C. WRIGHT, JR.

WIRE COILING MACHINE.

APPLICATION FILED JAN. 10, 1910.

963,197.

Patented July 5, 1910.

3 SHEETS—SHEET 1.

Fig. 1.

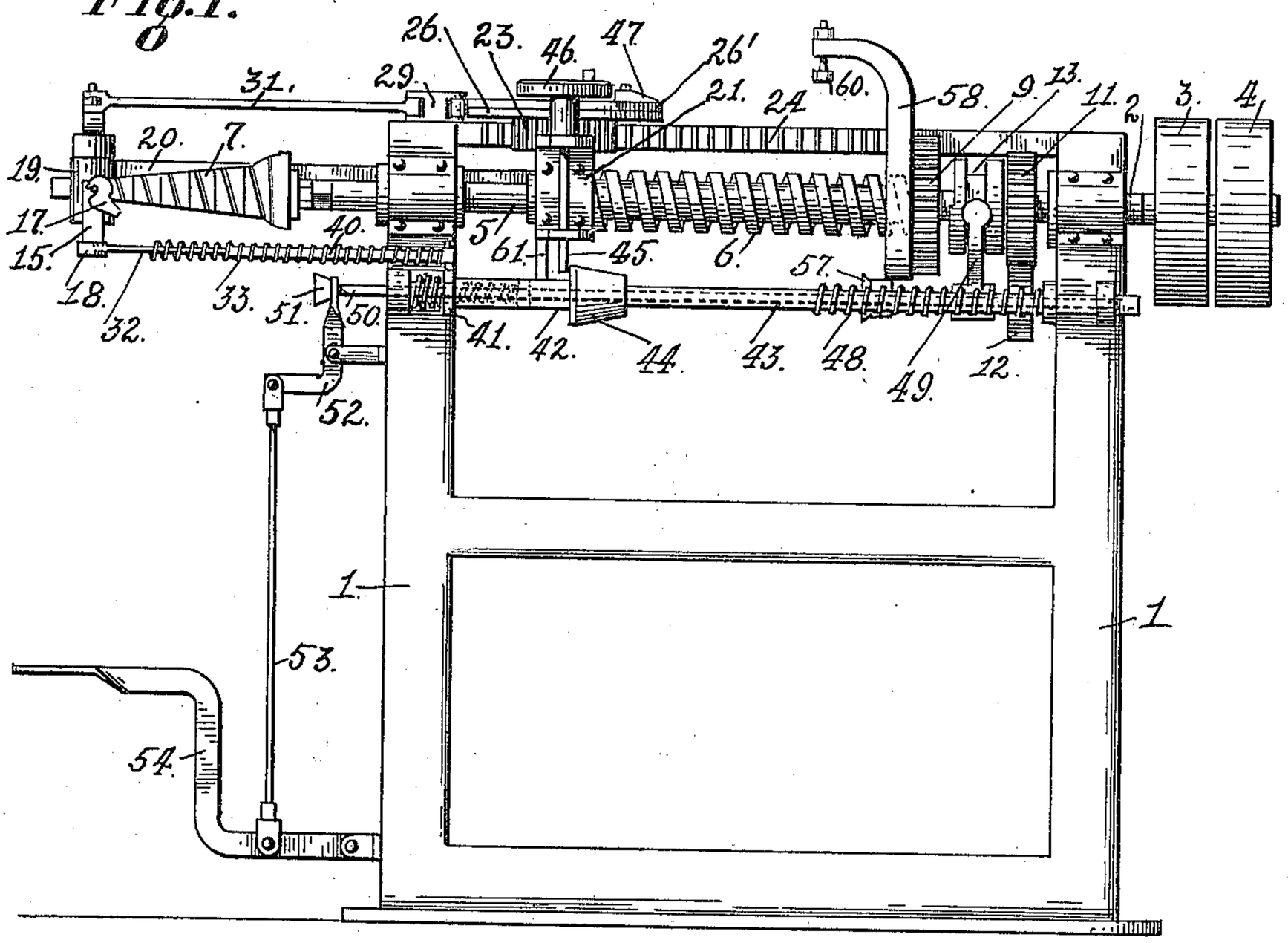
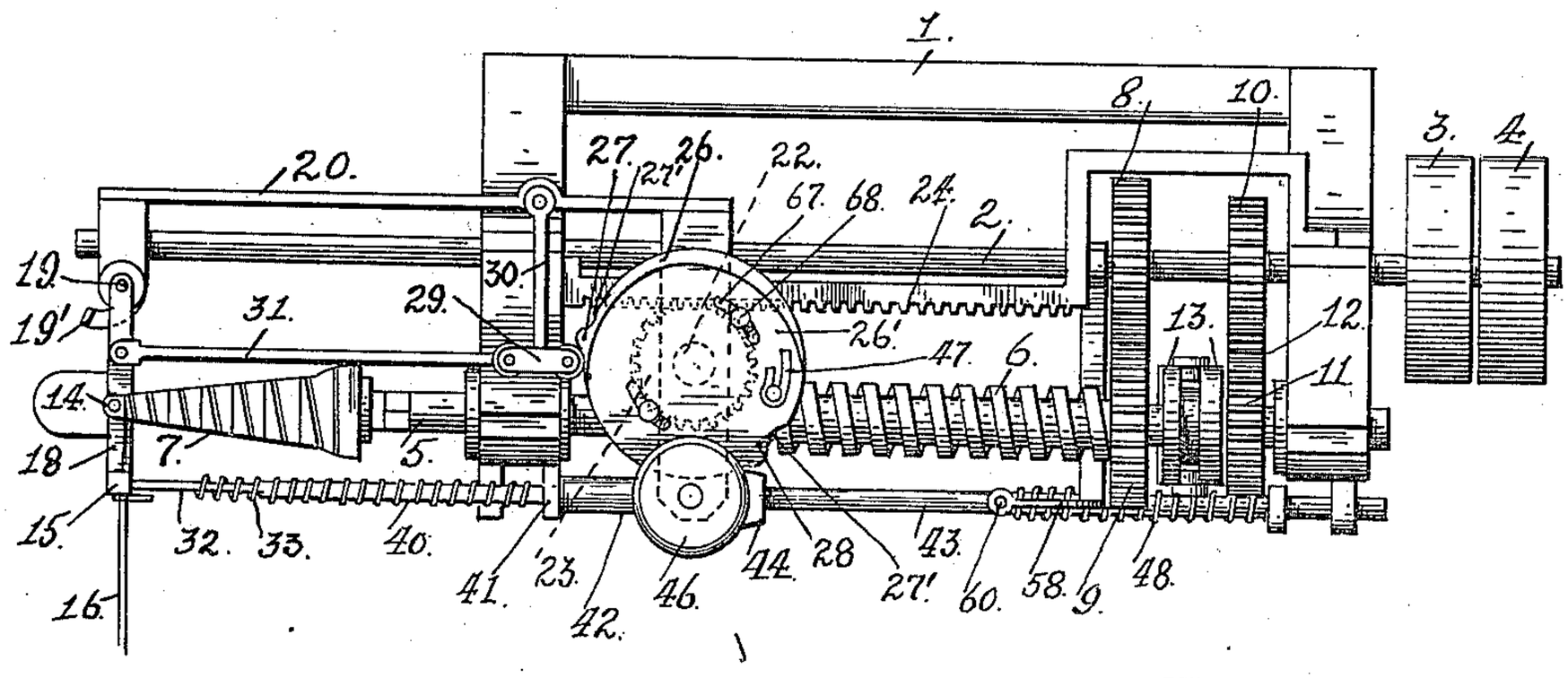


Fig. 2.



WITNESSES.

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3 SHEETS—SHEET 2.

Fig. 3.

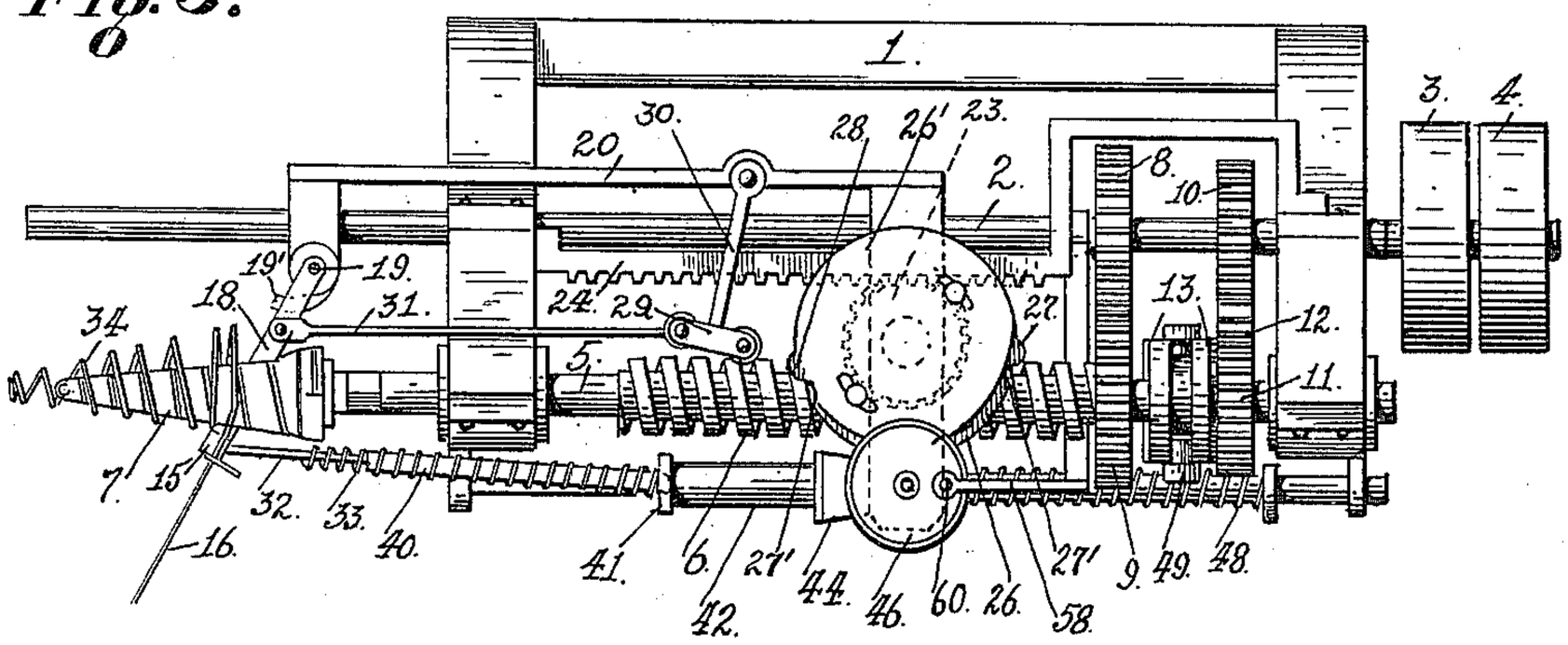


Fig. 4.

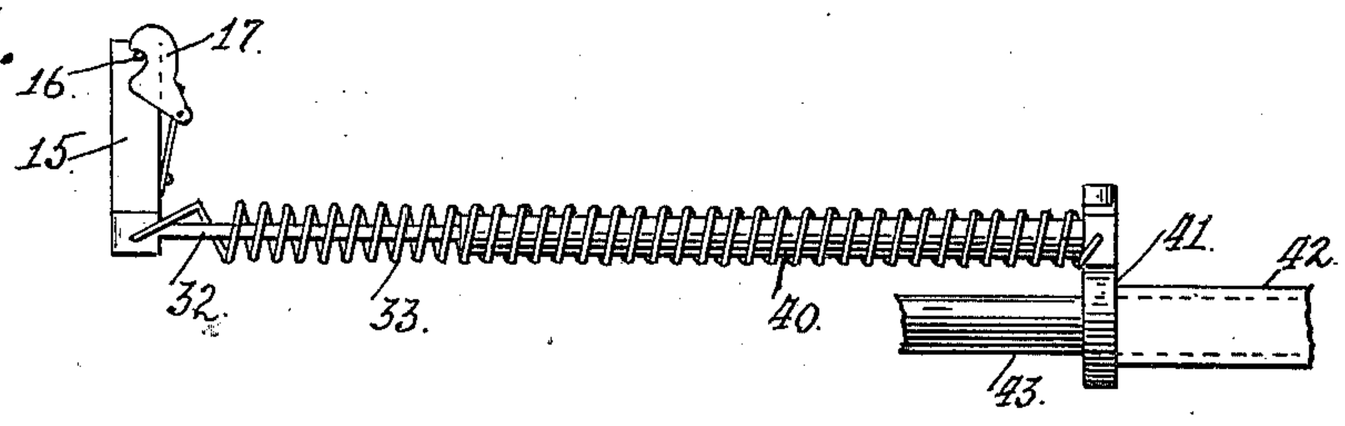
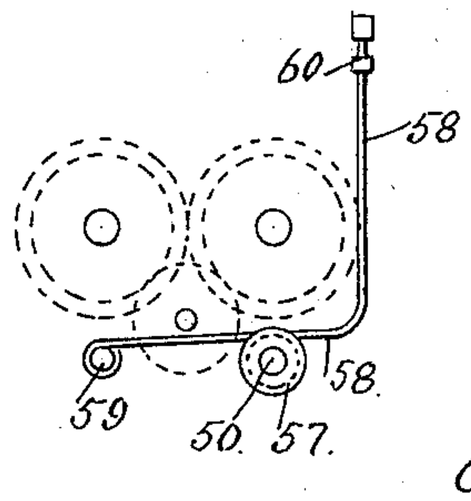


Fig. 5.

Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 7.

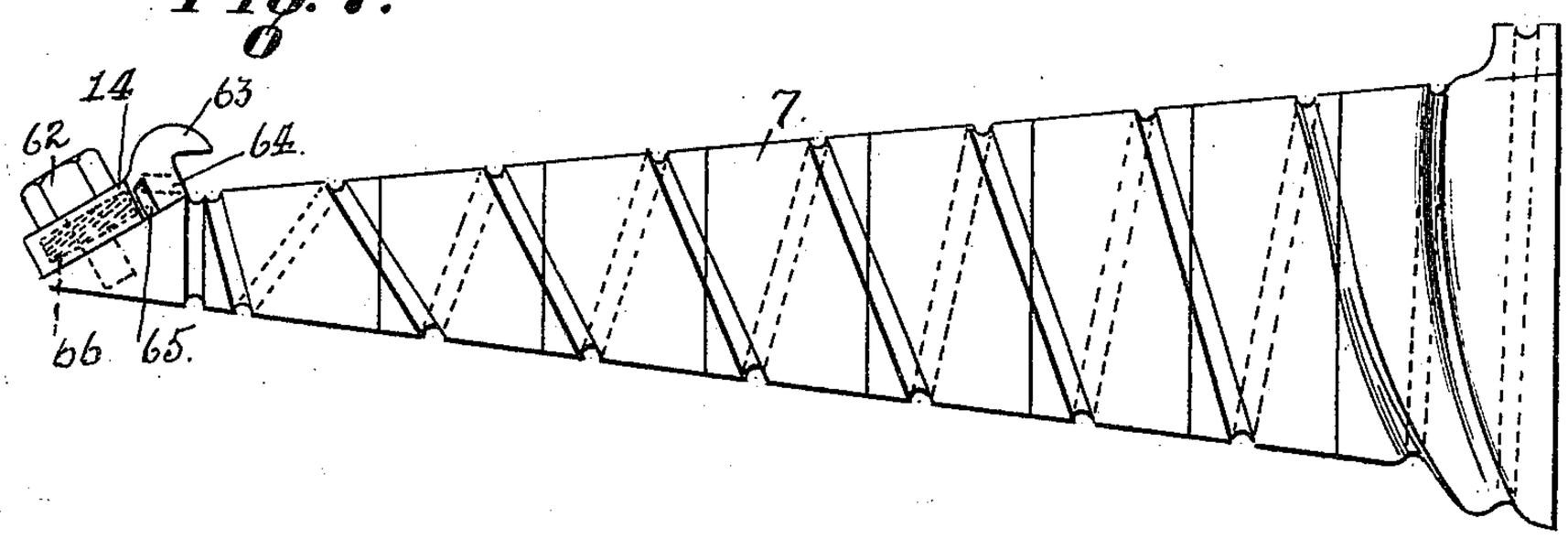

Fig. 8.

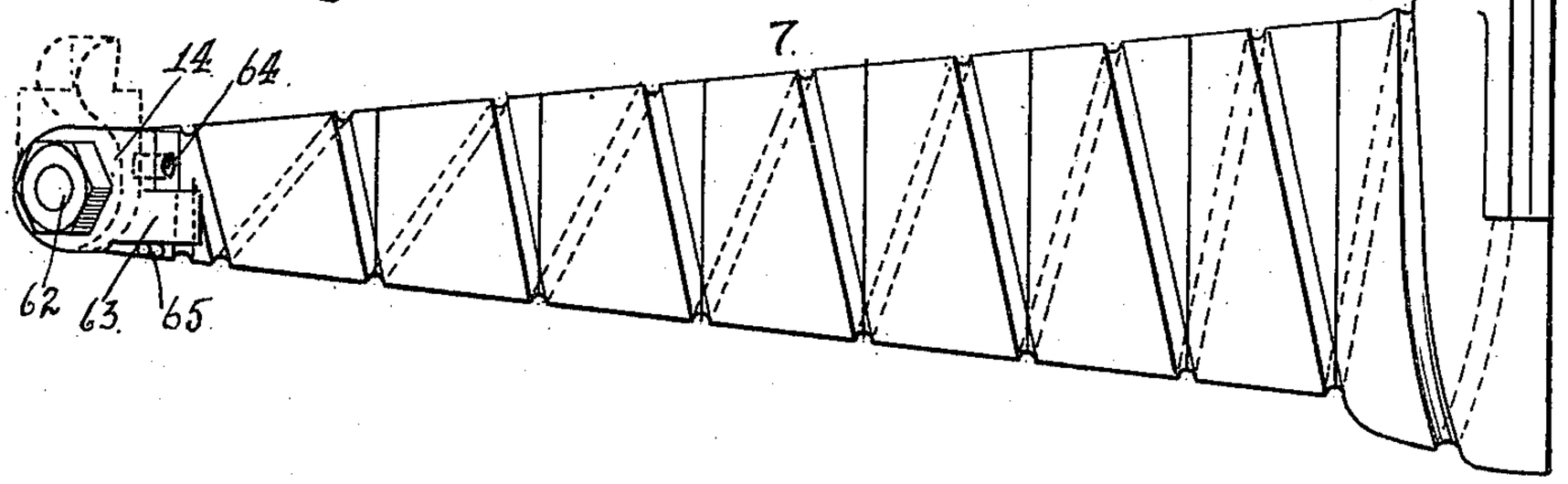

Fig. 9.

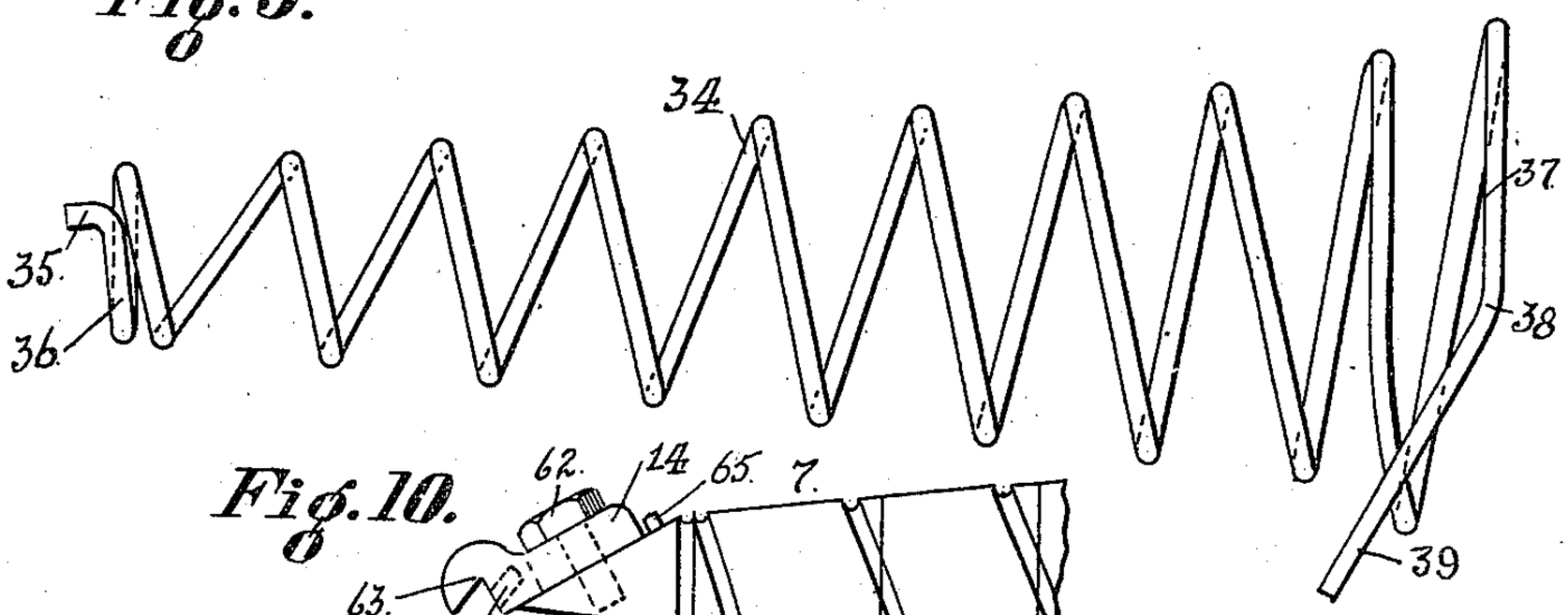

Fig. 10.

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UNITED STATES PATENT OFFICE.

CURTIS WRIGHT, JR., OF BERKELEY, CALIFORNIA.

WIRE-COILING MACHINE.

963,197. Specification of Letters Patent. Patented July 5, 1910.

Application filed January 10, 1910. Serial No. 537,125.

To all whom it may concern:

Be it known that I, CURTIS WRIGHT, JR., a citizen of the United States, residing at Berkeley, in the county of Alameda and State of California, have invented certain new and useful Improvements in Wire-Coiling Machines, of which the following is a specification.

My invention relates to wire-coiling machines, and particularly to that class of machinery, especially adapted for making bed-springs, in which the wire is coiled or laid up in the helical groove of a tapering mandrel.

The object of my invention is to provide a simple machine, practically automatic in operation, accurate in result and of great capacity.

To this end, my invention consists in the novel machine and in the several constructions, arrangements and combinations of its parts, which I shall now fully describe by reference to the accompanying drawings in which—

Figure 1 is a side elevation of my machine showing the parts at rest. Fig. 2 is a plan of the same. Fig. 3 is a plan of the machine showing the parts immediately after starting on the reverse stroke, the formed coil spring being shown in the act of relief from the mandrel. Fig. 4 is a detail, enlarged, of the wire-directing holder and part of its yielding connections. Fig. 5 is an elevation of the stroke-controlling means. Fig. 6 is a detail of the reversing trip. Fig. 7 is an elevation of the mandrel, enlarged, showing the gripper on its point in position to couple the wire to it. Fig. 8 is a plan of the mandrel, showing the gripper; the dotted lines showing the gripper turning back to uncouple the wire. Fig. 9 is an elevation of the coil or spring to be made on the machine. Fig. 10 is a detail view of the end of the mandrel, showing the gripper reversed to its limit, in a position to allow the coil-spring to pass over it in releasing.

1 is a stand. In the upper portion of the stand is mounted a drive shaft 2 carrying at one end a fast pulley 3 and loose pulley 4. In the stand is also mounted a shaft 5, which carries a feed screw 6, and has upon its end the mandrel 7. Direct rotation is imparted from shaft 2 to shaft 5 by the gears 8 and 9, and reverse rotation by the gears 10 and 11 and idler pinion 12. Gears 9 and 11 are loose on shaft 5, and are adapted to be alternately engaged by a clutch 13 feathered on the shaft, in order to throw either set of gears into action, or allow both to remain at rest. The mandrel 7 is of the usual tapering helically grooved type. Upon its smaller end is mounted a gripper 14 for the end of the wire. The details of this gripper will be hereinafter described.

15 is the directing holder for the wire. It is best seen in Fig. 4, and consists of an upright bar, through the top of which the wire 16 passes, as seen in Figs. 2 and 3, the wire being properly held therein by the spring controlled hook 17, as in Figs. 1 and 4. This holder 15 is carried by an arm 18, which passes below the mandrel 7 and is pivoted at 19 to one end of a traveling frame 20, the other end of said frame being connected with and forming part of a feed nut 21 mounted on the screw 6. A stop 19′ limits the back throw of the holder arm 18 on its pivot 19, as seen in Figs. 3 and 2. This nut 21 carries a short shaft 22 upon which is a pinion 23 which travels in a rack 24 secured to frame 1 parallel to the feed screw 6. The shaft 22 carries on its top a cam which is composed of two superposed plates, the lower 26 and the upper 26′. The lower cam has on its periphery a projection 27 and the upper cam has a projection 28, which projections impinge successively upon a bar 29, pivotally connected by a link 30 with the frame 20, and by a link 31 with the arm 18 of the holder 15, as seen best in Fig. 2. Each of these projections on the cams is followed by a depressed portion 27′ as seen in Figs. 2 and 3. A rod 32, to be more fully described hereinafter, connected with the holder 15, and controlled by a spring 33, Figs. 1, 2, 3 and 4, holds the bar 29 to its engagement with the cams 26 and 26′. For the sake of clearness, it will be best to describe, at this point, the operation of the devices as far as they have been indicated.

The coil spring to be produced is shown, somewhat conventionally, in Fig. 9, and is indicated as a whole by 34. It will be seen that at its smaller end it has a point 35, and then a convolution 36 which is practically at right angles to its axis. At its larger end it has a partial convolution 37 at right angles to its axis, said convolution terminating in a crimp or bend at 38 and thence extending in a stem 39 which is to form the knot or tie when the several springs are assembled in a

bed. It will be seen by reference to Figs. 7 and 8 that the mandrel 7 is grooved to make or lay up this spring.

Let us suppose the machine to be as shown in Figs. 1 and 2. The wire 16 leading from the main coil of wire, not shown, being in the holder 15, has its point 35 inserted in the gripper 14. Then the operator, by means presently to be described, throws the clutch 13 into engagement with the direct drive gear 9, whereupon the feed screw 6 is given rotation. The nut 21 is thus carried on the screw to the right, and the pinion 23 traveling in the rack 24 effects the rotation of the short shaft 22. This rotates the cams 26 and 26′. The projection 27 of lower cam 26 acting upon the bar 29, has the effect, through the link 31, of retarding the holder 15 by swinging its arm 18 on its pivot 19, backward against the general advance of the frame 20, and thereby keeping said holder opposite the first or flat convolution of the mandrel groove, and causing the wire, under the rotation of the mandrel to coil or lie up in said groove and form the flat convolution 36 of the spring. As soon as this retarding effect is complete, the succeeding depression 27′ takes effect and the holder 15 returning, catches up and moves steadily to the right with the traveling nut 21 and its attached parts, and the wire is laid up uniformly in the groove of the mandrel. This continues until the flat convolution at the larger end of the mandrel is reached, whereupon the projection 28 of the upper cam 26′ having reached the bar 29, the holder 15 is again retarded, in order to form the flat convolution 37 of the spring 34. At the moment of completion of this convolution, two operations occur simultaneously. One of these is the making of the crimp 38 of the spring, and the other is the reversal of the screw 6, in order to carry the parts back. The crimp 38 is formed as follows:—The rod 32, heretofore mentioned as being connected with the holder 15, freely telescopes in a tube 40, (see Fig. 4) the rear end of which is connected by an arm 41 with sleeve 42 which slides upon a fixed rail 43, and is provided with a collar 44. Figs. 1 and 3.

Mounted in the nut 21 (Fig. 1) is a vertically moving gravity pin 45, the top of which has a head disk 46, under which an inclined plane 47 (Figs. 1 and 2) secured on top of the cam 26′ is adapted to engage, in order to lift said disk and pin. Upon the rail 43 is a spring 48 adapted to be compressed by the collar 44 near the limit of the latter's travel.

By reference to Fig. 1, it will be seen that when the machine is about to start the gravity pin 45 extends down into engagement with the collar 44. When the nut 21 begins to travel, the pin 45 picks up and carries the collar 44 with it, thereby carrying along the sleeve 42 and tube 40, so that these parts move in general accord with the nut and the holder frame 20, though the holder 15 itself is permitted, on account of its telescopic spring engagement with the tube 40, to have imparted to it, in addition to its general travel, the retarding and catching up movements due to the cams 26 and 26′ as heretofore described. This general travel of all the parts to the right continues to the limit of the stroke, as before described, by which time the collar 44 has compressed the spring 48. When, however, the inclined plane 47 of the rotating cam 26′ reaches and lifts up the head disk 46, of the pin 45, the latter lifts away from and releases the collar 44, whereupon the spring 48 throws the collar sleeve 42 and its attached tube 40 backward suddenly and forcibly, which has the effect of swinging the holder 15 back to the stop 19′, to the position shown in Fig. 3. This movement of the holder is permitted by its several pivotal connections with its frame 20, as is clearly seen in Fig. 3, and said sudden and forcible throw has the effect of bending the wire in and against the extremity of the mandrel groove at a point between the final convolution 37 and the stem 39 thereby forming the crimp 38 as indicated in said Fig. 3. The spring 33, immediately thereafter restores the normal position of the holder, as the now made coil-spring 34 begins to be freed by the reversal of the mandrel.

The direct feed of the screw 6 and its reversal are effected as follows:—Fig. 5 affords the best view of the mechanism. The clutch 13, heretofore mentioned, is operated by a yoke 49, which is carried on a rod 50 mounted to slide in frame 1. This rod has on its end a collar 51 with which engages one extremity of a bell-crank 52, to the other end of which is connected the rod 53 of the treadle lever 54 (Fig. 1). Upon the slide rod is a spring 55, and a stop collar 56. Upon the rod is also a trip-collar 57.

58 is a trigger. As seen in Fig. 6, this is a bent bar, having a fixed pivotal connection at 59. The trigger lies upon the trip-collar 57 and thence bends upwardly and has its extremity provided with a contact point 60, which lies above and in the path of vertical movement of the disk head 46 of the gravity pin 45, as is seen in Fig. 3. Extending downwardly from the nut 21 is a stop arm 61, Fig. 1, which engages with the stop collar 56 on the slide rod 50, as indicated in Fig. 5.

Suppose the parts to be at rest as seen in Figs. 1 and 2, with the clutch in its middle position. To start the operation, the treadle lever 54 is depressed, thereby throwing the slide rod 50 over to the left. This throws the clutch 13 to its engagement with the direct feed gear 9 and starts the screw 6.

By this movement of the slide rod 50 its trip-collar 57 is slipped from under the trigger 58 which by gravity drops down behind said collar and holds the slide rod 50 over with the clutch in engagement, so that the operator may remove his foot from the treadle. When the limit of the forward travel of the feed nut 21 is reached, and the inclined plane 47 on the cam 26′ lifts the head disk 46 of the gravity pin 45, as heretofore described, said head disk will engage the contact point 60 of the trigger 58 and will thereby lift said trigger from behind the trip-collar 57, thus allowing the spring 55 to throw the slide rod 50 over to the right. This removes the clutch 13 from its former engagement, and throws it to its engagement with the reverse-feed gears, whereupon the feed screw 6 reverses. At the limit of the reverse stroke, the stop arm 61 of the nut 21 contacts with the stop collar 56 on the slide rod 50 as seen in Fig. 5, and moves the rod to the left sufficiently to withdraw the clutch 13 from the reverse gears, and to carry it to its neutral position, so that the screw 6 stops, and all the parts are returned to initial positions ready for a repetition of the operation. Though any suitable clutch may be used, I prefer to make the clutch a positive one, as with teeth or ribs, as shown, on the direct feed side, and a friction drive on the reverse side.

In order to hold or couple the wire 16 to the smaller end of the mandrel 7 at the beginning of the operation and to automatically uncouple it after the spring is formed and allow the spring to slip over the mandrel, I have a gripper 14, the details and operation of which are as follows:—

I now refer to Figs. 7, 8 and 10. The end of the mandrel 7 is beveled as shown in Fig. 7, and on this beveled surface is pivoted by a bolt 62 the gripper 14. This gripper has a projecting lip 63 which guards its face in which face is made the hole 64 to receive the point 35 of the wire. 65 is a stop pin which prevents movement of the gripper in the direction of strain as the wire is coiling, though the gripper is free to move in the other direction. When, now the point of the wire is inserted in the hole 64 of the gripper and is held down by the lip 63 the wire is coupled in the gripper, and when the mandrel begins to turn, the gripper is held against pivotal movement by the stop 65 and carries the wire around in the grooves of the mandrel.

When at the end of the coiling operation the mandrel reverses, and the strain on the coil is released, the resiliency of the coil will spring its larger convolutions out from the mandrel. But the gripper now reversing its direction of revolution with the mandrel, finds resistance from the end of the coil which is sufficient to cause it to turn back on its own pivot bolt 62 carrying the coil end, which still is coupled to it, with it. The gripper turns through the position indicated in dotted lines in Fig. 8, to a further position, shown in Fig. 10, in line with the mandrel. In this new position, the other shorter and smooth end or base of the gripper is presented forwardly, and lies flush with the general periphery of the mandrel end. It, therefore, presents no obstruction to the small end of the coil passing over it, and the hole 64 of the gripper as the latter is being turned back, allows the point of the coil to leave it. All this the coil itself does by reason of its tendency to condense, upon its relief at its larger end, so that almost as soon as the reverse action of the machine begins, the now completed coil flies free of the mandrel as seen in Fig. 3 and may be removed for cutting off at the end of its stem 39 in a separate machine which also forms the point 35 for the next coil. A spring 66 returns the gripper to initial position.

In wire coiling mandrels of the type here shown, it is common to make them in separate annular sections, as shown in Figs. 7 and 8, separately rotatively and relatively adjustable upon their core, so that the length of the helical groove may be slightly varied. All coils of wire from which the springs are made are not alike in stiffness; some are softer than others. The operator soon discovers this after making one or two springs from a coil, and as the springs must be of the same height when under final normal condition of rest, and should have as near as possible the same resiliency, and as in assembling the springs of the type here shown in a bed, the point 35 must always have the same relative position to the crimp 38, it follows that this equality must be gained by a variation in the length of the mandrel groove. Hence the necessity for adjusting the mandrel sections to properly vary the length of the groove to suit the particular wire being used.

It will now be seen that in my machine, wherein the wire directing holder 15, supplants the manual wire direction of hand machines, if the mandrel be adjusted to vary the length of the groove, said holder must likewise be subjected to a variance in its control, in order to conform its movements and times to the changed aspect of the mandrel. This I accomplish by making the upper cam 26′ adjustable upon the lower cam 26. For this purpose as is seen in Figs. 2 and 3, the upper cam 26′ is slotted at 67 over studs 68 in the lower cam 26. By this adjustment of the two cams the distance between their projections 27 and 28 is varied; and it follows that if the mandrel sections be adjusted to make a spring from a given length of wire the two cams will be rela-

tively set to time their effects upon the holder 15 accordingly, and if the mandrel be adjusted for a wire of a different length, the two cams will be correspondingly readjusted.

A résumé of the operation of the machine, in general terms, may now be of assistance. The operator fits the wire to the holder 15 and inserts its point 35 in the hole 64 of the gripper 14. He then presses down on the treadle lever 54 and the machine starts on its forward movement. The nut 21 and its connected parts advance, while the holder 15 is temporarily retarded by the first cam projection 27 to follow the beginning flat convolution of the wire, and thereafter the advance of all parts continues, and the wire is laid up or coiled on the mandrel. As the end of the stroke approaches, the holder is again retarded by the second cam projection 28 and immediately thereafter the reverse feed begins, and simultaneously the holder is forcibly thrown back a short distance, to make the crimp 38, and then all the parts continue their return, the now finished coil being at the beginning of this movement relieved and springing free of the mandrel as shown in Fig. 3. The stem 39 of the coil is then cut off and a new point formed on the end of the wire, in a separate machine.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:—

1. In a wire-coiling machine, the combination of a rotatable mandrel on which the wire is coiled, said mandrel being formed with a groove adjustable as to length; a traveling holder for directing the wire to the mandrel; and means for automatically controlling and timing the travel of the holder to register the wire with the convolutions of the mandrel groove, said means being adjustable to regulate the effect on the holder in accordance with the adjustment of the mandrel groove.

2. In a wire-coiling machine, the combination of a rotatable, grooved mandrel on which the wire is coiled, said mandrel being formed with separate relatively adjustable sections by which the length of the groove may be varied; a traveling holder for directing the wire to the mandrel; a cam and connections for automatically controlling and timing the travel of the holder to register the wire with the convolutions of the mandrel groove; and means for adjusting the cam to regulate its effect on the holder in accordance with the adjustment of the mandrel sections.

3. In a wire-coiling machine, the combination of a grooved mandrel upon which the wire is coiled; a shaft to impart rotation to said mandrel; a feed screw on said shaft; a nut to travel on the screw; a holder for directing the wire to the mandrel; and a frame connecting said holder with the nut to effect the travel of said holder to register the wire with the convolutions of the mandrel groove.

4. In a wire-coiling machine, the combination of a grooved mandrel upon which the wire is coiled; a shaft to impart rotation to said mandrel; a feed screw on the shaft; a nut to travel on the screw; a holder for directing the wire to the mandrel; yielding pivoted connections between the holder and the nut; and means operated by the travel of the nut for acting on said holder connections to control and time the travel of the holder to register the wire with the convolutions of the mandrel groove.

5. In a wire-coiling machine, the combination of a grooved mandrel upon which the wire is coiled; a shaft to impart rotation to said mandrel; a feed screw on the shaft; a nut to travel on the screw; a holder for directing the wire to the mandrel; a frame carried by the nut; pivotal connections between the holder and the frame; and a cam carried by the nut and adapted to operate on the holder connections to control and time the travel of the holder to register the wire with the convolutions of the mandrel groove.

6. In a wire-coiling machine, the combination of a grooved mandrel upon which the wire is coiled; a shaft to impart rotation to said mandrel; a feed screw on the shaft; a nut to travel on the screw; a holder for directing the wire to the mandrel; a yielding connection between the nut and holder by which the travel of the holder is effected; a cam carried by the nut and adapted to operate on the holder connections to control and time the travel of the holder to register the wire with the convolutions of the mandrel groove; and means operatable by the travel of the nut for rotating the cam.

7. In a wire-coiling machine, the combination of a grooved mandrel upon which the wire is coiled; a shaft to impart rotation to said mandrel; a feed screw on the shaft; a nut to travel on the screw; a holder for directing the wire to the mandrel; a yielding connection between the nut and holder by which the travel of the holder is effected; a cam carried by the nut and adapted to operate on the holder connections to control and time the travel of the holder to register the wire with the convolutions of the mandrel groove; and means operatable by the travel of the nut for rotating the cam, consisting of a rack and pinion connection with the cam.

8. In a wire-coiling machine, the combination of a grooved mandrel upon which the wire is coiled, said mandrel being composed of sections relatively adjustable to vary the length of its groove; a shaft to impart rotation to the mandrel; a feed screw on the shaft; a nut to travel on the screw; a holder for directing the wire to the

mandrel; a yielding connection between the nut and holder by which the travel of the holder is effected; and a pair of cams carried by and rotatable by the travel of the nut for operating on the holder connections to cause said holder to register the wire with the convolutions of the mandrel groove, said cams being relatively adjustable to regulate their effect on the holder in accordance with the adjustment of the mandrel sections.

9. In a wire-coiling machine, the combination of a rotatable, grooved mandrel upon which the wire is coiled; a holder for directing the wire to the mandrel; means for effecting the travel of the holder in timely motion to register the wire with the convolutions of the mandrel groove; and means for effecting a limited backward impulse of the holder at the end of its outward stroke, to crimp the wire at the terminus of its final convolution.

10. In a wire-coiling machine, the combination of a grooved mandrel upon which the wire is coiled; a shaft to impart rotation to said mandrel; a feed screw on the shaft; a nut to travel on the screw; a holder for directing the wire to the mandrel; a yielding connection between the holder and the nut for effecting the travel of the holder in timely motion to register the wire with the convolutions of the mandrel groove; and a spring to effect a limited backward impulse of the holder at the end of its outward stroke, to crimp the wire at the terminus of its final convolution.

11. In a wire-coiling machine, the combination of a grooved mandrel upon which the wire is coiled; a shaft to impart rotation to said mandrel; a feed screw on the shaft; a nut to travel on the screw; a frame carried by the nut; a holder for directing the wire to the mandrel; pivotal connections between the holder and frame, whereby the travel of the holder is effected from the nut; a sliding collar having a yielding connection with the holder; means on the nut for carrying said collar forward in unison with the nut and holder; means for tripping the collar at the end of the stroke, and a spring for suddenly throwing said collar backward when tripped, to cause the holder to crimp the wire at the terminus of its final convolution.

12. In a wire-coiling machine, the combination of a grooved mandrel upon which the wire is coiled; a shaft to impart rotation to said mandrel; a feed screw on the shaft; a nut to travel on the screw; a frame carried by the nut; a holder for directing the wire to the mandrel; pivotal connections between the holder and frame for effecting the travel of the holder; a cam operatable by the travel of the nut to act on the holder connections for controlling and timing the travel of said holder to cause it to register the wire with the convolutions of the mandrel groove; a sliding collar having a yielding connection with the holder; a pin on the nut to engage with said collar and cause its forward travel in unison with the nut and holder, an inclined plane on the cam for lifting the pin and tripping the collar at the end of the stroke, and a spring for suddenly throwing said collar backward when tripped, to cause the holder to crimp the wire at the terminus of its final convolution.

13. In a wire-coiling machine, the combination of a grooved mandrel upon which the wire is coiled; a shaft to rotate said mandrel; a feed screw on the shaft; a nut to travel on the screw; a holder to direct the wire to the mandrel; connections from the holder to the nut to effect the travel of the holder to register the wire with the convolutions of the mandrel groove; a drive shaft; direct and reverse gears from the drive-shaft to the mandrel shaft; a clutch to alternately engage the direct and reverse gears, and means operatable from the nut to throw the clutch at the limits of travel of said nut.

14. In a wire-coiling machine, the combination of a grooved mandrel upon which the wire is coiled; a shaft to rotate said mandrel; a feed screw on the shaft; a nut to travel on the screw; a holder to direct the wire to the mandrel; connections from the holder to the nut to effect the travel of the holder to register the wire with the convolutions of the mandrel groove; a drive shaft; direct and reverse gears from the drive-shaft to the mandrel shaft; a clutch to alternately engage the direct and reverse gears, and means operatable from the nut to throw the clutch at the limits of travel of said nut, consisting of a spring controlled slide rod connected with the clutch, a treadle and connections to operate the slide rod to throw the clutch into engagement with the direct gears, a trigger and trip collar to hold said engagement during the forward stroke, means on the traveling nut to trip the trigger and collar at the end of the stroke whereby the spring of the slide rod throws the clutch to the reverse gears; and a stop arm on the nut and a stop collar on the slide rod to pull the clutch to a neutral position at the end of the reverse stroke.

15. In a wire-coiling machine, the combination of a rotatable, grooved mandrel upon which the wire is coiled, said mandrel having on its smaller end a beveled surface beyond the first convolution of its groove; and a gripper for the wire, having a hole in its face, to receive the wire end and register the wire with the first convolution of the mandrel groove, said gripper being pivoted upon the beveled end of the mandrel and having a base short enough when turned to the top to permit the coiled wire to slip over

it, as said coil disengages its end from the gripper hole.

16. In a wire-coiling machine, the combination of a rotatable grooved mandrel upon which the wire is coiled, and a spring-controlled gripper pivotally mounted upon the mandrel point beyond the first convolution of its groove, said gripper having a face with a hole in it in position to receive the wire end and to register the wire in the first groove convolution, and having a base short enough, when the gripper is turned back, to lie within the periphery of the mandrel if extended, and a stop in the mandrel to permit the turning of the gripper on its pivot in one direction only.

17. In a wire-coiling machine, the combination of a rotatable grooved mandrel upon which the wire is coiled, and a spring-controlled gripper pivotally mounted upon the mandrel point beyond the first convolution of its groove, said gripper having a face with an overlying lip and a hole in said face in position to receive the wire end and to register the wire in the first groove convolution, and having a base short enough, when the gripper is turned back, to lie within the periphery of the mandrel if extended, and a stop in the mandrel to permit the turning of the gripper on its pivot in one direction only.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CURTIS WRIGHT, Jr.

Witnesses:
Wm. F. Booth,
D. B. Richards.