Feb. 16, 1960 V. J. BERGSTROM 2,925,099

SPRING UNIT LACING MACHINE

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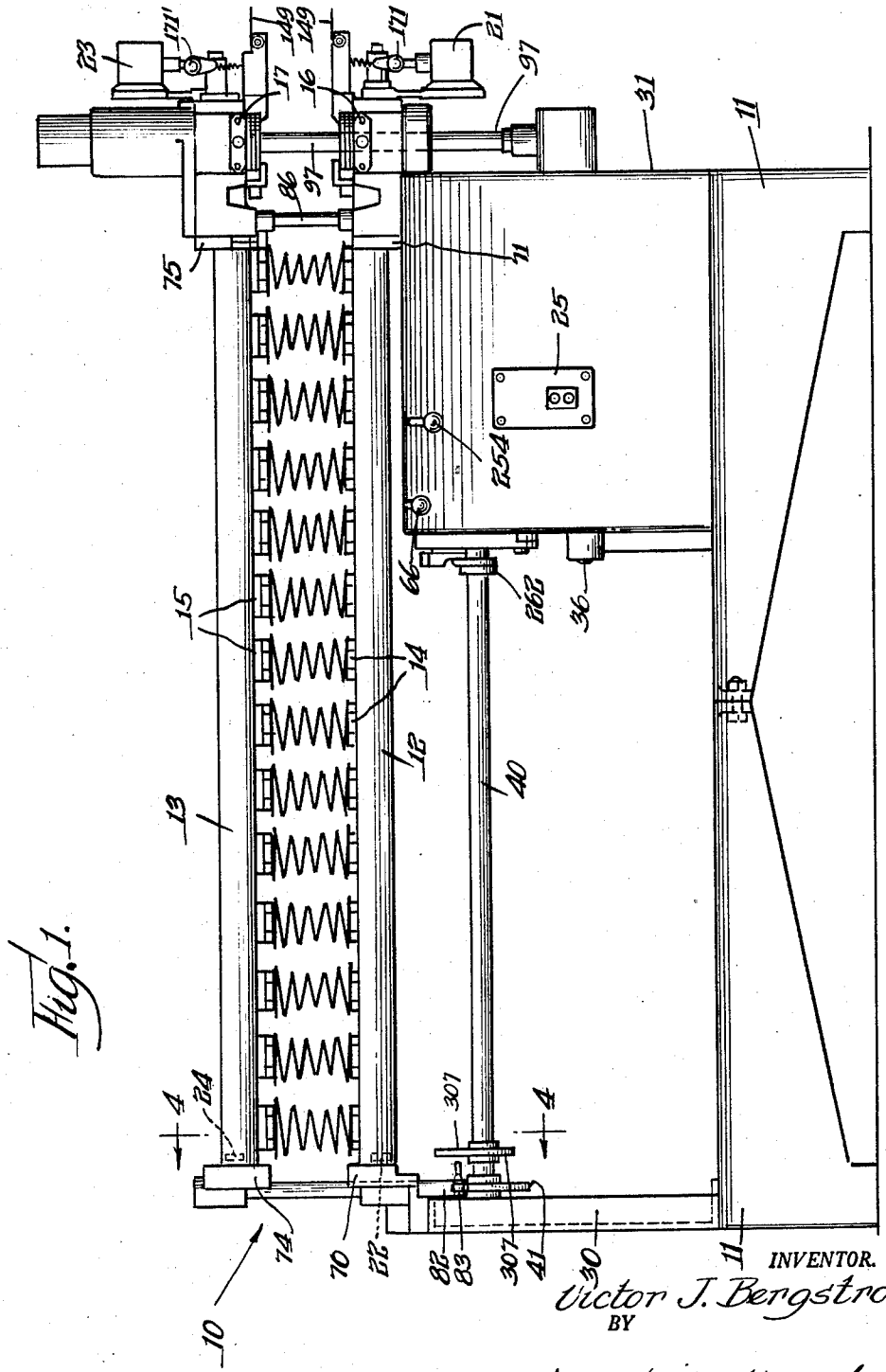


Fig. 1.

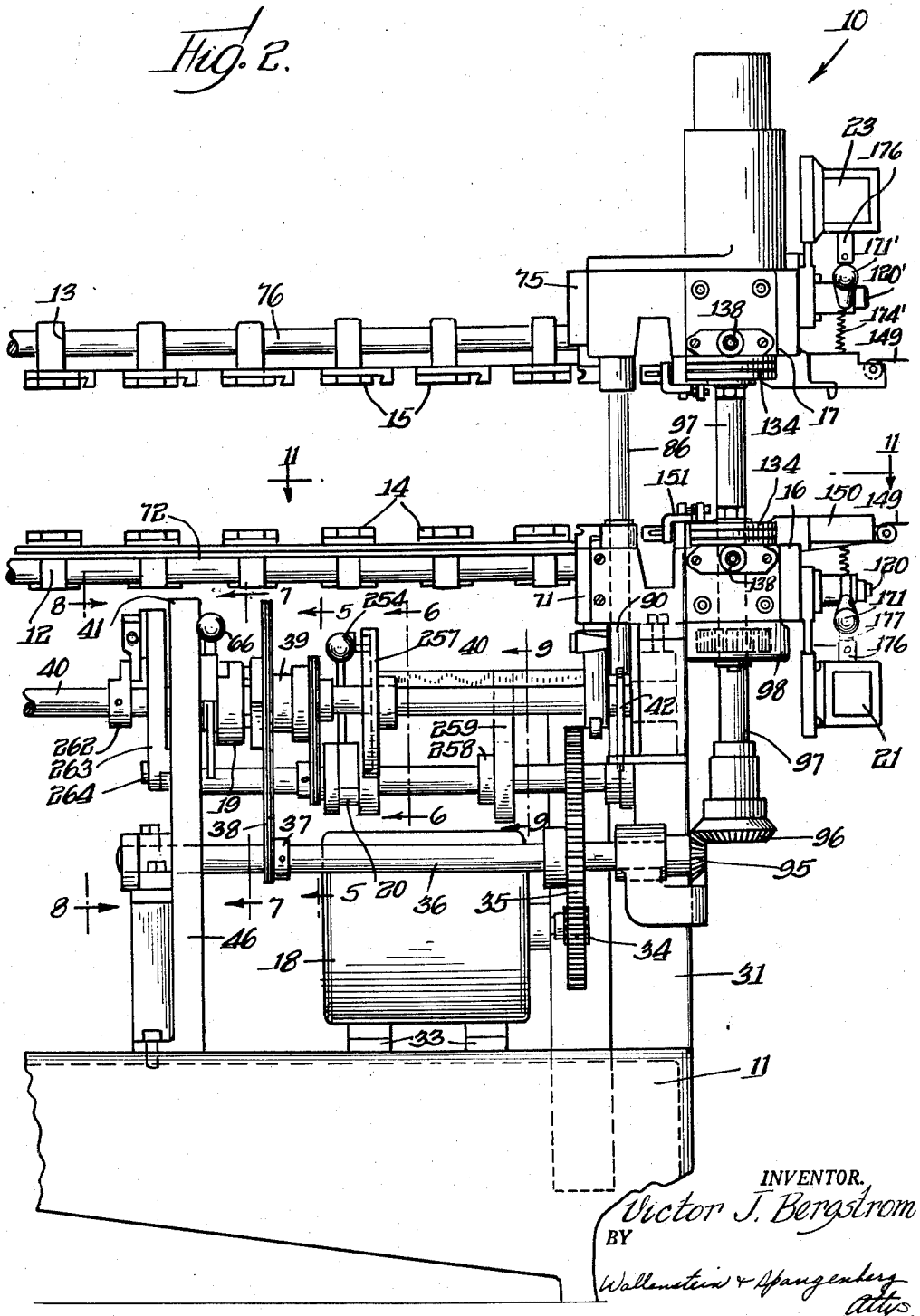
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Fig. 2.



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Fig. 3.

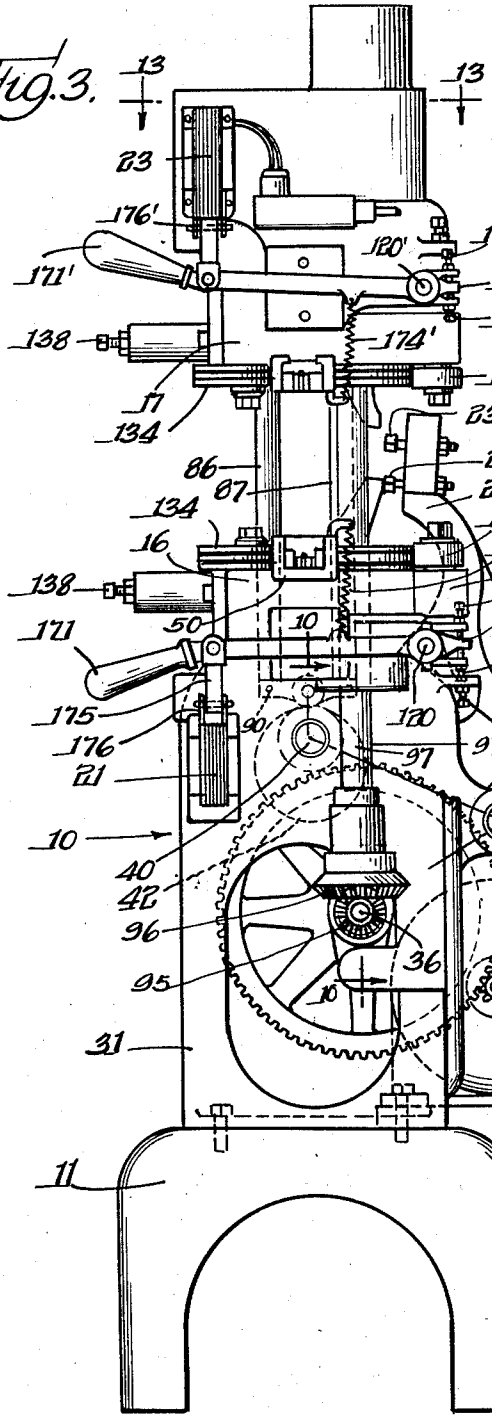


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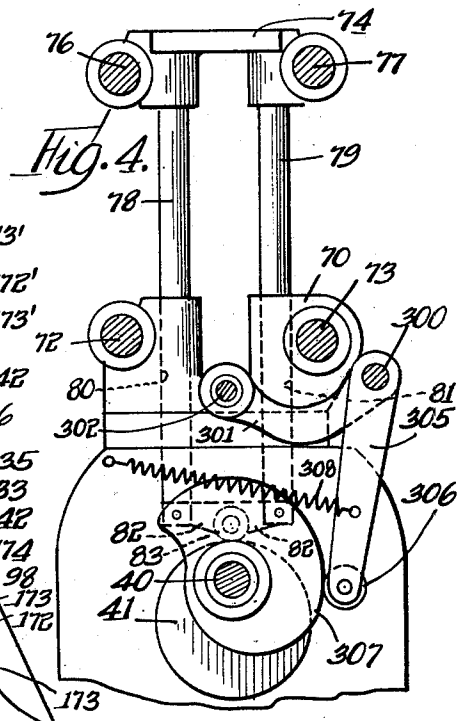
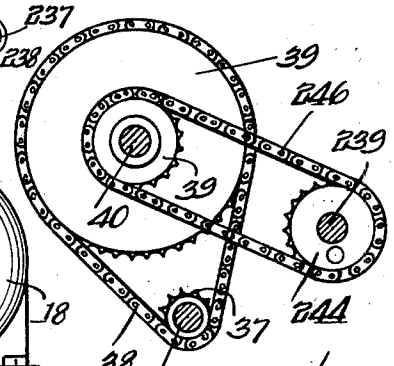


Fig. 5.



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Fig. 6.

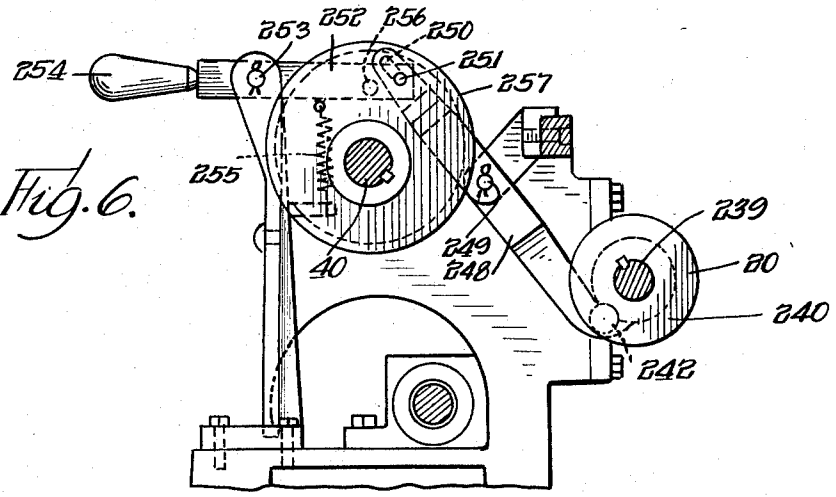


Fig. 7.

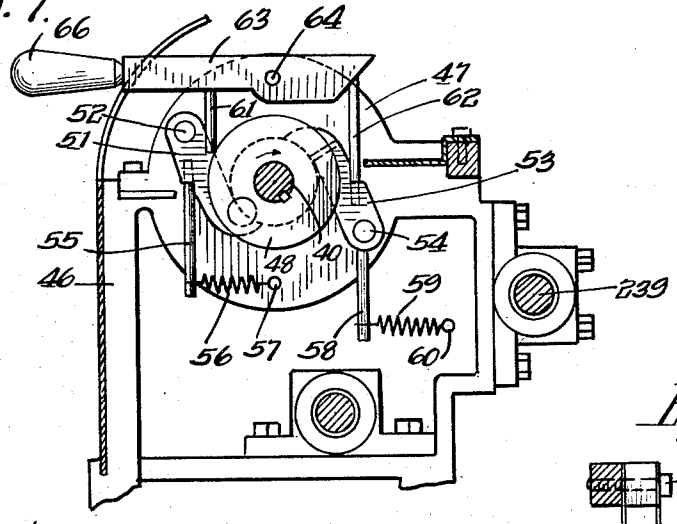


Fig. 8.

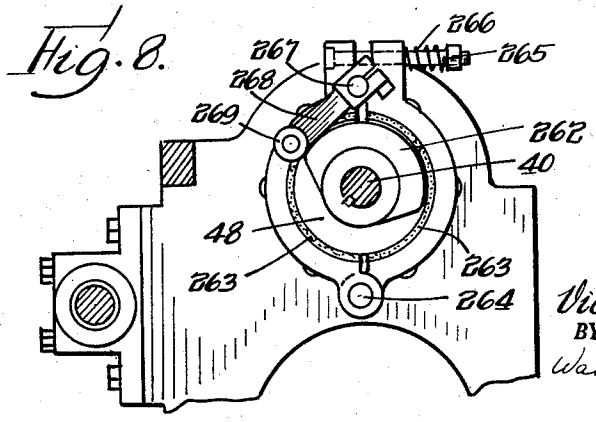
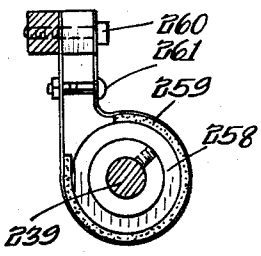


Fig. 9.



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SPRING UNIT LACING MACHINE

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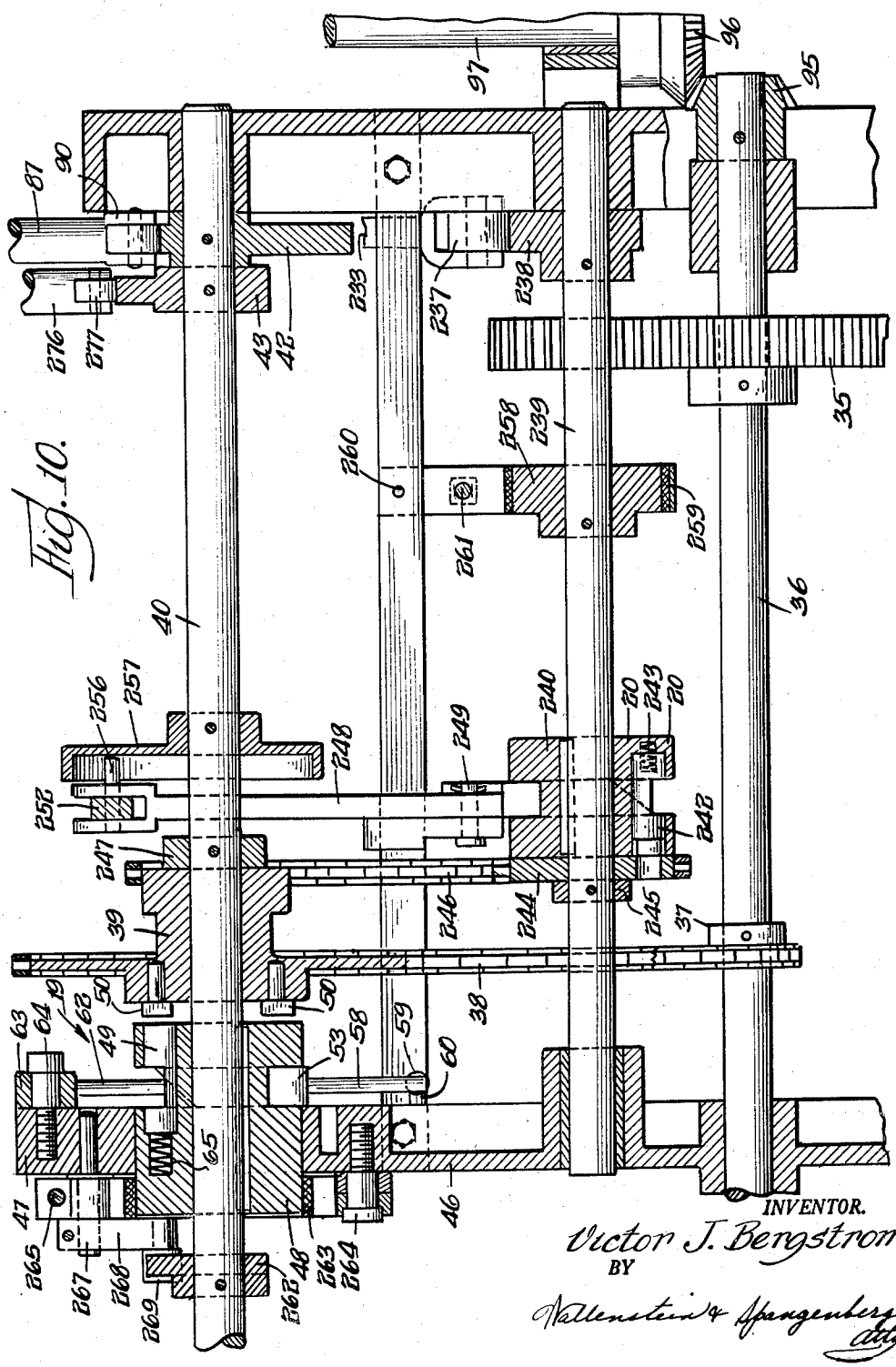


Fig. 10.

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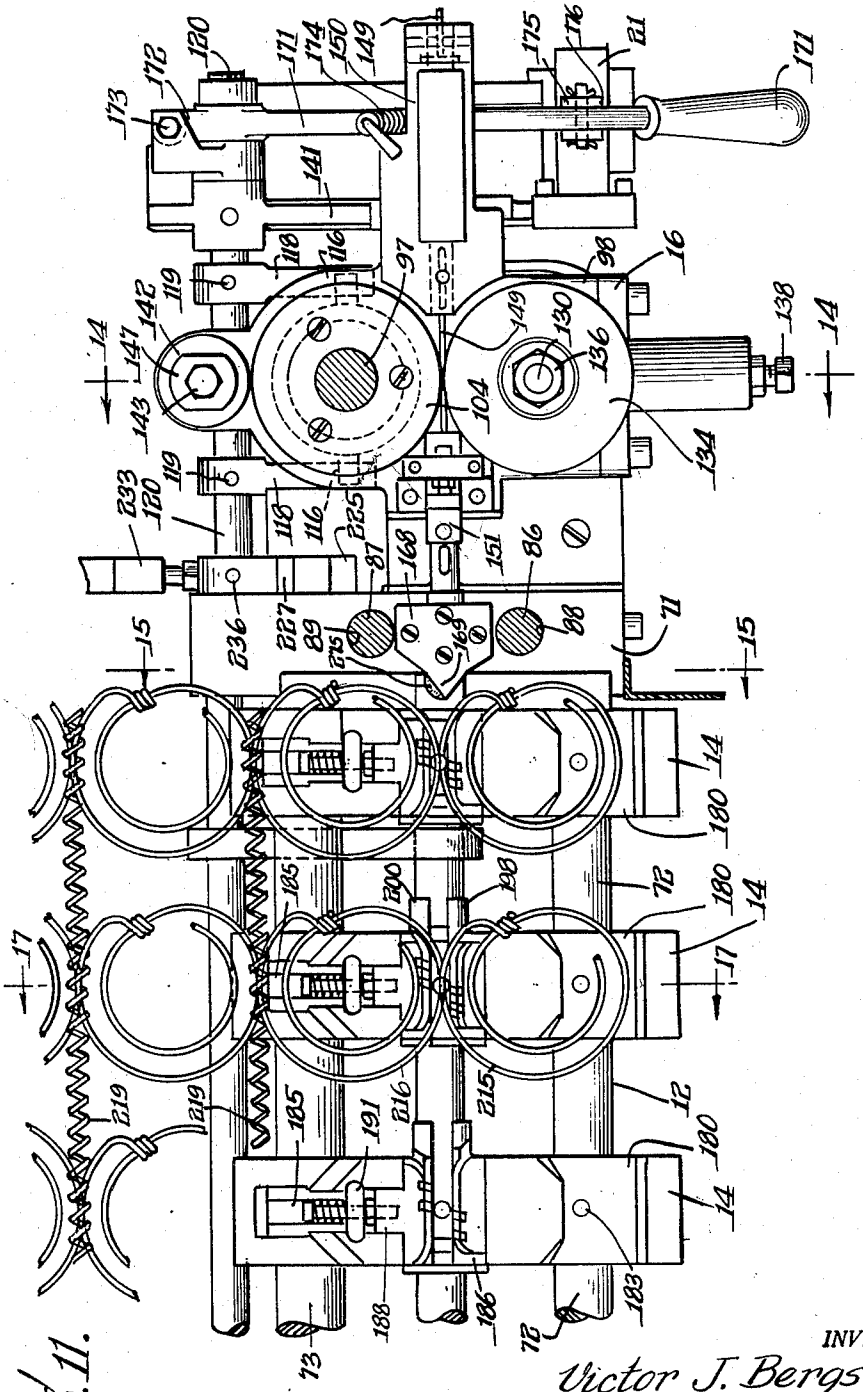


Fig. 11.

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Fig. 12.

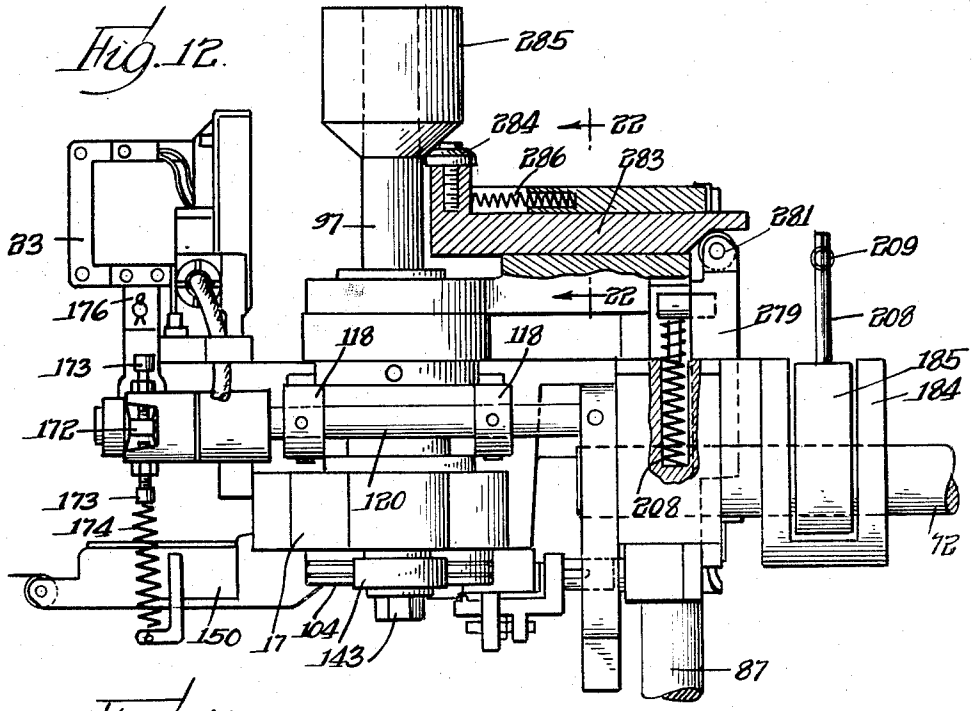
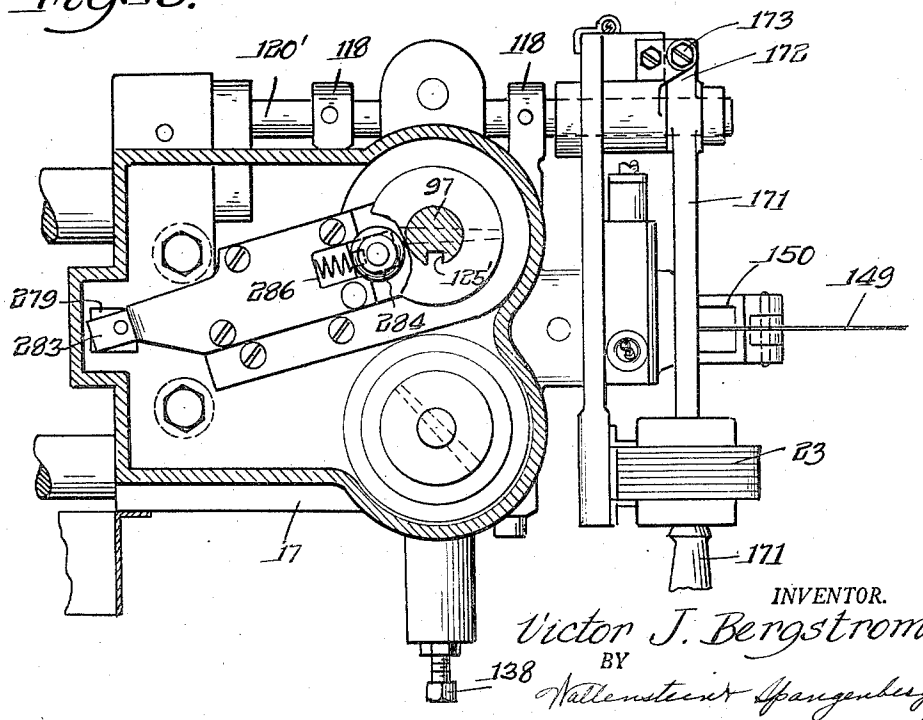


Fig. 13.



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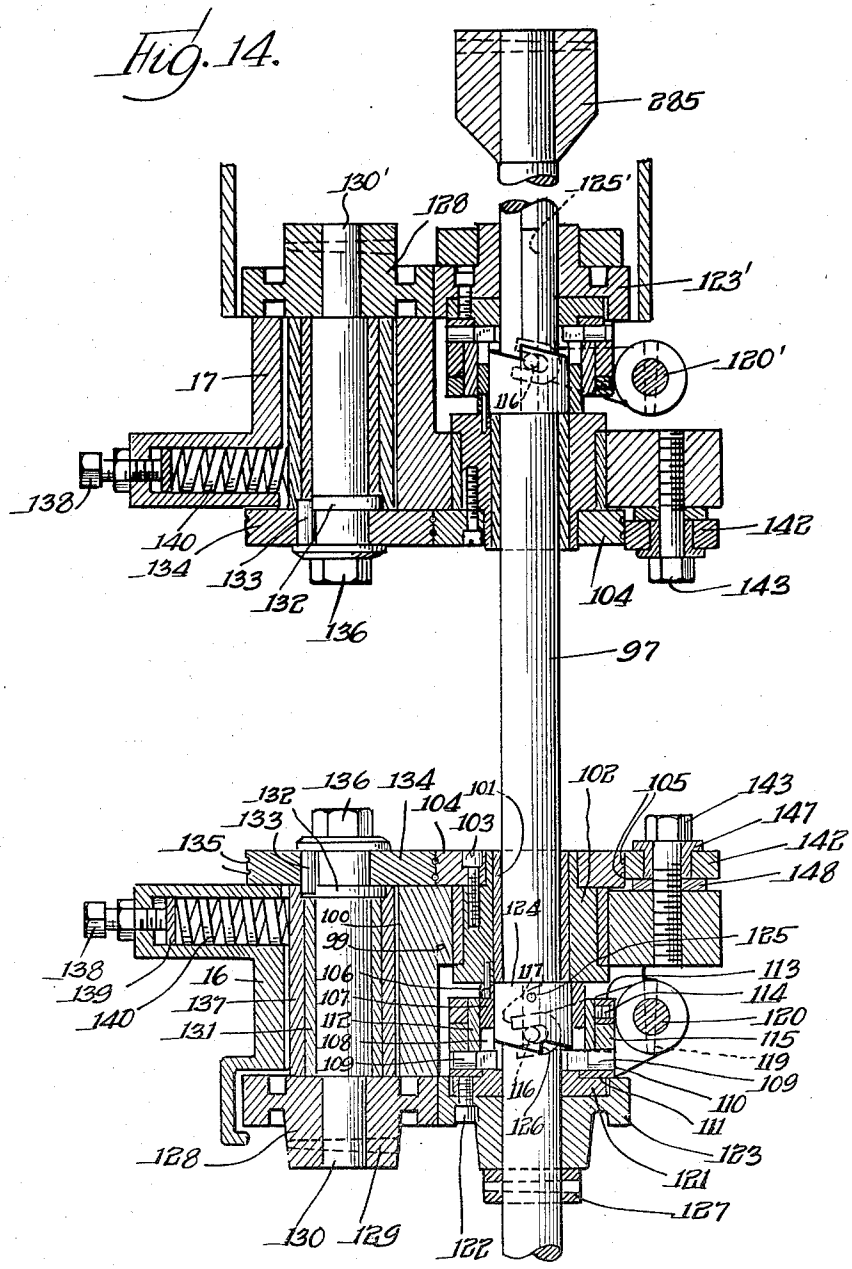
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SPRING UNIT LACING MACHINE

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Fig. 14.



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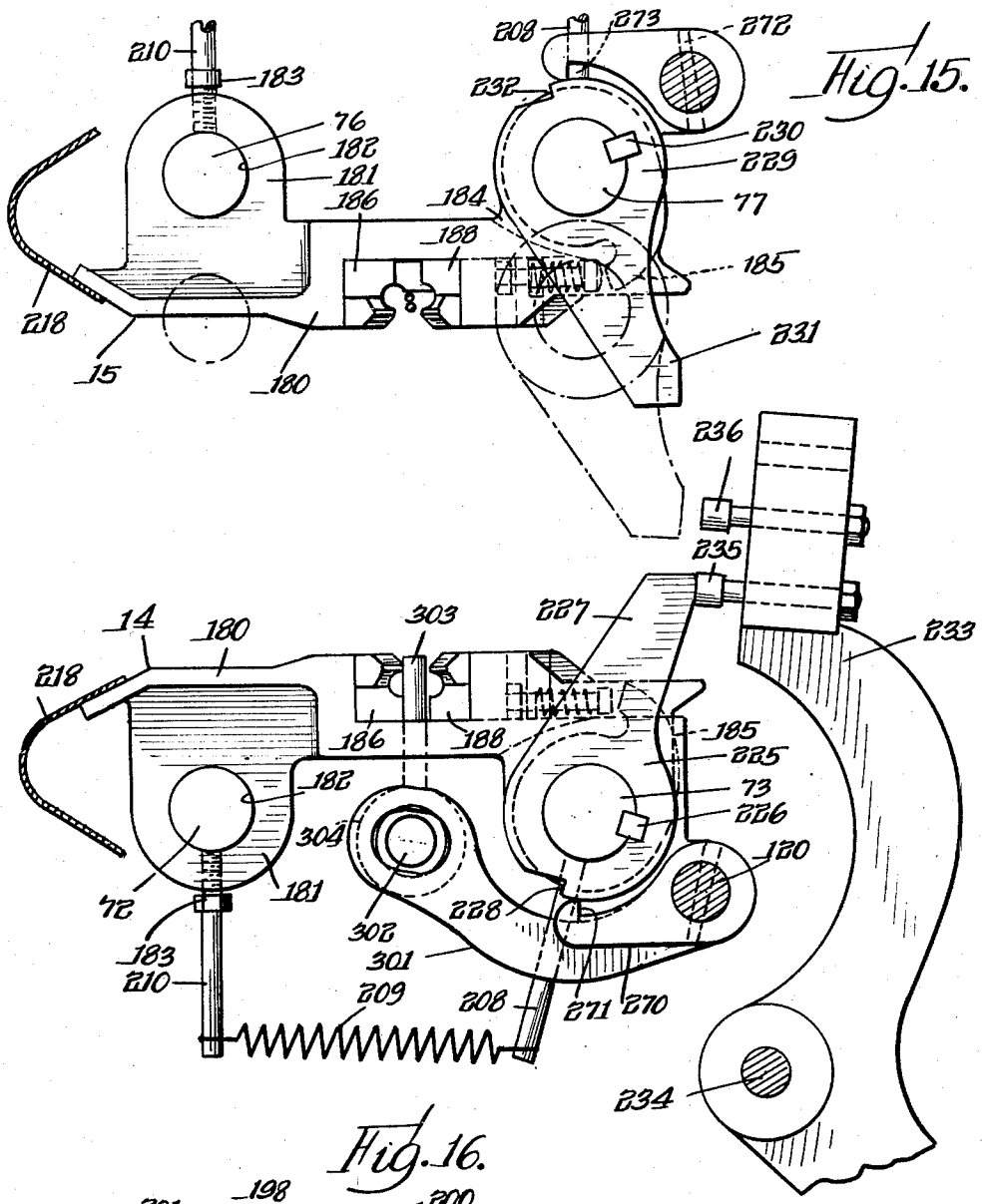


Fig. 15.

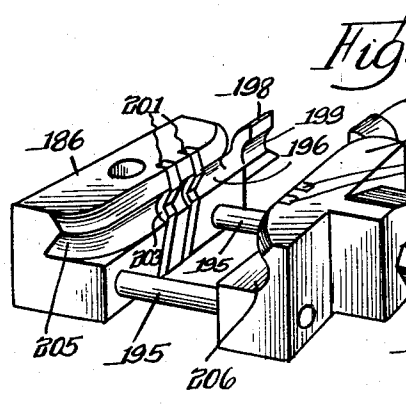


Fig. 16.

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Fig. 17.

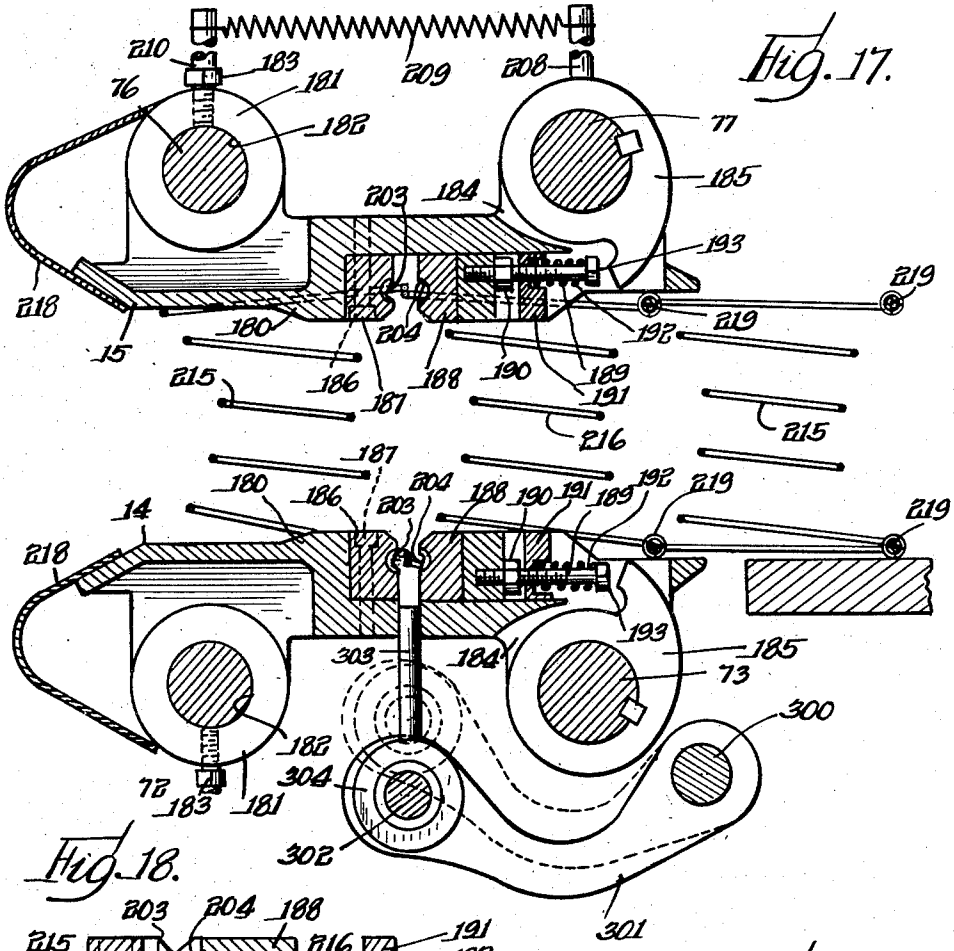


Fig. 18.

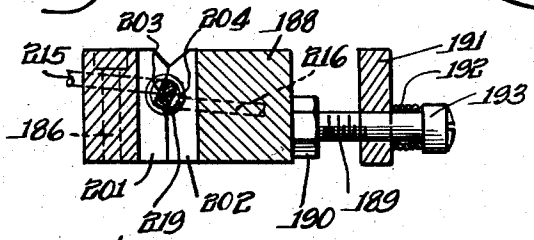


Fig. 19.

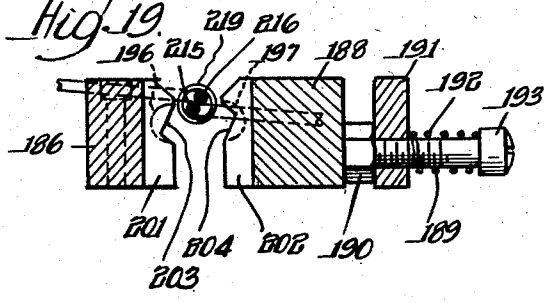
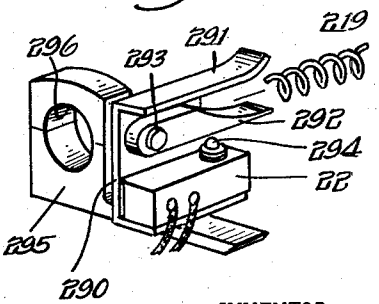


Fig. 20.



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Fig. 21.

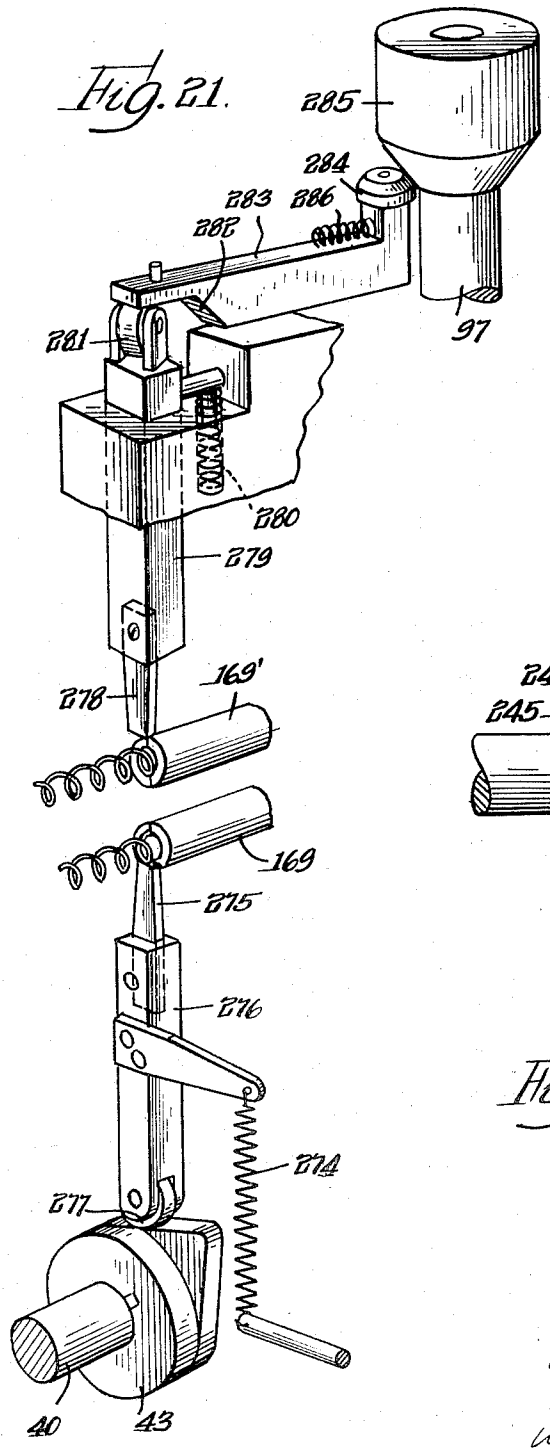


Fig. 22.

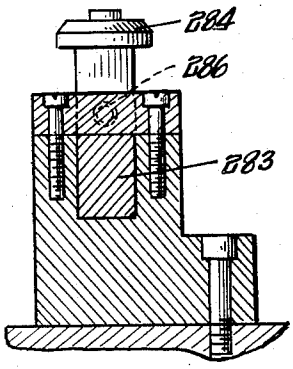


Fig. 23.

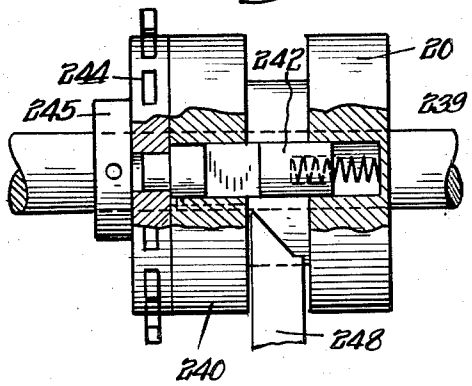
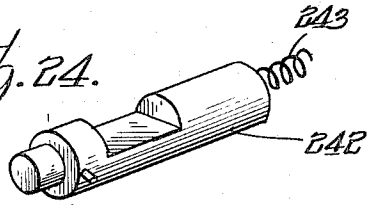


Fig. 24.



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United States Patent Office 2,925,099 Patented Feb. 16, 1960

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SPRING UNIT LACING MACHINE

Victor J. Bergstrom, Chicago, Ill., assignor to Johnson Spring Cushion Company, Chicago, Ill., a corporation of Illinois

Application December 7, 1953, Serial No. 396,495

17 Claims. (Cl. 140—92.7)

This invention is directed to improvements in a spring unit lacing machine and this application is a continuation-in-part of my copending application Serial No. 17,867, filed March 30, 1948, now Patent No. 2,694,418.

The spring unit lacing machine of this invention, like the machine of the aforementioned application, is for lacing together coil springs by wire helices into a spring unit for use in mattresses, cushions and the like. Both machines comprise an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies. They both also include means for raising and lowering the upper frame and means for operating the jaw operating shafts and the helix forming and advancing mechanisms.

In operation, the clamping jaw asemblies are opened and the upper frame is lowered. The end turns of two rows of coil springs are arranged in the clamping jaw assemblies and then the clamping jaw assemblies are closed to clamp the same and the helix forming and advancing mechanisms are operated to advance wire helices about the end turns of the coil springs to lace the same together. When the lacing is completed, the helix forming and advancing means are stopped and the clamping jaw assemblies opened. Then the upper frame is raised and the laced springs removed from between the clamping jaw assemblies. The cycle of operation is then repeated until the spring unit is completely formed.

The instant invention is directed to particular improvements in this kind of machine for improving the construction and operation of the machine and the objects of this invention are directed to these improvements in this machine taken singly and in combination. Among the various improvements in this machine are an improved clutch and brake mechanism for raising and lowering the upper frame, a clutch and brake mechanism for power operating the jaw operating shafts and the helix forming and advancing mechanisms, pins for raising the laced coil springs from the lower frame when the upper frame is raised, interconnecting means for preventing closing of the clamping jaw assemblies and operation of the helix forming and advancing mechanisms when the upper frame and pins are raised, improved cutters for cutting the wire helices when the upper frame is raised and improved feeding means for the helix forming and advancing mechanisms.

Further objects of this invention reside in the details of construction of the spring unit lacing machine and in the cooperative relationships between the component parts thereof.

Other objects and advantages of this invention will become apparent to those skilled in the art upon reference to the accompanying specification, claims and drawings in which—

Fig. 1 is a front elevational view of the spring unit lacing machine of this invention;

Fig. 2 is an enlarged front elevational view of the right hand portion of the machine as illustrated in Fig. 1 with the cover plate removed;

Fig. 3 is an end view of the spring unit lacing machine looking from the right in Fig. 1;

Fig. 4 is a partial vertical sectional view taken substantially along the line **4—4** of Fig. 1;

Fig. 5 is a partial vertical sectional view taken substantially along the line **5—5** of Fig. 2;

Fig. 6 is a partial vertical sectional view taken substantially along the line **6—6** of Fig. 2;

Fig. 7 is a partial vertical sectional view taken substantially along the line **7—7** of Fig. 2;

Fig. 8 is a partial vertical sectional view taken substantially along the line **8—8** of Fig. 2;

Fig. 9 is a partial vertical sectional view taken substantially along the line **9—9** of Fig. 2;

Fig. 10 is a partial vertical sectional view taken substantially along the line **10—10** of Fig. 3;

Fig. 11 is a partial horizontal view taken substantially along the line **11—11** of Fig. 2;

Fig. 12 is an elevational view of the upper right hand portion of the machine illustrated in Fig. 1 but taken from the rear of the machine, parts being shown in section for clarity;

Fig. 13 is a top plan view of the upper right hand portion of the machine as illustrated in Fig. 1 but having the housing broken away;

Fig. 14 is a vertical sectional view taken substantially along the line **14—14** of Fig. 11;

Fig. 15 is a vertical sectional view taken substantially along the line **15—15** of Fig. 11;

Fig. 16 is a perspective view of one of the clamping jaw assemblies;

Fig. 17 is a vertical sectional view taken substantially along the line **17—17** of Fig. 11;

Fig. 18 is a sectional view through one of the clamp-jaw assemblies but showing the clamping jaws closed;

Fig. 19 is a view similar to Fig. 18 but showing the clamping jaws opened;

Fig. 20 is a perspective view of the switch construction for stopping operation of the helix advancing and forming mechanisms and for opening the jaw assemblies;

Fig. 21 is a perspective view of the cutter mechanisms for cutting the helices after they have been laced through the end turns of the coil springs;

Fig. 22 is a vertical sectional view taken substantially along the line **22—22** of Fig. 12;

Fig. 23 is an elevational view partly in section of one of the clutches; and

Fig. 24 is a perspective view of one of the pins utilized in the clutch.

Referring first to Figs. 1, 2 and 3, the spring unit lacing machine of this invention is generally designated at **10** and it includes a supporting standard **11**, an elongated lower frame **12** and an elongated upper frame **13** which

is adapted to be raised and lowered with respect to the lower frame. The lower frame carries a plurality of upwardly facing clamping jaw assemblies **14** which are adapted to be longitudinally adjustably positioned along the lower frame. In a like manner, the elongated upper frame **13** carries a plurality of downwardly facing clamping jaw assemblies **15** which are likewise adapted to be longitudinally positioned along the upper frame.

The lower frame carries at one end a wire helix forming and advancing mechanism **16** and likewise at the corresponding end of the upper frame **13** there is also carried a similar wire helix forming and advancing mechanism **17**. These mechanisms **16** and **17** operate to form and advance helices along the lower and uper frames for the purposes of lacing together coil springs clamped in position by the clamping jaw assemblies **14** and **15** of the lower and upper frames.

A source of power in the form of an electric motor **18** is supported on the supporting standard **11** and it operates through a clutch **19** for raising and lowering the upper frame **13** and through a clutch **20** for opening and closing the clamping jaw assemblies and for operating the wire helix forming and advancing mechanisms **16** and **17**.

A solenoid **21** and a control switch **22**, both associated only with the lower frame, operate to stop the wire helix forming and advancing mechanism **16** and to open the jaw assemblies **14** when the wire helix has completed its travel in lacing together the lower parts of the coil springs. Similarly, a solenoid **23** controlled by a control switch **24**, both associated only with the upper frame, operate to stop the wire helix forming and advancing mechanism **17** and open the clamping jaw assemblies **15** when the wire helix has completed its travel in lacing together the upper parts of the coil springs.

In the operation of the machine, the clutch **19** is manipulated to lower the upper frame, at this time the jaw assemblies being opened. Two rows of coil springs are then inserted under compression in the clamping jaw assemblies. The clutch **20** is then operated whereupon the clamping jaw assemblies close to hold firmly the coil springs and the wire helix forming and advancing mechanisms **16** and **17** automatically operate to form and advance helices through the clamping jaw assemblies for lacing together the coil springs clamped therein. When the wire helix of either the upper or lower frame completes its travel in lacing the springs together, its associated helix forming and advancing mechanism is stopped and the associated clamping jaw assemblies opened. The clutch **19** is then manipulated to raise the upper frame **13** and at the same time to cut both helices. The laced rows of coil springs are then pushed back the distance of one row. The clutch **19** is then again manipulated to lower the upper frame **13** so that the machine is conditioned for the reception of another row of coil springs to be laced to the previous row. The foregoing sequences of operation are repeated until the desired size spring unit is obtained.

The supporting frame **11** carries a front panel which in turn carries a starting box **25** which is connected by electrical conduits to the electric motor **18**, the solenoids **21** and **23** and the switches **22** and **24**. In this way, electrical energy under the control of the starting box **25** is supplied to the electric motor **18** and the solenoids **21** and **23**, and the solenoids **21** and **23** are controlled by the switches **22** and **24**.

The supporting standard **11** includes end frames **30** and **31** and an auxiliary frame **33** carried by the supporting standard **11** supports the electric motor **18**. The electric motor **18** drives a pinion **34** meshing with a gear **35** keyed to a shaft **36**. The shaft **36** carries a sprocket wheel **37** which is connected by a chain **38** to a sprocket wheel **39** loosely mounted on a shaft **40**. The shaft **40** extends the length of the machine and is journaled in the end frames **30** and **31**. The clutch **19** connects and disconnects the sprocket wheel **39** with the shaft, **40** to provide rotation of the shaft **40** to 180 degrees each time that the clutch is manipulated. The left end of the shaft **40** carries an eccentric or cam **41** and the right end also carries a corresponding eccentric or cam **42**, the purposes of which are to raise and lower the upper frame **13**. Adjacent the cam **42**, the shaft **40** carries a collar **43** provided with a cam surface for operating the cutter of the lower frame.

Referring now more particularly to Figs. 7 and 10, the clutch **19** includes a stationary member **47** secured to an auxiliary frame **46** carried by the supporting standard **11**. The auxiliary frame **46** also operates to assist in rotatably supporting the shaft **40**. A cylinder **48**, provided with a peripheral groove, longitudinally carries a pin **49** which is resiliently urged outwardly by a spring **65**. When the pin **49** is extended outwardly, it is adapted to be engaged by one or the other of a pair of pins **50** carried by and rotating with the sprocket wheel **39**, the pins being located 180 degrees apart. A pair of fingers **51** and **53**, pivoted at **52** and **54**, respectively, ride on the peripheral groove in the rotatable member **48** for the purpose of controlling the position of the pin **49**. The fingers **51** and **53** have cam surfaces on their ends for engaging a slot in the pin **49** for moving the same against the action of the spring **65**. The finger **51** is provided with an extension **55** connected by a spring **56** to a pin **57** for urging the finger inwardly. Likewise, the finger **53** is urged inwardly by a spring **59** connected between pins **58** and **60**. The fingers **51** and **53** are provided with extensions **61** and **62** to be engaged by a pivoted operating member **63**, pivoted at **64**, and provided with a handle **66**. When the handle **66** is in the neutral position as indicated in Fig. 7, the pin **49** is retracted and the rotatable member **48** is stationary. When the handle **66** is depressed, the finger **51** is released to extend the pin **49** so that it is engaged by one of the moving pins **50**. The pin **49** and hence the rotatable member **48** are thereupon rotated through 180 degrees where the pin **49** is retracted by the finger **53** so that rotation of the rotatable member **48** is stopped after 180 degrees of rotation. If now the handle **66** is raised, the finger **53** is retracted to permit the pin **49** to protrude and be engaged by one or the other of the pins **50**. The rotatable member **48** is then rotated through another 180 degrees where the finger **51** engages the pin **49** to retract the same and stop further rotation. In this way, the shaft **40**, to which the cylinder **48** is keyed, is rotated through 180 degrees upon lowering and raising of the handle **66**. The rotatable member **48** is so arranged with respect to the cams **41** and **42** carried by the shaft **40** that upon raising the handle **66** the upper frame **13** is raised and upon lowering the handle **66** the upper frame is lowered.

The elongated lower frame **12** includes end pieces **70** and **71** carrying a pair of shafts **72** and **73** therebetween. The end pieces **70** and **71** are secured to the end frames **30** and **31** and hence to the supporting standard **11** and the shaft **72** is rigidly secured in these end pieces. The shaft **73** is permitted to rotate in the end pieces and is journaled for rotation therein. In a like manner, the upper frame **13** includes end pieces **74** and **75** with shafts **76** and **77** extending therebetween. The shaft **76** is rigidly secured in the end pieces **74** and **75** and the shaft **77** is journaled for rotation therein.

The end piece **74** of the upper frame receives and is secured to two depending shafts **78** and **79** which extend through holes **80** and **81** in the end piece **70** of the lower frame **12**. These shafts **78** and **79** terminate in a yoke **82** provided with a cam follower in the form of a roller **83** engaging the eccentric or cam **41**. In a like manner, the end piece **75** of the upper frame carries depending shafts **86** and **87** extending downwardly through holes **88** and **89** in the end piece **71** of the lower frame and terminating in a yoke **90** carrying a cam follower in the form of a roller engaging the cam or eccentric **42**.

When the shaft **40** is rotated to the position shown in Figs. 3 and 4, the cams **41** and **42** allow the upper frame

to be lowered and when the shaft **40** is rotated through 180 degrees the cams **41** and **42** raise the upper frame to the upper position. In this way, the cams **41** and **42**, the yokes **82** and **90** and the vertical shafts form a lifting mechanism for raising and lowering the upper frame **13**, which raising and lowering is controlled by the clutch **19**.

The shaft **36** which drives the sprocket **37** also carries a beveled gear **95** meshing with a beveled gear **96** secured to a vertical shaft **97** for driving the wire helix forming and advancing mechanisms **16** and **17**. Referring more particularly to Figs. 11 and 14, the wire helix forming and advancing mechanism **16** for the lower frame includes a housing **98** provided with a pair of vertical bores **99** and **100**. A bearing sleeve **101** is rotatably journaled on the shaft **97** and carries a sleeve **102** which is secured by screws **103** to a feed roll **104** having a pair of peripheral feeding grooves **105**. The sleeve **102** is secured by pins **106** to a sleeve **107** having a flange **121** and a pair of vertical slots **108** for receiving a pair of dogs **109**. The dogs **109** are secured in holes **110** in the flange **111** of a sleeve **112**. A rim **113** is secured to the upper end of the sleeve **112** by set screws **114** to provide a race between the rim **113** and the flange **111** for receiving a rim **115** carrying a pair of pins **116** extending outwardly into the bifurcated ends **117** of a pair of levers **118** which are secured by pins **119** to a shaft **120**. The flange **121** of the sleeve **107** is secured by screws **122** to a gear **123**. Located within the sleeve **107** is a collar **124** secured by a pin **125** to the shaft **97** and the collar **124** is provided with a pair of ears **126** adapted to engage the dogs **109**.

The gear **123** meshes with a gear **128** mounted on a shaft **130** by means of a pin **129**. The shaft **130** is journaled in a bearing **131** and is provided with a flange **132** adjacent its upper end which is connected by a pin **133** to a feed roll **134** having feeding grooves **135**. A nut **136** on the end of shaft **130** secures the feed roll **134** to the shaft. The bearing **131** is carried in a sleeve **137** which is laterally movable in the bore **100**. A screw **138** adjustably controls the position of a member **139** and a compression spring **140** is located between the member **139** and the sleeve **137**. The spring **140** operates to urge the feed roller **134** toward the feed roller **104**. By manipulating the screw **138** the amount of this resilient force may be varied at will for controlling the gripping action by the feed rollers **104** and **134** on the wire fed through the feeding grooves **105** and **135**. In this way, accurate feeding of the wire may be brought about. The shaft **120** is journaled in the end piece **71** of the lower frame and also in a bracket **141**.

When the parts are in the position shown in Fig. 14, the shaft **97** is rotating, but since the dogs **109** are downwardly located, the remaining parts are stationary. When the shaft **120** is rotated in a counter-clockwise direction as illustrated in Fig. 14, the levers **118** operate through the pins **116** and rim **115** to raise the dogs **109** whereupon they are engaged by the ears **126** to impart rotation to the sleeves **112** and **107**. The sleeve **112** drives the gears **123** and **128**, the shaft **130** and the feed roll **134**. The sleeve **107** through the pins **106** and sleeve **102** drives the feed roll **104**. Thus the dogs **109** and ears **126** form a clutch for driving the feed rolls **104** and **134** when they are engaged by manipulation of the shaft **120**. When the shaft **120** is rotated in a clockwise direction, the clutch is disengaged and rotation of the feed rolls **104** and **134** is interrupted.

A roller **142** is carried by a screw **143**, the roller being journalled for rotation by bearing members **147** and **148**. This roller **142** engages the feed roll **104** and operates to counterbalance the force of the spring **140**. The housing **98** carries a bracket **150** provided with guide rollers for guiding a wire **149** into the feed grooves between the feed rollers **104** and **134** so that when the feed rolls are rotated the wire **149** is advanced. The wire **149** is advanced through a helix forming die **151**. Referring more particularly to Fig. 11, the end piece **71** is provided with a bracket **168** carrying a sleeve **169** through which the wire helix formed by the forming die **151** passes. The sleeve **169** is a hardened sleeve and operates in conjunction with a knife **275**, to be explained hereinafter, for forming a cutter for severing the wire helix.

The mechanism **17** associated with the upper frame **15** for forming and advancing the wire helix along the upper frame is the same as the mechanism **16**, and therefore, a further disclosure thereof is not considered necessary. In this respect however, it is pointed out that the connection between the shaft **97** and the clutch in the mechanism **17** is a slidable spline connection **125'** instead of the pin connection in order to permit movement of the mechanim **17** upwardly and downwardly with respect to the shaft **97**. The shaft for controlling the clutch of the mechanism **17**, corresponding to the shaft **120** of the mechanism **16**, has been designated in the drawings as **120'**.

As seen in Figs. 3 and 11, the shaft **120** rotatably carries a lever **171** provided with a handle at one end and an extension **172** at the other end. The extension **172** is located between a pair of adjustable stops **173** carried by a lever secured to the shaft **120** so that the amount of movement of the handle required to rotate the shaft **120** may be adjusted. A spring **174** urges the shaft **120** in a clockwise direction as illustrated in Fig. 3. The lever **171** is connected by a link **175** to the armature **176** of the solenoid **21** so that when the solenoid is energized, the lever **171** and shaft **120** are rotated in a counter-clockwise direction as illustrated in Fig. 3. The shaft **120'** on the upper frame is provided with the same lever and solenoid construction and like reference characters primed have been utilized for like parts.

The clamping jaw assemblies **14** of the lower frame **12** are illustrated in detail in Figs. 11 and 15 to 19. The clamping jaw assemblies include a support **180** having an extension **181** provided with a bore **182** for receiving the stationary shaft **72**. The support **180** may be clamped to the stationary shaft **72** in any desired position therealong by a clamping screw **183**. In this way, the clamping jaw assemblies may be longitudinally adjustably positioned along the stationary shaft **72**. The support **180** is also provided with a pair of extensions **184** having bores for receiving the rotatable shaft **73**. Between the extensions **184** there is provided an operating arm **185** which is keyed to the rotatable shaft **73**. The rotatable shaft **73** therefore also supports the support **180** and provides means for operating the arm **185** upon rotation thereof.

A stationary clamping jaw **186** is secured to the support **180** by a screw **187**. A slidable clamping jaw **188** slides on the support **180** and is provided with a crew **189** locked into position by a lock nut **190**. The screw **189** extends through a hole in a partition **191** carried by the support **180** and at its outer end is provided with a head **193**. A spring **192** extending between the part **191** and the head **193** urges the clamping jaw **188** away from the clamping jaw **186**. When the shaft **73** is rotated in the counter-clockwise direction as viewed in Fig. 17 the spring **192** is overcome and the movable clamping jaw **188** is moved into engagement with the stationary clamping jaw **186**. When the rotation affect on the shaft **73** is released, the spring **192** moves the movable jaw **188** away from the stationary jaw **186** and rotates the shaft **73** in the clockwise direction as viewed in Fig. 17. The screw **189** and the lock nut **190** provide means for adjusting the position of the movable jaw **188** with respect to the shaft **73**. Alignment between the clamping jaws **186** and **188** is assured by guide pins **195** extending therebetween.

The stationary clamping jaw **186** includes a semi-cylindrical bore **196** and the movable jaw **188** is provided with a corresponding semi-cylindrical bore **197**. The stationary jaw **186** is provided with an extension **198** having a semi-cylindrical bore **199** and likewise the movable jaw **188** is provided with an extension **200** having a corresponding semi-cylindrical bore. When the clamping jaws

are closed, there is therefore provided in the jaws a cylindrical bore and in the extensions a similar cylindrical bore. The cylindrical bore in the extensions is for the purpose of guiding the wire helix into the cylindrical bore in the jaws.

The stationary jaw **186** is provided with diagonal inserts **201** and the movable jaw **188** is provided with diagonal inserts **202**, the inserts **201** being provided with notches **203** and the inserts **202** being provided with notches **204**. The notches **203** and **204** are angular notches and it is noted that the predominant portion of the notches **203** is offset on one side of the center line of the bore while the notches **204** are predominantly offset on the other side of the center line through the bore. The purpose of the offset notches is to clamp the end turns of the coil springs in overlapping relation as is illustrated in Fig. 18. The clamping jaw **186** is provided with a guide surface **205** which is located substantially in alignment with the center line of the bore and the movable clamping jaw **188** is provided with a guide surface **206** which is offset with respect to the center line of the bore. These guide surfaces **205** and **206** are utilized for receiving the round coil springs when the jaw assemblies are opened for guiding the coil springs in proper alinement between the jaws so that when the jaws are closed, the coil spring **215** is guided by the guide surface **205** will lie above the coil spring **216** guided by the guide surface **206** when the clamping jaws are closed. In this way, movement of the coil spring **215** into the notch **204** and movement of the coil spring **216** into the notch **203** are accurately brought about. The coil springs **215** are those which are last inserted into the machine and the coil springs **216** are those which were previously inserted in the machine.

The wire helix **219** advanced through the bore in the clamping jaws thereupon laces together the coil springs **215** and **216**. The diagonal inserts **201** and **202** with their notches **203** and **204** are utilized solely for the purpose of clamping the coil springs **215** and **216** and are so arranged that as the helix is advanced through the bore for lacing together the coil springs they do not contact the wire helix. The notches **203** and **204** in conjunction with the guide surfaces **205** and **206** temporarily deform or distort the coil springs when the clamping jaws are closed so that the maximum number of turns of the wire helix encompasses the coil springs. When the clamping jaws are opened the coil springs attempt to assume their original contours thereby providing a tight joint therebetween and between them and the wire helix. In this way, squeaking and pinging of the spring unit is substantially prevented.

The clamping jaw assemblies **15** for the upper frame are the same as the clamping jaw assemblies **14** of the lower frame and like reference characters primed for like parts have been utilized. The clamping jaw assemblies **15** are adjustably positioned on the shafts **76** and **77** of the upper frame and rotation of the shaft **77** causes opening and closing of the clamping jaws. The shafts **73** and **77** are resiliently biased toward jaw opening position. This is accomplished by means of a pin **208** carried in an arm **185** which pin is connected by a spring **209** to a pin **210** connected in one of the extensions **181**, this arrangement being illustrated in Figs. 15 and 17.

The supports **180** of the clamping jaw assemblies carry guide plates **218** which are provided with suitable recesses for guiding the outer edges of the coil springs **215** so that the coil springs are retained in proper position on the support **180** before and during the clamping operation. These guide plates **218** greatly assist in the proper insertion and location of the coil springs **215** into the machine. The wire helix which laces the coil springs together is designated at **219**.

The mechanism for rotating the shafts **73** and **77** of the lower and upper frames and the clutches in the wire helix forming advancing mechanisms **16** and **17** is illustrated in more detail in Figs. 11 and 15. The shaft **73** of the lower frame has a collar **225** secured to it by a key **226**. The collar **225** carries a member or arm **227** and is provided with a latching shoulder **228**. In a like manner the shaft **77** of the upper frame has secured to it a collar **229** by a pin **230**, the collar **229** being provided with a member or an arm **231** and a latching shoulder **232**.

A lever **233** is pivoted to the supporting standard at one end of the machine as indicated at **234** and is provided at one end with a pair of adjustable pins **235** and **236**. The pin **235** is adapted to engage the arm **227** and the pin **236** is adapted to engage the arm **231** when the upper frame is lowered. As shown more clearly in Figs. 3 and 10, the other end of the lever **233** is provided with a roller **237** which acts as a cam follower for a cam **238** secured to a shaft **239**. As the shaft **239** is rotated through 360° the lever **233** is oscillated from a retracted position as illustrated in Fig. 15 to a forward position and then retracted again. The shaft **239** is rotated in steps of 360° by the clutch **20** which is shown in more detail in Figs. 6, 10, 23 and 24.

The clutch **20** includes a cylinder **240** which is keyed to the shaft **239**, the cylinder **240** having an annular groove. A pin **242** is slidably received in the cylinder **240** and it is urged in one direction by a spring **243**. The pin **242** is adapted to engage in a hole in a sprocket wheel **244** which is rotatably mounted on the shaft **239** and held in place by a collar **245**. A chain **246** connects the sprocket wheel **244** to a sprocket portion on the sprocket wheel **39**, the sprocket wheel being held in place on the shaft **40** by a collar **247**. A lever **248** pivoted intermediate its ends at **249** has one end riding in the annular groove in the cylinder **240**. This end of this lever **248** has a cam surface for engaging in a notch in the pin **248** for moving the pin **242** against the action of the spring **243**. When the lever **248** is in the groove of the cylinder **240**, the clutch is disengaged and hence the cylinder **240** and the shaft **239** are stationary. When, however, the lever **248** is retracted from the pin **242** the cylinder **240** is rotated by the sprocket wheel **244** through 360° whereupon the pin **242** is retracted to disengage the clutch.

The other end of the lever **248** is provided with a slot **250** for receiving a pin **251** carried by a lever **252** pivoted at **253** and provided with a handle **254**. When the handle **254** is pushed downwardly the lever **258** is moved about its pivot **249** to withdraw the same from the pin **242**. The handle **254** is maintained in its upper position by means of a spring **255**. The lever **252** also carries a pin **256** which is received in a box cam **257** carried by the shaft **40**. The cam **257** is eccentrically mounted on the shaft **40** so that when the cam is in the position shown in Figs. 6 and 10 the handle **254** may be depressed. This condition occurs only when the upper frame is in its lower position. When, however, the shaft **40** is rotated through 180° to raise the upper frame the flange on the box cam **257** lies adjacent the pin **256** so that at this time the handle **254** can not be depressed for disengaging the clutch **20**.

As shown in Figs. 9 and 10 the shaft **239** is provided with a brake wheel **258** suitably secured thereto. A brake band **259** is wrapped around the brake wheel **258** and is suitably secured by a bolt **260** to the frame. A screw **261** is utilized for adjusting the tension in the brake band **259** and hence the braking effect thereof. This brake operates effectively to maintain the shaft **239** in its correct position each time that it is rotated through 360° by the clutch **20**.

A brake is also applied to the shaft **40** as is illustrated in more detail in Figs. 8 and 10. Here a pair of brake shoes **263** extend about the end of the cylinder **48**. These brake shoes are pivoted together and to the frame by a pivot pin **264**. A pin **265** extending from one of the brake shoes through the other is provided with a spring **266** which applies spring pressure to the brake shoes **263**. Interposed between the brake shoes **263** is a shaft **267** having a cam surface thereon for spreading the

brake shoes 263 against the action of the spring 266 for the purpose of releasing the brake. The outer end of the shaft 267 has secured thereto a lever 268 which has a cam follower or roller 269 which is engaged by a cam 262 secured to the shaft 40. When the shaft 40 and cam 262 are in the position indicated in Fig. 8, the upper frame is in its lower position and the brake is released. As the shaft 40 and cam 262 are rotated through 180° for raising the upper frame to its upper position the brake remains released during the raising operation and when the upper frame is in its upper position. However, when the shaft 40 and cam 262 are rotated through the next 180° step of rotation to lower the upper frame, the brake is applied so as to prevent jarring of the upper frame during the lowering operation.

Referring again to Figs. 11 and 15 the shaft 120 which operates the clutch of the helix forming and advancing mechanism 16 carries a latch 270 provided with a latching shoulder 271 which rests against the collar 225 by reason of the action of the spring 174 operating on the lever 171 also secured to the shaft 120. In a like manner, the shaft 120' which operates the clutch of the wire helix forming and advancing mechanism 17 carries a shaft 272 provided with a latching shoulder 273 which bears against the collar 229.

After the upper frame is lowered and when the clutch 20 is operated to move the lever 233 to the left as shown in Fig. 15, the collars 225 and 229 are moved by the pins 235 and 236 to allow the latches 270 and 272 to move inwardly so that the latching shoulders 271 and 278 thereof engage the latching shoulders 228 and 232 of the collars 225 and 229. The collars remain latched even though the lever 233 is retracted by the continuation of the rotation of the shaft 239 through 360°. This latches the clamping jaw assemblies in closed position. This operation of the latches 270 and 272 also causes rotation of the shafts 120 and 120' to engage the clutches of the wire helix forming and advancing mechanisms 15 and 17 to cause them to form and advance the wire helices 219 for lacing purposes. When the wire helix of the lower frame 12 has completed its lacing operation, the switch 22 is operated to energize the solenoid 21 whereupon the lever 171 is pulled downwardly against the action of the spring 174 to rotate the shaft 120 in a counter-clockwise direction as illustrated in Fig. 15. This rotation as pointed out above, disengages the clutch of the wire helix forming an advancing mechanism 16 to stop operation thereof and also releases the latch 270 whereupon the collar 225 and shaft 73 are rotated in a clockwise direction as viewed in Fig. 15 for opening the jaw assemblies 14 of the lower frame. Likewise, when the wire helix of the upper frame has completed its lacing operation, the switch 24 energizes the solenoid 23 for raising the lever 171' to rotate the shaft 120' in a clockwise direction as viewed in Fig. 15. This clockwise rotation of the shaft 120' as pointed out above, disengages the clutch of the wire helix forming and advancing mechanism 17 to stop operation thereof and also releases the latch 272 whereupon the collar 229 is rotated in a counter-clockwise direction as viewed in Fig. 15 to open the clamping jaw assemblies 15 of the upper frame.

The upper frame may then be raised by manipulation of the clutch 19 so that the laced coil springs may be removed from the clamping jaw assemblies 14 and 15. When the upper frame is thus lifted, the wire helices are cut by cutters, the construction of which is shown in more detail in Figs. 11, 12, 13 and 21. The cutter for the helix of the lower frame includes a knife 275 cooperating with the hardened sleeve 169 which extrudes the wire helix. The knife 275 is carried on a plunger 276 which is suitably guided for reciprocation and the plunger carries a roller 277 which is engaged by the cam surface on the collar 43 mounted on the shaft 40. Thus, when the shaft 40 is rotated to raise the upper frame 13 the cam surface 44 engages the roller 277 to move the knife across the end of the sleeve 169 thereby cutting the wire helix of the lower frame. The knife 275 is normally retracted by a spring 274.

The cutter of the upper frame includes a knife 278 adapted to sweep across the face of the hardened sleeve 169' which extrudes the wire helix along the upper frame. The knife 278 is carried by a plunger 279 which is slidably mounted in the upper frame. The knife 278 is normally retracted by a compression spring 280. The upper end of the plunger 279 carries a roller or cam follower 281 which is engaged by a cam surface 282 of a sliding member 283. The sliding member 283 suitably mounted for sliding movement carries at its inner end a roller 284 for engaging a cam 285 mounted on the top of the shaft 97. The sliding member 283 is normally retracted by a compression spring 286. When the upper frame is in its lower position, the parts are in the position shown in Fig. 21 and the knife 278 is retracted. When, however, the upper frame is raised the roller 284 rides up the cam surface of the cam member 285 (the cam member 285 not moving upwardly) to move the slidable member 283 outwardly. In so doing, the slidable member 283 operates through its cam surface 282 on the cam follower 281 to push the plunger 279 downwardly. This causes the knife 278 to sweep across the end of the hardened sleeve 169' and cut the wire helix of the upper frame. Accordingly, when the shaft 40 is rotated through 180° to lift the upper frame 13 the cutters 275 and 278 simultaneously operate to cut the wire helices of the lower and upper frames.

The switch 22 for energizing the solenoid 21 is illustrated in more detail in Fig. 20. This switch 22 is carried by a bracket 290 having a flared flange 291, a switch operating lever 292 having a flared end which is pivoted at 293 for operating the plunger 294 of the switch 22. When the plunger 294 is depressed, the switch is closed. The bracket 290 is carried by a mounting bracket 295 provided with a hole 296 by which the assembly may be secured to the stationary shaft 72 of the lower frame. The switch 22 is normally maintained open and the flared ends of the bracket and switch operating lever are located in the path of the advancing wire helix 219. When the wire helix 219 completes its travel it enters the flared opening and depresses the switch operating lever 292 to depress the plunger 294 to close the switch 22 for energizing the solenoid 21 thereby stopping the advance of the wire helix. By reason of the flared construction of the bracket and the switch operating lever, the extent of the advance of the wire helix 219 may be accurately predetermined and the wire helix may be readily removed laterally from between the bracket and switch operating lever.

Referring more particularly to Figs. 4, 15 and 17 the lower frame carries a shaft 300 which is in substantial alignment with the shaft 120. This shaft 300 is provided with a pair of arms 301 which carry at their ends a rod 302. Pins 303 extend upwardly through holes in the supporting members 180 of the clamping jaw assemblies 14, these pins 303 having eyes 304 at their lower end receiving the rod 302. A lever 305 is secured to the shaft 300 and is provided with a roller or cam follower 306 for engaging a cam 307 carried by the shaft 40. As the shaft 40 is rotated through steps of 180° the cam 307 operating through the levers 305 and 301 raise and lower the rod 302 and hence raise and lower the pins 303. The arrangement is such that when the upper frame is raised the pins 303 are pushed upwardly between the clamping jaws 186 and 188 as illustrated in Fig. 15 in order to dislodge and raise the coil springs from between the clamping jaws 186 and 188. When the shaft 40 is rotated to lower the upper frame, the cam 307 operates to retract the pins 303 from between the clamping jaws 186 and 188. If the pins 303 remain in their raised positions when the clamping jaws 186 and 188 are closed, either the pins 303 or the clamping jaws 186 and 188

would be broken. In view of the interlock connection between the clutches **19** and **20** as described above, this contingency can not occur for it is impossible to close the clamping jaw assemblies if the upper frame is in its upper position and the pins **303** are extended. The clamping jaws can only be closed when the upper frame is in its lower position and the pins **303** retracted.

While for purposes of illustration, one form of this invention has been disclosed, other forms thereof may become apparent to those skilled in the art upon reference to this disclosure, and therefore, this invention is to be limited only by the scope of the appended claims.

I claim as my invention:

1. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, means for raising and lowering the upper frame, and means for operating the jaw operating shafts and the helix forming and advancing mechanisms, the improvement consisting of interlocking means connected between said last two mentioned means for preventing operation of the jaw operating shafts and the helix forming and advancing mechanisms until the upper frame is lowered.

2. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, means for raising and lowering the upper frame, and means for operating the jaw operating shafts and the helix forming and advancing mechanism, the improvement consisting of a normally retracted pin located in each clamping jaw assembly of the lower frame and adapted to engage the laced coil springs therein when raised, means connected to the pins and controlled by the raising and lowering means for the upper frame for raising the pins when the upper frame is raised to lift the laced coil springs from the clamping jaws of the lower frame, and interlocking means connected between the raising and lowering means for the upper frame and the operating means for the jaw operating shafts and the helix forming and advancing mechanisms for preventing operation of the jaw operating shafts and the helix forming and advancing mechanisms when the upper frame and the pins are raised.

3. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, and means for operating the jaw operating shafts and the helix forming and advancing mechanisms, the improvement consisting of a continuously power driven shaft, means associated with the upper frame and including a shaft and cams rotated through steps of 180° for raising and lowering the upper frame, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 180° steps of rotation, a friction brake on said last mentioned shaft for retarding rotation thereof, and means connected to and controlled by said last mentioned shaft for applying said brake as said upper frame is being lowered.

4. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, and means for raising and lowering the upper frame, the improvement consisting of a continuously power driven shaft, means associated with the jaw operating shafts and the helix forming and advancing mechanisms and including a shaft and cam rotated through steps of 360° for operating the jaw operating shafts to close the jaw assemblies and for operating the helix forming and advancing mechanisms to form and advance the wire helices, and a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 360° steps of rotation.

5. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, and means for raising and lowering the upper frame, the improvement consisting of a continuously power driven shaft, means associated with the jaw operating shafts and the helix forming and advancing mechanisms and including a shaft and cam rotated through steps of 360° for operating the jaw operating shafts to close the jaw assemblies and for operating the helix forming and advancing mechanisms to form and advance the wire helices, and a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 360° steps of rotation, and a friction brake on said last mentioned shaft for retarding rotation thereof.

6. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, the improvement consisting of a continuously power driven shaft, means associated with the upper frame and including a shaft and cams rotated through steps of 180° for raising and lowering the upper frame, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 180° steps of rotation, means associated with the jaw operating shafts and the helix forming and advancing mechanisms and including a shaft and cam rotated through steps of 360° for operating the jaw operating shafts to close the jaw assemblies and for operating the helix forming and advancing mechanisms to form and advance the wire helices, and a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 360° steps of rotation.

7. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end

turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, the improvement consisting of a continuously power driven shaft, means associated with the upper frame and including a shaft and cams rotated through steps of 180° for raising and lowering the upper frame, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 180° steps of rotation, a friction brake on said last mentioned shaft for retarding rotation thereof, and means connected to and controlled by said last mentioned shaft for applying said brake as said upper frame is being lowered, means associated with the jaw operating shafts and the helix forming and advancing mechanisms and including a shaft and cam rotated through steps of 360° for operating the jaw operating shafts to close the jaw assemblies and for operating the helix forming and advancing mechanisms to form and advance the wire helices, and a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 360° steps of rotation.

8. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, the improvement consisting of a continuously power driven shaft, means associated with the upper frame and including a shaft and cams rotated through steps of 180° for raising and lowering the upper frame, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 180° steps of rotation, means associated with the jaw operating shafts and the helix forming and advancing mechanisms and including a shaft and cam rotated through steps of 360° for operating the jaw operating shafts to close the jaw assemblies and for operating the helix forming and advancing mechanisms to form and advance the wire helices, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 360° steps of rotation, and a friction brake on said last mentioned shaft for retarding rotation thereof.

9. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, the improvement consisting of a continuously power driven shaft, means associated with the upper frame and including a shaft and cams rotated through steps of 180° for raising and lowering the upper frame, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 180° steps of rotation, a friction brake on said last mentioned shaft for retarding rotation thereof, and means connected to and controlled by said last mentioned shaft for applying said brake as said upper frame is being lowered, means associated with the jaw operating shafts and the helix forming and advancing mechanisms and including a shaft and cam rotated through steps 360° for operating the jaw operating shafts to close the jaw assemblies and for operating the helix forming and advancing mechanisms to form and advance the wire helices, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 360° steps of rotation, and a friction brake on said last mentioned shaft for retarding rotation thereof.

10. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, and means for operating the jaw operating shafts and the helix forming and advancing mechanisms, the improvement consisting of a normally retracted pin located in each clamping jaw assembly of the lower frame and adapted to engage the laced coil springs therein when raised, means connected to the pins and including a rod for raising and lowering the pins for lifting the laced coil springs from the clamping jaws of the lower frame, a continuously power driven shaft, means associated with the upper frame and the rod and including a shaft and cams rotated through steps of 180° for raising and lowering the upper frame and for operating the rod to raise and lower the pins, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 180° steps of rotation, a friction brake on said last mentioned shaft for retarding rotation thereof, and means connected to and controlled by said last mentioned shaft for applying said brake as said upper frame is being lowered.

11. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, the improvement consisting of a normally retracted pin located in each clamping jaw assembly of the lower frame and adapted to engage the laced coil springs therein when raised, means connected to the pins and including a rod for raising and lowering the pins for lifting the laced coil springs from the clamping jaws of the lower frame, a continuously power driven shaft, means associated with the upper frame and the rod and including a shaft and cams rotated through steps of 180° for raising and lowering the upper frame and for operating the rod to raise and lower the pins, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 180° steps or rotation, means associated with the jaw operating shafts and the helix forming and advancing mechanisms and including a shaft and cam rotated through steps of 360° for operating the jaw operating shafts to close the jaw assemblies and for operating the helix forming and advancing mechanisms to form and advance the wire helices, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 360° steps of rotation, and means interconnecting said manually controlled clutches to prevent operation of the last mentioned clutch when the first mentioned clutch has been operated to raise the upper frame and the pins.

12. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together

by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, the improvement consisting of a normally retracted pin located in each clamping jaw assembly of the lower frame and adapted to engage the laced coil springs therein when raised, means connected to the pins and including a rod for raising and lowering the pins for lifting the laced coil springs from the clamping jaws of the lower frame, a continuously power driven shaft, means associated with the upper frame and the rod and including a shaft and cams rotated through steps of 180° for raising and lowering the upper frame and for operating the rod to raise and lower the pins, a clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 180° steps of rotation, means associated with the jaw operating shafts and the helix forming and advanching mechanisms and including a shaft and cam rotated through steps of 360° for operating the jaw operating shafts to close the jaw assemblies and for operating the helix forming and advancing mechanisms to form and advance the wire helices, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 360° steps of rotation, manually operated means connected to and controlling said last mentioned clutch, a cam on the shaft wrich raises and lowers the upper frame, and inter-connecting means between the manually operated means and said cam to prevent operation of the last mentioned clutch when the upper frame and pins are raised.

13. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, the improvement consisting of a continuously power driven shaft, means associated with the upper frame and including a shaft and cams rotated through steps of 180° for raising and lowering the upper frame, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 180° steps of rotation, means associated with the jaw operating shafts and the helix forming and advancing mechanisms and including a shaft and cam rotated through steps of 360° for operating the jaw operating shafts to close the jaw assemblies and for operating the helix forming and advancing mechanisms to form and advance the wire helices, a clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 360° steps of rotation, manually operated means connected to and controlling said last mentioned clutch, a cam on the shaft which raises and lowers the upper frame, and interconnecting means between the manually operated means and said cam to prevent operation of the last mentioned clutch when the upper frame is raised.

14. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, the improvement consisting of a continuously power driven shaft, means associated with the upper frame and including a shaft and cams rotated through steps of 180° for raising and lowering the upper frame, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 180° steps of rotation, means associated with the jaw operating shafts and the helix forming and advancing mechanisms and including a shaft and cam rotated through steps of 360° for operating the jaw operating shafts to close the jaw assemblies and for operating the helix forming and advancing mechanisms to form and advance the wire helices, a manually controlled clutch connecting said power driven shaft and said last mentioned shaft for driving said last mentioned shaft through 360° steps of rotation, and means interconnecting said manually controlled clutches to prevent operation of the last mentioned clutch when the first mentioned clutch has been operated to raise the upper frame.

15. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, means including a shaft rotatable through steps of 180° for raising and lowering the upper frame, and means for operating the jaw operating shafts and the helix forming and advancing mechanisms, the improvement consisting of a cutter adjacent one end of the lower frame for cutting the wire helix after it has been formed and advanced along the lower frame, a cam on said rotatable shaft and associated with said cutter for operating said cutter when the shaft is rotated to raise the upper frame, a cutter adjacent one end of the upper frame for cutting the wire helix after it has been formed and advanced along the upper frame, a stationary cam carried by the machine, a cam follower carried by the upper frame and engaging said stationary cam and connected to said last mentioned cutter for operating said cutter when the upper frame is raised.

16. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof having a pair of wire feeding rolls for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, means for raising and lowering the upper frame, and means for operating the jaw operating shafts and the helix forming and advancing mechanisms, the improvement consisting of means associated with one of the wire feeding rolls of each helix forming and advancing mechanism for slidably mounting the same toward and away from the other wire feeding roll thereof, and adjustable spring means associated with said last mentioned means for urging said slidably mounted wire feeding rolls toward said other wire feeding rolls.

17. In a spring unit lacing machine for lacing together coil springs into a spring unit comprising an elongated lower frame and an elongated upper frame, each frame including mechanism at one end thereof having a pair of wire feeding rolls for forming and advancing a wire helix along the frame, a plurality of clamping jaw assemblies for clamping together the end turns of two rows of coil springs to be laced together by the advancing wire helix and a jaw operating shaft for opening and closing the clamping jaw assemblies, means for raising and lowering the upper frame, and means for operating the jaw operating shafts and the helix forming and adadvancing mechanisms, the improvement consisting of means associated with one of the wire feeding rolls of each helix forming and advancing mechanism for slidably mounting the same toward and away from the other wire feeding roll thereof, adjustable spring means associ-

ated with said last mentioned means for urging said slidably mounted wire feeding rolls toward said other wire feeding rolls, and pressure rolls engaging the opposite sides of said other wire feeding rolls to balance the force of said spring means.

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