July 26, 1927. 1,636,689

S. H. HARTSHORN

APPARATUS FOR WINDING SPRINGS

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Fig. 1

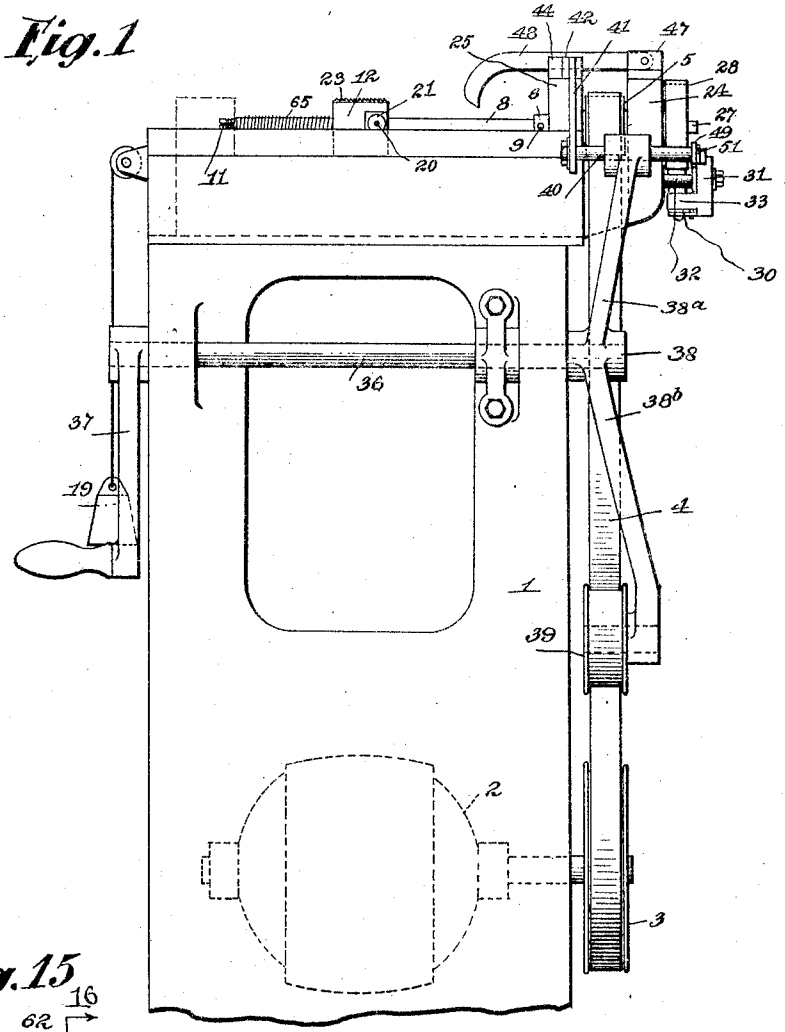
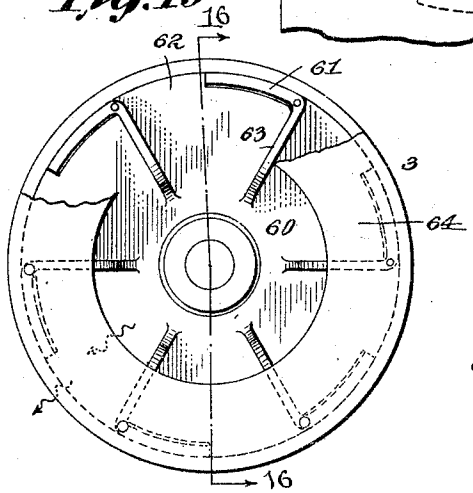


Fig. 15



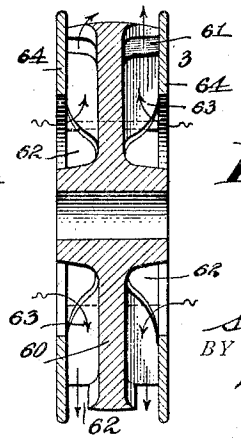


Fig. 16

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APPARATUS FOR WINDING SPRINGS

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Fig. 2

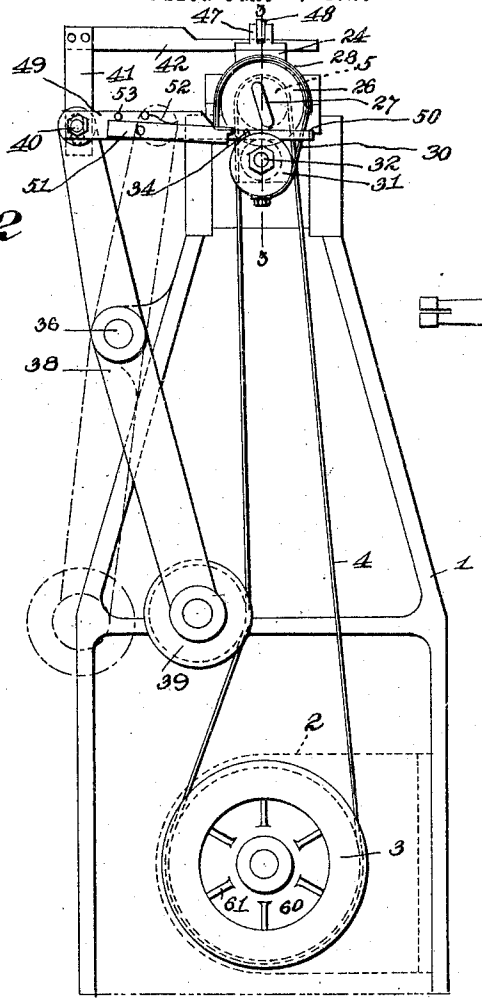


Fig. 17

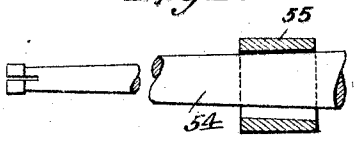


Fig. 9

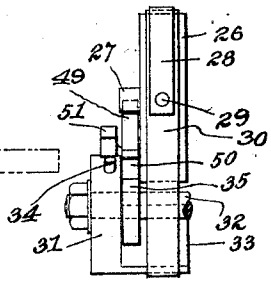


Fig. 8

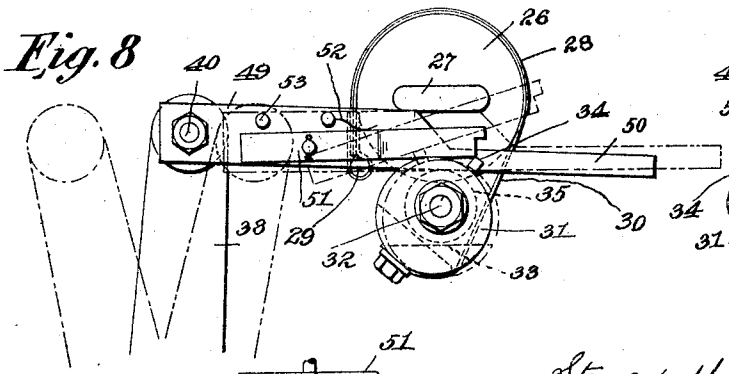


Fig. 10.

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S. H. HARTSHORN

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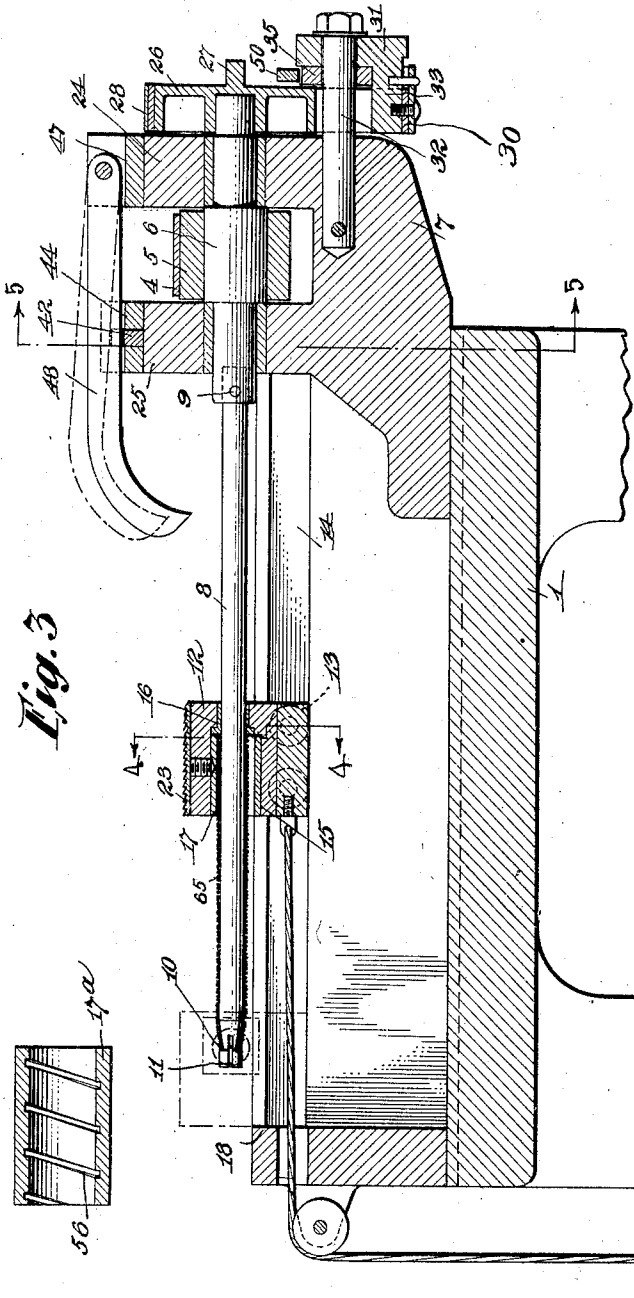


Fig. 3

Fig. 11

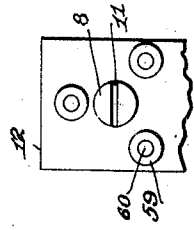


Fig. 14

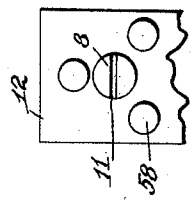


Fig. 13

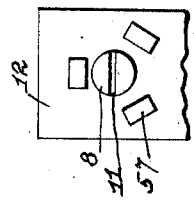


Fig. 12

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APPARATUS FOR WINDING SPRINGS

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Fig. 4

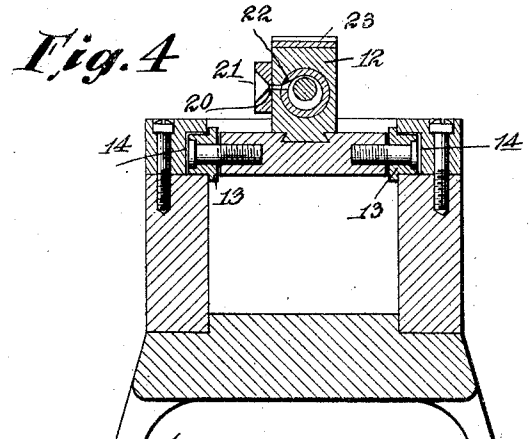
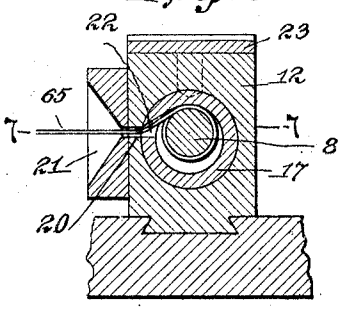


Fig. 6



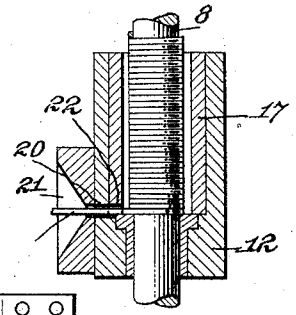


Fig. 7

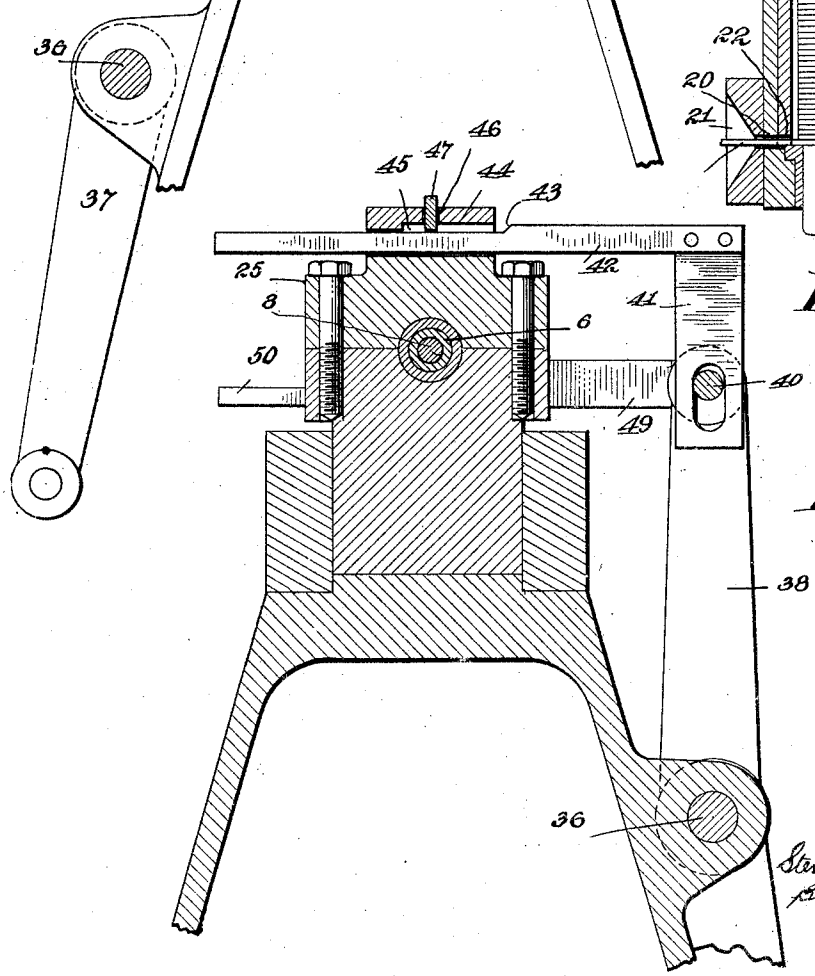


Fig. 5

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Patented July 26, 1927. 1,636,689

UNITED STATES PATENT OFFICE.

STEWART H. HARTSHORN, OF SHORT HILLS, NEW JERSEY, ASSIGNOR TO STEWART HARTSHORN COMPANY, OF EAST NEWARK, NEW JERSEY, A CORPORATION OF NEW JERSEY.

APPARATUS FOR WINDING SPRINGS.

Application filed June 6, 1925. Serial No. 35,268.

The invention relates to apparatus for winding spiral springs, and has for its objects the production of a device in which the spring when formed, will be of uniform volume or mass; in which all springs will be of uniform length; in which the spring will not be distorted as to diameter; in which the stock will be completely wound, the last convolution being true; in which waste will be eliminated; in which the speed of production will be increased; in which the material to be acted on will function as a part of the apparatus; to correct errors in the material; which will be cheap to construct, economical to operate, and which will be of strong and rugged construction.

These and further objects will more fully appear in the following specification and claims, and in the accompanying drawings, considered together or separately.

One embodiment of the invention is illustrated in the accompanying drawings in which like parts in all of the several figures are designated by similar characters of reference, and in which

Fig. 1 is a side elevation of the apparatus.

Fig. 2 is an end elevation of the same.

Fig. 3 is a longitudinal section, on an enlarged scale, taken on the line 3—3 of Fig. 2.

Fig. 4 is a transverse section on the line 4—4 of Fig. 3.

Fig. 5 is a transverse section on the line 5—5 of Fig. 3.

Fig. 6 is a detail sectional view, on a much enlarged scale, of the winding head.

Fig. 7 is a horizontal section taken on the line 7—7 of Fig. 6.

Fig. 8 is an end elevation of the braking and locking mechanism.

Fig. 9 is a side elevation of the same.

Fig. 10 is a plan view of the bolt-pawl.

Fig. 11 is a sectional view of a modified form of winding bushing.

Fig. 12 is a detail view of a modified form of winding head.

Fig. 13 is a similar view of a further modification.

Fig. 14 is a similar view of another modification.

Fig. 15 is a front elevation of a ventilating pulley.

Fig. 16 is a section on the line 16—16 of Fig. 15, and

Fig. 17 is a diagrammatic view of a modified form of mandrel and bushing.

In the embodiment of the invention illustrated, 1 designates a frame of any suitable construction on or within which is mounted a motor 2 the shaft of which carries a pulley 3 over which passes a belt 4 which latter passes over and drives a pulley 5 on a spindle 6 the latter being journalled in a bearing head 7 carried on the frame, and at a distance from the motor.

Projecting from one end of, and in axial alinement with, the spindle 6 is a mandrel 8 of any suitable length and configuration. One end of the mandrel is preferably secured within a socket in the spindle by means of a pin 9 or the like, whereby the mandrel will be removable. The mandrel extends along the top of the frame toward the end thereof opposite the head 7 and its free end is preferably provided with a shoulder 10 and with a short longitudinal slot 11, the inner end of the slot being inside the shoulder.

The mandrel has a bearing 16 in a carriage 12 adapted to slide along the frame longitudinally of the mandrel. The slide is preferably carried on rollers 13 traveling within guides 14, as shown in Fig. 4.

In winding a spring upon the mandrel, the wire is preferably maintained under tension during its application with the mandrel to thereby insure the production of a completed spring which is uniform throughout its length. This end is accomplished in my invention by providing in combination with the mandrel, a spring engaging element which is substantially tangential to the spring on the mandrel at the point of application of the wire to thereby frictionally engage the rotating spring and limit its recoil. In the embodiment illustrated, the carriage is provided with an internal cavity or socket 15 within which is positioned a suitable hardened bushing 17 with its inner surface adapted to frictionally engage a spring upon the mandrel along its length and particularly at the point of engagement of the wire with the mandrel to thereby limit the recoil of the spring and maintain the same under tension during the process of winding. To reduce the generation of heat and the wear and tear on both the spring and the bushing 17, the latter is preferably arranged eccentric to the mandrel so that

its engagement with the spring is thus limited to a comparatively narrow strip longitudinally of the spring, such a strip including the point of application of the wire to the mandrel. When the bushing 17 is so arranged eccentric to the mandrel, the cavity 15 is suitably made cylindrical and similarly eccentric to the mandrel to thus make possible the use of a standard cylindrical bushing as the braking element.

The carriage 12 will be held normally in engagement with the end wall 18 of the frame and during the winding of the spring the bearing block 16 will be held in close engagement with the wire as it is fed to the mandrel, by means of a suitable resistance retarding the advanced movement of the carriage. Herein, I have illustrated this resistance as a suitable weight 19 of mass sufficient to strip the spring from the mandrel upon its completion and upon the interruption of the rotation of the mandrel.

The carriage 12 is provided with a suitable lateral horizontal perforation 20 through which the wire is fed to the mandrel 8 and a funnel shaped mouth 21 facilitates the insertion of a wire therein. Corresponding to this perforation 20 in the carriage wall, a similar opening or notch 22 is formed in the bushing 17, the two openings being in alinement.

In order to further insure the maintenance of the wire under tension and particularly at the moment it engages the mandrel, the bushing 17 is made eccentric to the mandrel so as to engage the spring at the top of the mandrel, and the upper wall of the notch 22 is preferably inclined upward so as to be substantially tangential to the bore of the bushing 17 at the top of the latter, as shown in Figs. 4 and 6. With this arrangement, the friction of the wire against the wall of the perforation 20 and the inclined face of the notch 22 further insures the production of a tightly wound spring.

Carried on the top of the carriage is a plate 23 the upper surface of which is formed of ratchet teeth the vertical faces of which face the free end of the mandrel.

The spindle 6, in the embodiment of the invention illustrated, is journaled in two spaced bearings 24 and 25 with the pulley 5 between the bearings.

On that end of the spindle opposite the mandrel, and outside of the bearing 24, is a brake drum 26, and the outer face of the drum is provided with an integral lug 27. Said lug is arranged diametrically of the drum and at the center thereof but preferably does not extend entirely across the same.

An elastic metal band 28 secured to a pin 29 extending from the head 7 encircles the upper part of the brake drum, and is provided with a brake lining preferably in the form of a rawhide strap 30 secured to the inner side of the band. One end of the band is free and the strap extends beyond the free extremity thereof and its end is secured to a tightening device. The tightener, in the embodiment of the invention illustrated, comprises an eccentric 31 freely rotatable on a pin 32 carried by the head 7, and the end of the strap 30 is secured to the member 31 at its point of greatest eccentricity, and said point is weighted as by means of a relatively heavy lug 33 whereby the lug will normally hang down, the elasticity of the band 28 holding the lining 30 away from the drum 26.

The eccentric carries a stop 34 projecting from its surface a short angular distance from the shortest radius of the eccentric.

The pin 32 is mounted directly below the spindle 6, is parallel thereto and projects beyond the outer face of the brake drum 26, and carries a roller 35 positioned between the eccentric and the face of the drum, as shown in Fig. 3.

Carried in bearings on the frame and extending longitudinally thereof is a shaft 26 carrying on its end adjacent the belt 4 a lever 38 having a pair of outwardly extending arms 38^a and 38^b, and on its opposite end a crank handle 37. The arm 38^a carries a jockey pulley 39 adapted to cooperate with the belt 4 and thereby provide a driving connection between the motor 2 and the spindle 6.

The opposite arm 38^b of the lever carries a pin 40 projecting outwardly on both sides of the arm. Carried on the pin and at one side of the arm is a bar 41 having a right angled extension 42 having a cam surface 43 and projects across and rests upon the head bearing 25. The extension is retained in position by means of a housing 44 secured to the top of the bearing. The housing has a longitudinal groove 45 through which the extension is adapted to move and said groove has a portion of greater depth to accommodate the cam portion of the extension. The housing is also provided with a slot 46 extending at right angles to the groove 45 and allowing communication with the latter from above the housing. The slot 46 is preferably in the longitudinal center of the frame and parallel to and above the spindle 6.

Pivoted in a block 47 on the bearing 24 is an elongated hook 48 which extends over the bearing 25, is guided in the slot 46 and rests upon the extension 42. The free end of the hook is disposed in the path of the carriage 12 and when the latter is below the hook its tip will engage, by gravity, the teeth on the plate 23 and prevent movement of the carriage under the influence of the weight 19.

Pivoted to the opposite end of the pin

40 is a bolt 49 which extends across the face of the brake drum 26 and below the lug 27. The bolt has an extension 50 of less height than the body of the bolt, and an inclined face joins the two. The bottom of the bolt rests upon the roller 35, and pivoted to the bolt is a pawl 51. The end of the pawl is adapted to engage the stop 34 whereby tightener 31 may be rotated to shorten up on the strap 30 to apply the brake to the drum and retard the rotation of the spindle 6. The pawl is normally pressed downward by a light spring 52 carried by the bolt, and a pin 53 also carried by the bolt, limits such movement.

In the embodiment of the invention illustrated the apparatus is shown as adapted to wind a closed spring of flat wire such as is employed in spring shade-rollers. Such a spring is, when completed, of substantially cylindrical form from end to end, but it is to be understood that by employing a mandrel of a form other than cylindrical, springs of different shapes may be wound. In Fig. 17 is shown, diagrammatically, a form of mandrel and bushing whereby a tapered, or conical, spring may be formed. The mandrel 54 is tapered and the bore of the bushing 55 is tapered correspondingly.

By providing a female thread 56 in the bore of the mandrel, as shown in Fig. 11, open springs may be wound, the pitch of the thread determining the space between the convolutions of the spring. The thread may be cut around the entire bore of the bushing, but obviously the threads may be in the upper part only, and the lower portion may be cylindrical.

In the modifications illustrated in Figs. 12, 13 and 14, the bushing may be dispensed with, and pins or the like, eccentrically disposed relatively to the mandrel, may project from the face of the bearing 16. In Fig. 12 the pins 57 are shown as of rectangular cross-section. Fig. 13 shows the pins 58 cylindrical and Fig. 14 shows rollers 59 carried on pins 60.

In Figs. 15 and 16 is illustrated a form of drive pulley particularly adapted in the situation here presented. In the embodiment of the invention, in order to produce speed in production, the motor should run at high speed and, as the drive pulley must often rotate relatively to the belt when the jockey pulley is off there will be friction between the belt and pulley when the jockey is off and this friction will be increased when the jockey is applied and until the drive pulley takes hold, and the heat engendered by such friction would quickly destroy the belt. To obviate this danger the pulley is not only ventilated but acts as a blower to draw in cool air and blow it against the rim and against the inner side of the belt whereby the pulley as well as the belt will be kept cool at all times during the operation of the apparatus.

The pulley comprises an unperforated web 60 connecting the hub and rim 61, the latter having gaps 62 at intervals and on both sides of the web. On each side of the web is arranged a series of vanes 63, which do not extend to the hub, and an annular cheek plate 64 is secured to each edge of the rim. The cheek plates are of greater diameter than the rim of the pulley and form flanges therefor. Obviously the said plates may be of the same diameter as the edges of the rim and form part of the pulley surface.

In operation air will be drawn in through the openings in the cheek plates, and discharged through the gaps 62 against the belt.

The operation of the device, as a whole, is as follows:—

When the apparatus is at rest with the motor running, the jockey will be swung away from the belt. The bolt 49 will be under the lug 27 to hold the same in its horizontal position and prevent rotation of the spindle 6. The high part of the extension 42 will be beneath the hook 48 to sustain the latter in position out of the path of the carriage, as shown in dotted lines Fig. 3. The weighted end of the eccentric 31 will hang plumb and the elasticity of the band 28 will release the brake band from the drum, as shown in Fig. 2.

The mandrel is positioned with the slot 11 always in line with the lug 27 whereby, when at rest, the said stop will be horizontal, as shown in Fig. 3.

The carriage 13 will be moved by the weight 19 to its stopped position against the wall 18, as shown in dotted lines Fig. 3, and the perforation 20 therein will be in line with the slot 11 and back of the shoulder 10 of the mandrel.

The operator will insert the end of a length of wire 65 in the perforation 20, the funnel 21 acting as a guide, until it is stopped by engagement with wall on the opposite side of the bushing 17. The wire has been cut the exact length necessary to form a spring of the length and diameter desired. The diameter of the wire is such that it will bear against the inner wall of the notch, and the inner face of the bearing block 16.

The fact that the carriage is fed toward the head 7 by the accumulation of convolutions on the mandrel will automatically correct errors of wire. The wire, which may be of any desired cross section, will always be wound on the mandrel, within the limits of the plate 23. Should the wire be rolled thinner in spots a shorter spring will result. Should the average thickness of the wire be greater than its supposed

gauge, a longer spring will result, but in all cases the wire will be wound out to the end.

The operator will now throw the handle 37 in the direction to engage the jockey 39 with the belt 4 to tighten the same on the pulleys 3 and 5. The early part of the movement of the lever 38 carrying the jockey, will withdraw the cam of the extension 42 from beneath the hook 48 and the latter will fall to its normal position with its point in the path of travel of the serrated plate on the carriage. At the same time the bolt 49 will be withdrawn from below the lug 27. The continued movement of the jockey will tighten the belt on the pulleys and the spindle and mandrel will be rotated at a high rate of speed.

The rotation of the mandrel will wind the strip of spring metal thereon in a spiral. The first convolution will be jammed between the shoulder 10 and the inner face of the bearing 16 and the shoulder being stationary as regards linear movement, the carriage will be moved toward the head 7 as the mandrel rotates and convolutions are added to the spring. The friction of the wire against the wall of the perforation 20 and the inclined wall of the notch 22 will cause the wire to be wound tightly on the mandrel, and the last convolution will be exactly like those preceding it and there will be no tangential end as is usual.

Before all of the wire is wound on the mandrel the carriage 12 will be beneath the hook 48. After the end of the wire disappears in the opening 20, the operator will swing the handle to release the jockey from the driving belt. This movement will also cause the hook 48 to drop into engagement with the plate 23 to hold the carriage against the pull of the weight 19, the brake will be applied to the drum 26 to retard the rotation of the spindle 6 and mandrel, the bolt 49 will be shot across the face of the drum and the lug 27 will engage the top of the bolt when it reaches the horizontal position, the spindle and mandrel will be locked against rotation, and the spring being freed of the frictional restraint will recoil from the mandrel but the recoil will be arrested by the bushing 17, the diameter of the bore of which is slightly less than the recoil limit of the spring. The spring will thus be released from its tight contact with the mandrel.

The continued movement of the handle 37 will move the cam 43 on the extension 42, under the hook and release the same from the carriage and the weight 19 will pull the carriage toward the front of the frame, and the spring will be stripped from the mandrel and ejected from the bore of the carriage.

The rotation of the parts having been stopped with the lug 27 in its horizontal position, the slot 10 at the free end of the mandrel will be horizontal and in line with the feed hole in the carriage. The device is now in position to repeat the operation. A new wire is inserted as before, the handle 37 is swung in the opposite direction, the hook 48 drops, the bolt 49 is withdrawn, the brake is released, the jockey tightens the belt and the operation is repeated.

The operation of the braking and locking mechanism is as follows:—

The bolt 49 pivoted on the pin 40 rests upon the roller 35 and its lower extension extends across the face of the drum 26 below the path of the lug 27. As the handle is swung to release the jockey from the belt, the bolt 49, and the pawl 51 carried thereby, are moved to the right in Figs. 2 and 8. The end of the pawl engages the stud 34 and turns weighted eccentric 31 in the clockwise direction to apply the brake band to the drum and retard the rotation thereof. The high part of the bolt 49 will come into the path of the lug 27 and lock the spindle against rotation. During this movement the pawl will ride up on the eccentric and its end will be released from the stud, whereupon the weighted lower portion of the eccentric will swing around in the anti-clockwise direction, the stud 34 raising the pawl against the spring 52, the eccentric will swing to its plumb position and the brake will be released.

On the reverse movement of the handle the bolt will be withdrawn, the belt will be tightened, the pawl will assume its initial position and the operation of winding will be resumed.

In order to adapt my invention, as particularly represented by the above described device, for use in the winding of open springs I have formed the restricting eccentric bushing 17 with a spiral groove formed in its inner wall, the spiral having a form corresponding to the particular shape and spacing of the spring desired. Details of the construction of such a bushing are shown in Fig. 11 in which a bushing 17^a is provided with a spiral groove 56 cut or otherwise formed in its inner wall, the spacing of the convolutions of the spiral 56 corresponding to the pitch of the particular spring desired. The depth of the groove 56 will preferably be made somewhat less than the diameter of the wire so that the latter will be wound tightly upon the mandrel and its recoil limited.

Instead of the threaded device of Fig. 11, any other means of changing the angle of incidence of the wire relatively to the axis of the mandrel, may be employed.

In accordance with the provisions of the patent statutes the principle of the invention has been described, together with the apparatus which is now considered to represent the best embodiment thereof, but it is de-

sired to have it understood that the apparatus shown is merely illustrative, and that the invention may be carried out in other ways.

The invention having been described what is claimed as new and desired to be secured by Letters Patent of the United States, is—

1. In a device of the character described, the combination with a supporting framework, a rotatable mandrel journalled therein and driving means for the mandrel, of a travelling carriage adapted to advance parallel to the mandrel upon the winding of a spring upon the latter, and means arranged eccentric to the mandrel and frictionally engaging a spring along its length while on the mandrel.

2. In a spring winding device, the combination with a rotary arbor and actuating means therefor, of a carriage slidable longitudinally of the arbor and means on the carriage tangential to a spring on the mandrel and frictionally engaging the spring at the point of engagement of the wire with the arbor to limit its recoil and maintain the wire under tension.

3. In a spring winding device, the combination with an arbor for receiving the spring, and means for rotating it, of a carriage surrounding the arbor and adapted to be moved parallel to the latter, the carriage having an entrance through which the wire is passed to the arbor, and a wire braking element carried eccentric to the arbor by the carriage whereby wire wound on the arbor is maintained under tension.

4. In a spring winding device, the combination with a movable chambered carriage having an interior annular shoulder and an entrance for a wire adjacent the latter, of a rotatable mandrel extending axially through the carriage, and a bushing carried within the chamber of the carriage eccentric to the mandrel for limiting the recoil of the spring on the mandrel.

5. In a spring winding apparatus, the combination with a rotatable arbor, of a carriage guided thereon having an interior recess larger than the arbor provided with an entrance for a wire adjacent the inner end of the recess, and a bushing within the recess surrounding the arbor having a wire guiding channel, the disposition of the wire entrance and bushing being such that the wire is wound upon the arbor in accordance with the channeled path.

6. In a spring winding machine, the combination with a rotary arbor and means for driving the same, of a carriage movable along the arbor in timed relation to the development of the spring, a clamping member cooperating with the wire on the arbor to restrict the recoil of the wound spring, a resistance for returning the carriage to the starting position, a gripping device for holding the carriage against the action of the resistance after a given length of wire has been fed to the arbor, and means for arresting the rotation of the arbor and releasing the gripping device.

7. In a machine for winding springs of a given length, the combination with an arbor for receiving a spring, a source of power, and actuating connections between said parts, of a guide sliding in a path parallel to the arbor, the engagement of the wire with the latter serving to move the guide, restricting means carried by the guide for limiting the recoil of the spring on the arbor, means resisting the advance of the guide and automatically returning it to the starting position, a gripping device for retaining the guide at the end of its advance movement, stop mechanism for retarding and arresting the rotation of the arbor, and a release for the gripping device operated by the stop mechanism upon interruption of the arbor rotation.

8. In a machine for winding springs of a given length, the combination with an arbor, a source for rotating it, and a carriage actuated longitudinally of the arbor by the engagement therewith of a wire being wound on the arbor, a means on the carriage cooperating with the wire on the arbor to restrict the recoil of the spring wound thereon, means for holding the carriage upon reaching the limit of its movement upon finishing the winding of a spring, a lever for temporarily disengaging the arbor actuating connections, a brake for successively retarding and arresting the rotation of the arbor actuated by the movement of said lever, means for releasing the carriage actuated upon the arrest of the arbor, and a tension device for automatically returning the carriage to its starting position.

9. Spring winding apparatus, comprising a spindle, means for rotating the same, a mandrel carried by and in axial alinement with the spindle, a carriage, a bearing for the mandrel carried by the carriage, there being a cylindrical chamber in the carriage, said chamber being eccentric to the bearing the mandrel extending through the chamber, a lining for the chamber, there being a longitudinal kerf in the free end of the mandrel, a lug carried by the spindle and extending diametrically thereof, the length of the lug being in the same diametrical plane as the kerf in the mandrel, a member adapted to engage beneath the lug to arrest rotation of the spindle and mandrel, there being an opening in the carriage and lining, said opening being so positioned that when the lug is in engagement with the member the slot and opening will be in lateral alinement.

10. Spring winding apparatus, comprising a spindle, means for rotating the same,

a mandrel carried by and in axial alinement with the spindle, a carriage, a bearing for the mandrel carried by the carriage, there being a cylindrical chamber in the carriage, said chamber being eccentric to the bearing, the mandrel extending through the chamber, a lining for the chamber, there being a longitudinal kerf in the free end of the mandrel, a brake drum on the spindle, a brake band cooperating with the drum, a lug on the end of the drum and extending diametrically thereof, the length of the lug being in the same diametrical plane as the kerf in the mandrel, means for applying the band to the drum to retard the movement thereof, a member adapted to engage beneath the lug to arrest rotation of the spindle and mandrel, there being an opening in the carriage and lining, said opening being so positioned that when the lug is in engagement with the member the slot and opening will be in lateral alinement.

11. In a spring winding device, the combination with a rotary mandrel supported with one end free and adapted to receive a wire at its free end and means for rotating it, of a guide actuated longitudinally of the mandrel by the engagement therewith of the wire fed on the mandrel, a means resisting the advance of the guide and automatically returning it to the starting position upon the completion of a predetermined length of spring, the return movement of the guide stripping the spring from the mandrel.

12. In a spring winding device, the combination with a rotatable arbor supported with one end free and adapted to receive the end of a wire at its free end and a source of power for rotating it, of a carriage driven along the arbor by the engagement therewith of a wire being fed on the arbor, means for interrupting the rotation of the arbor upon the completion of a given length of spring, and a means resisting the advance of the carriage and serving to automatically effect its return to the starting position upon the completion of its advanced movement.

13. In a spring winding device, the combination with a supporting framework, a rotatable arbor slotted at one end to receive a wire and journalled in the framework with its slotted end free, a source of power and actuating connections between the source and the arbor, of a carriage actuated along the arbor by the engagement therewith of a wire fed to the arbor, its starting position being adjacent the free slotted end of the arbor whereby a wire fed through the carriage engages the slotted end, stop mechanism for temporarily disengaging the arbor actuating connections, and a tension device for automatically returning the carriage to its starting position upon the completion of its advanced movement and the interruption of the arbor rotation.

This specification signed this first day of June, 1925.

STEWART H. HARTSHORN.