No. 771,549. PATENTED OCT. 4, 1904.

R. S. HILL.

SPRING MAKING MACHINE.

APPLICATION FILED DEC. 11, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

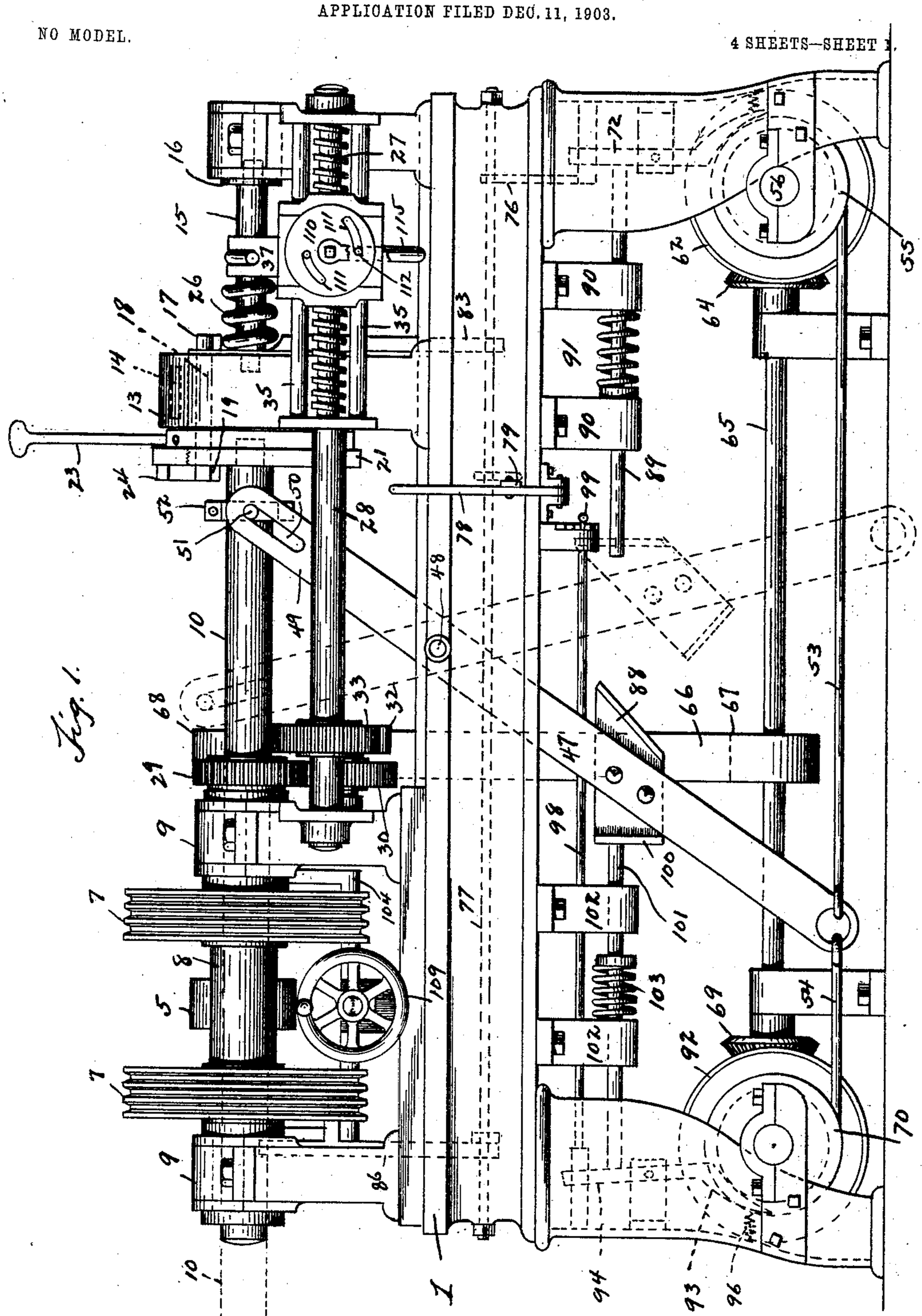

Fig. 1.

Witnesses:
Chas. E. Wheeler
F. G. Howlett.

Inventor
Robert S. Hill.

By His Attorneys
E. S. Wheeler & Co.

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NO MODEL. 4 SHEETS—SHEET 2.

Fig. 2.

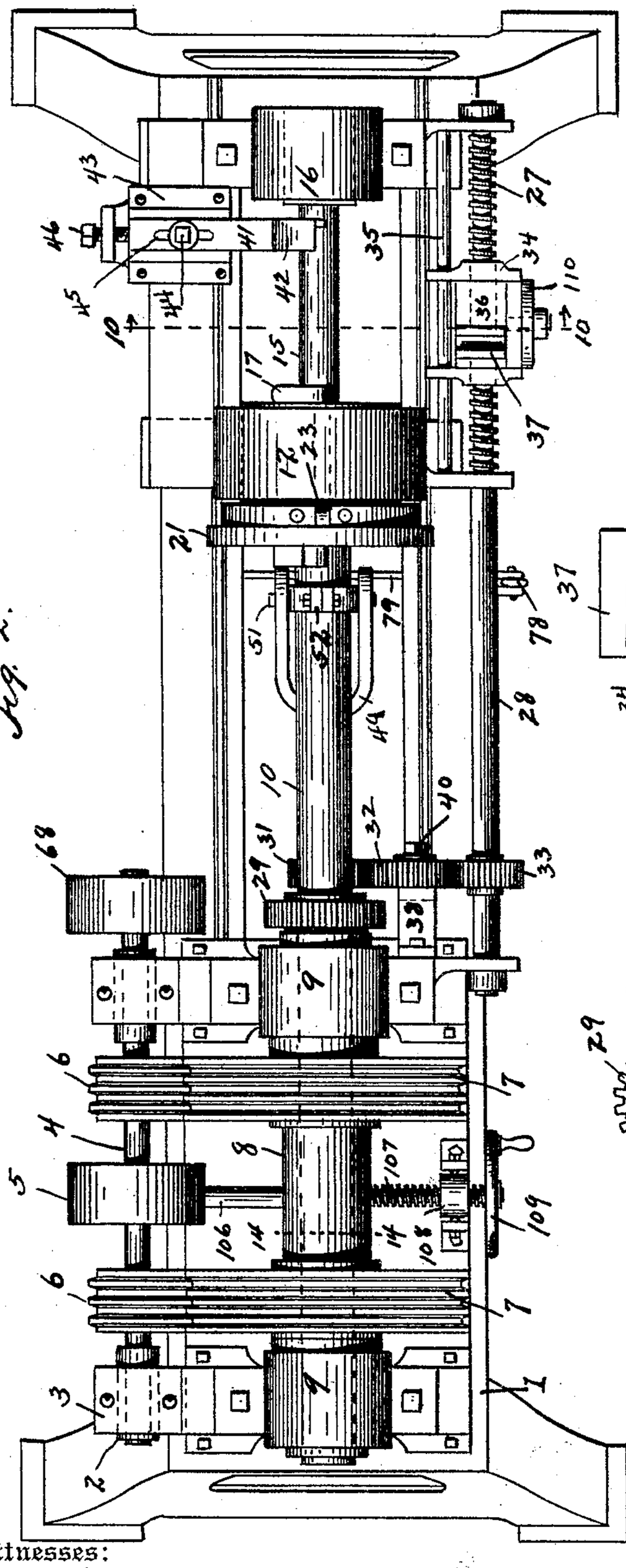


Fig. 13.

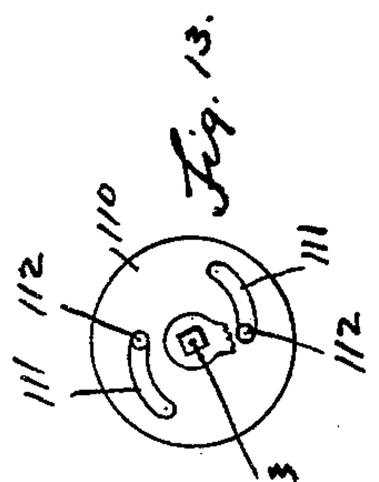


Fig. 12.

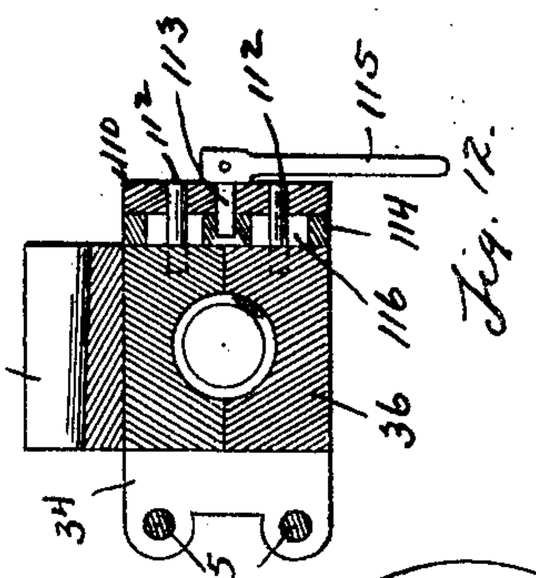


Fig. 14.

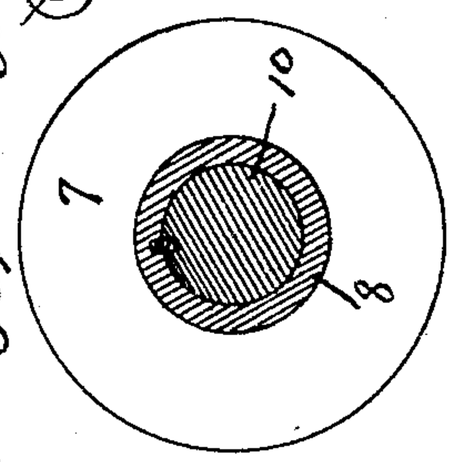
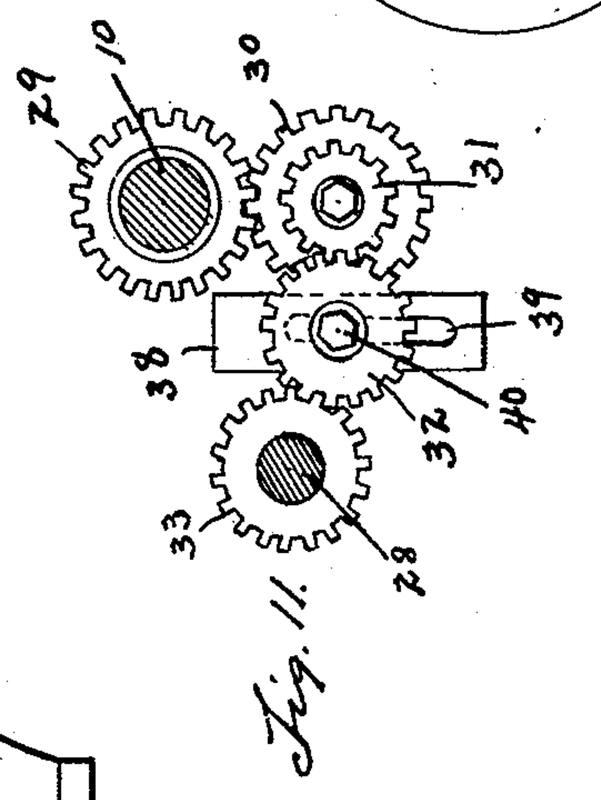


Fig. 11.



Witnesses:
Chas. E. Wiener
I. G. Howlett.

Inventor
Robert S. Hill.
By His Attorneys
E. S. Wheeler & Co.

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NO MODEL. 4 SHEETS—SHEET 3.

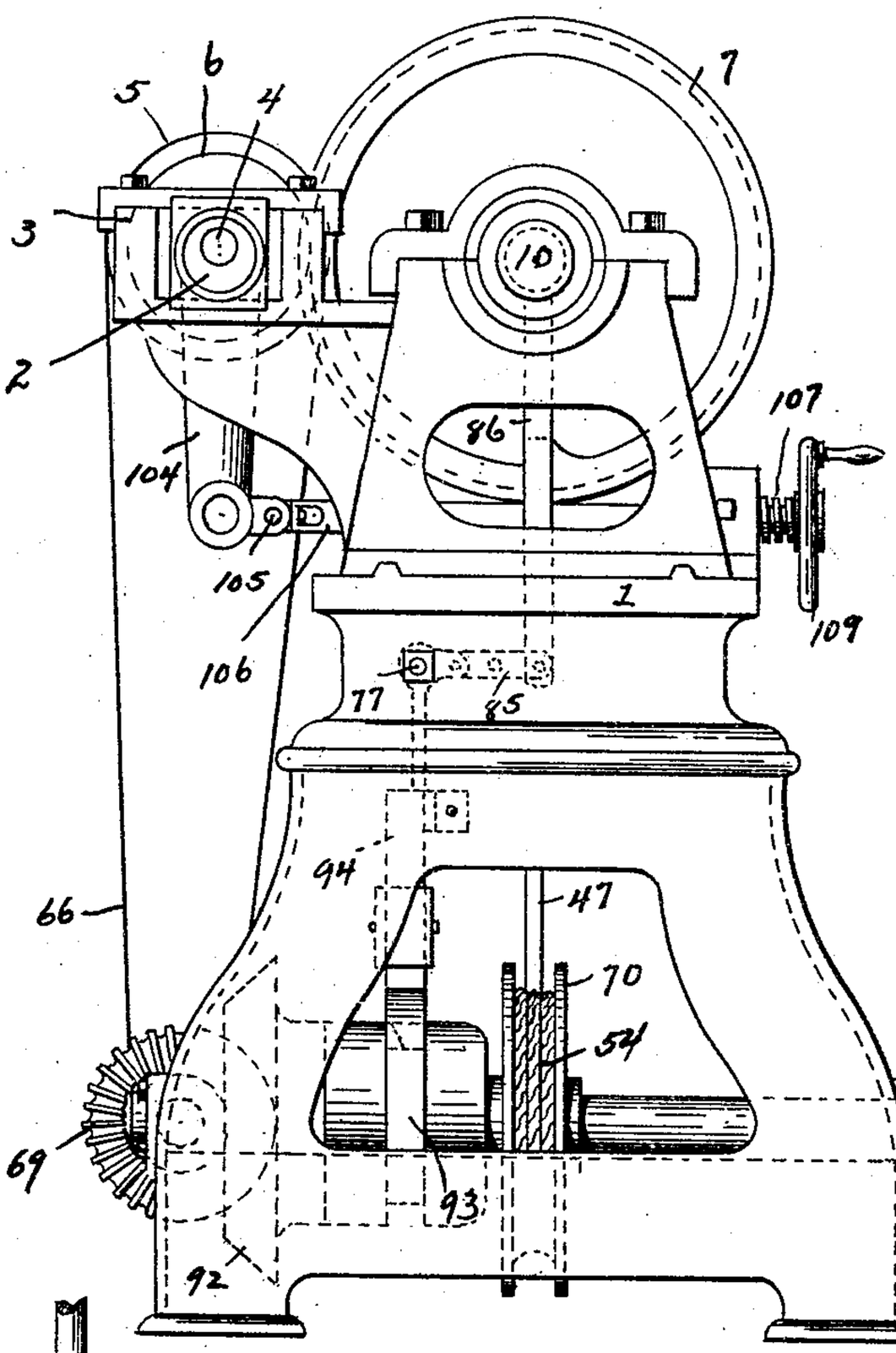


Fig. 3.

Fig. 15.

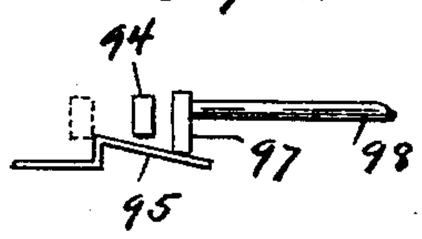


Fig. 8.

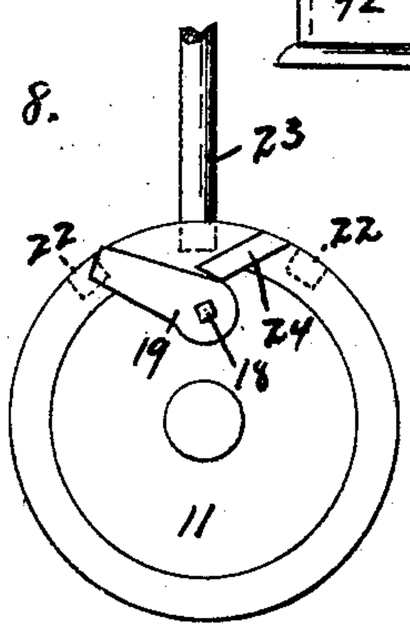


Fig. 9.

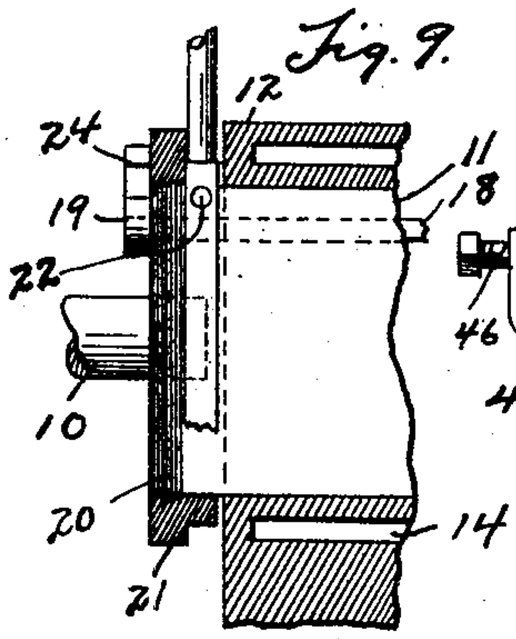
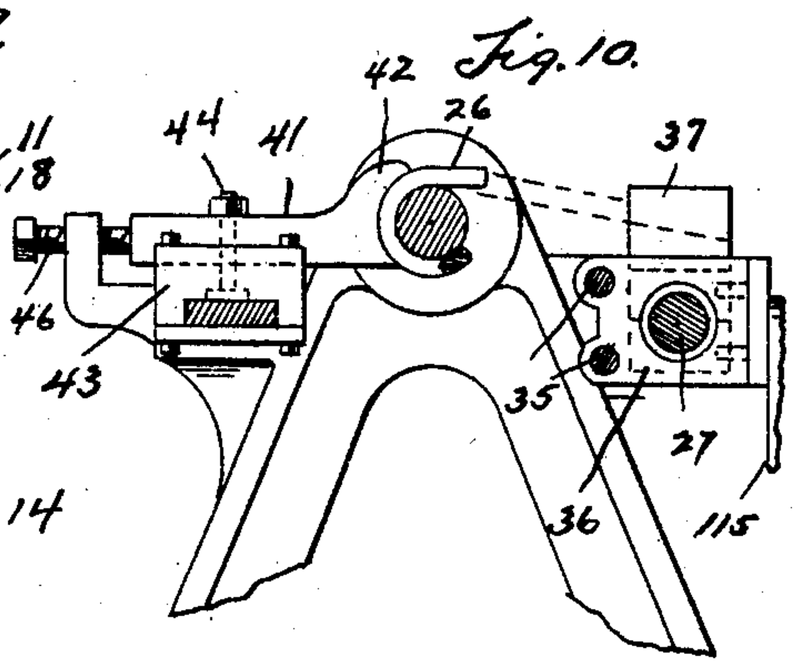


Fig. 10.



Witnesses:
Chas. E. Wimer
F. G. Howlett.

Inventor
Robert S. Hill.
By His Attorneys
E. S. Wheeler & Co.

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R. S. HILL.

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NO MODEL. 4 SHEETS—SHEET 4.

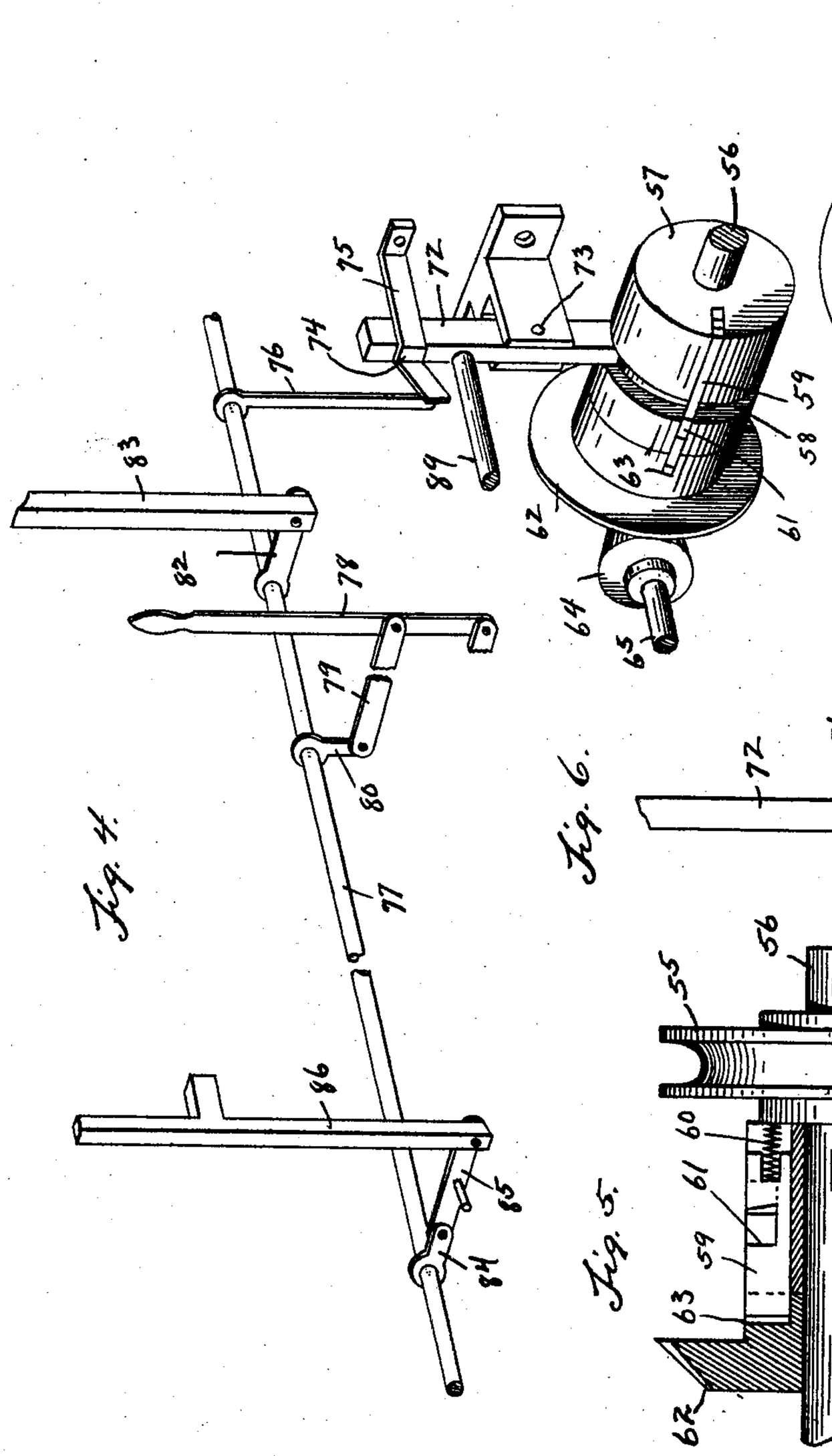

Fig. 4.

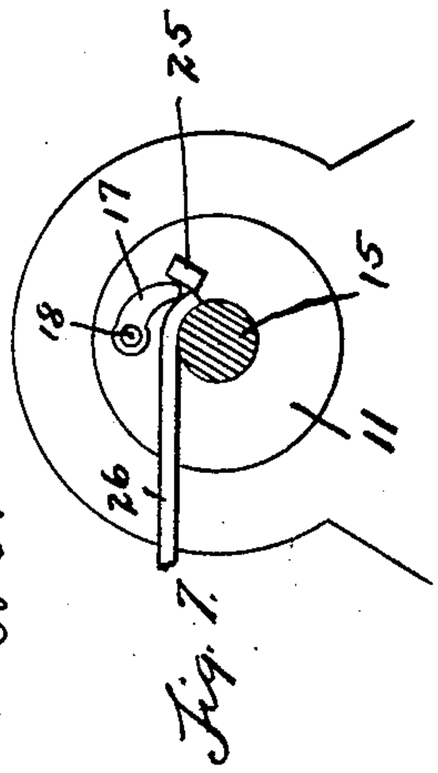

Fig. 7.

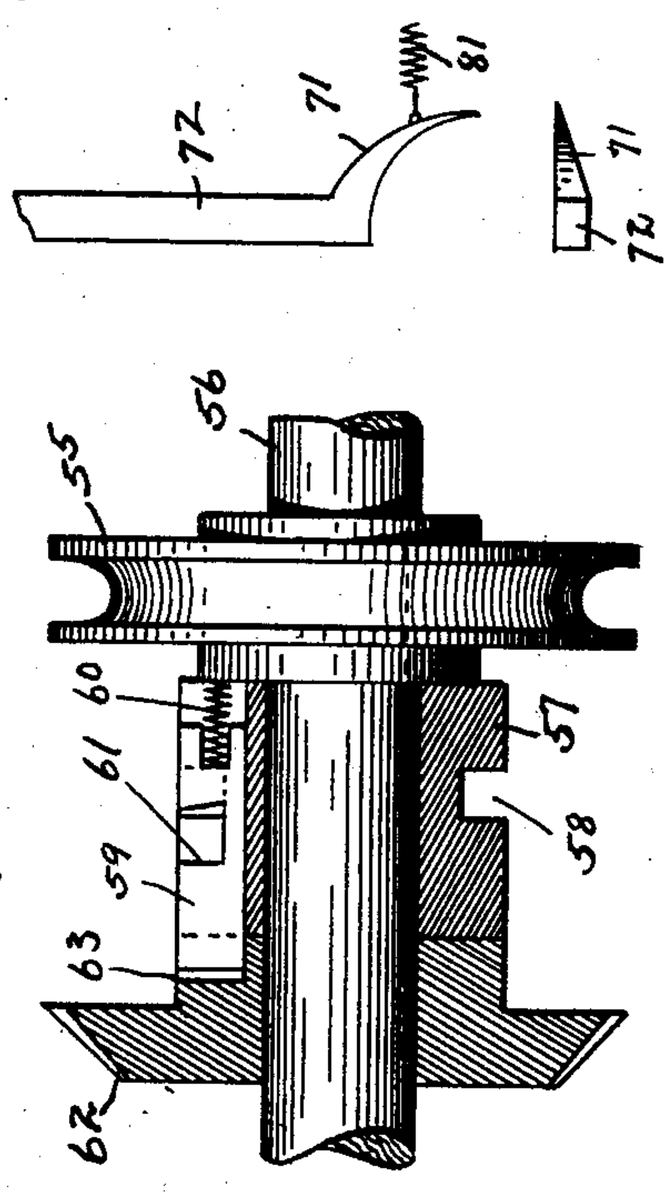

Fig. 6.

Fig. 5.

Witnesses:
Chas. E. Wimer
I. G. Howlett.

Inventor
Robert S. Hill.
By His Attorneys
E. S. Wheeler & Co.

No. 771,549. Patented October 4, 1904.

UNITED STATES PATENT OFFICE.

ROBERT S. HILL, OF DETROIT, MICHIGAN.

SPRING-MAKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 771,549, dated October 4, 1904.

Application filed December 11, 1903. Serial No. 184,752. (No model.)

To all whom it may concern:

Be it known that I, ROBERT S. HILL, a citizen of the United States, residing at Detroit, in the county of Wayne, State of Michigan, have invented certain new and useful Improvements in Spring-Making Machines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

This invention relates to spring-making machines; and it consists in the construction and arrangement of parts hereinafter fully set forth, and pointed out particularly in the claims.

The primary object of the invention is to produce a machine of the character described wherein the arrangement is such as to facilitate the manufacture of coiled springs in a manner to enable a greater number of springs to be manufactured in a single machine without a corresponding increase in the cost of production.

A further object is to provide improved means for feeding the heated bar to the mandrel and quickly returning the feeding-carriage.

A further object is to provide improved means for regulating the speed of the feeding-carriage.

A further object is to provide improved means for dogging the bar to the mandrel and for discharging the spring from the mandrel and restoring the mandrel to its normal position.

The above objects are attained by the structure illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a machine embodying my invention. Fig. 2 is a plan view thereof. Fig. 3 is an end elevation of the machine. Fig. 4 is a perspective view, in fragmentary detail, of the operative levers and clutch devices which control the reciprocatory movement of the mandrel and driving-shaft. Fig. 5 is a detail, partly in section, of the driving-gear and clutch mechanism which controls the reciprocatory movement of the mandrel. Fig. 6 is an elevation of the curved wedge-shaped finger which controls said clutch. Fig. 7 is a detail showing the mandrel in section and the rotary head in elevation which carries said mandrel, as well as the dog upon said head adapted to clamp or pinch the end of the bar to the mandrel, and also showing the stop against which the end of the bar is thrust. Fig. 8 is a view, partly in section, looking at the opposite face of said rotary head, showing the threaded ring thereon carrying a foot adapted to bear upon a short curved arm to turn the rock-shaft and actuate said dog. Fig. 9 is a longitudinal section through said rotary head and its bearing. Fig. 10 is a transverse section through the upper portion of the machine as on line 10 10 of Fig. 2. Fig. 11 is a detail of the train of gears through the medium of which the feed-screw is driven. Fig. 12 is an enlarged sectional view through the feeding-carriage, showing the split nut which engages the feed-screw and the means of separating the halves of said nut to free it therefrom. Fig. 13 is an elevation of the disk having eccentric slots therein and through the partial rotation of which the two halves of the split nut in the carriage are actuated. Fig. 14 is a transverse section as on line 14 14 of Fig. 2. Fig. 15 is a plan view in detail of the operative parts for controlling one of the clutches, as hereinafter explained.

Referring to the characters of reference, 1 designates the frame of the machine, which may be constructed in any suitable manner. Journaled in eccentric bearings 2, embraced by the boxes 3, is the driving-shaft 4, carrying an ordinary belt-pulley 5, through the medium of which said shaft is driven. Fixed on the shaft 4 are the small peripherally-grooved friction-pulleys 6, which are adapted to be brought into peripheral contact with the large peripherally-grooved friction-pulleys 7, made fast to the large tubular shaft 8, which is supported at its opposite ends in the bearings 9. Passing through the tubular or hollow shaft 8 is a second shaft 10, which is keyed or splined to said tubular shaft in a manner to allow of its longitudinal movement there-

through, yet causing it to rotate therewith, as shown in Fig. 14. The inner end of shaft 10 is screwed into a rotary head 11, supported in a suitable bearing 12, in which it is adapted to rotate and which is provided with a surrounding water-space 14 to keep down the temperature of said bearing caused by the presence of the heated bar from which the spring is formed. Screwing into the opposite face of the rotary head 11 to that in which the shaft 10 enters is a mandrel 15, which is fixed to and turns with said head and is supported at its outer end in a socket-bearing 16. This mandrel is driven through the rotation of the shaft 10, and upon it the bar is wound in the operation of forming the spring. The end of the heated bar from which the spring is formed is clamped to the mandrel through the operation of the dog 17, which is fixed to one end of the rock-shaft 18, journaled in and passing through the rotary head 11. On the opposite end of said shaft is a short curved arm 19. The inner end of the rotary head 11 is threaded, as at 20, and screwing thereon is a tapped ring 21, having in a portion of its periphery a plurality of apertures or sockets 22, in which may be seated the end of an operative lever 23, whereby said ring may be turned upon said threads. Fixed to the side of said ring is a foot 24, which as said ring is turned in one direction will engage the free end of the curved arm 19 and force it downwardly, thereby rocking the shaft 18 and causing the end of the dog 17 to clamp the end of the bar from which the spring is formed onto the mandrel, as shown in Fig. 7, there being upon the face of the rotary head 11 a stop 25, which regulates the distance which the bar may be shoved into the machine. The operation of turning the threaded ring 21 to rock the shaft 18 screws said ring off of the head 11 and causes it to crowd against the arm 19, thereby locking said arm against movement and holding the shaft 18 from rotation, whereby the dog 17 when once set is maintained in place until said shaft is released.

After the bar has been clamped to the mandrel through the operation of the dog 17 the spring is formed by the rotation of the mandrel, which winds the bar thereon, as shown at 26. To provide for feeding the bar to the mandrel so that the coils of the spring shall be a uniform distance apart, there is employed a feed-screw 27, formed upon one end of the counter-shaft 28, journaled in suitable bearings in the frame and driven from a train of gears from the hollow shaft 8, said train comprising the gear 29 upon said hollow shaft and the gear 30, with which it meshes and which carries a pinion 31, that in turn meshes with the gear 32, interposed between said pinion and the gear 33 upon the counter-shaft 28, as shown more clearly in Fig. 11, whereby the shaft 28 is driven to revolve the screw 27 at any desired rate of speed. The bar which is fed into the machine is supported on a suitable carriage comprising a suitable frame 34, through the sides of which passes the screw 27, the inwardly-projecting ends of said side pieces being mounted to slide upon the rods 35 parallel with said screw. Within the frame of the carriage is a split nut 36, whose movable parts are adapted to embrace said screw and cause the carriage to travel longitudinally thereof as said screw revolves. Upon the upper portion of the carriage is a guide 37, in which the bar is adapted to lie as it feeds into the machine. The movement imparted to the carriage by the operation of the screw carries the bar longitudinally as it winds onto the mandrel, thereby forming the spring in a manner to space the coils thereof a predetermined distance apart. The feed of the screw may be varied by changing the size of the gear 33 upon the shaft 28. To accommodate this change in the gear 33, the interposed gear 32 is mounted on a support 38, having a slot 39 therein, which receives the stub-shaft 40, upon which said gear is journaled, and allows of a vertical adjustment of said gear or its removal and replacement by a gear of different size, accordingly as the conditions require. A slow movement of the screw 27 will cause the coils of the spring to be formed close together, while a rapid movement of said screw will cause the spring to be wound with open coils, as will be well understood.

To prevent the spring having a straight end portion when coiled completely onto the mandrel, there is provided a former 41, having an inwardly-projecting end 42, provided with a face curved concentric with the mandrel and adapted to receive the end of the bar and form it to the contour of the mandrel as it coils thereon, as clearly shown in Fig. 10. This former is mounted in a carriage 43, adapted to slide longitudinally of the frame, so that it may be properly positioned for any length of spring, and said former is transversely adjustable of said carriage by means of the bolt 44, which passes through the slot 45 therein, whereby it may be adjusted to accommodate a bar of any diameter. A screw 46 engaging the rear end of said former provides for the transverse movement thereof.

After the spring has been formed upon the mandrel it is necessary to shift the mandrel longitudinally in order to strip the spring therefrom. This shifting of the mandrel is accomplished through the longitudinal movement of the shaft 10, which carries with it the head 11, to which said mandrel is attached, said shaft 10 moving through the tubular or hollow shaft 8, as shown by dotted lines in Fig. 1. To move the shaft 10 longitudinally, a bifurcated lever 47 is employed, which is fulcrumed at 48 to the frame and whose fork sides 49 are slotted, as shown at 50, to receive the pins 51, projecting from opposite sides of

the collar 52, which is seated in a peripheral channel in said shaft and is embraced by the sides of said fork, as shown in Figs. 1 and 2. This lever is actuated to shift the shaft 10 longitudinally by means of the cables 53 and 54, of which 53 winds onto a drum 55, keyed to the shaft 56. Contiguous to the drum 55 and also keyed to the shaft 56 is a clutch-collar 57, having a peripheral channel 58 therein and having a transverse channel crossing said peripheral channel, in which is seated the slide-bolt 59, backed by a coiled spring 60 and having a notch 61 therein (see Fig. 5) corresponding with the peripheral channel 58 in said collar. Loose upon the shaft 56 is a beveled gear 62, having in the hub thereof a socket 63, which forms a keeper for the end of the slide-bolt 59, when said parts are brought into position to register, and said bolt is released to enable the spring 60 to force it into the keeper in said hub, in which position of parts the drum 55 will be turned by said gear so as to wind the cable 53 thereon and actuating the lever 47 to retract the mandrel and discharge the spring therefrom. The gear 62 is driven through the medium of a beveled gear 64 on the shaft 65, in turn driven by a belt 66, running on the pulley 67 thereon, said belt leading from the pulley 68 on the driving-shaft 4. Also mounted upon the shaft 65 is a beveled gear 69, adapted to drive the drum 70 to wind the cable 54 thereon and restore the lever 47 and shaft 10 to their normal position in a manner hereinafter explained.

During the operation of the machine in forming the spring the drum 55 remains stationary, owing to the fact that the gear 62 is loose upon the shaft and the slide-bolt 59, which locks the collar 57 to the hub of said gear, is held from engagement in the socket 63 in said hub by the curved wedge-shaped finger 71, formed on the vertical stem 72, which is fulcrumed at 73 in position to cause said finger to normally lie in the peripheral channel 58 of said collar, so as to engage the notch 61 in the slide-bolt 59 and move said bolt longitudinally against the action of the spring 60, so as to withdraw its outer end from the socket in the hub of the gear 62, the stem of the curved wedge-shaped finger being held in this position by the engaging shoulder 74 on the spring-catch 75. The finger 71 is withdrawn from the channel of the clutch-collar to enable said collar to become locked to the hub of said gear 62 by means of a depending arm 76, fast to the rotatable rod 77, which is suitably supported in the frame and operated through the medium of the lever 78, connected, by means of the pivoted bar 79, with the crank 80 on said rod, through the operation of which said rod may be rotated.

The operation of the parts just described and shown more clearly in Figs. 4, 5, and 6 is as follows: The spring having been wound upon the mandrel and it being desired to retract the mandrel in order to strip the spring therefrom the lever 78 is actuated to rotate the rod 77 and cause the arm 76 to swing against the spring-catch 75 and release the stem 72 of the curved wedge-shaped finger 71, when the spring 81, (see Fig. 6,) attached to said finger, will withdraw it from the peripheral channel 58 of the clutch-collar, allowing the slide-bolt by the action of the spring 60 to move longitudinally and enter the socket or keeper 63 in the hub of the gear 62 to lock said collar to said gear and cause the shaft 56 to rotate, thereby rotating the drum 55 and winding the cable 53 thereon. As the cable winds upon the drum the lever 47 is drawn upon, so as to move it upon its fulcrum and shift the shaft 10 longitudinally. By the same operation of the rod 77 which places the clutch in operation a second arm 82, carried by said rod and pivoted to the lower end of a vertically-movable stripper 83, will raise said stripper so as to project the upper end thereof against the mandrel and in the path of the spring thereon, so that as the mandrel is retracted the spring will be stripped therefrom. Simultaneous with the operation which places the clutch in engagement and projects the stripper a short crank-arm 84 on the rotary rod 77 is actuated to operate a pivoted link 85, which is connected with a vertically-movable locking-bar 86, whose upper end normally lies in a peripheral channel 87 (see dotted lines in Fig 1) in the shaft 10 and withdraws the end of said bar from said channel, so as to release said shaft and allow it to move longitudinally. The movement of the lever 47 due to the winding of the cable 53 upon its drum is automatically arrested at the proper time by means of the buffer-plate 88, which is mounted upon said lever and is carried by the movement thereof against the projecting end of the rod 89, suitably supported in hangers 90 and having thereon, between said hangers, a coiled spring 91. As the plate 88 engages said rod it is moved longitudinally to carry it against the stem 72 of the curved wedge-shaped finger 71, whereby said stem is moved upon its pivot to swing said finger into the channel 58 of the clutch-collar, thereby causing said finger to engage and retract the slide-bolt 59 from the keeper in the hub of the gear-wheel 62, when the rotation of the drum 55 will be arrested, stopping the movement of the lever 47. As the stem 72 of the curved wedge-shaped finger is moved by the rod 89 into the position just described it is locked in said position by the spring-catch 75 and retained by said catch until released, as before described. The spring 91 upon the rod 89 serves to return said rod after an operation. After the spring has been stripped from the mandrel, as above described, it is necessary to restore the mandrel to its normal position by

a return movement of the lever 47. This return movement of said lever is accomplished through the winding of the cable 54 upon the drum 70, driven by the beveled gear 69, meshing with a like gear 92, connected with said drum by a clutch device exactly like that shown in Figs. 4, 5, and 6, the description of which need not be repeated, said clutch being actuated by a curved wedge-shaped finger 93 (see Fig. 3 and dotted lines in Fig. 1) upon the lower end of the pivot-stem 94, which is held in the locked position by the spring-catch 95 (see Fig. 15) engaging the stem 94 of said wedge-shaped finger. The spring-catch 95 is actuated to release said stem and allow the spring 96 to withdraw the wedge-shaped finger 93 and set the clutch by means of a cam-disk 97 upon the end of the rotary rod 98, suitably supported in the frame and actuated by the lever 99, through the operation of which the clutch may be set to cause a rotation of the drum 70, whereby the cable 54 is wound thereon and the lever 47 is returned to slide the shaft 10 longitudinally and restore the mandrel to its working position. When said lever shall have reached the limit of its return movement, the end 100 of the plate 88 will engage one end of the rod 101, mounted to slide in the hangers 102 and adapted to engage the stem 94 of the wedge-shaped finger 93 and move said stem upon its pivot, retracting said finger to disengage the clutch and stop the rotation of the drum 70. Upon the rod 101 is a compression-spring 103, adapted to restore said rod for a succeeding operation, when the lever 47 moves in the opposite direction and carries the plate 88 from the end of said rod. The rotation of the hollow shaft 8, which drives the mandrel through the longitudinally-movable shaft 10, sliding within said hollow shaft, is controlled, as before described, through the medium of the friction-rollers 6 and 7. These rollers are brought into engagement and carried from engagement by the operation of the eccentric bearings 2, (see Fig. 3,) from which depends a yoke-shaped frame 104, to which is swiveled at 105 the shaft 106, passing transversely of the frame and having a screw 107 at one end which turns in a threaded oscillating box 108, as shown in Fig. 2. Upon the end of said shaft is a hand-wheel 109, by means of which the shaft may be turned to cause it to travel through the box 108 and swing the yoke to bring the friction-rollers into peripheral contact for operating the machine or moves said rollers apart to stop the machine, as will be well understood. As before stated, there is a split nut 36 in the carriage 34, that travels upon the screw 27 in feeding the bar into the machine. It is necessary after the carriage has reached the limit of its movement in completing the operation of forming the spring that it be quickly returned for a succeeding operation. In order to free the nut in the carriage from the screw 27, said nut is made in two parts, and said parts are adapted to be separated to disengage their threads from the screw by means of a rotary disk 110, having the eccentric slots 111 therein adapted to receive the pins 112, projecting from the halves of said nut. The plate 110 is rotatably supported upon the central pin 113, which is journaled in a supporting-plate 114 and to the projecting end of which is attached the lever 115. In the supporting-plate 114 are the slots 116 to accommodate the movement of the pins 112. By rotating said disk through the lever 115 so as to bring the pins to the outer extremities of the eccentric slots 111 the halves of the split nut will be separated to free them from the screw, enabling the carriage to be moved back to the starting-point upon the guide-rods 35, when by moving said lever in the opposite direction the halves of the nut are caused to again embrace the threads of the screw.

Having thus fully set forth my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a machine for making springs, the combination of the rotary tubular shaft and means for driving it, of the second shaft longitudinally movable within the tubular shaft and rotatable therewith, a mandrel carried by and rotating with the second shaft upon which the spring may be formed, a carriage longitudinally movable only for guiding the spring to the mandrel, means for automatically moving the carriage as the spring-bar feeds therefrom, and means for reciprocating longitudinally the shaft carrying the mandrel.

2. In a machine for making coiled springs, the combination of the rotary and longitudinally-movable shaft, the mandrel movable longitudinally with said shaft and rotatable therewith, a lever for reciprocating said shaft longitudinally, means for automatically actuating said lever in opposite directions, a movable carriage at the side of the mandrel for directing the spring-bar thereon, and means for automatically moving said carriage.

3. In a machine for making springs, the combination with the rotary shaft and means for driving it, of the mandrel rotatable with said shaft, a movable carriage for directing the spring-bar onto the mandrel, means for regulating the speed of said movable carriage, a former adjacent to the mandrel having a working face concentric therewith, said former being adjustable longitudinally of the mandrel and transversally thereof.

4. In a machine for making springs, the combination with the rotary shaft, of the mandrel connected to and rotatable therewith, means for clamping the end of the bar to the mandrel, a movable carriage for feeding the bar to the machine, a rotary screw for driv-

ing said carriage, a split nut in the carriage through which said screw passes, and means for actuating the parts of said nut to disengage them from said screw and bring them into engagement therewith.

5. In a machine for making coiled springs, the combination with the rotary shaft and means for rotating it, of the mandrel driven by said shaft, a movable carriage for guiding the bar to the mandrel, a rotary screw for driving said carriage, a split nut in the carriage engaging said screw, a rotary disk on the carriage having eccentric slots, and pins projecting from the parts of said nut into the slots of said disk.

6. In a machine for making coiled springs, the combination with the rotary shaft and means for driving it, of a rotary head carried by said shaft supported in a suitable bearing, a mandrel projecting from said head in axial alinement with said shaft, a rock-shaft journaled in the head carrying at one end a clamping-dog adapted to clamp the spring-bar to the mandrel, a curved arm upon the opposite end of said rock-shaft, a ring rotatable upon said head having a foot adapted to engage said arm to rock the shaft and actuate said dog.

7. In a machine for making coiled springs, the combination with the tubular shaft and means for rotating it, of the shaft longitudinally movable through said tubular shaft, and rotatable therewith, an annular head upon the end of said longitudinally-movable shaft, a mandrel projecting from said head, a clamping-dog upon said head adjacent to said mandrel, means for actuating said dog to clamp the spring-bar, a carriage for directing the bar to the mandrel, and means for automatically moving said carriage to feed the bar into the machine.

8. In a machine for making coiled springs, the combination with the rotatable and longitudinally-movable shaft, a mandrel attached to said shaft to rotate and movable therewith, means for automatically feeding the spring-bar to the mandrel, a lever for moving said shaft and mandrel longitudinally, means for actuating said lever to slide said shaft in one direction, and means for actuating said lever to return said shaft.

9. In a machine for making coiled springs, the combination with the rotatable and longitudinally-moving mandrel, of means for automatically feeding the bar to the mandrel, a lever for moving the mandrel longitudinally, means operating automatically for moving said lever in opposite directions and means for automatically arresting the movement of said lever at the limit of its travel in both directions.

10. In a machine for making coiled springs, the combination with the rotary and longitudinally-moving mandrel, of means for automatically feeding the spring-bar to the mandrel, means for shifting the mandrel longitudinally, means for locking the mandrel against longitudinal movement, and means operating in conjunction with the mandrel-shifting means for unlocking the mandrel to allow it to move longitudinally and simultaneously strip the spring therefrom.

In testimony whereof I sign this specification in the presence of two witnesses.

ROBERT S. HILL.

Witnesses:
E. S. WHEELER,
I. G. HOWLETT.