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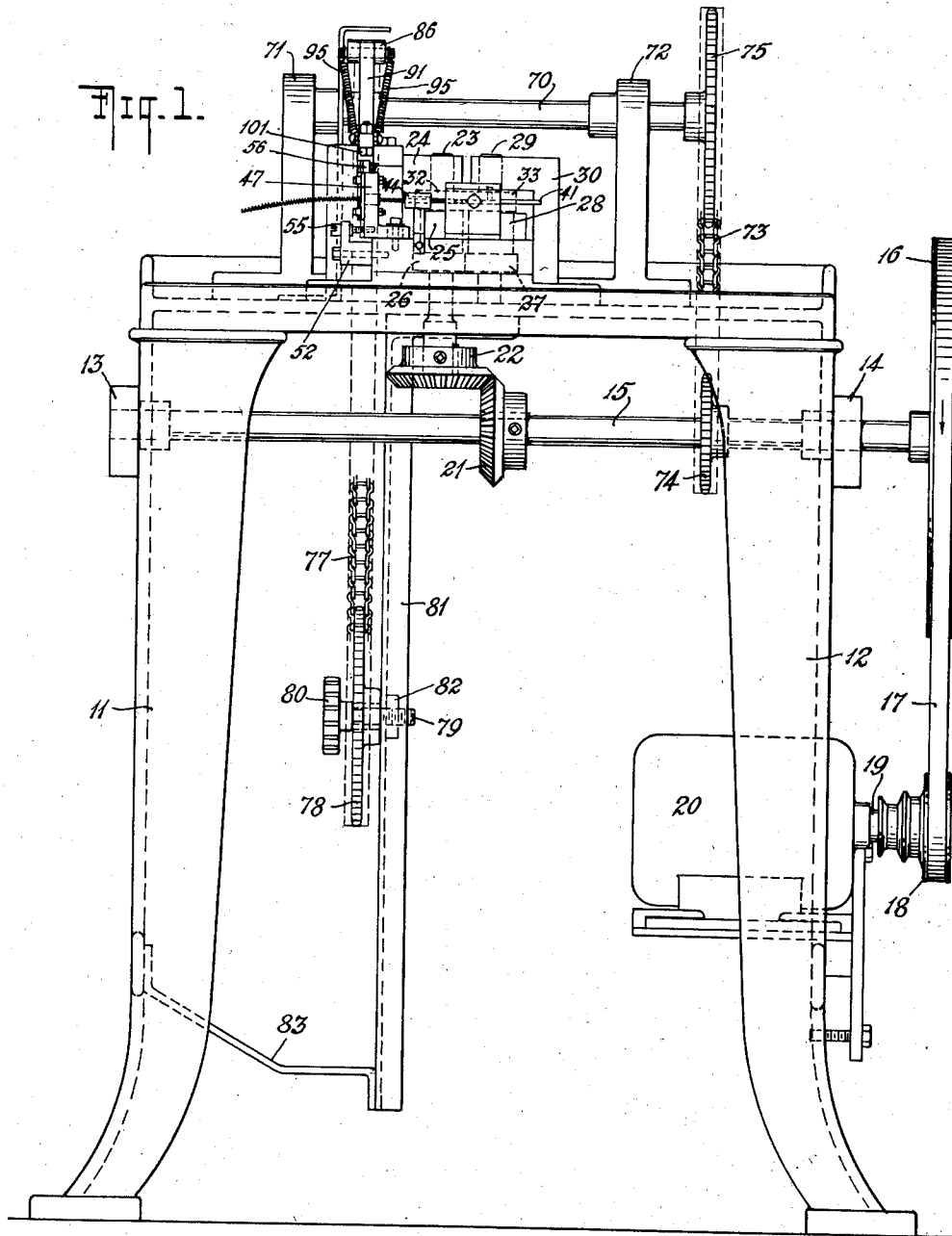
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2,275,131

MACHINE FOR MAKING SEPARABLE FASTENER ELEMENTS

Filed July 25, 1940

4 Sheets-Sheet 1



WITNESS

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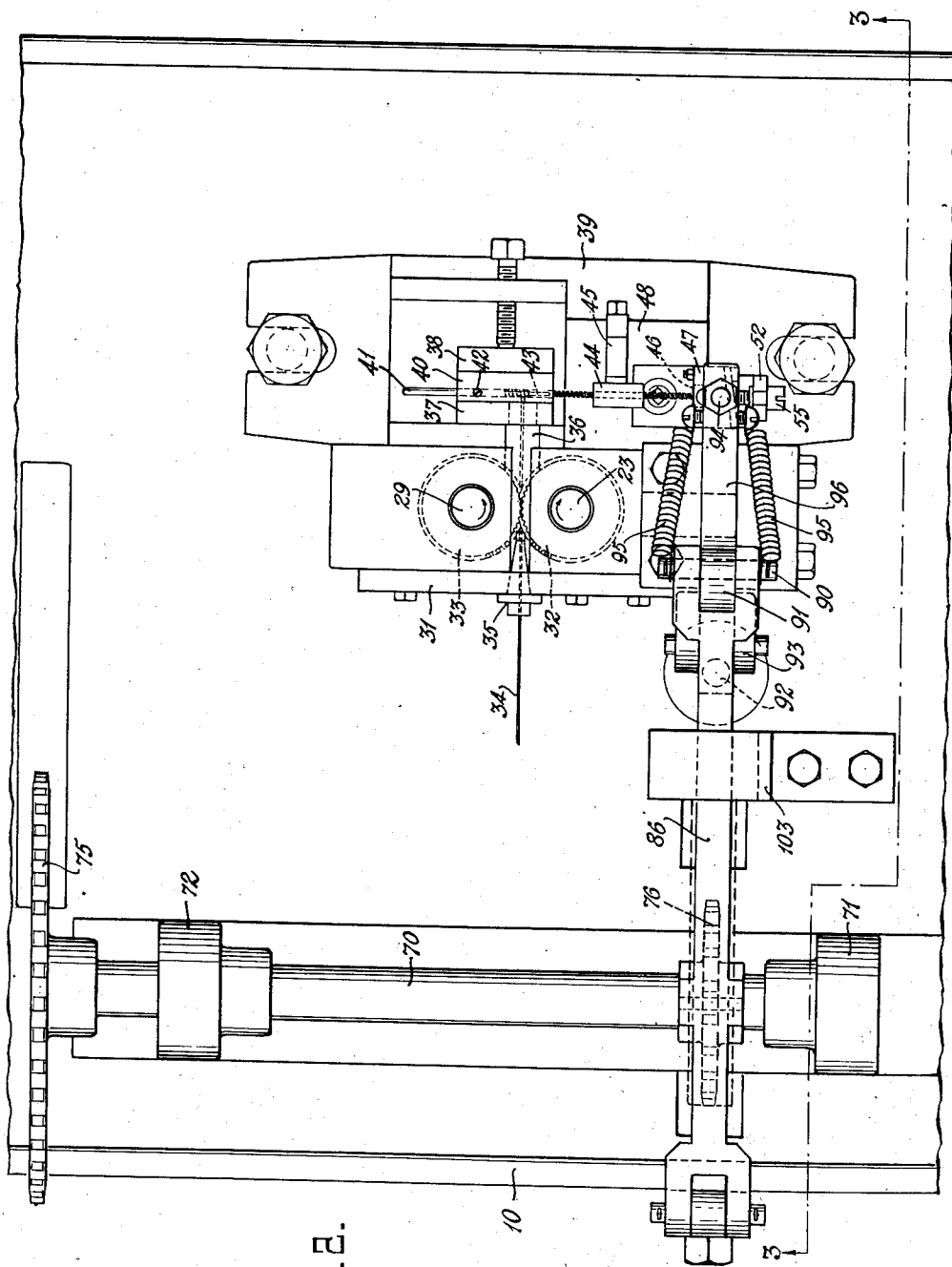
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WITNESS

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Fig. 2.

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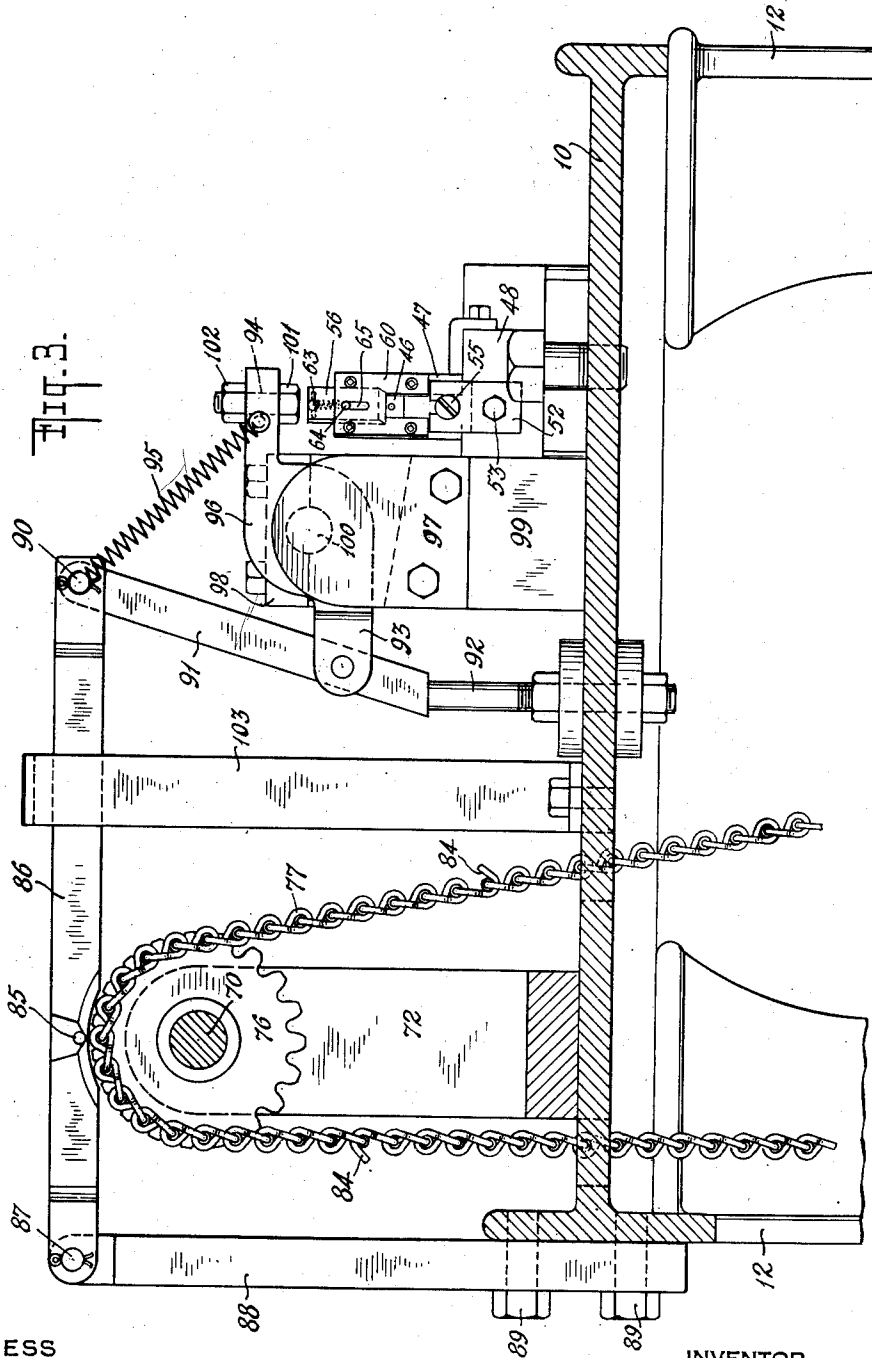
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4 Sheets-Sheet 3



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FIG. 4.

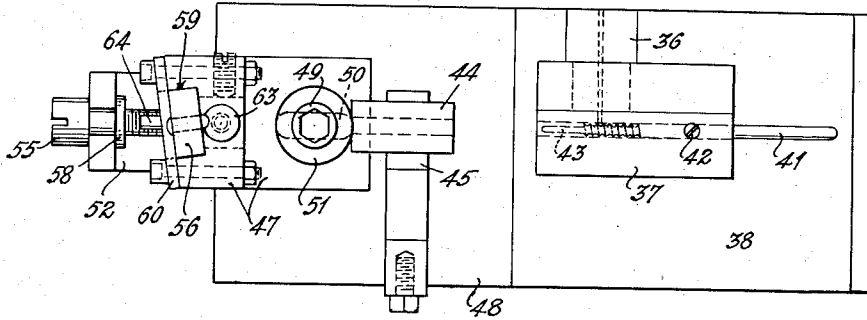
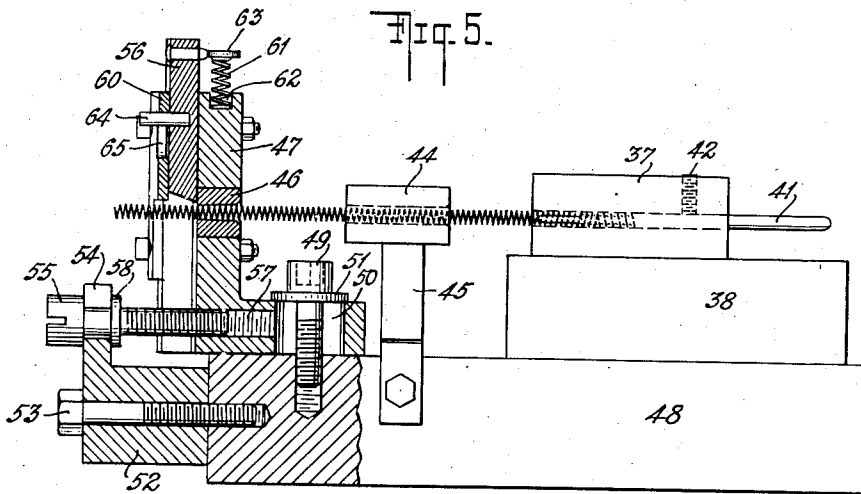


FIG. 5.



WITNESS

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MACHINE FOR MAKING SEPARABLE
FASTENER ELEMENTS

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Application July 25, 1940, Serial No. 347,420

7 Claims. (Cl. 153—64)

This invention relates to improvements in machines for use in the manufacture of slide fastener elements and more particularly to machines for making separable fastener structures in which the fastener elements comprise the coils of a pair of spiral or helical springs, one of such springs being a plain coiled springs while the other spring has a series of wave-like formations or hooks which are adapted to interlock with the coils of the plain spring to close the fastener structure. The interlocking of the two coiled springs is controlled by a slider which is slidably mounted on such members and may be operated manually in one direction to cause interlocking engagement of the hooks of the one coiled spring with the coils of the other coiled spring and in the other direction to disengage such hooks and coils to open the fastener structure.

The principal object of the invention is to provide an improved machine capable of forming helical spring members of a predetermined length, such as the aforementioned fastener elements, in a continuous operation and without any stoppage or interruption of the feeding and forming mechanisms so that the maximum speed of production of such members is attained.

A further object of the invention is to provide an improved form of machine which is simply constructed, sturdy and reliable in action, which is capable of simplifying and reducing the expense of manufacturing helical spring members and which will produce perfectly formed units of the above indicated type.

Other objects and advantages of the invention, as well as the novel features of construction, combination of elements and arrangement of parts will become more apparent after a perusal of the following description read in connection with the accompanying drawings in which Fig. 1 is a front elevational view of a machine embodying the improvements of this invention; Fig. 2 is an enlarged top plan view of a portion of the machine illustrated in Fig. 1, some of the parts being omitted for the sake of clearness; Fig. 3 is an enlarged detailed sectional view of the upper portion of the machine taken along the line 3—3 of Fig. 2; Fig. 4 is an enlarged detailed plan view of the forming and cutting mechanism and Fig. 5 is a front elevational view of the parts illustrated in Fig. 4, some of the parts being shown in vertical section and such view illustrating the feeding of a helical wire from the forming mechanism through the cutting mechanism.

In the drawings the reference numeral 10

designates a table which is supported on a pair of side frame members 11 and 12. Beneath the table 10 there is positioned the main shaft 15 of the machine which is rotatably supported at one end by a bearing block 13 mounted on the side frame member 11 and rotatably supported adjacent its other end by a bearing block 14 provided on the side frame member 12. The end of the shaft 15 extending through the bearing block 14 is provided with a pulley wheel 16 on which is mounted a belt 17 which connects such pulley wheel to a pulley 18 mounted on the end of a motor shaft 19. The motor 20 is supported on the side frame member 12 in any suitable manner and means (not shown) are also provided to connect such motor 20 to a source of current and to control the operation thereof.

Means are provided for transmitting the rotative movement of the shaft 15 to the various operating mechanism utilized in the manufacture of the helically-shaped spring member, such means including a bevel gear 21 secured to the shaft 15, as by means of a set screw, and meshing with a bevel gear 22 which is mounted on the lower end of a depending shaft 23, the latter of which extends upwardly through the horizontally disposed arms of a roller bracket 24. Intermediate the arms of the bracket 24 and fixedly secured to the shaft 23 is a roller 25 which is provided at its lower end with a spur gear 26 adapted to mesh with a spur gear 27 provided on the lower end of a roller 28. The roller 28 is mounted on a vertically disposed shaft 29 whose ends extend through apertures in the spaced arms of a roller bracket 30 which is positioned adjacent to the roller bracket 24 and connected thereto by means of a horizontally disposed plate 31 (see Fig. 2). Provided on the upper end of the roller 25 is an annular member 32 which is aligned with and cooperates with an annular member 33 provided on the upper end of the roller 28 to feed a strand of wire forwardly toward the coil forming mechanism at the front of the machine. The members 32 and 33 may have plain exterior surfaces so that they function solely as feeding rollers for the wire or they may have teeth cut in such surfaces as is indicated in Fig. 2 of the drawings so that they in addition function as kinking rollers to produce a wave-like formation or kinks in the wire prior to forming it into spiral form as will hereinafter be more fully explained.

The wire to be fed or fed and kinked may be supplied from a coil or roll which may be carried on a supporting plate or table provided at the rear of the machine or otherwise suitably dis-

posed with relation to the machine. The wire which is indicated generally by the numeral 34, is passed forwardly in its feed through a guide 35 which is carried by the plate 31 connecting the roller brackets 24 and 30 and adapted to direct such wire between the two annular members 32 and 33 as is shown more clearly in Fig. 2 of the drawings. If the two members 32 and 33 are constructed so that they are in the nature of kinking gears, as is indicated in Fig. 2 of the drawings, the wire is given a wave-like formation, the wave being of sinuous form and disposed in a plane parallel to the horizontal surfaces of the table 10. In this case the teeth in the two members 32 and 33 are preferably so constructed with respect to the diameter of the final helically-shaped fastener member that each spiral or coil of the latter will include three complete kinks or waves, the kinks or waves of each spiral or coil being aligned in rows with the kinks or waves of the other coils to form a longitudinal series of hooks which are positioned in spaced relation about the periphery of the formed spiral wire to provide three longitudinally extending series of hooks on the fastener member by which it may be interlocked with the loops or coils of the plain spiral wire of the fastener. In either case, whether the members 32 and 33 are to be used merely as feeding rollers or as feeding and kinking rollers the portion of the wire emerging from such members is fed by the latter through a suitable guide 36 which is secured at its forward end to a block 37 mounted on a clamp 38 which is supported in any suitable manner on a die bed 39 carried by the table 10.

Positioned in cooperative relation with the forward end of the guide 36 is a die 40 provided with a passageway or elongated opening through which extends a die member 41. The die member 41 may be adjusted longitudinally in the die 40 and is maintained in its adjusted position by means of a set screw 42 (see Figs. 2, 4 and 5). The portion of the die member 41 which lies in the path of the exit or forward end of the guide 36 is tapered in form to control the diameter of the spiral coil to be formed and is provided with a spiral thread. Thus as the portion of the wire emerging from the guide 36 is fed to the tapered portion of the die member 41 under the influence of the feeding members 32 and 33, it is formed around such portion of member 41 by the action of the adjacent interior surface portions of the passageway or channel in the die 40 and given a spiral form, the tapered spiral thread of the die member 41 directing the spiralled wire towards the reduced end portion 43 of the die member 41. After passing from the die 40 the spiral wire enters the aligned passageway of a guide member 44 positioned in spaced relation to the die 40 and supported upon a bracket 45 secured at its lower end to a block 48 provided on the die bed 39. The spiralled wire then passes from the guide 44 to the aligned passageway of a cutting die 46 and as it emerges from such cutting die is cut to the desired lengths by the intermittent action of a knife 56.

The cutting die 46 is in the nature of a plug which is positioned in an opening or aperture provided in a vertically disposed bracket member or standard 47 (see Fig. 5) and is fixedly secured in place as by means of a set screw. The die 46 at its inlet end is slightly greater in diameter than the other or outlet end thereof which is approximately the same in diameter as the outside diameter of the spiral wire going through the

plug. As an illustration of a typical die which has been used in the manufacture of a helical wire having an outside diameter of $\frac{11}{10000}$ of an inch, the die or plug utilized was approximately $\frac{1}{4}$ of an inch long and approximately $\frac{3}{8}$ of an inch in outside diameter. The diameter of the hole in the plug at the outlet end thereof was approximately $\frac{120}{10000}$ of an inch, only $\frac{10}{10000}$ of an inch greater than the outside diameter of the helical coil. From the outlet end of the die to the inlet end thereof the passageway of the die plug gradually increased in diameter to a point adjacent to the inlet end thereof, the degree of increase being such that there is a $1\frac{1}{2}^\circ$ taper throughout the length of the plug from the outlet end thereof to a point adjacent the inlet end thereof. The inlet opening of the plug is bevelled to enable the ready threading of a coiled wire into the plug and to facilitate the passage of the coiled spring into the plug during the feeding operation.

The standard or supporting bracket 47 is provided at its lower end with a foot portion which rests on the block 48 provided on the die bed 39 and is secured to such block by means of a bolt 49 which extends through an opening 50 provided in such foot portion into threaded engagement with the block 48. The opening 50 in the foot portion of the standard 47 is substantially larger than the diameter of the shank of the bolt 49 to permit of adjustment of the standard with relation to the block 48, the bolt 49 being secured to such foot portion through the agency of a washer 51 which is large enough to span the opening 50 therein and rests on the edges of such foot portion bordering the opening 50 as is shown more clearly in Fig. 5 of the drawings. The standard 47 is further secured to the block 48 by means which include a clamping member or extension block 52 which is fixedly secured to such block 48 by the bolt 53 and which is provided with an upwardly extending portion 54. A bolt 55 extends through the clamp portion 54 and into threaded engagement with a horizontally disposed thread 57 provided in the base of the standard 47. It will be apparent therefore that the standard 47 may be adjusted with respect to the block member 48 and the guide member 44 and die 40 by loosening the bolt 49 and then adjusting the bolt 55 to vary the position of the standard. The bolt 55 is provided with a collar 58 so that it does not move longitudinally in the aperture of the clamp portion 54 during the adjustment of the standard 47.

Co-acting with the die member 46 is a knife 56 which is mounted for slidable movement in a vertical direction in a vertically disposed channel or recess 59 provided in the standard 47, the knife 56 being confined in such recess by means of a cover plate 60 which is bolted to the side edges of the recess, as is clearly indicated in Figs. 4 and 5 of the drawings. The channel or recess 59 in the standard 47 is constructed so that the face of the knife blade 56 contacting with the bottom surface of the recess is disposed at an oblique angle to a vertical plane passed through the axial center of the coiled wire fed to the cutting die 46. The angle at which the knife 56 is turned is preferably the same as the angle of pitch of the coils in the wire being fed thereto so that as the knife passes over the exit end of the die plug 46 the cut on the wire will be a straight transverse cut. The knife 56 is normally maintained in its uppermost position in the channel 59 with the cutting edge thereof positioned just above the outlet opening of the die plug 46, by means of a

spring 61 which is seated at its lower end in a cup shaped recess 62 provided on the upper end of the standard 47 and is connected at its upper end to a spring seat 63 which is fixedly secured to the upper end of the knife 56. Movement of the knife 56 in the channel or recess 59 of the standard 47 is controlled by means of a pin 64 which is attached to the knife intermediate the latter's ends and extends through an elongated guideway 65 provided in the cover plate 60 mounted on the standard 47.

Intermittent downward movement is imparted to the knife 56 from the main shaft 15 of the machine through a sprocket wheel 74 mounted on the shaft 15 and connected by means of a chain 73 and a sprocket wheel 75 provided on the righthand end of a shaft 70, as viewed in Fig. 1 of the drawings, to the shaft 70. The shaft 70 is rotatably supported on a pair of spaced bearing standards 71 and 72 mounted on the table 10 of the machine and provided on the shaft 70 intermediate such standards is a sprocket wheel 76 (see Fig. 3) which carries a chain 77, the lower end of such chain passing around an idler sprocket wheel 78, as is shown in Fig. 1. The idler wheel 78 is rotatably mounted on an axle member 79 which is provided at one end with a hand wheel 80 and at its other end extends through a chain adjusting channel 81 and a clamp 82, the shank of such member being threaded and being in threaded engagement with the clamp 82. Thus by operating the hand wheel 80, the sprocket wheel 78 may be adjusted from the position illustrated in Fig. 1 to any other position desired on the chain adjusting channel 81 to take care of various lengths of fasteners or coiled springs as will hereinafter become more clear. The chain adjusting channel 81 is suitably supported at its upper end to the under side of the table 10 and braced at its lower end by means of a brace 83 which is attached to the side frame 11 as is shown more clearly in Fig. 1 of the drawings.

The chain 77 is provided at spaced intervals with a plurality of trip or knocker links 84 which are formed and arranged to engage with a knocker pin 85 in the movements of the chain around the sprocket wheel 76 as is shown more clearly in Fig. 3 of the drawings. The knocker pin 85 is mounted intermediate the ends of a knocker arm or lever 86 so as to be positioned directly over the sprocket wheel 76. The lever 86 is pivotally mounted at one end on a pin 87 provided at the upper end of a bracket arm 88 which is secured at its lower end as by means of the bolts 89, 89 to the rear side of the table 10. The forward or free end of the lever arm 86 is fork-shaped, the arms of the fork supporting a pin 90 which may be secured in position as by means of cotter pins and on which is pivotally mounted a depending link member 91. As is shown more clearly in Fig. 3 of the drawings the link member 91 inclines rearwardly from the pin 90 and at its lower end rests on a stop member 92 provided on the table 10 of the machine. Adjacent to the lower end of the link 91 and intermediate the ends of the latter, is connected one arm 93 of a rocker member 96. The other arm 94 of the rocker member 96 has attached thereto the lower ends of two springs 95, 95 which are connected at their upper ends to the pin 90. The rocker member 96 is pivotally mounted on a pin 100 extending between the upstanding bearing arms 97 and 98, the latter of which is integral with a block 99 mounted on the table 10 and the

former of which is connected to the block 99 as by means of bolts (see Fig. 3).

It will thus be seen that as the sprocket wheel 76 is rotated by the shaft 15 through sprocket wheel 74, chain 73, sprocket wheel 75 and shaft 70, the chain 77 will be moved in a clockwise direction as viewed in Fig. 3 of the drawings. As each of the trip or knocker links 84 of the chain 77 comes into engagement with the knocker pin 85 the latter, together with the lever arm 86 supporting it, will be pivoted upwardly about the pin 87 thereby raising the free end of such lever together with the link 91. The raising of the free end of the lever 86 and the link 91 causes the arm 93 of the rocker member 96 to be pivoted upwardly or in a clockwise direction and the arm 94 of the member 96 to be pivoted downwardly, thereby placing the springs 95, 95 under increased tension. As soon as the knocker or trip link 84 has passed the knocker pin 85, the tensioned springs 95, 95 contract to immediately return the rocker member 96 back to its normal position. The upward movement of the lever arm 86 is limited by a stop consisting of an elongated plate 103 secured at its lower end to the table 10 of the machine and having an offset upper end which overlies and is in the path of movement of the lever arm 86. The arm 94 of the rocker member 96 is provided with an inverted bolt 101 whose head is positioned above the upper end of the knife 56 and whose shank extends through an opening in the arm 94 and is secured to the latter by means of a nut 102. It will thus be seen that as the arm 94 of the rocker member 96 is pivoted downwardly, the knife 56 is depressed against the tension of its spring 61 and wipes past the outlet opening in the die plug 46, the pin 64 of such knife through its engagement with the guide aperture 65 in the cover plate 60 limiting the downward movement of such knife. In this downward movement the bottom end portion of the knife first bends the wire down and then as it continues its movement cuts through the wire of which the coil is constituted, the cut being a straight transverse cut due to the fact that the knife is disposed at an angle similar to the pitch of the coils of the coiled wire member. To facilitate these operations the cutting end of the knife should preferably be so constructed that the bottom surface of the knife inclines upwardly from the cutting edge thereof at an angle of approximately 15° from the horizontal. As soon as the head of bolt 101 has delivered the hammer blow to knife 56 and is returning to its upwardly or normal position under the influence of the springs 95, 95, the spring 61 associated with the knife 56 comes into action to return the knife to its normal position where the blade thereof will be positioned just above the outlet end of the die plug 46.

It will be evident from the foregoing description of the machine of this invention that the parts thereof are relatively simple and rugged in construction and will be relatively inexpensive to make. The machine in its operations produces the desired construction of fastener elements quite rapidly, the wire being fed by the feeding rollers 32 and 33 which are directly propelled from the main shaft 15 of the machine through the gears 21 and 33 into the passageway of the die member 40 where the wire is coiled around the die member 41 and thence passed through the spaced guide 44 to the spaced cutting die member 46. The rotative movements of the main shaft 15 of the machine is likewise utilized to deliver hammer blows at intermittent intervals

to a knife 56 which coacts with the cutting die member 46 to cut the coiled wire into proper lengths. The means for accomplishing this are, as has been above explained, the sprocket wheel 74, chain 73 and sprocket wheel 75 which transfer the rotative movements of the shaft 15 to the shaft 70 and a sprocket wheel 76 mounted upon the latter. The rotation of sprocket wheel 76 causes the knocker links 84 on chain 77 to intermittently come into engagement with and to raise the knocker pin 85. The quick upward blow imparted to the knocker pin 85 by a link 84 causes the lever 86 supporting such pin to pivot abruptly about pin 87 thereby jerking link 91 upwardly and through the rocker member 96 causing the head of bolt 101 to deliver a blow to the top of knife 56. As soon as the blow is imparted to knife 56, the parts return to their normal positions, the springs 95, 95 rotating the rocker member 96 back to normal position so that the link 91 again rests on the stop 92 and the lever 86 is in its lowermost position with the knocker pin 85 carried thereby again positioned in the path of movement of the links 84. The number and position of the links 84 on the chain 77 determine the lengths of the fastener units or helical springs being made. For example in the coiled fastener element illustrated, there are twenty-two coils to the inch. The feeding of the gears 32 and 33 is so related to the travel of the chain 77 that sixteen links of one-half inch from center to center are required in such chain for each inch of fastener. Thus if the fastener elements are to be three inches in length the chain will be approximately three feet long and have a knocker link at the end of each 47 links. In other words there will be 96 links in the chain, two of which will be two knocker links spaced so that at each one-half of a revolution of the chain one will come into engagement with the knocker pin 85 to cause a blow to be delivered to the knife 56.

The blow delivered to the knife 56 by the head of bolt 101 causes a quick wiping movement of the knife past the outlet end of the cutting die 46, the knife as has been explained, during such movement bending the helical wire spring down and then cutting through the wire of such spring at an angle approximately equal to the pitch or off-set of the coils of such spring so as to make a straight transverse cut. During the engagement of the knife 56 with the coiled helical spring, the forward movement of the latter at the point of engagement is momentarily halted so that the coiled spring winds up back to the guide member 44 but such backing action of the coiled spring does not extend beyond the guide 44 so as to interfere with the feeding and forming of the wire 34 by the feed wheels 32 and 33 and the spiral forming members 40 and 41. The guide 44 therefore is so positioned intermediate the forming die 40 and cutting die 46 as to provide sufficient length of spring on the one hand to enable the backing up action to take place and on the other hand to prevent any interference to the feeding and forming mechanisms because of such backing up action. The feeding and forming of the wire therefore can be made a continuous operation while the cutting operations can be intermittent. The spring 61 associated with the knife 56 assures that it will be immediately withdrawn as soon as the force imparted to the knife by the bolt 101 has been spent so that the knife will be in engagement with the helically formed spring only momentarily and not long enough to cause a backing up of such

spring past the guide member 44. The guide member during these operations functions to maintain the spring in straight line and prevents wobbling and disconnection of such spring from the cutting die 46 during the feeding movements of the feed wheels 32 and 33.

While I have described and illustrated a preferred embodiment of my invention, it will be apparent to those skilled in the art that various modifications and changes may be made without departing from the spirit and scope of the invention. For example I may utilize the different feeding mechanisms shown and described in my copending application Serial No. 307,975, filed December 7, 1939, or the forming mechanisms illustrated in such application. This application is a continuation-in-part of the aforesaid application, which matured into Patent No. 2,244,243, dated June 3, 1941. Other and various changes and modifications can also be made as will be readily apparent to those skilled in the art. Hence I do not intend to be limited to the specific embodiment above described but intend in the appended claims to cover such changes and modifications as are within the scope of the invention.

I claim:

1. A machine for producing spirally-shaped slide fastener elements comprising a shaft, means for continuously driving said shaft, wire feeding means continuously driven by said shaft, mechanism for continuously forming into a spiral form the wire fed by said feeding means, wire cutting means spaced from said forming mechanism, cutter actuating means connected to said continuously driven shaft and operable at predetermined intervals to cause said cutting means to cut the spiralled wire into predetermined lengths, a guide positioned intermediate said forming mechanism and cutting means and spaced therefrom so that there are two sections of formed wire intermediate said forming mechanism and cutting means which are free from hindrance to their movements, said guide being tubularly-shaped and being at a distance from said cutting means such that when the movements of the spiralled wire are stopped at the place of cutting, the closing of the coils of such wire will not extend to the suspended section of wire between the guide and the forming mechanism.

2. A machine for producing spirally-shaped elements comprising a shaft, means for continuously driving said shaft, means for feeding and forming a wire into a spiral form, wire cutting means spaced from said feeding and forming means, and cutter actuating means including a pivoted hammer member normally spaced from said wire cutting means, means connected to and continuously driven by said shaft and mechanism connecting said hammer member to said continuously driven means, the latter being adapted at predetermined intervals to actuate said connecting mechanism to cause said hammer member to deliver a blow to said cutting means and cause the latter to cut the wire.

3. A machine such as is defined in claim 2, in which said wire cutting means includes a knife arranged to be struck by said hammer member and a die having a passageway disposed in substantial alignment to the line of feed of the spiralled wire, said passageway being at its inlet end of greater diameter than at its outlet end and gradually increasing in diameter from its outlet end to its inlet end.

4. A machine such as is defined in claim 2, in which said wire cutting means includes a standard, a vertically disposed knife slidably mounted in a guideway provided in said standard and arranged to be struck by said hammer member, said guideway and knife being disposed at an angle similar to the angle of pitch of the coils in the spiralled wire and said knife having a cutting edge which is disposed at an angle from the horizontal, and spring means normally maintaining said knife in its uppermost position in said guideway.

5. A machine for producing spirally-shaped elements comprising a shaft, means for continuously driving said shaft, means for feeding and forming a wire into a spiral form, wire cutting means spaced from said feeding and forming means, and cutter actuating means including a pivoted hammer normally spaced from said wire cutting means, an endless chain having a plurality of knocker members provided thereon in predetermined, spaced relation and connected to said shaft for continuous movement, a pivoted lever connected to said hammer member and having a portion thereof normally positioned in the path of movement of said knocker members, said lever being arranged and adapted when struck by said knocker members to cause said hammer member to deliver a blow to said wire cutting means and cause the latter to cut the wire, and means for limiting the range of movement of said pivoted lever.

6. A machine such as is defined in claim 5, including stop means for limiting the movement of said pivoted hammer in one direction

and spring means for normally maintaining said stop means operative and adapted to yieldingly resist movement of said pivoted hammer in the striking direction.

7. A machine for producing spirally-shaped elements comprising a shaft, means for continuously driving said shaft, means for feeding and forming a wire into a spiral shape, wire cutting means spaced from said feeding and forming means including a cutting knife, resilient means normally maintaining said knife in retracted position, an endless chain having a plurality of knocker members provided thereon in predetermined, spaced relation and connected to said shaft for continuous movement, a pivoted lever having a portion thereof normally positioned in the path of movement of said knocker members, a pivotally mounted hammer member, a link connecting said hammer member to said lever and adapted to pivot said hammer member towards said cutting knife when said lever is struck by a knocker member, a stop and spring means normally maintaining said hammer member out of engagement with said cutting knife and said stop operative to limit the rotation of said hammer member, said spring means being adapted to yield when said hammer member is actuated to strike said cutting blade and being adapted to return said hammer member to its normal position after it has struck said cutting knife a blow, the resilient means associated with said cutting knife being adapted to withdraw said knife from its advanced cutting position to its retracted normal position.

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