United States Patent [19]

Sturm

[11] **3,774,652**

[45] **Nov. 27, 1973**

[54] **SPRING TRANSFER APPARATUS**

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[73] Assignee: **Frank L. Wells Company,** Kenosha, Wis.

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[21] Appl. No.: **219,765**

[52] **U.S. Cl.** ..... **140/3 CA**
[51] **Int. Cl.** **B21f 27/16**
[58] **Field of Search** ..... 140/3 CA, 92.3, 92.7, 140/92.8; 198/41

[56] **References Cited**

UNITED STATES PATENTS

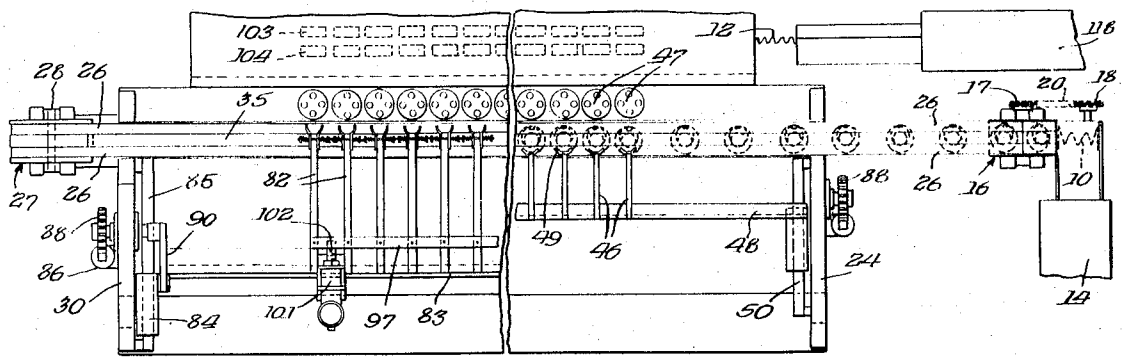
3,193,136	7/1965	Stumpf et al.	140/92.7
2,388,106	10/1945	Woller	140/92.7
3,205,915	9/1965	Kamp	140/3
2,716,308	8/1955	Hodges, Jr.	140/3
3,565,234	2/1971	Birdsong	198/41

Primary Examiner—Lowell A. Larson
Attorney—Russell H. Clark

[57] **ABSTRACT**

Conventional coil springs having a knot on both top and bottom convolutions are delivered to a rotating transfer drum of hexagonal shape having magnetized flat surfaces around which pass a pair of endless belts and which thus have movement with the transfer drum. The top run of each belt passes over and is supported by the magnetized top surface of a longitudinal table. The coil springs which are delivered to the transfer drum one at a time adhere to a flat surface thereof and are caused to move with the endless belts along the top surface of the table to form a longitudinal row. Solenoid actuated positioning pins provided along the length of the table are actuated in succession to stop a coil spring and hold the same in stopped position while the belts continue to move. Lower pusher arms are actuated to simultaneously push all the coils of a positioned row off the belts and onto turntables respectively which are in a lowered position for receiving the same. The turntables are thereupon elevated and rotated to rotate each coil in a selective direction to obtain the desired knot orientation in the completed mattress or other inner spring structure. A plurality of upper pusher arms are next actuated to push all the coils from off the elevated turntables and onto the dies of an assembling unit and which dies are open at the time for receiving the top and bottom convolutions of the coils respectively.

21 Claims, 17 Drawing Figures



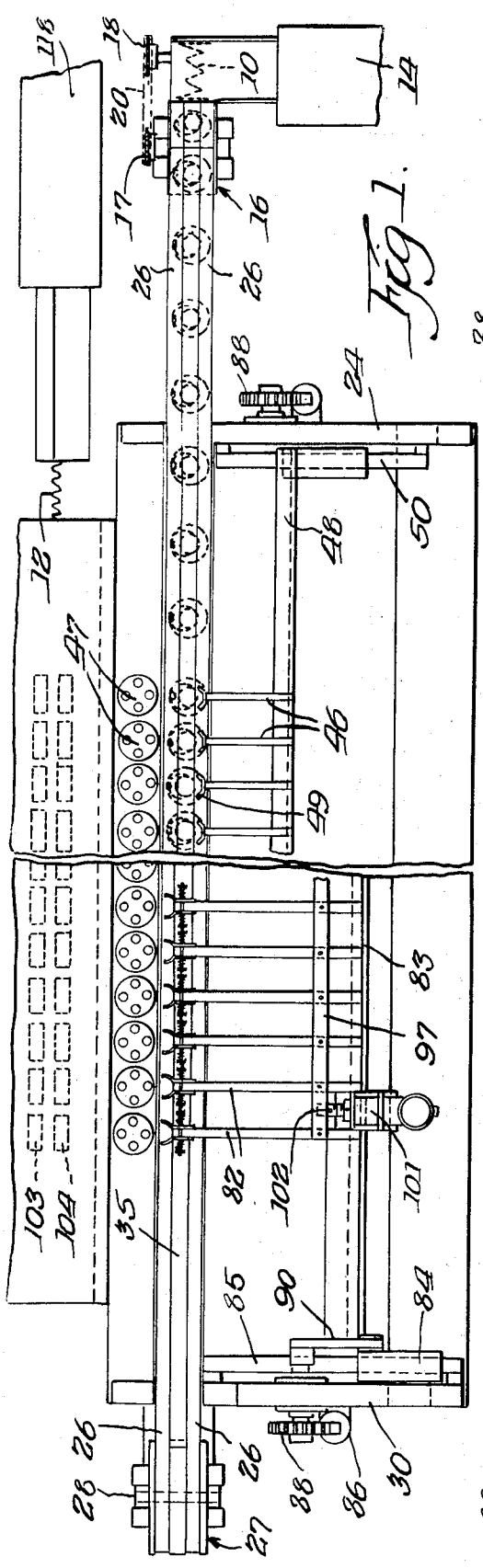


Fig. 1.

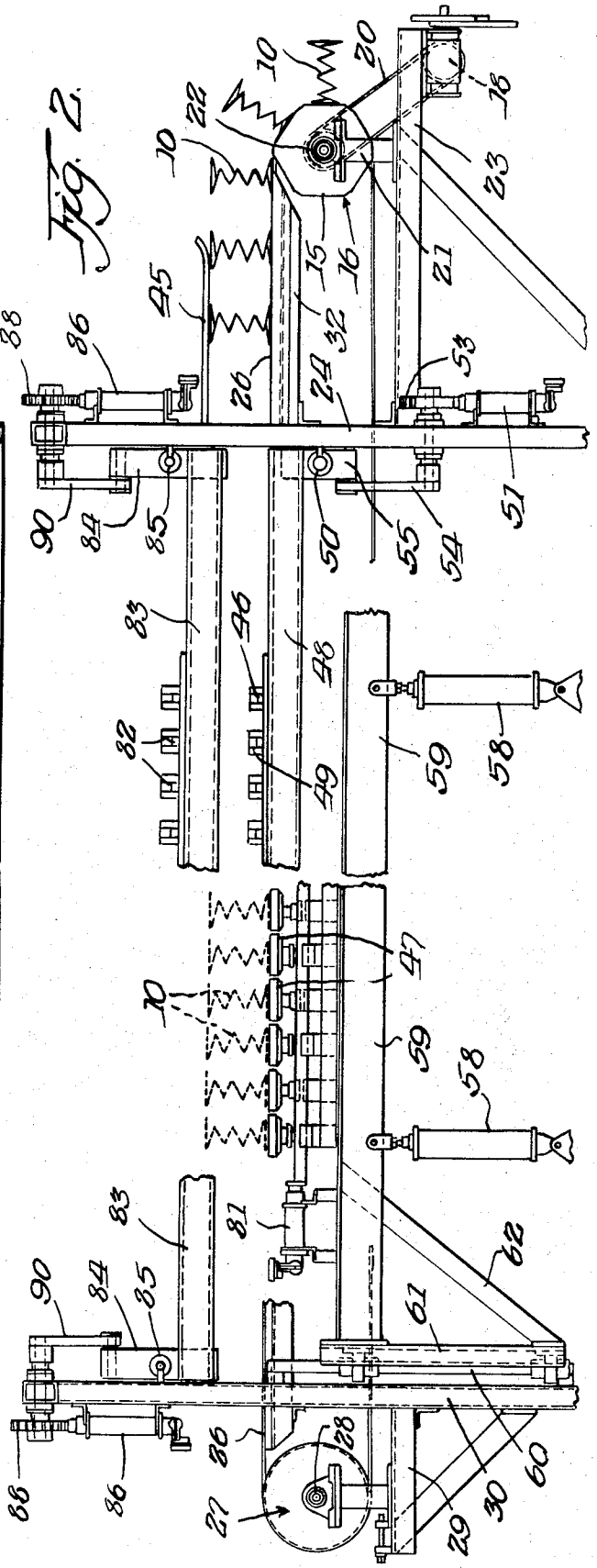


Fig. 2.

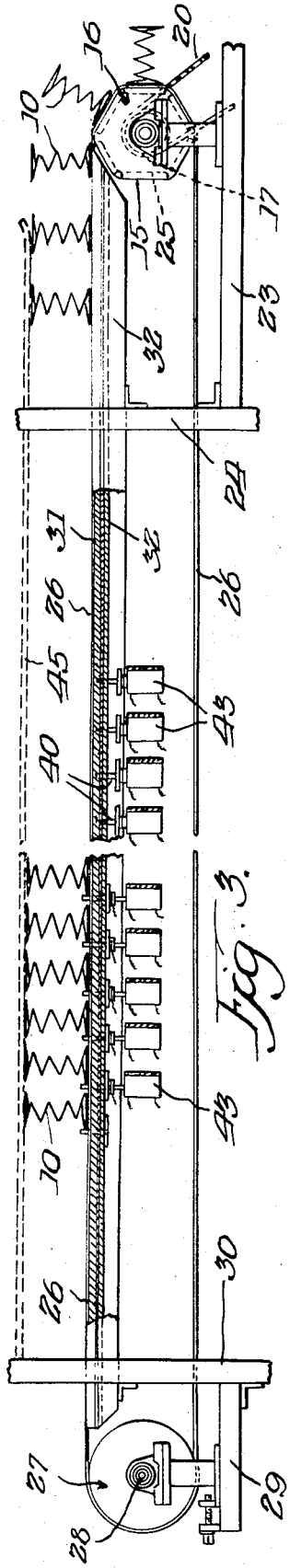


Fig. 3.

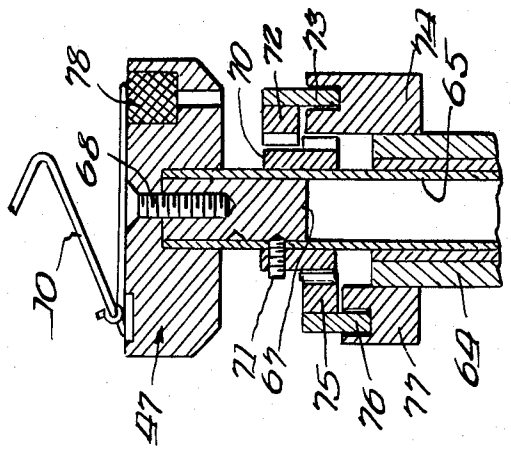


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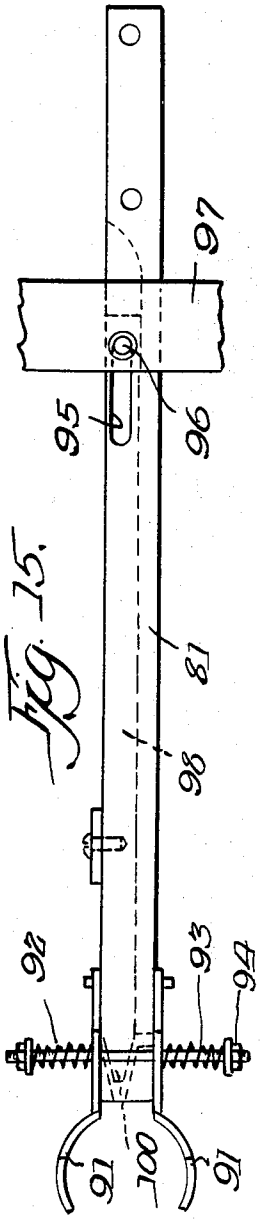


Fig. 15.

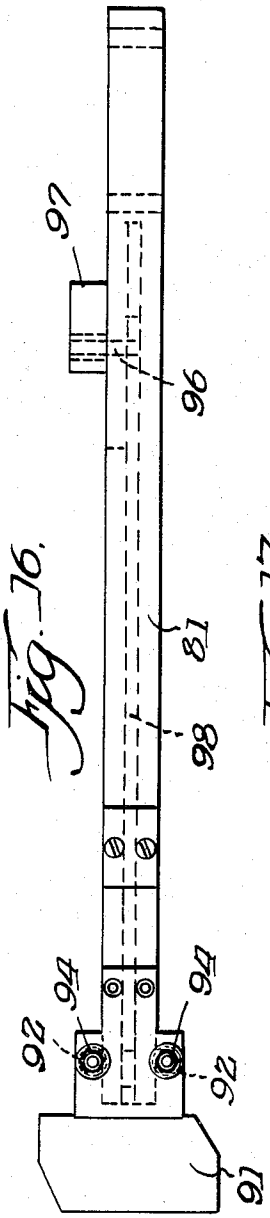


Fig. 16.

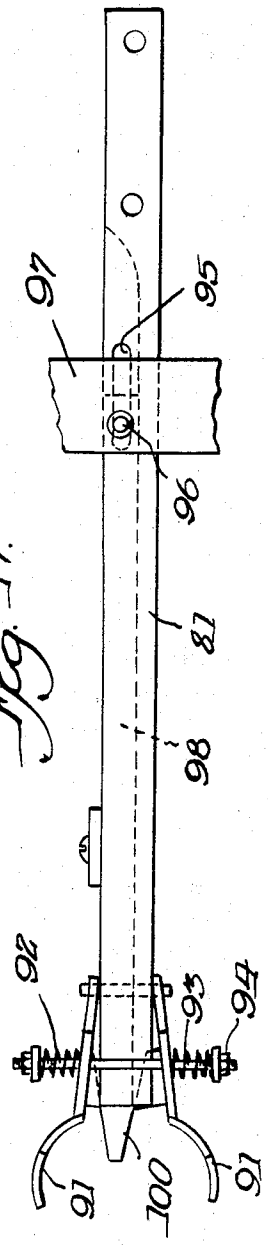
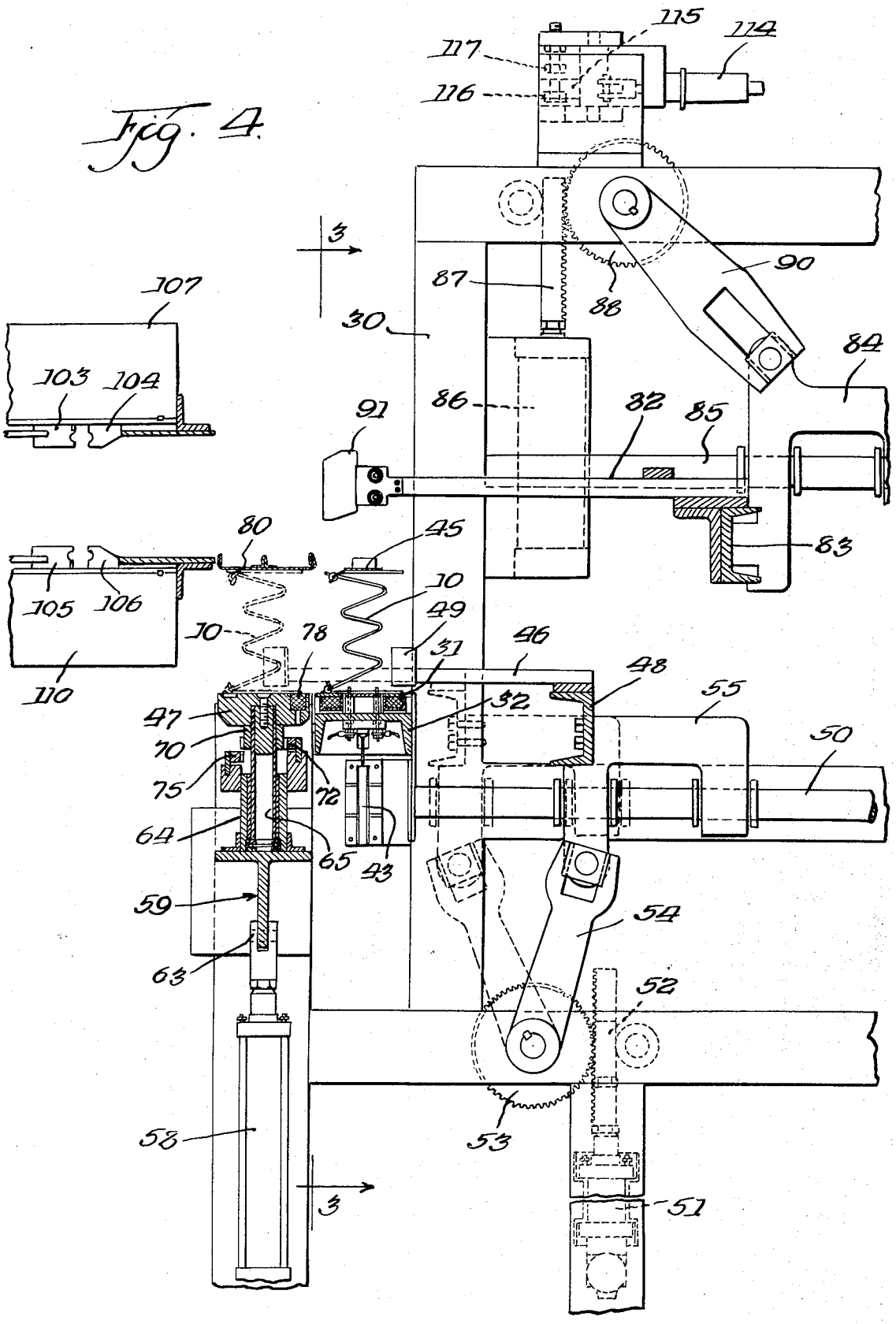


Fig. 17.

Fig. 4.


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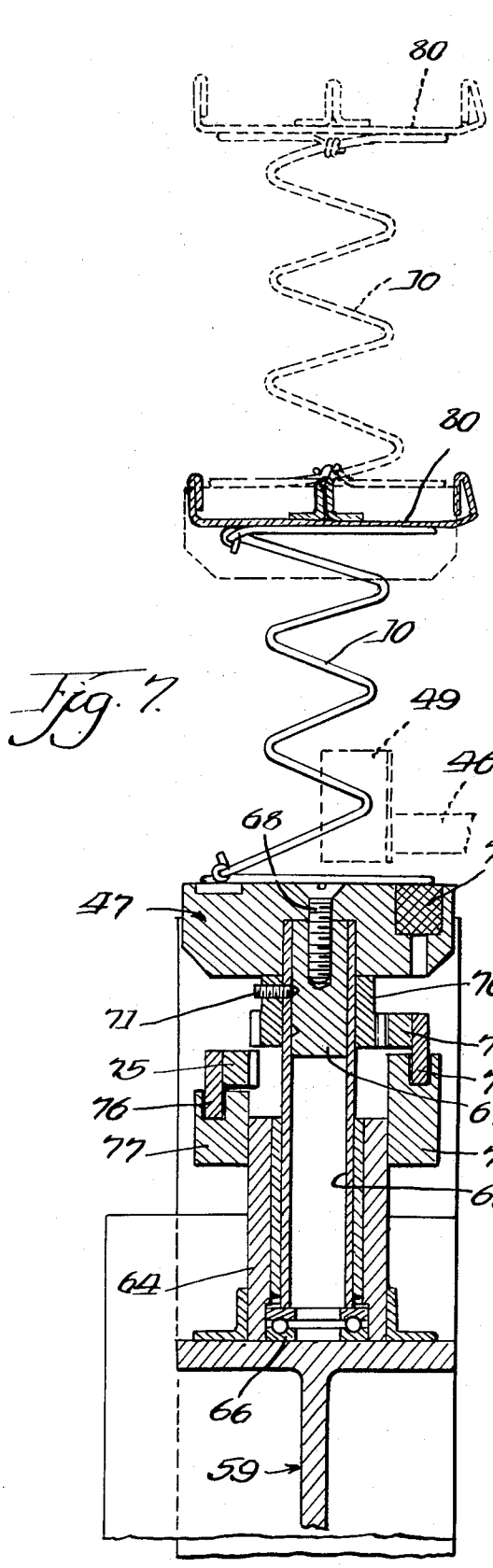


Fig. 7.

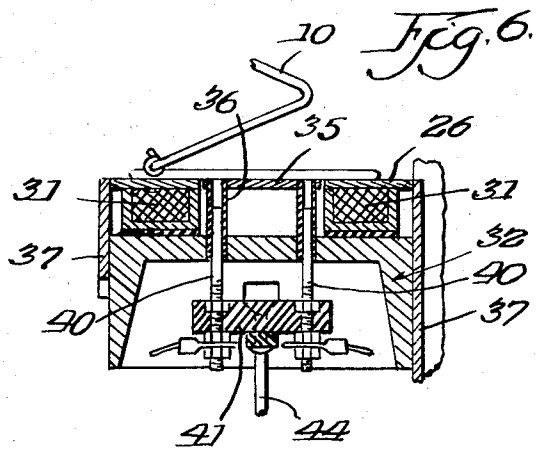


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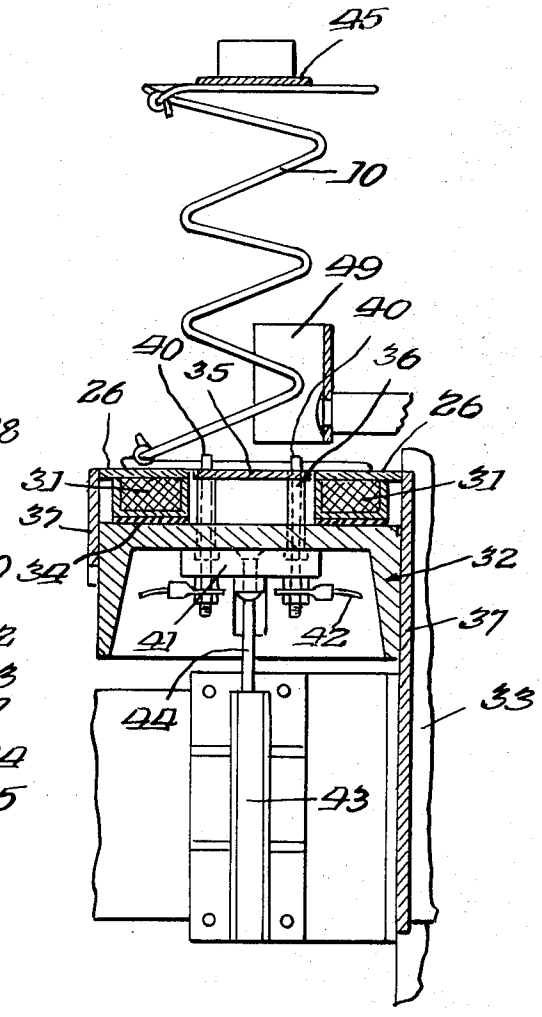


Fig. 5.

Fig. 9

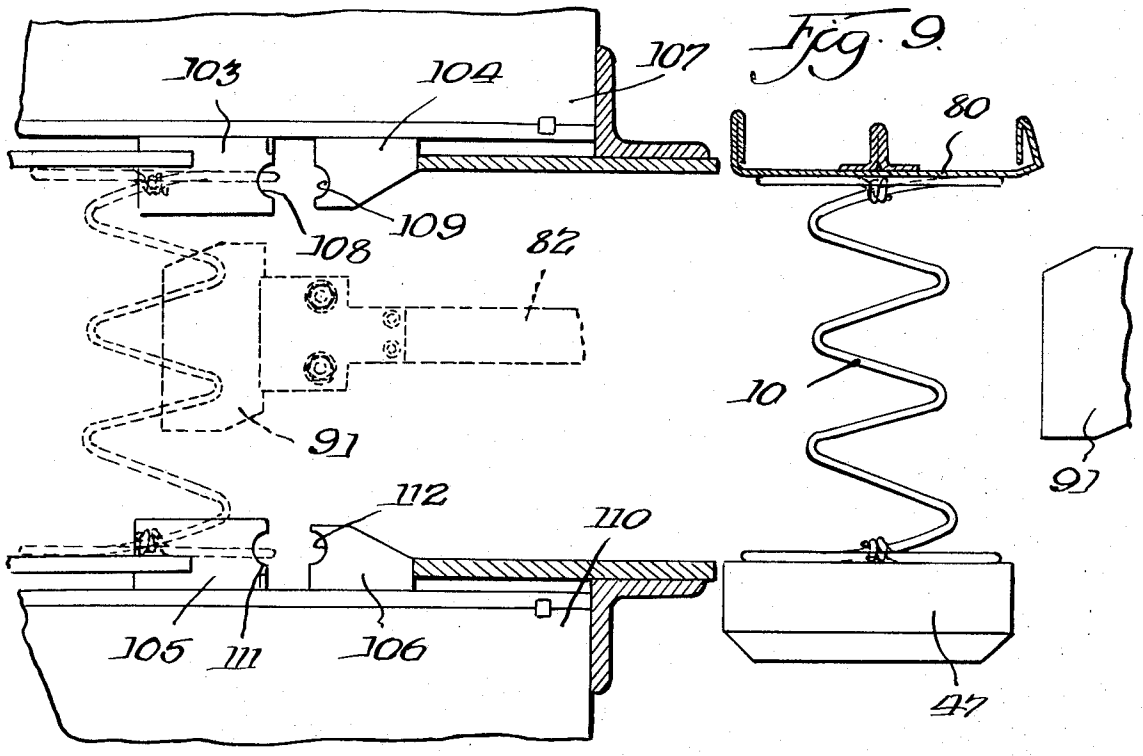
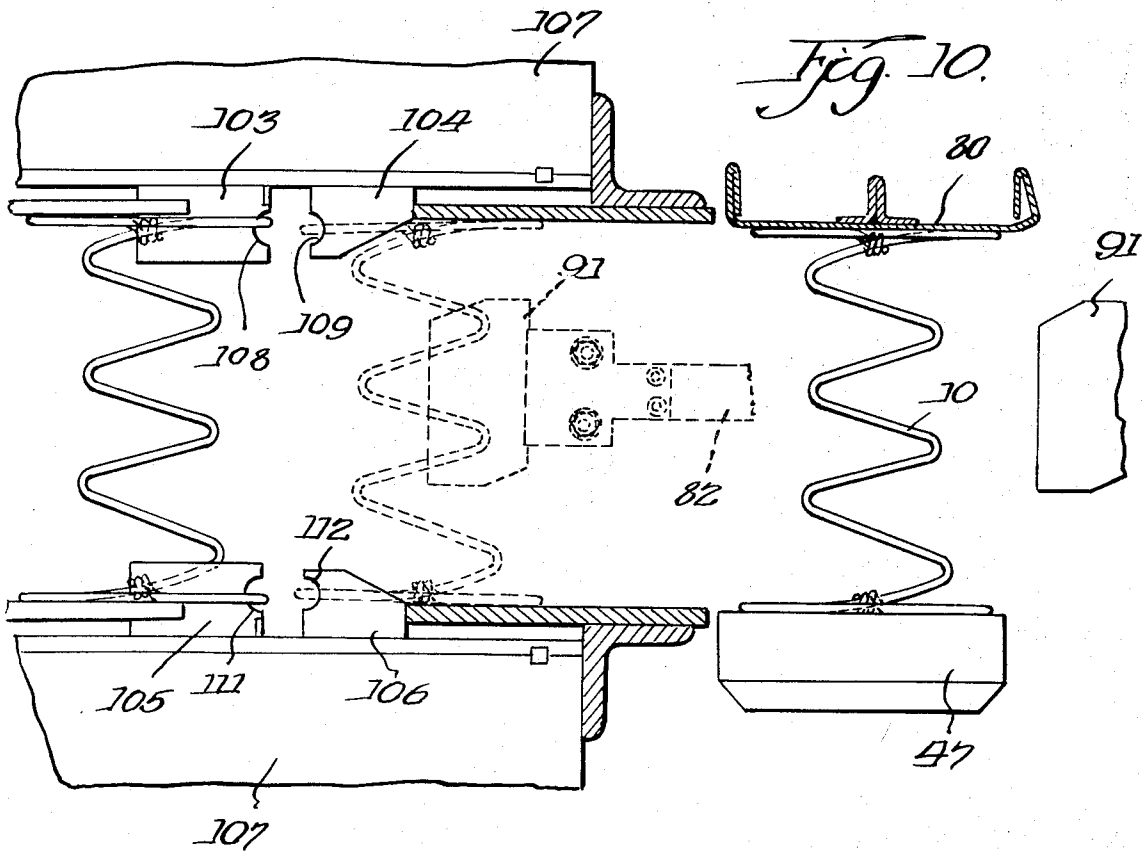

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Fig. 10


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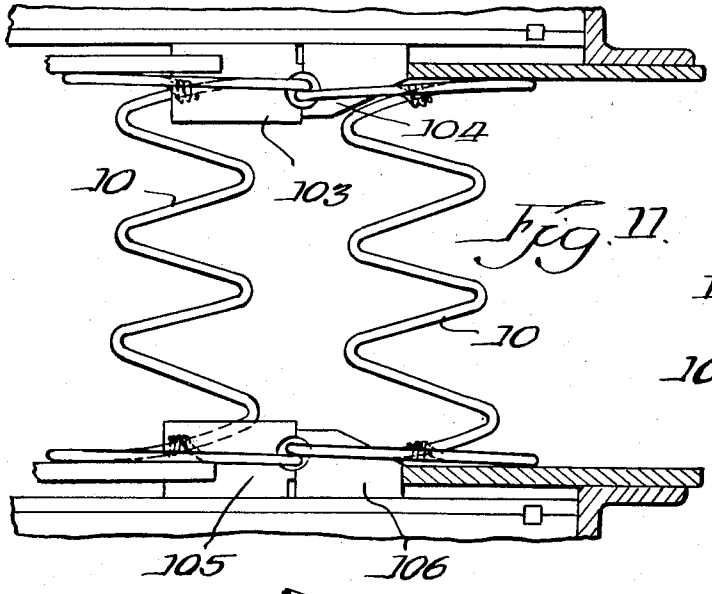


Fig. 11.

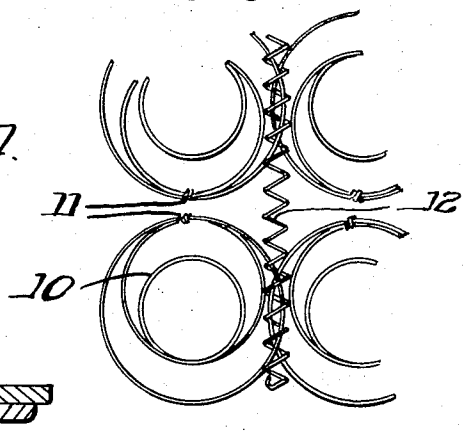


Fig. 14.

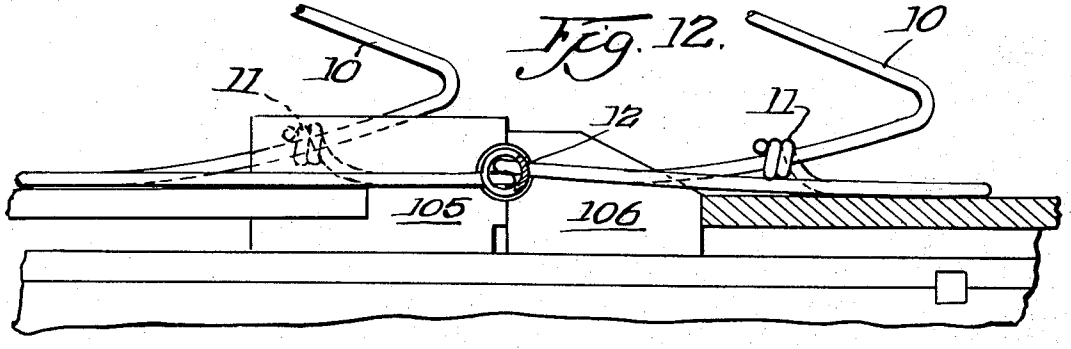


Fig. 12.

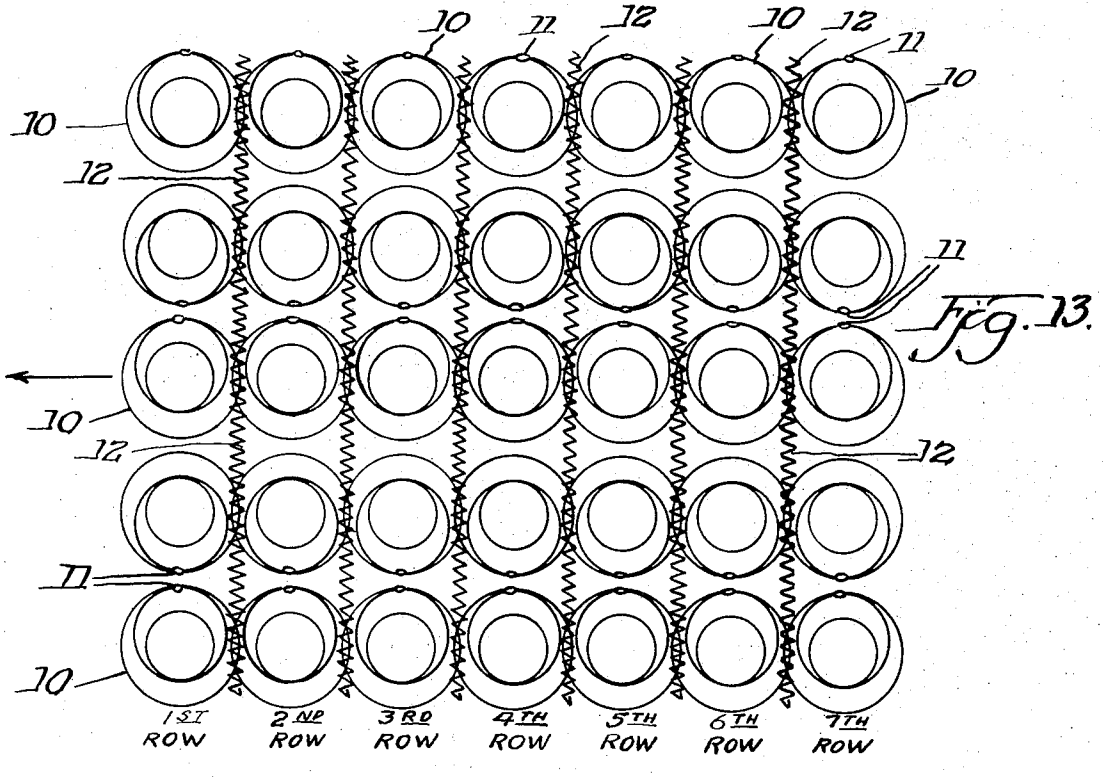


Fig. 13.

SPRING TRANSFER APPARATUS

The invention relates to a method and to a machine for transferring, positioning and assembling coil springs in the production of mattresses and the like and has reference in particular to improvements in apparatus for receiving hour-glass shaped coil springs from a coiler and which in the process of transferring the coil springs from the coiler to a mattress assembling unit will rotate individual springs selectively for knot orientation.

In spring assembling machines for making inner spring units for mattresses, box springs and the like, the conventional procedure required the services of an operator for placing the coil springs manually into separate pockets of the spring assembling machine and which were thereupon propelled forwardly and connected at respective end convolutions by helical springs. In the machine of the present invention the coil springs are received from the coiler one at a time as they are produced and all subsequent operations from the coiler to the spring assembling unit are automatic including the new and novel step of positioning a plurality of said coil springs in a longitudinal row and in rotating the coil springs of each positioned row in either a clockwise or a counter-clockwise direction for knot orientation, both steps being performed during the process of transferring the coil springs from the coiler and before they are propelled forwardly into the assembling unit. For accomplishing the foregoing operations the present machine incorporates endless belts wherein the upper runs thereof pass over longitudinal magnets, wherein solenoid actuated pins are provided for positioning the coils in a longitudinal row while the belts continue to have movement and wherein turntables receive the coil springs from the belts and elevate them in addition to turning the coils approximately 90° in selected directions to orient the knots on the end convolutions.

In view of the foregoing, a main objective of the present invention resides in the provision of endless belts for receiving the coil springs from the coiler or from a supply of said coils and for positioning the coils in longitudinal alignment and wherein the coils are properly spaced and held in position in spaced relation by means of solenoid actuated pins. The upper runs of the belts pass over longitudinal magnets respectively, which assist in holding the coil springs on the belts while the belts have movement for transferring and locating the coil springs that follow in their aligned spaced positions.

Another object resides in the provision of apparatus as described which will additionally incorporate horizontally reciprocating pusher arms for pushing the longitudinally aligned row of uniformly spaced coil springs forwardly off the belts and onto turntables respectively, the said turntables each having a lowered position for receiving the coil springs from the belts and thereafter having an elevated position.

Another object of the invention is to provide a plurality of turntables for individually receiving the coil springs from the belts, the said turntables having a lowered position for such purpose and wherein the turntables are immediately thereafter elevated to locate the entire row of aligned coil springs at an elevation above and forwardly of the continuously moving belts. In the process of elevating the coil springs, the turntables are rotated in either a clockwise or a counter-clockwise direction for knot orientation.

Another object resides in the provision of a second set of pusher arms having horizontal reciprocation for pushing the rotated coil springs from off the turntables and onto dies which at the time are open for receiving the top and bottom convolutions respectively. As the pusher arms are reciprocated forwardly, the coil gripping elements of each arm are caused to open momentarily against spring tension and to then close in gripping relation with a coil spring, whereby adequate control is obtained at all times in pushing the coil springs off the turntables respectively and into the open dies as regards their end convolutions.

With these and other objects in view, the invention may consist of certain novel features of construction and operation as will be more fully described and pointed out in the specification, drawings and claims appended thereto.

In the drawings which illustrate an embodiment of the invention and wherein like reference characters are used to designate like parts;

FIG. 1 is a top olan view showing spring transfer apparatus embodying the improvements of the invention including the endless belts, the upper run of which pass over longitudinal magnets, the lower pusher arms, the turntables and the upper pusher arms;

FIG. 2 is an elevational view of the operator's side of the spring transfer apparatus as shown in FIG. 1;

FIG. 3 is part elevational and part sectional view taken substantially on line 3—3 of FIG. 4 and showing the endless belt structure in combination with the solenoid actuated positioning pins;

FIG. 4 is a vertical sectional view taken transversely through the spring transfer apparatus of the invention and showing details of the various improved features;

FIG. 5 is a transverse sectional view showing details of the endless belts with their upper run being supported on longitudinally extending magnets and also showing a pair of the solenoid actuated positioning pins in up position;

FIG. 6 is a fragmentary detail sectional view similar to FIG. 5 and illustrating one pair of positioning pins in down position;

FIG. 7 is a transverse sectional view taken vertically and showing details of the elevating and rotating structure for the turntables, the adjustable geat wheel having an up position;

FIG. 8 is a fragmentary detail sectional view of the turntable structure showing a down position of the adjustable gear wheel;

FIG. 9 is a fragmentary sectional view illustrating an operation of an upper pusher arm in pushing a coil spring of the gear row from off of a turntable and onto forward dies which are open for receiving the top and bottom convolutions respectively;

FIG. 10 is a fragmentary sectional view similar to FIG. 9 but illustrating an operation of the upper pusher arm in pushing a coil spring from the second and subsequent rows onto the rear dies which are open for receiving the convolutions respectively;

FIG. 11 is a fragmentary sectional view similar to FIGS. 9 and 10 and showing the dies in closed position on the convolutions of a pair of coil springs from transversely adjacent rows and wherein the convolutions overlap;

FIG. 12 is an enlarged fragmentary sectional view illustrating the action of a helical coil in joining the overlapping portions of the convolutions of the coil springs;

FIG. 13 is a top plan view showing portions of a coil spring mattress such as can be produced by the spring transfer apparatus of the invention;

FIG. 14 is a fragmentary plan view showing a group of coil springs as illustrated in the mattress of FIG. 13 in connected relation by means of a helical coil which joins adjacent convolutions of the springs;

FIG. 15 is a top plan view showing details of the upper pusher arms;

FIG. 16 is a side view of the pusher arm shown in FIG. 15; and

FIG. 17 is a top plan view similar to FIG. 15 but showing the coil gripping elements of the pusher arm in an actuated open position.

Referring to the drawings and in particular to FIG. 13 it will be understood that the coil spring transfer apparatus of the invention is capable of producing spring interiors such as mattresses, cushions and etc. and wherein the same are formed of resilient wire coil srings generally of a helical hour glass shape and wherein the ends of the wire are connected to the top and bottom convolutions by knots. In FIGS. 13 and 14 the coil springs are designated by the numeral 10, the knots by the numeral 11 and the helical coils which join the top and bottom convolutions of transversely adjacent rows by the numeral 12. In FIG. 13 the top convolutions of rows 1 and 2 are joined by a helical coil 12, and likewise a helical coil joins the top convolutions of rows 2 and 3 and so on. The bottom convolutions of said coil springs are joined in the same manner. Also the coil springs have been selectively rotated to orient the knots 11 as shown so that the forward edge of the mattress and also the two side edges and the rear edge will be free of knots since the coils have been so rotated as to position the knots inwardly of the mattress structure.

THE ENDLESS BELT STRUCTURE

The coil springs 10 are produced by a coiler, FIG. 1, well known in the art and which need only be designated by the block diagram 14. The coils are pushed forwardly of the coiler so as to be positioned in contact with a flat magnetized surface 15 of the transfer drum 16, FIG. 2, The drum is rotated intermittently by the drive sprockets 17 and 18 connected by the endless chain 20, the drive preferably having operative connection with the coiler 14 so that the drive to the belts synchronizes with the operation of the coiler. The upright standards 21 support journalling means 22 for the drum 16 and the standards are in turn supported by the frame structure 23, the same including the vertical right hand frame standards 24. Each flat surface 15 of the hexagonal drum 16 is rendered magnetic by the permanent magnets 25 shown in FIG. 3 and thus the coil springs are held to a flat surface and elevated to a horizontal position as the drum 16 rotates.

A pair of endless belts 26 pass around the drum 16 at the right hand end of the belt structure, FIGS. 2 and 3, and the belts pass around the circular drum 27 at the left hand end of the same. The circular drum is journalled at 28 and the drum is supported by the element 29 from the left hand frame standard 30. A pair of spaced endless belts 26 are employed as shown in FIG. 5 and said belts have their upper runs passing over and the same are thus supported respectively by a pair of longitudinally extending magnets 31. Said magnets are of the permanent type and they extend from drum 16 to drum 27. A longitudinally extending channel member 32 is supported by frame element 33 from the standards 24 and 30 and said member 32 supports the magnets 31 which are insulated at 34. The member 32 also supports the center metal strip or plate 35 by suitable blocks not shown. The insulating tubes 36 are anchored in channel 32 and they extend upright to pass through the plate 35. Said plate extends between the belts 26 forming a separator so as to maintain the belts in contact with their magnet 31 and which function is assisted by the side guides 37. The belts, magnets and plate provide a horizontal supporting table for the coils which adhere to the belts due to the magnets. With continuous movement of the belts in an intermittent manner, the coil springs are first received by the transfer drum one at a time and as the drum rotates the coils are positioned upright and delivered to the longitudinal table. While on the table the coils are moved by the belts to form a row of longitudinally aligned and spaced coils.

THE SOLENOID ACTUATED POSITIONING PINS

Although the endless belts continue to move, the coils are stopped and held against movement by pairs of positioning pins 40, shown in FIGS. 5 and 6,and which are employed for positioning each coil spring and the pins extend through the tubes 36 so it will be understood that the pins are insulated from the channel member 32 and also from the metal center strip 35. The pins are further insulated from the frame of the machine since they are suitably anchored in the insulation block 41, and have their lower extending ends connected to the conductor leads 42. As best shown in FIG. 3, a plurality of pairs of pins are positioned in longitudinal alignment between the frame standards 24 and 30 and each pair, with the exception of the first pair, is actuated from a down position to an up position by electro-magnetic means such as a solenoid 43. For illustrative purposes it can be assumed that the present apparatus embodies a total of 15 pairs of pins and 14 solenoids with pair 1 being located on the extreme left, FIG. 3, then pair 2,3,4,etc. until the last pair 15 is located on the extreme right. The pins of the first pair are fixed in an up position so that the first coil will contact the pins as shown and remain in held position while the belts continue to move. The second pair of pins are actuated by the solenoid 43 of said pair, the solenoid having a stem 44 which is suitably fixed to its insulating block 41. The remaining solenoids are connected to their pins in a similar manner and the solenoids and pins are disposed in spaced relation for spacing the coil springs in a longitudinal row as required for the particular inner spring structure to be produced.

In starting operation of the present machine, the first coil will be received from the coiler and transferred by the moving belts to the first pair of positioning pins. The pins of said first pair are up at all times and so the first coil will contact the same and be held thereby. This contact of the metal coil with the positioning pins will close an electric circuit so as to energize the solenoid for the pins of pair 2 and said pins will move up as shown in FIG. 5 to stop and position coil 2. When coil 2 contacts its pins it energizes the solenoid for coil 3 and so on until all coils have been positioned on the belts in longitudinal alignment. The conductors 42

form the positive of the electric circuit for each solenoid with the metal of the frame providing a grounded negative. More particularly each coil spring will have its base convolution in contact with a pair of positioning pins **40** with its top convolution in contact with the metal slide plate **45,** FIG. **5.** Thus the coil will function in a manner to close an electrical circuit such as will energize the next solenoid on its right side, FIG. **3.** Since the belts continue to move intermittently, they help to maintain the coils against their pair of pins and said movement has the desirable effect of stabilizing the coil positioning operation.

THE LOWER PUSHER ARMS

The lower pusher arms **46** are actuated at intervals in timed relation with the positioning of the last or number **15** coil so as to push all 15 of the positioned coil springs off the moving belts **26** and onto turntables **47** disposed in down position for receiving the coil springs, see FIGS. **1,2** and **7.** A pusher arm is required for each coil and the arms are fixed to a reciprocating channel member **48** with each arm at its opposite end carrying a coil engaging element **49.** The numeral **50** indicates a slide supporting bar for the channel member **48** and which is thus supported for horizontal reciprocating movement. Said movement is imparted to the lower pusher arms **46** at predetermined times by the power cylinders **51,** FIGS. **2** and **4,** suitably supported on the frame standards **24** and **30** respectively at each end of the member **48.** The power cylinders each have a piston actuated rack **52** in meshing relation with a gear wheel **53.** The gear wheel thus rotates to oscillate the arms **54** which reciprocate the sliding element **55** on the slide bar **50.** The channel member **48** is fixed at respective ends to the elements **55.**

Immediately following the positioning of the last coil in the aligned row on the moving belts, the power cylinders **51** are rendered operative to move the pusher arms **46** in a forward direction, whereby all coils of the row are simultaneously pushed forwardly off the belts and onto the turntables **47.** The pusher arms return immediately since the belts continue to move and another coil spring number **1** etc. as regards a new row is being moved by the belts and the pusher arms **46** must be retracted out of the way.

THE TURNTABLES

The turntables rotate as they are elevated from a low position in horizontal alignment with the moving belts to an elevated position in substantial horizontal alignment with the bottom or lower dies to be presently described, FIGS. **7,9** and **10.** A turntable for each coil is provided and the mechanism for supporting and for rotating the turntables forms a unit and the units are all supported for elevating movement which is effected by the power cylinders **58** best shown in FIG. **4.** The longitudinally extending metal supporting beam **59** is elevated upon actuation of the power cylinders and accordingly said beam at its respective ends is mounted for vertical movement on the slide bars **60.** For such purpose each end of the beam is provided with a sliding member **61** secured to the beam and stabilized by member **62.** The vertical flange of the beam is connected at **63** with the piston rods of the power cylinders **58** and the horizontal flange provides the support for the cylinders **64,** FIG. **7,** one for each turntable. Each cylinder **64** journals a tube **65** for rotation on a vertical axis for which purpose the ball bearing element **66** is provided. The tube at its top end is fixed to a turntable **47** as by means of the stem **67** and the fastening screw **68.** Since the turntables must have either clockwise or counter-clockwise rotation, the invention provides an adjustable gear **70** which is fixed to the tube **65** by the set screw **71** in either an up position, FIG. **7,** or in a down position FIG. **8.** The gear has meshing relation when in up position with a longitudinally extending rack **72** located on the right hand side of the gear **70** and fixed to the actuating member **73** supported by the element **74.** When the gear is fixed in down position, FIG. **8,** the gear has meshing relation with the rack **75** secured to the actusting member **76** which is supported by the support **77.**

The turntables **47** are each provided with a number of permanent magnets **78** located around the periphery of the turntable and which assist in holding the coil spring on the turntable. Whereas the bottom convolution is held on the turntable by magnetic attraction, the top convolution is in contact with the top slide plate **80,** which is unitary with the turntable structure and moves up and down with the turntables upon actuation of the power cylinders **58.** As the turntables are elevated from their low or down position, the racks **72** and **75** are simultaneously reciprocated by the power cylinders **81** shown in FIG. **2,** to in turn rotate the turntables and thus the coils supported thereby for knot orientation. For certain turntables the gear **70** will be in meshing relation with the rack **72** for rotating the turntables in a counterclockwise direction and for other turntables the gear **70** will be in meshing relation with rack **75** for rotating the turntables in a clockwise direction. The final result of the operation is to orient the knots on the various coil springs as shown in the mattress of FIG. **13.**

THE UPPER PUSHER ARMS

Following the elevation and rotation of the coil springs individually supported on a turntable, the upper pusher arms **82** are next actuated for pushing the coil springs from off the turntables and into dies which at the time are open for receiving the top and bottom convolutions thereof. The combination angle and channel member **83** extends longitudinally of the machine from frame standard **24** to frame standard **30** and the upper pusher arms **82,** one for each turntable, are fixedly secured thereto. The member **83** is supported for reciprocating movement by the sliding members **84** which have sliding movement on the rods **85,** located at each end of the member **83.** A power cylinder **86** is suitably supported on each frame standard **24** and **30** and each cylinder has a piston connected rack **87** in mesh with a gear wheel **88.** Oscillation of the gear wheel will oscillate the arms **90** and thus the member **83** and the upper pusher arms **82** are reciprocated.

As shown in FIGS. **15,16** and **17** the upper pusher arms **82** are provided at their forward ends with coil gripping elements **91,** which are pivotally carried by each arm and spring tensioned by the resilient springs **92** to close on and grip a coil spring **10.** Said springs **92** are carried by the connecting pin **93** and each resilient spring is located outside a coil gripping element and held on the pin by the retaining nut **94.**

Each pusher arm is slotted at **95** to receive the pin **96** which is carried by a connecting member **97** extending longitudinally from the first pusher arm to the fifteenth or last pusher arm. The pin **96** of each pusher arm is in

turn fixed to a cam bar **98** carried by each pusher arm and having a cam shaped forward end **100** for effecting an opening action of the coil gripping elements **91.** The power cylinders **101** shown in FIG. **1** are suitably carried by reciprocating channel member **83** and the piston end of each cylinder is connected at **102** to the connecting member **97** and through the pins **96** to the cam bars **98.** As the upper pusher arms **82** are moved forwardly to push the row of coil springs from off the turntables and into dies, such as **103** to **106** inclusive shown in FIGS. **9** and **10,** the power cylinders **101** are energized and the cam bars are moved forwardly to cause the coil gripping elements to open. Thus it will be seen that when the pusher arms **82** are moved forwardly, the coil gripping elements **91** are immediately caused to open so that said elements may receive a coil spring and resiliently grip the same upon retraction of the cam bars **98** which action thereupon takes place following contact of the gripping elements with a coil spring.

THE DIES AND THE HELICAL COIL CONNECTING OPERATION

As previously explained, when the coil springs have been elevated and rotated by the turntables, they are pushed by the upper pusher arms **82** from off the turntables and into the dies **103** to **106** inclusive which are at the time open for receiving their respective top and bottom convolutions. This action of the upper pusher arms is illustrated in FIGS. **9** and **10.** The top dies **103** and **104** are suitably supported by frame structure **107** and each die has a special formation including a semicircular recess such as **108** and **109** respectively. The lower dies **105** and **106** are likewise supported by frame structure **110** and said dies have semicircular recesses **111** and **112.**

For the first row of coil springs as designated in FIG. **13,** the pusher arms **82** will have their maximum reciprocating movement forwardly so as to push the entire first row off the turntables and into the forward dies **103** and **105** as regards their top and bottom convolutions. The top convolution will encircle the top forward die **103** and the semi-circular recess **108** will receive part of the same. In a like manner the bottom convolution will encircle the lower forward die **105** and the semi-circular recess **111** will receive part of the same. The pusher arms **82** are permitted to reciprocate their full extent for this first row since the power cylinder **114** FIG. **4,** will have been energized to withdraw the block **115** carrying the stop member **116.** As a result the rack **87** will move up to its full extent until it contacts the stop **117.** On subsequent operations for the second,third and the remaining rows the block **115** will have been moved forwardly and located again in its former position and thus the rack will next engage the stop **116** which action will reduce the length of the forward reciprocating stroke of the pusher arms **82.** On these subsequent operations of the upper pusher arms for the second, third and remaining rows, the coil springs from the turntables will be pushed into the rear dies **104** and **106,** see FIG. **10.** The top convolution will encircle the top rear die **104** and part will lie in the recess **109.** The bottom convolution will encircle the lower rear die **106** with part lying in the recess **112.** With the completion of each forward feeding operation as above described for the subsequent rows, the dies are caused to close and the convolutions in the respective semicircular recesses will overlap as shown in FIG. **11.** Each circular opening thus formed by the closed dies will receive a helical coil **12** which joins the overlapping convolutions of adjacent rows of coils as illustrated in in FIGS. **12** and **13.**

The helical coil **12** is formed by the machine **118** FIG. **1** and the helical is fed transversely of the mattress structure to join the convolutions of adjacent rows of coil springs. Means are provided for cutting the helical coil when it has been fed for the required length and each end of the helical coil wire is then bent inwardly to complete the connecting operation on adjacent transverse rows of coil springs.

OPERATION OF THE MACHINE

As the coil springs are produced by the coiler **14** they are pushed forwardly onto a magnetized flat surface **15** of the transfer drum **16.** By the rotation of the drum the coils are bodily moved from a horizontal axial position to a vertical position and since the endless belts **26** pass over the transfer drum, the coils are moved by the belts along the longitudinal table formed by the spaced magnets **31** and the center metal plate **35.** The magnets assist in holding the coil springs on the belts while the coils move with the belts and until they contact the coil positioning pins **40** which are solenoid actuated as described. Thus the coils are properly spaced and maintained in position longitudinally to form a row. When the row is complete as regards the number of coils, the lower pusher arms are actuated by the power cylinders **51** to push the entire row onto the turntables **47** which at the time will be in down position for receiving the coil springs. The turntables rotate each coil spring as they are being elevated to a position above and forwardly of the endless belts. At predetermined times in synchronism with the operations of the turntables, the upper pusher arms **82** are reciprocated forwardly to push the coils from off the turntables and onto the dies **103** to **106** inclusive all in a manner as previously explained in detail. Each upper pusher arm has a resilient gripping action with its particular coil spring by reason of the coil gripping elements **91** which are opened by the cam bars **98** for encircling a coil. Upon retraction of the cam bars the elements **91** close and grip the coil. This action is very desirable since it provides the necessary control of the coils as they are caused to enter the dies.

With the return reciprocating stroke of the upper pusher arms, the elements **91** open against the tension of the resilient springs **92.** This action automatically releases the grip on the coils and as a result the coils are left on the dies in the desired position thereon for the final operation namely the feeding of the helical coil for connecting the top and the bottom convolutions. After the coils have been pushed off the turntables they are lowered and also rotated to their original position. The turntables **47** and their supporting means, the adjustable gear **70,** the racks **72** and **75,** power cylinder **81** and the top slide plate **80** all comprise a unitary structure which is bodily moveable up and down by the power cylinders **58.**

The positioning pins **40** and their mode of operation is an important feature of the present invention. Energization of the solenoids takes place in succession as regards the longitudinal row and in a direction opposite to movement of the belts. Thus actuaction of the pins stops movement of the coils one at a time and positions each coil in desired spaced relation in its row although

the belts continue to move. When a coiler is employed as herein shown the belts have intermittent movement to synchronize the rotation of the transfer drum with the operation of the coiler. However it is possible to produce the coil springs at locations removed from the present apparatus and manually place the coils respectively on the flat magnetic surfaces of the transfer drum. When the coil transfer apparatus is operated in this manner the belts can have continuous movement instead of intermittent movement.

What is claimed is:

1. In a method of transferring resilient coil springs, each having a knot on their top and bottom convolutions, from a coiler where the coils are produced to an assembling unit where the coils are joined to form an interior spring structure, the steps which include receiving the coil springs one at a time as they are produced by the coiler and positioning a pre-determined number of the coil springs in spaced relation in a first longitudinally aligned row, simultaneously pushing all the coils of said row onto turntables respectively, elevating and rotating the coils of said row by elevating and rotating each turntable, whereby the coils of said row are now at a higher elevation with the coils having been turned for the desired knot orientation, and finally pushing the coils of said row from off the elevated turntables and onto the respective top and bottom dies of the assembling unit which dies are open at the time for receiving the top and bottom convolutions thereof.

2. In a method of transferring resilient coil springs as defined by claim **1,** wherein the step of positioning a pre-determined number of coil springs in spaced relation in a first longitudinal row takes place in succession for the second and all subsequent rows, and wherein the step of rotating the coils by rotating each turntable takes place selectively with some turntables and their coils rotating clockwise and the others rotating counter-clockwise.

3. In a method of transferring resilient coil springs as defined by claim **1,** wherein the step of pushing the coils of said row from off the turntables and onto the dies of the assembling unit includes the steps of positively gripping each coil as the same is pushed off the turntable and maintaining the grip on each coil until the coil is located on the said dies, and finally the step of releasing the grip thus leaving the coil located on the dies in the desired position.

4. In a method of transferring resilient coil springs as defined by claim **1,** wherein the step of positioning a pre-determined number of coil springs in spaced relation in a first longitudinal row includes the step of moving the coils along a horizontal longitudinally extending table by means of intermittently moving belts, the top run of which pass over and are supported by the said longitudinal table, and the steps of stopping movement of the coils seriatim in desired spaced relation while the belts continue to move, and in holding each coil in its respective stopped position until the entire row is pushed off the belts and onto the turntables.

5. In a method of transferring resilient coil springs as defined by claim **4,** wherein the step of moving the coils along said horizontal longitudinally extending table by means of the continously moving belts and the step of holding each coil in its respective stopped position are materially assisted by subjecting the coils to magnetic attraction effected by magnets comprising part of the longitudinally extending table.

6. In a method of transferring resilient coil springs, each having a knot on their top and bottom convolutions, from a supply of said coils to an assembling unit where the coil springs are joined to form an interior spring structure, said assembling unit including top and bottom forward dies and top and bottom rear dies, the steps which include receiving the coil springs one at a time and positioning a pre-determined number of the coils in spaced relation in a first longitudinally aligned row and with their axes disposed vertically, simultaneously pushing all the coils of said row onto turntables, respectively, elevating and rotating the coils of said row by elevating and rotating each turntable, whereby the coils of said row are now at a higher elevation with the coils having been turned selectively for the desired knot orientation, repeating the above operations for the second and each subsequent row as required for the particular spring structure, pushing the coils of said first row from off the elevated turntables and onto the respective top and bottom forward dies of the assembling unit which dies are open at the time for receiving the top and bottom convolutions thereof, and thereafter pushing the coils of the second and subsequent rows in succession from off the turntables and onto the respective top and bottom rear dies of the assembling unit which are open at the time for receiving the top and bottom convolutions thereof.

7. In a method of transferring resilient coil springs as defined in claim **6,** wherein the step of rotating the coils by rotating each turntable takes place as the coils are being elevated, and wherein the rotation is selective with some turntables and their coils rotating clockwise and the others rotating counterclockwise.

8. In a method of transferring resilient coil springs as defined by claim **6,** wherein the step of positioning a pre-determined number of coil springs in spaced relation in said first and subsequent longitudinal rows includes the step of moving the coils along a horizontal longitudinally extending table by means of moving belts having their top runs passing over and being supported by the longitudinal table, and also the steps of stopping the movement of the coils seriatim in desired spaced relation while the belts continue to move, and in holding each coil in its respective stopped position until the entire row is pushed off the belts and onto the turntables.

9. In a method of transferring resilient coil springs as defined by claim **6,** wherein the step of pushing the coils of each said row from off the turntables and onto the dies of the assembling unit includes the step of positively gripping each coil as the same is pushed off the turntable and maintaining the grip on each coil until the coil is located on the said dies, and finally the step of releasing the grip thus leaving the coil located on the dies in the desired position.

10. In apparatus for handling and transferring conventional knotted coil springs, the combination with a supply of the coil springs, of endless belt structure located relatively near the supply and including a transfer drum at the supply end and a second drum at the opposite end of the structure, endless belts passing around the said drums and providing longitudinally extending top and bottom runs therebetween, a longitudinal table also extending between the drums and having the top run of the endless belts passing over and being supported by the table, said transfer drum having a plurality of flat surfaces which directly support the belts as

they pass around the transfer drum, magnetic means in operative associated relation with each flat surface of the transfer drum, and means for rotating the transfer drum during operation of the apparatus to cause movement of the endless belts, whereby a coil spring from the supply upon being presented to a certain flat surface will adhere thereto with a portion of the endless belts being interposed between the flat surface and the bottom convolution of the coil spring.

11. In apparatus for handling and transferring conventional knotted coil springs as defined by claim **10,** additionally including magnetic members extending longitudinally and forming a top surface for the table and which thus have the top run of the belts passing over and being supported thereby.

12. In apparatus for handling and transferring conventional knotted coil springs as defined by claim **11,** wherein the top surface of the table includes a pair of said longitudinal magnetic members in spaced relation, and additionally includes a metal center plate located between the magnetic members to complete the top surface, and wherein a pair of endless belts are employed with each belt having its top run passing over and being supported by a magnetic member, whereby a coil spring in magnetically adhered relation with a certain flat surface may be moved bodily from an axial horizontal position to an axial vertical position by rotation of the transfer drum, and whereby a plurality of vertically positioned coil springs may be moved by the moving belts along the table to form a longitudinally aligned row with the coils being magnetically attracted and held on the belts by the magnetic members.

13. In apparatus for handling and transferring conventional coil springs as defined by claim **11,** wherein the magnetic means in associated relation with each flat surface of the transfer drum and the longitudinal magnetic members which form the top surface of the table both comprise magnets of the permanent type.

14. In apparatus for transferring coil springs from a coiler to an assembling unit, in combination, endless belt structure for receiving the coil springs from the coiler and for moving and positioning the coils in a longitudinal row, said endless belt structure including a longitudinally extending table providing a flat top surface, a rotatable transfer drum at the coiler end of the table, a second drum rotably mounted at the opposite end of the table, a pair of endless belts passing around the drums at respective ends and having their top runs passing over and being supported by the table, said belts being transversely spaced and a center plate forming part of the top surface of the table having location between the belts, a plurality of positioning pins disposed in spaced relation along the length of the table, means supporting the positioning pins for vertical movement including solenoids respectively, said pins normally having an inoperative position below the center plate and an operative position projecting above the plate upon energization of their particular solenoid, means intermittently rotating the transfer drum during operation of the apparatus to cause intermittent movement of the endless belts, and electrical means for energizing the solenoids one at a time and in succession in a direction reverse to the movement of the belts, whereby said pins upon being rendered operative are located in the path of a coil spring to stop movement of the same and hold the coil in position while the belts continue to move.

15. In apparatus for transferring coil springs from a coiler to an assembling unit as defined by claim **14,** additionally including a pair of longitudinal magnetic members of the permanent magnetic type supported by the table on respective sides of the center plate and forming with said plate the top surface of the table, wherein the top run of each belt passes over and is supported by a magnetic member, wherein each solenoid supports a pair of transversely spaced positioning pins and which are vertically movable from an inoperative position below the center plate to an operative position projecting above the plate upon energization of their particular solenoid, and additionally including a pair of fixed positioning pins provided by the table in a stationary position projecting above the center plate, said fixed pair of positioning pins being located in longitudinal alignment with the solenoid actuated pins and at the operative end of the longitudinal table relatively adjacent the second rotatably mounted drum.

16. In apparatus for transferring knotted coil springs from a supply of said coils to an assembling unit where the coils are joined to form an inner spring structure, in combination, endless belt structure including a longitudinal table having a flat top surface, a rotating transfer drum at the supply end of the table, a pair of endless belts adapted to have movement and which pass around the transfer drum at one end and have their top runs passing over and being supported by the top surface of the table, whereby coil springs delivered one at a time to the transfer drum are transfered thereby to the belts and which effect movement of the coils in succession along the top surface of the table, a plurality of positioning pins provided by the table in spaced relation longitudinally thereof, a plurality of solenoids for supporting the pins respectively for vertical movement from a normal inoperative position below the said top surface to an operative position above the top surface upon energization of their particular solenoid, said pins upon being rendered operative projecting above the belts and into the path of a coil spring being moved by the belts, whereby to stop movement of the coil and produce a longitudinal row in stopped position on the belts while the belts continue to move, a plurality of turntables each being supported for vertical movement and for rotation in a predetermined direction, each turntable being located in associated relation with the endless belts and in aligned relation with one of said solenoids, reciprocable pusher arms equal in number to the number of turntables, each pusher arm having an aligned relation with a positioned coil spring and with its respective turntable, and means for actuating the pusher arms in an operative direction to simultaneously push the entire row of positioned coil springs off the belts and onto the turntables respectively.

17. In apparatus for transferring knotted coil springs as defined by claim **16,** additionally including a pair of spaced permanent magnetic members forming the top surface of the table and having a metal center plate located therebetween, wherein the top run of an endless belt passes over and is supported by a magnetic member, wherein a pair of transversely spaced positioning pins are supported and actuated by each solenoid, and additionally including a pair of fixed positioning pins provided by the table in a stationary position projecting above the center plate, said fixed pair of positioning pins being located in longitudinal alignment with the

solenoid actuated positioning pins and at the other end of the table from the transfer drum.

18. In apparatus for transferring knotted coil springs from a supply of said coils to an assembling unit where the coils are assembled to form an inner spring structure, in combination with, endless belt structure including endless belts and which are adapted to have movement for receiving the coils from the said supply and for moving the coils along the endless belt structure in a longitudinal row, a plurality of solenoid actuated positioning pins in associated relation with the endless belt structure for stopping movement of the coil springs in succession and for holding each coil in stopped position on the belts while the belts continue to move, a plurality of vertically movable turntables in associated relation with the solenoid actuated positioning pins respectively, lower pusher arms having reciprocating movement for simultaneously pushing all the coils in stopped position from off the belts and onto the turntables, gear means having operative connection with each turntable for selectively rotating the same in either a clockwise or a counter-clockwise direction, whereby the coil springs supported by the turntables can be rotated individually for achieving a desired knot orientation, and upper pusher arms also having reciprocating movement for pushing the coil springs from off the turntables and onto dies respectively, said dies forming part of the assembling unit and which are open at the time for receiving the top and bottom convolutions of their particular coil spring.

19. In apparatus for transferring knotted coil springs as defined by claim **18,** additionally including a pair of magnetic members of the permanent magnetic type forming part of said endless belt structure and wherein a pair of endless belts are employed with each belt having its top run passing over and being supported by a magnetic member, wherein the solenoid actuated positioning pins comprise a plurality of pairs of pins with each pair being supported and actuated by a solenoid, and additionally including power means for reciprocating the lower pusher arms, independent power means for moving all the turntables and their gear means vertically as a unit, whereby the turntables and their associated gear means may be bodily elevated as a unit above the endless belt structure and whereby the turntables may be rotated during the elevating operation, and other independent power means for reciprocating the upper pusher arms.

20. In apparatus for transferring knotted coil springs as defined by claim **19,** wherein the turntables are each provided with magnetic members of the permanent magnetic type whereby to assist in holding the coil springs on the turntables as the same are being elevated and rotated.

21. In apparatus for transferring knotted coil springs as defined by claim **18,** additionally including a pair of opposed coil gripping fingers pivotally carried by each upper pusher arm at the forward end of the same, resilient means in association with each pair of fingers for resiliently maintaining the same in a closed coil gripping position, reciprocable cam means also carried by each pusher arm for opening the gripping fingers against the tension of said resilient means when reciprocated in a forward direction, power means for reciprocating the upper pusher arms, and other independent power means carried by the upper pusher arm structure and movable therewith for simultaneously actuating all the cam means to cause forward and rearward reciprocating movement thereof.

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