaging only the portions of the springs spanning said last-named channels.

37. A machine for fabricating upholstery spring-assemblies, which includes a pair of spaced-apart conveyors each equipped with a plurality of rows of spaced-apart spring-end engaging means, each row being spaced center to center from the next adjacent row a distance equal, substantially, to the diameter of the spring ends intended to be engaged in said means, the said means of one conveyor being opposed to and spaced face to face from those of the other a distance less than the length of the said springs, and said conveyors being adapted to be moved at intervals in unison to cause said means to travel in parallel while springs are engaged therewith, said means equipped with guide channels for helical tie wires into which predetermined spring end portions of contiguous rows of springs are caused to project for coupling by said tie wires, cooperatively associated elements on said means for guiding the spring-ends into the last-named positions, and mechanism for rotatably advancing said tie wires through said channels into coupling relation to the said spring end portions while the conveyors are at rest.

38. A structure as defined in claim 37 which includes mechanism operable to force and hold the spring end portions in their predetermined relative positions with respect to said guide channels during the passage of tie wires through the latter, and wherein said mechanism is removable from the path of travel of coupled rows of springs following the tie-wire feeding operations.

39. A structure as defined in claim 37, which includes a reciprocable plunger movable into and out of space between rows of springs engaged in said means during the periods of rest of said conveyors, and which is equipped with spring-end engaging devices adapted to move automatically into clamping relation to the spring end portions of two rows of springs as said plunger attains the limit of its movement into the space aforesaid, thereby to force and firmly hold the spring end portions of said rows in predetermined relative positions with respect to said guide channels.

40. In a machine of the kind specified, the combination with a pair of rows of dies opposed to and parallel with each other and each die equipped with a tie-wire guide channel and with a pair of grooves parallel with said channel and disposed upon opposite sides thereof and having bottom walls of less depth than said channels, each die being also equipped with a pair of opposed spring end portion receiving grooves intersecting said last-named groove and communicating with said channel, of a plunger reciprocable into and out of the space between the opposed rows of dies, a pair of opposed guide channel covering and spring retaining bars mounted upon said plunger and movable laterally toward and from said dies and equipped with parallel flanges opposed to and adapted to be projected into the grooves parallel with said channels into retaining relation to spring end portions engaged in said spring end receiving grooves, means for effecting the lateral movements of said bars, and mechanism for rotatably advancing helical tie-wires through said channels while said bars are disposed in said retaining position.

41. A structure as defined in claim 40 wherein the lateral movements of the retaining bars are effected automatically as said bars approach and attain the inner limits of their movement and during the initial portion of their outward movement.

42. A structure as defined in claim 40 wherein said clamping bars are locked against lateral movement during the major portions of their inward movement and are automatically rendered free to move laterally as they approach the inner limits of their movement and wherein they are automatically forced into clamping relation to spring end portions engaged in the dies during further movement in said last-named direction and are forced back automatically and re-locked against lateral movement during an initial portion of their outward movement from between said dies.

43. A structure so defined in claim 40 wherein cam elements are disposed for engagement with said retaining bars for forcing the flanges thereof into retaining relation to spring end portions engaged in the dies as the plunger approaches the inner limit of its movement and for returning the said bars to normal position with respect to said plunger during the initial reverse movement of said plunger.

44. A structure as defined in claim 40 wherein a spring held latch engages the retaining bars against lateral movements during the major part of the reciprocations of the plungers and wherein the machine frame is equipped with means for automatically releasing said latch as the plunger approaches the inner limit of its movement, and wherein cam elements effect forced outward movement in said bars into retaining position during the remainder of the inner movement of said plunger.

45. A structure as defined in claim 40 wherein a spring-held latch engages the retaining bars against lateral movements during the major part of the reciprocation of the plungers and wherein the machine frame is equipped with means for automatically releasing said latch as the plunger approaches the inner limit of its movement, and

wherein cam elements effect forced outward movement of said bars into retaining position during the remainder of the inner movement of said plunger and wherein said cam elements restore the bars to their normal positions relative to the plunger and thereby cause said latch to re-lock them against said lateral movements during initial outward movement of the plunger.

46. A structure as defined in claim 40, wherein the retaining bars are equipped with pins and the machine frame is equipped with a pair of cam slots for the reception of said pins and cooperation therewith to effect movements of said bars toward the dies as the plunger approaches the inner limit of its movement and to effect return movements of said bars to normal position during the initial reverse movement of the plunger.

47. A structure as defined in claim 40, wherein the machine frame is equipped with a pair of cam elements and the retaining bars are equipped with devices positioned for cooperation with said cam elements to effect lateral movements of said bars into and out of said retaining relation, and wherein said bars are equipped with a spring-held latch mechanism to hold them against lateral movements with respect to each other and said plunger and wherein the machine frame is equipped with an obstruction disposed in the path of said latch mechanism for automatically effecting release thereof against the action of said spring as said plunger approaches the inner limit of its movement and at substantially the instant that said pins enter the said cam slots.

48. A structure as defined in claim 40 which includes toggle links connecting the said bars with said plunger and maintaining the same parallel therewith in all respective positions of the same and said bars, stops disposed in the path of the inner ends of said bars for cooperation with said plunger as the latter approaches the limit of its movement to force said bars into said channel covering and spring retaining position, and which includes means cooperating with said plunger for drawing said bars toward and retaining the same in their normal position relative to said plunger at all times other than during movement of said plunger from the instant of contact of said bars with said stops to the inner limit of its movement and equal reverse movement thereof.

EDWARD L. BRONSTIEN.
JOEL G. STRANDBERG.