

July 30, 1963

J. E. HECKETHORN ETAL

3,099,310

SPRING FORMING DEVICE

Filed Sept. 14, 1961

3 Sheets-Sheet 1

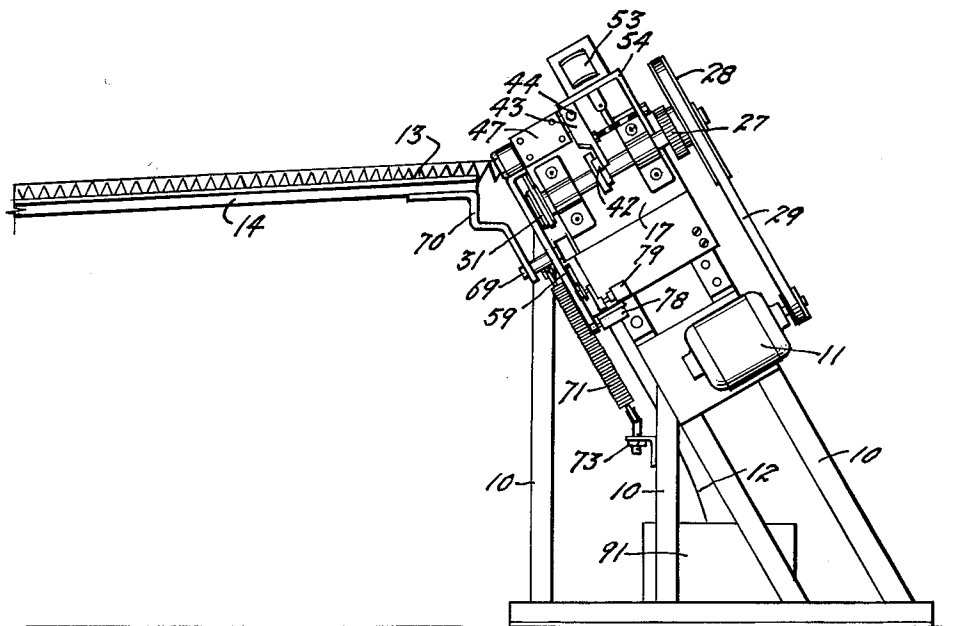


FIG. 1

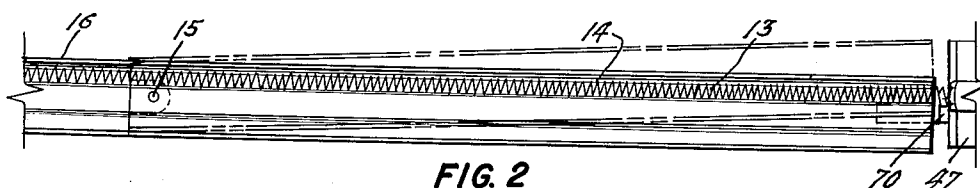


FIG. 2

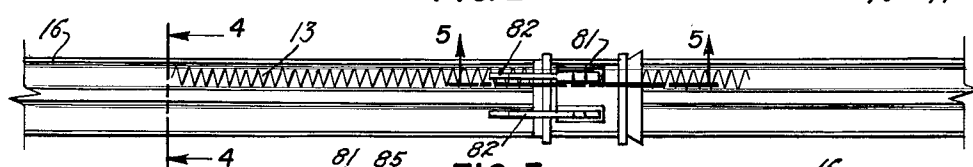


FIG. 3

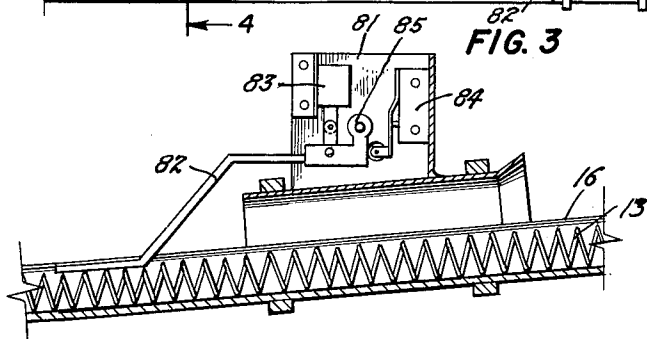


FIG. 5

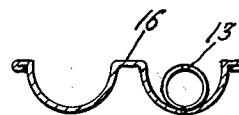


FIG. 4

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3 Sheets-Sheet 2

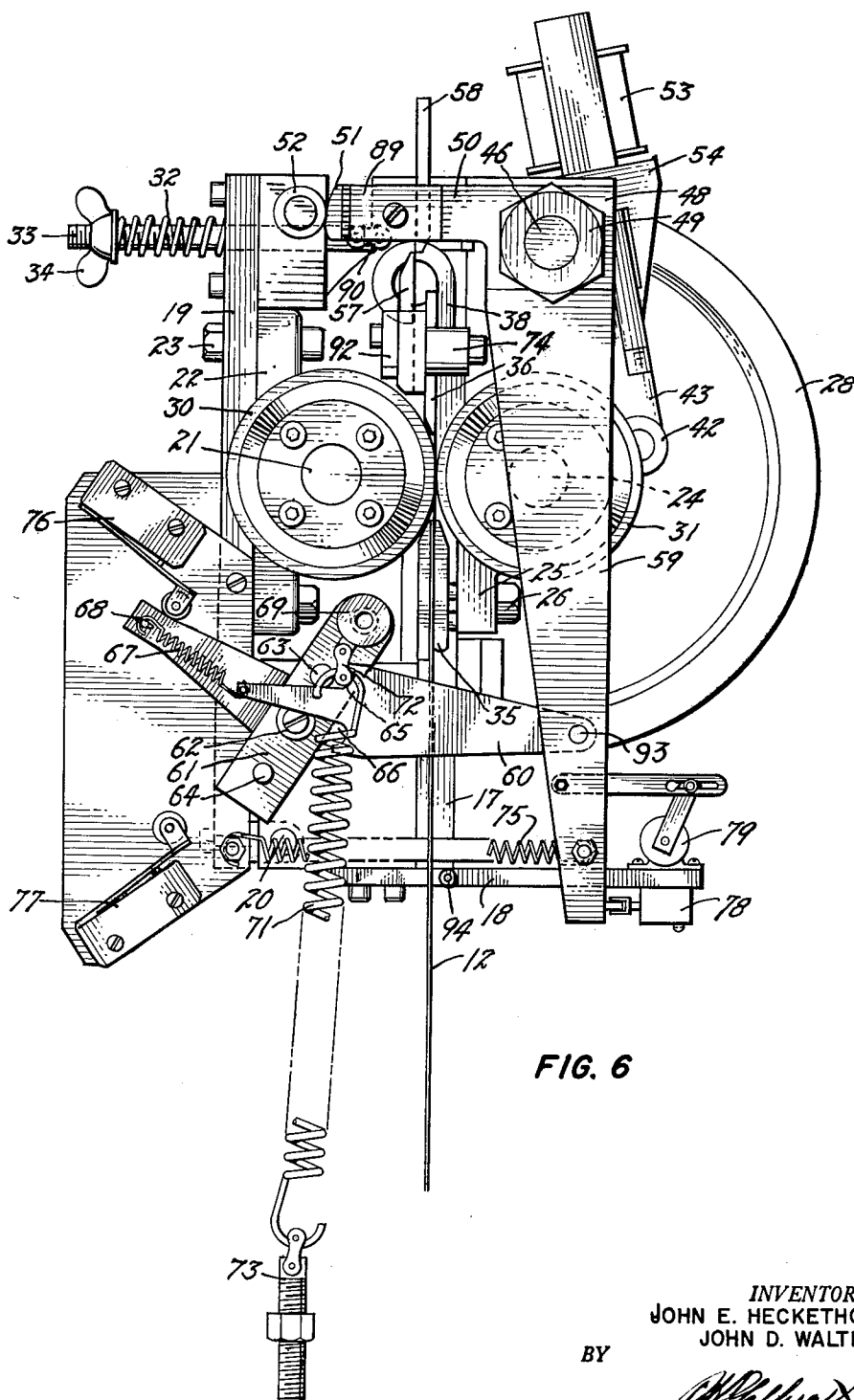


FIG. 6

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3 Sheets-Sheet 3

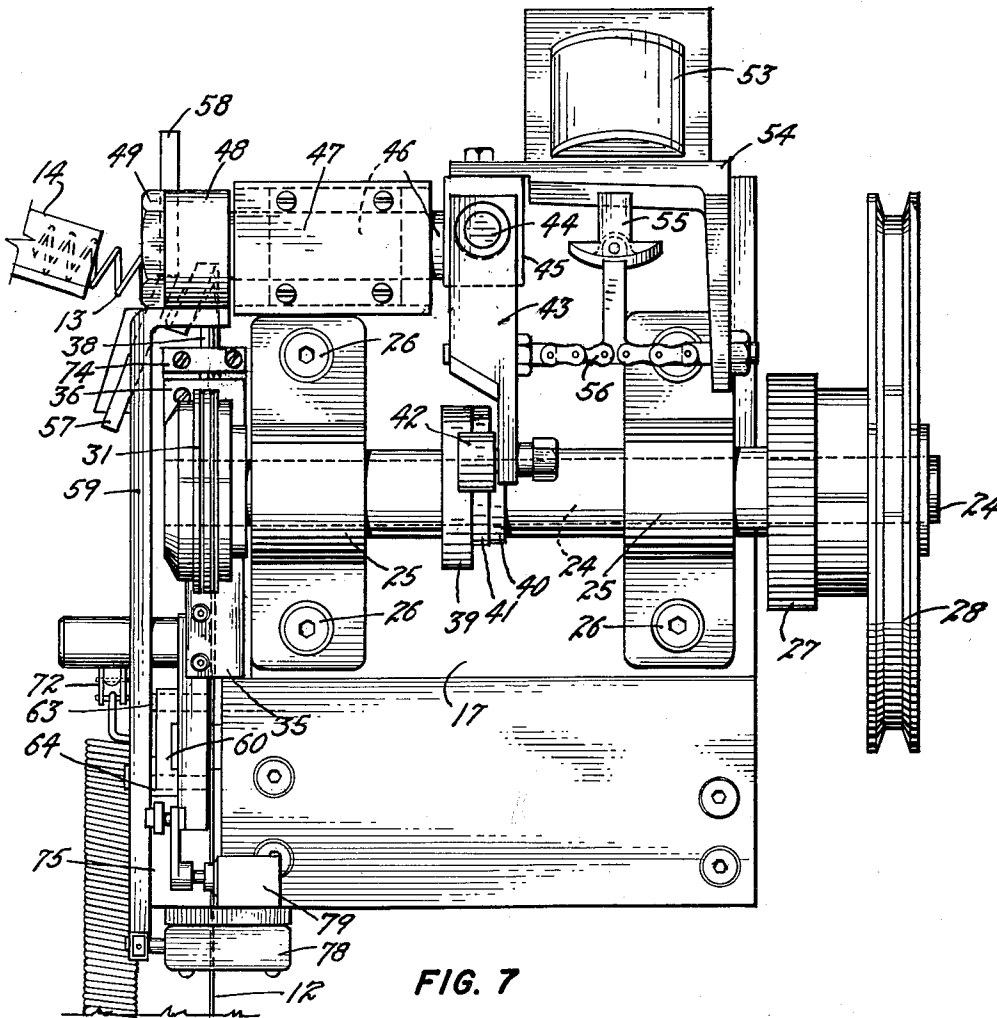


FIG. 7

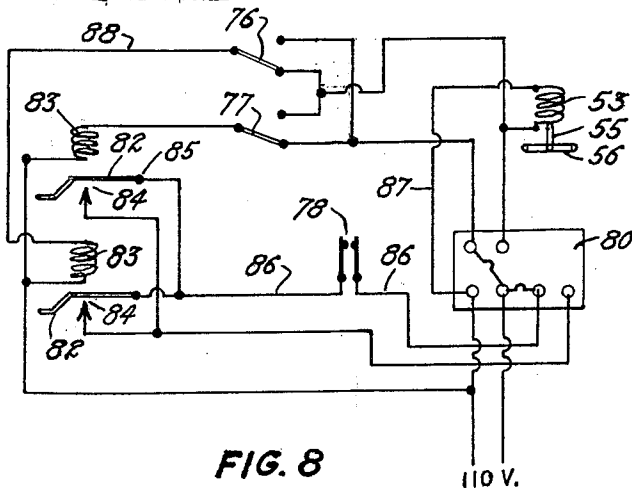


FIG. 8

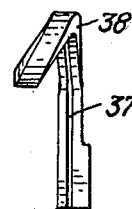


FIG. 9

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3,099,310

SPRING FORMING DEVICE

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5 Claims. (Cl. 153—66)

In the manufacture of certain types of seat cushions, more particularly auxiliary cushions for placement on the seats of automotive vehicles relatively long, spirally coiled wire springs are employed. The springs are entwined in the cushions so as to lie in the plane of their lengths to provide a relatively flat, resilient, ventilated auxiliary seat or back cushion. Such springs and cushions are described more in detail in applicants co-pending application Serial No. 67,737 now Patent No. 3,028,021.

It has been customary to form the spiral spring coils upon spring winding machines and to deliver the wound springs to the cushion assemblers in bundles or batches. This has resulted in great difficulties since the springs are exceedingly long and difficult to handle and are prone to become entangled and entwined.

The principal object of this invention is to provide a relatively small, simple and exceedingly efficient spring coiling device which will enable each individual cushion assembler to have an individual winding machine to provide the coiled springs as they are needed in the assembling operation and to provide automatic controls for the coiling device whereby a second spring will be automatically undergoing formation while the assembler is completing the assembly of a preceding spring in a cushion, so that, a spring is always instantly available without loss of time and without possibility of entanglement or accidental entwinement.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention, reference is had to the accompanying drawings which form a part hereof. Like numerals refer to like parts in all views of the drawings and throughout the description.

In the drawing:

FIG. 1 is a fragmentary side view of the head or coiling extremity of the improved individual spring coiling device showing the head or receiving extremity of the dual channel receiving trough;

FIG. 2 is a fragmentary detail top view of the receiving extremity of the trough of FIG. 1;

FIG. 3 is a similar fragmentary top view of the delivery extremity of the dual channel receiving trough;

FIG. 4 is an enlarged cross section through the trough, taken on the line 4—4, FIG. 3;

FIG. 5 is a similarly enlarged fragmentary longitudinal section taken on the line 5—5, FIG. 3;

FIG. 6 is an enlarged detail side view showing a spring coiling mechanism, as used in the device with the receiving trough detached;

FIG. 7 is a similarly enlarged front view of the mechanism of FIG. 6;

FIG. 8 is a schematic diagram of the electrical circuits employed in the spring forming mechanism; and

FIG. 9 is a detail view of a wire curling tool employed in this invention.

In FIGS. 6 and 7 the mechanism is shown in the idling or at rest position.

The improved spiral spring coiling device employs the coiling mechanism of FIGS. 6 and 7, which will be later described in detail, mounted on suitable structural supporting stand 10. A continuous wire 12 is fed into the

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winding mechanism and a cylindrical, spirally coiled spring 13 formed from the wire 12 discharges from the coiling mechanism at an angle corresponding to the angular pitch of the spring. The winding mechanism is mounted on the supporting stand 10 at a corresponding angle so that the coiled spring will be discharged substantially horizontally from the coiling mechanism as shown in FIG. 1. For convenience of illustration, however, the coiling mechanism has been illustrated, in the detail views of FIGS. 6 and 7, in a vertical position.

The coiled springs 13 are received from the coiling mechanism in a hinged portion 14 of a dual channel receiving trough. The hinged trough portion is supported at its rear or intake extremity from the coiling mechanism, as will be later described, and is hinged at its forward or discharge extremity, by means of a suitable vertical axis hinge 15, to the rear or intake extremity of a similar fixed portion 16 of the dual channel receiving trough from which the coiled springs are withdrawn for assembly purposes.

The hinged trough 14 and the fixed trough 16 are similar and each is provided with a right and a left spring receiving channel in parallel, closely spaced relation. In actual use, the two troughs have a total length of 30 feet.

The device is designed so that a coiled spring of substantially the length of the troughs will flow into one channel of the trough. When a predetermined length of this spring has been withdrawn for use, the hinged trough will automatically shift to receive a second spring in the other channel. When a predetermined length of the second spring has been withdrawn, the hinged trough will automatically shift back to receive a third spring in the first channel and this successive alternative production will continue as long as springs are withdrawn. The alternate shifting of the rear extremity of the hinged trough is a function of the spring coiling mechanism.

The spring coiling mechanism comprises an upstanding, rectangular fixed bearing plate 17, positioned substantially in the vertical plane of the troughs, unitarily mounted on a base plate 18. A hinged bearing plate 19 is pivoted at 20 on and along one edge of the base plate 18 and arises in substantially parallel relation to the fixed bearing plate 17. A first roller shaft 21 is mounted in two pillow-block-type bearings 22 which are secured by means of suitable bolts 23 to the forward face of its hinged bearing plate 19. A second roller shaft 24 is similarly mounted in similar bearings 25 which are secured by means of suitable bolts 26 to the forward face of the fixed bearing plate 17. The two shafts 21 and 24 lie in a common plane at right angles to the bearing plates and in parallel relation. They are caused to rotate in unison and in opposite directions by means of intermeshing spur gears 27, there being one gear fixedly mounted adjacent the rearward extremity of each shaft. The shafts are driven from a belt pulley 28 mounted on the rear extremity of the second shaft 24 to which power is supplied in any desired manner such as from an electric motor 11 through the medium of a transmission belt 29.

A shiftable wire gripping roller 30 is mounted on the forward extremity of the first shaft 21 and a second similar fixed wire gripping roller 31 is mounted on the forward extremity of the second shaft 24. The hinged bearing plate 19 is constantly urged toward the fixed bearing plate 17 by means of a compression spring 32 which surrounds a spring pin 33 which is hingedly secured to the fixed bearing plate as shown at 90 and extends through the hinged bearing plate and terminates in a spring compression adjusting nut 34. The thrust of the spring 32 urges the shiftable gripping roller 30 towards the fixed gripping roller 31 to grip the wire 12 therebetween so as to frictionally force the wire upwardly under

the influence of the upwardly rotating gripping rollers. The wire is guided between the wire gripping rollers by lower wire guide blocks 35 and is guided from the gripping rollers by means of upper wire guide blocks 36. The guide blocks 35 and 36 are attached to and supported from the fixed bearing plate in any desired manner and the guides as well as the gripping rollers are grooved to retain the wire in place therebetween.

The wire discharges from the upper wire guide blocks 36 into a guide groove 37 of a curling tool 38 attached to the bearing plate by means of a suitable toe clamp 74 and shown more in detail in FIG. 9. The upper extremity of the curling tool is curved in a semi-cylindrical spiral corresponding to the diameter and pitch of the desired spiral spring. The wire 12 is forced upwardly into the spiral guide groove 37, is contorted into a spiral form and exits from the curling tool at an angle to the incoming wire as a fully formed, continuous, rotating, spiral spring 13 which feeds into and along one of the channels of the hinged dual trough 14.

Since the gripping rollers operate continuously, means must be provided for separating the gripping rollers and stopping the production when a spring of the desired length has been produced. This is accomplished by the following elements.

A unitary multiple cam element having a hub 40, a relatively circular cam track 39, and an eccentric cam track 41 is fixedly mounted on the second roller shaft 24. The eccentricity of the eccentric cam track 41 is such that its largest diameter corresponds to the diameter of the large track 39 and its smallest diameter approximates the diameter of the hub 40 so that it will serve to lift a cam follower roller 42 from a retracted position in alignment with the hub 40 to a traveling position on the cam track 39, as shown in FIG. 7.

The cam follower roller is mounted on a cam arm 43 which is pivoted upon a pivot bearing 44 which allows the roller 42 to be swung back and forth between the traveling and retracted positions. The pivot bearing 44 is mounted on a head 45 on one extremity of an oscillating shaft 46 journaled in a shaft bearing 47 mounted on the fixed bearing plate 17. A bell crank lever 48 is mounted on the other extremity of the oscillating shaft 46 at the opposite side of the bearing 47 through the medium of a suitable retaining nut 49. The bell crank lever 48 is provided with a downwardly extending long leg 59 which is constantly pulled rearwardly by means of a tensioned return spring 75 and with a rearwardly extending cam lever 50 having a cam extremity 51 arranged to be swung downwardly, against the bias of the spring 75, into contact with a contact roller 52 mounted on the hinged bearing plate 19 to force the latter rearwardly to cause the shiftable gripping roller 30 to retract from the wire to relieve the friction thereon and stop the travel of the wire.

The cam lever 50 is swung downwardly to the position of FIG. 6 when the cam follower roller 42 is riding on the large circular cam track 39. If the follower roller 42 be swung to the right in FIG. 7, it will leave the track 39 and allow the return spring 75 to rotate the oscillating shaft 46 so as to swing the cam arm and its extremity 51 upwardly out of contact with the contact roller 52 so that the hinged bearing plate 19 will swing forwardly to bring the gripping rollers into driving engagement with the wire. A stop 94 on the base plate 18 limits the forward movement of the leg 59 to prevent the cam follower roller 42 from striking the hub 40. If the follower roller 42 be swung to the left, it will climb the eccentric cam track 41, against the bias of the spring 75, and ride on the large cam track 39, as shown in FIG. 7, thus swinging the cam arm extremity downwardly so as to contact the contact roller 52 to separate the gripping rollers and stop the travel of the wire.

The shifting or swinging of the follower roller 42 is accomplished through the medium of an electric solenoid 53 mounted on an L-shaped solenoid yoke 54 which is

in turn mounted on the head 45 of the rocker shaft 46. The plunger of the solenoid, indicated at 55, is connected to toggle element 56 which is tensioned between the cam arm 43 and the yoke 54. Thus, when the solenoid 53 is activated, the plunger will pull sidewise on the toggle element 56 shortening its effective length so as to instantly swing the cam arm 43 and its follower roller 42 to the right and away from the cam tracks 39 and 41. Thus, the wire will travel and the springs will form as long as the solenoid is energized and all production will stop when the solenoid is de-energized.

At the completion of each forming cycle, the wire is cut as it leaves the curling tool 39. The cutting is accomplished by means of a lower stationary shear blade 57 mounted on the bearing plate 17 by means of a suitable clamp 92 so that it will project upwardly into the spiral spring as the wire exits from the curling tool 38, and a movable upper shear blade 58 clamped to the cam arm 50 by means of a clamp member 89 so that when the cam arm swings downwardly to "stop" position of FIG. 6, the upper shear blade will be forced downwardly into shearing relation with the lower shear blade to sever the completed coiled spring.

Means are provided for shifting the receiving extremity of the hinged trough portion 14 to receive the next succeeding spring in a vacant channel. This is accomplished by pivotally connecting a pusher member 60 to the long leg 59 of the bell crank lever, as shown at 93, and extending the pusher member forwardly to actuate a rocking lever 61 alternately back and forth. The rocking lever is pivotally mounted at 62 and is provided with an upper push pin 63, projecting from the lever above the pivot 62 and a lower push pin 64 below the pivot 62. The pusher member 60 is formed with an upper pin socket 65, which aligns with the upper push pin 63 when the pusher member 60 is swung upwardly, and a lower pin socket 66 which similarly aligns with the lower push pin 64 when the pusher member is swung downwardly.

The pusher member 60 is swung upwardly and downwardly through the medium of a relatively light tension spring, which will be herein designated as the over-center spring 67, extending from the extremity of the pusher member 60 to the extremity of a spring arm 68 formed on the rocking lever 61 and projecting radially from the pivot 62 at right angles to the rocking lever 61. Thus, when the lever 60 is in the right hand position of FIG. 6, the spring 67 will urge the pusher member upwardly to align the pin socket 65 with the upper pin 63 so that when the long leg 59 swings to the left, when the cam follower roller 42 is released from the large cam track 39, the pusher member will push the upper extremity of the rocking lever 61 to the left. As the latter occurs the spring arm 68 will be forced downwardly until it passes the projected center line of the pusher member at which time the over-center spring 67 will snap the pusher member downwardly to align the lower socket 66 with the lower push pin 64 to be ready for returning the upper extremity of the rocking lever to the right.

The upper extremity of the rocking lever 61 is provided with an internally threaded stud 69 upon which a supporting bracket 70, which supports the rear extremity of the hinged trough portion 14, is mounted.

The rocking lever and its supported hinged trough portion 14 are snapped to and held in their extreme right and left positions by means of a relatively strong tension spring which will be herein designated as a dead-center spring 71. The dead-center spring is tensioned between a spring hanger 72 on the trough-supporting stud 69 and a stationary spring anchor 73 in the supporting stand 10. The anchor is positioned on diametric line through the pivot 62 intermediate the extreme positions of the rocking lever so that whenever the rocking lever is moved beyond the said diametric line or dead center, the dead-center spring 71 will rapidly continue the movement

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until stopped by a push pin engaging a receiving socket in the pusher member 60.

The spring arm 68 of the rocking lever 61 reciprocates between and alternately actuates two electrical "micro" switches, which will be designated as a right interlock switch 76 and a left micro interlock switch 77. The long leg, when forced to the stop position of FIG. 6, contacts and actuates a third micro-switch 78 mounted on the base plate 18. The long leg 59 also may be used to actuate a conventional counting device 79 to count the number of springs produced.

It can be seen from the above that each time the solenoid 53 is de-energized the gripping rolls will separate and release the wire, the wire will be sheared and the receiving trough will be shifted. The opening of the circuit to the solenoid must be made dependent upon the length of the springs desired and upon the withdrawal of the coiled springs for use.

The spring length is determined by the pre-setting of a conventional electrical timer 80 which breaks the solenoid circuit a pre-determined time interval after the close of the circuit. The timer is activated in consequence of withdrawal of a spring from one of the channels of the trough.

To accomplish this, a feeler mechanism 81, such as illustrated in FIGS. 3 and 5, is positioned on the fixed trough portion 14 adjacent the discharge extremity. The feeler mechanism comprises two similar devices, one being positioned over each channel of the fixed trough portion 15. Each device comprises a detect finger 82 pivoted at 85 and extending longitudinal of a trough channel toward the discharge extremity. Upward movement of the detect finger 82 actuates a limit switch 84 to open an electrical circuit to the solenoid 53. Each device also includes a relative small lifting solenoid 83 the plunger of which is connected to the finger 82 to lift the latter when the solenoid is energized. The solenoids 83 are in the circuit of the control solenoid 53 so that as soon as the solenoid 53 is energized to start production, the lifting solenoids 83 will lift the detect fingers 82 out of the way so that the incoming coiled spring can pass without interference. As soon as the cycle is completed, the de-energization of the control solenoid 53 will also de-energize the lifting solenoids 83 dropping the detect fingers 82. If a spring is in place in each trough channel the limit switches 84 will be held open. If a spring be missing in either channel, the detect finger in that channel will drop sufficiently to allow its limit switch to close a circuit to the control solenoid 53 and the timer 80 to initiate another cycle. The new cycle cannot start, however, until one of the interlock switches 76 or 77 and the cycle completion switch 78 have closed to complete the previous production cycles.

Let us assume that each trough channel contains a completed spring and that a cushion assembler is located at the discharge extremity of the fixed trough portion 16. The detect fingers 82 of both channels are resting upon the completed springs 13, as shown in FIG. 5 and are maintaining their respective limit switches open to break the circuit to the timer 80 and the winding mechanism is in the "stop" position of FIG. 6 with the wire gripping rollers 30 and 31 rotating in spaced relation to the wire 12.

The assembler gradually draws a spring from a channel and simultaneously assembles the spring in a cushion. When the spring has been withdrawn through the feeler mechanism 81 of that channel, the detect finger 82 of that channel will drop and close its limit switch 84 to complete a circuit 86 through the cycle completion switch 78 to the timer 80. The timer closes a circuit 87 to the control solenoid 53. The latter solenoid will actuate the toggle element 56 to withdraw the cam follower roller to a position over the small cam track 40 allowing the two gripping rollers to grip the wire and initiate spring production.

Simultaneously a circuit 88 will be closed through one

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of the interlock switches 76 and the lifting solenoid 83 of the empty channel to lift the detect finger 82 therein to allow the spring being formed to pass therebeneath. When the new spring has reached a predetermined length, the timer will de-energize the solenoids 53 and 83 stopping the production until the spring in the second channel has been withdrawn for use at which time the detect finger in the second channel will initiate another cycle of operation to place a second spring in the second channel. This alternate filling of the channels continues as long as springs are withdrawn.

While a specific form of the improvement has been described and illustrated herein, it is to be understood that the same may be varied within the scope of the appended claims, without departing from the spirit of the invention.

Having thus described the invention what is claimed and desired to be secured by Letters Patent is:

1. Means for forming elongated cylindrical, helically-coiled, wire springs comprising: a fixed wire gripping roller; a movable wire gripping roller; spring means urging said movable roller towards said fixed roller to grip a spring wire therebetween; a curling tool having a helical conformation conforming to the diameter and pitch of the desired springs; means for driving said rollers to continuously force said wire into said curling tool to form the wire into the form of a rotating, elongated, cylindrical, helical spring as it exits from said curling tool; a movable bearing support for said movable roller; a fixed bearing support for said fixed roller; a cam lever pivotally mounted on said fixed bearing support and positioned to swing against an abutment on said movable support to urge said movable support away from said stationary support at the termination of a formed spring; a fixed shear blade mounted on said fixed bearing support adjacent the exit of the wire from the curling tool; and a movable shear blade mounted on said cam lever in shearing relation to said fixed shear blade so that when said cam lever moves into roller-separating relation with said abutment said wire will be sheared from the formed spring.

2. Means for forming elongated cylindrical, helically-coiled springs comprising: a fixed wire gripping roller; a movable wire gripping roller; spring means urging said movable roller towards said fixed roller to grip a spring wire therebetween; a curling tool having a helical conformation conforming to the diameter and pitch of the desired springs; means for driving said rollers to continuously force said wire into said curling tool to form the wire into the form of a rotating, elongated, cylindrical, helical spring as it exits from said curling tool; means for severing the wire from the formed spring; a movable bearing support for said movable roller; a fixed bearing support for said fixed roller; a cam lever pivotally mounted on said fixed bearing support and positioned to swing against an abutment on said movable support to urge said movable support away from said stationary support at the termination of a formed spring; a cam rotatable in unison with said fixed wire gripping roller; a cam follower arm connected to said cam lever and riding upon said cam and acting to maintain said cam lever in roller-separating contact with said abutment; and means for withdrawing said cam follower from the path of said cam to allow said spring means to move said movable roller toward said fixed roller to grip said wire therebetween.

3. Means for forming springs as described in claim 2 having a rocker shaft rotatably mounted in said fixed bearing support, said cam lever being fixedly mounted adjacent one extremity of said rocker shaft to provide a pivot for said lever and a yoke fixedly mounted on and adjacent the other extremity of said rocker shaft, said cam follower being pivotally mounted on said yoke on an axis at right angles to the axis of said rocker shaft as to swing in a plane parallel to the axis of said rocker shaft to enable said follower to depart from the path of said cam.

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4. Means for forming springs as described in claim 3 in which said cam has a relatively large diameter concentric cam track; and an eccentric cam track whose point of greatest eccentricity corresponds to the diameter of said concentric track so that when said cam follower is drawn away from the path of said concentric cam track it will cross said eccentric cam track and permit working engagement of said means for forming and when released will travel onto and be lifted by said eccentric cam track to the large diameter cam track resulting in disengagement of said means for forming.

5. Means for forming springs as described in claim 3 having an electric solenoid fixedly mounted on said yoke with its plunger operatively connected to said cam

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follower so that when said solenoid is energized said plunger will withdraw said cam follower from the path of said concentric cam.

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