G. H. RUPLEY.

WINDING MACHINE.

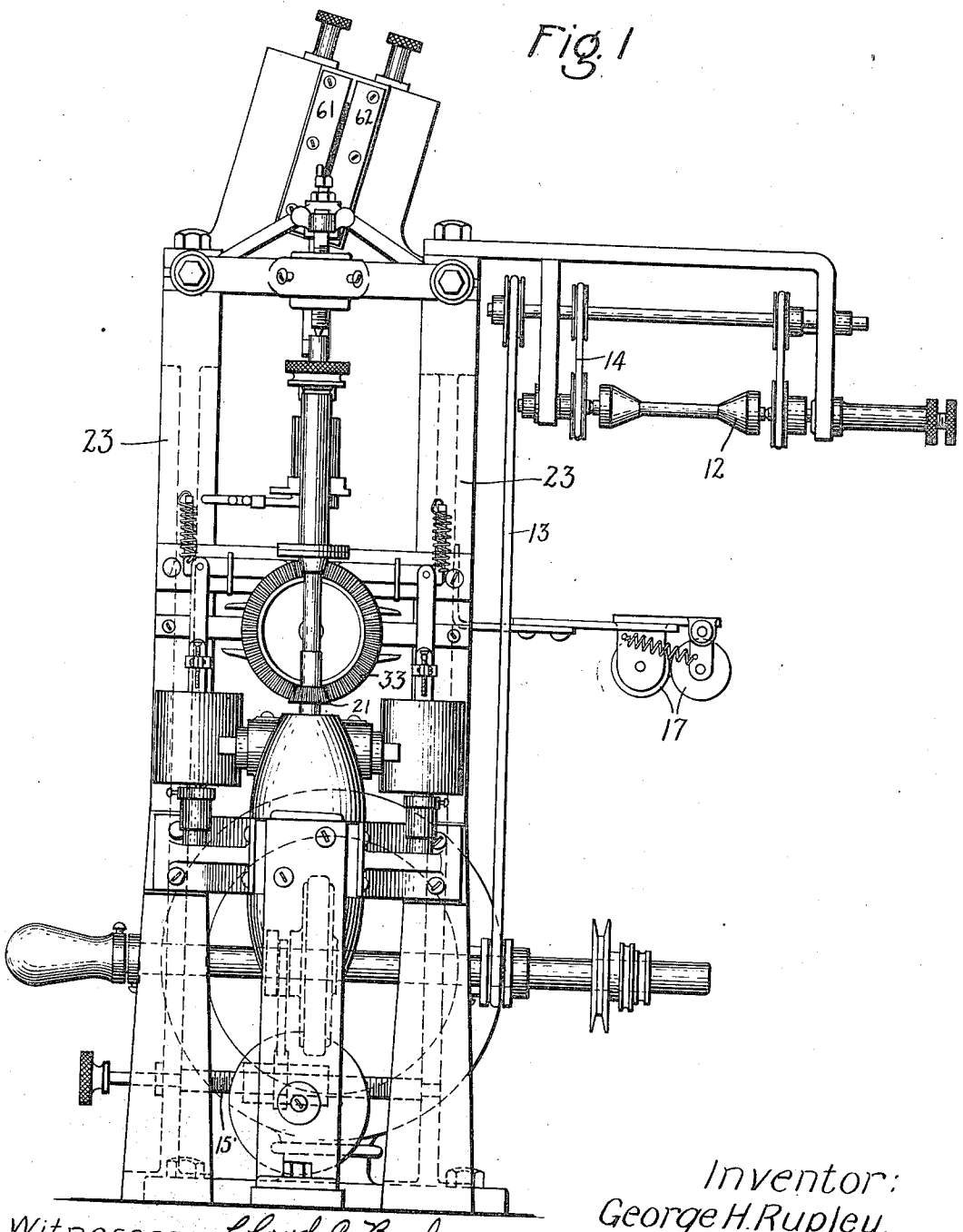
APPLICATION FILED MAR. 25, 1907.

1,028,390.

Patented June 4, 1912.

5 SHEETS—SHEET 1.

Fig. 1



Witnesses:- Lloyd C. Bush
J. Ellis Glen

Inventor:
George H. Rupley.
By Albert G. Davis
Atty.

G. H. RUPLEY.

WINDING MACHINE.

APPLICATION FILED MAR. 25, 1907.

1,028,390.

Patented June 4, 1912.

5 SHEETS—SHEET 2.

Fig 2

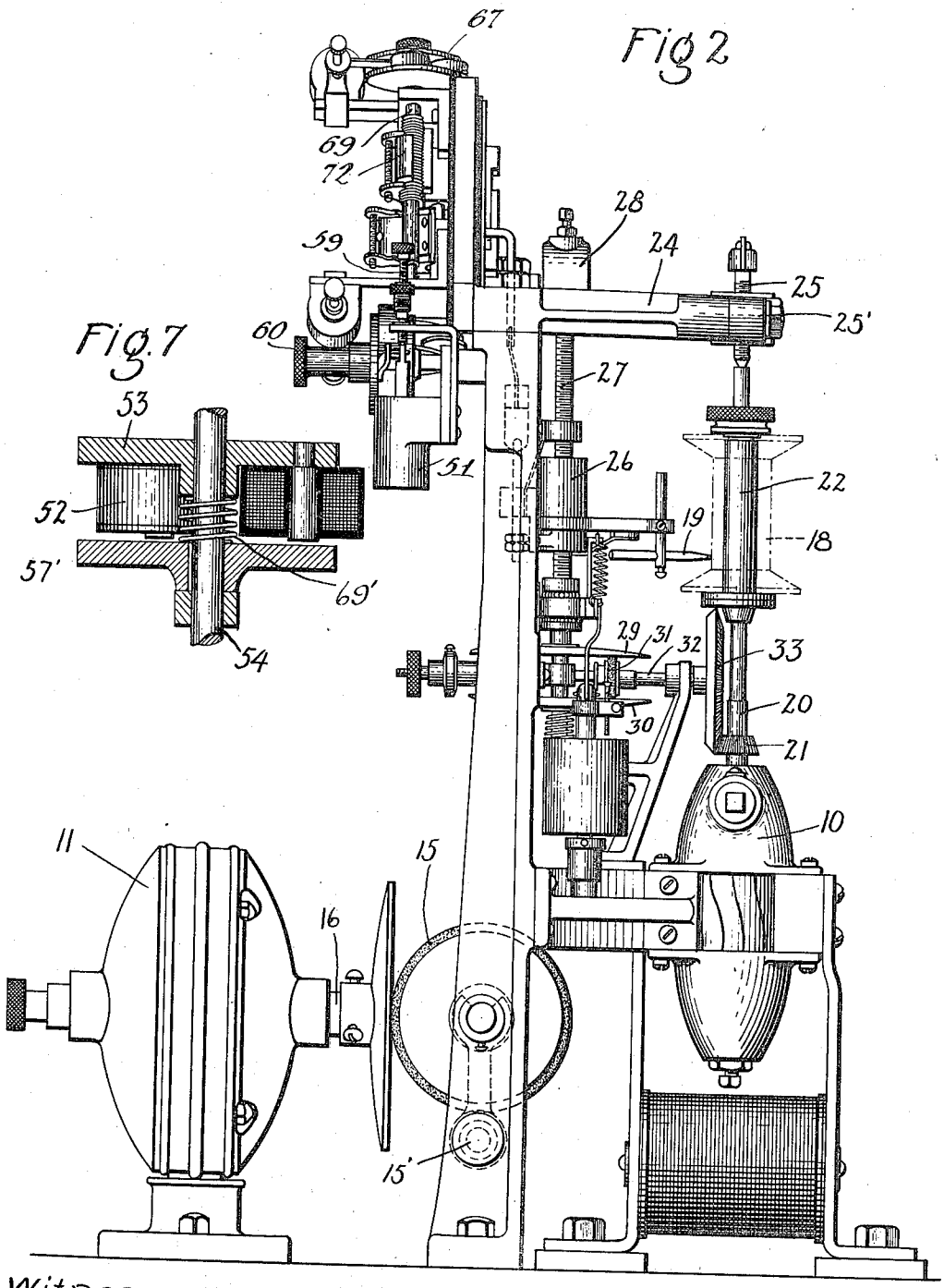


Fig. 7

Witnesses:
Lloyd C. Bush
J. Ellis Glen

Inventor:
George H Rupley.
By Albert G. Davis
Atty.

G. H. RUPLEY.

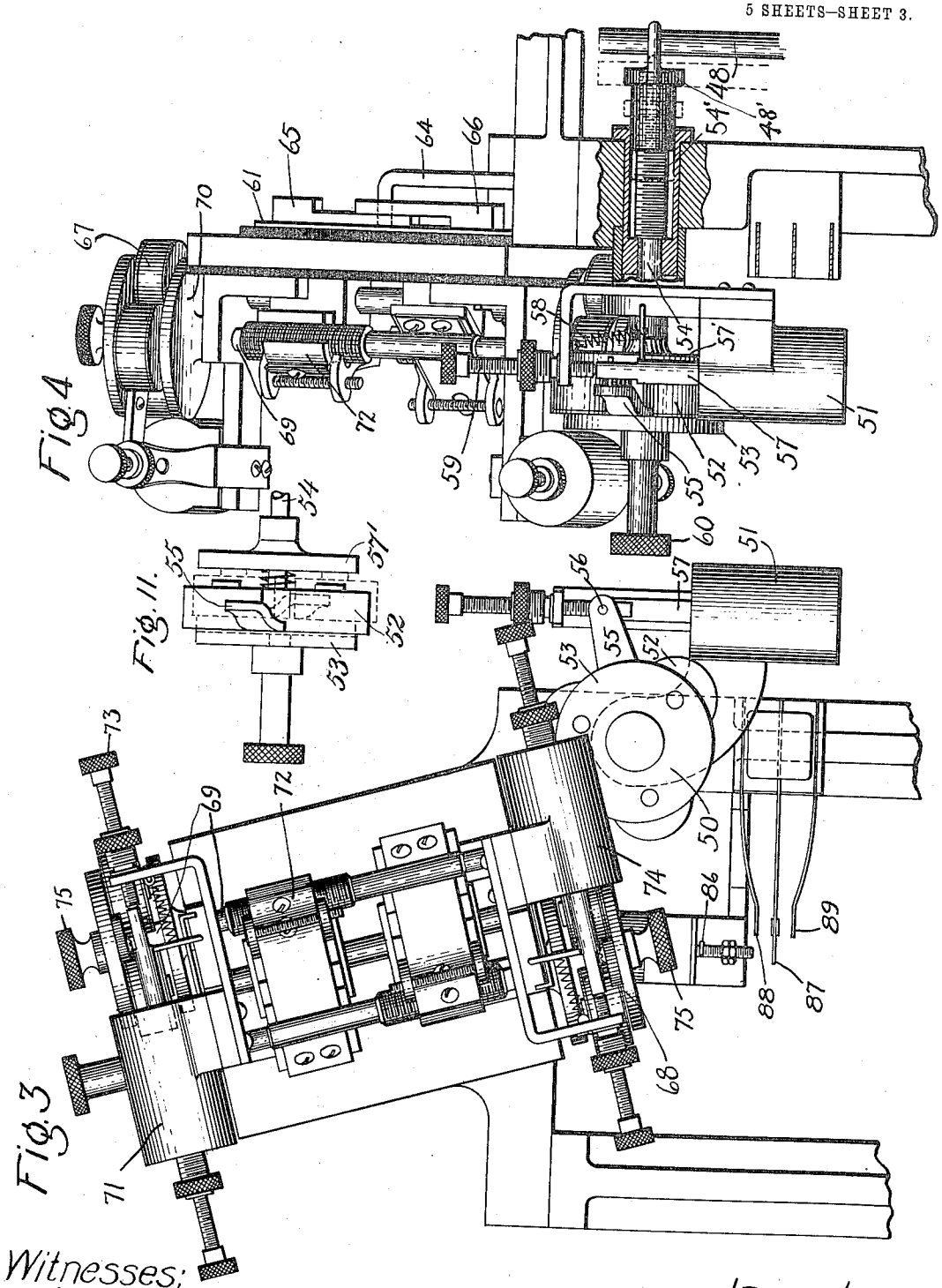
WINDING MACHINE.

APPLICATION FILED MAR. 25, 1907.

1,028,390.

Patented June 4, 1912.

5 SHEETS—SHEET 3.



Witnesses:
Lloyd C. Bush
J. Ellis Glen

Inventor:
George H. Rupley.
By Allen A. Davis
Att'y.

G. H. RUPLEY.

WINDING MACHINE.

APPLICATION FILED MAR. 25, 1907.

1,028,390.

Patented June 4, 1912.

5 SHEETS—SHEET 4.

Fig. 5

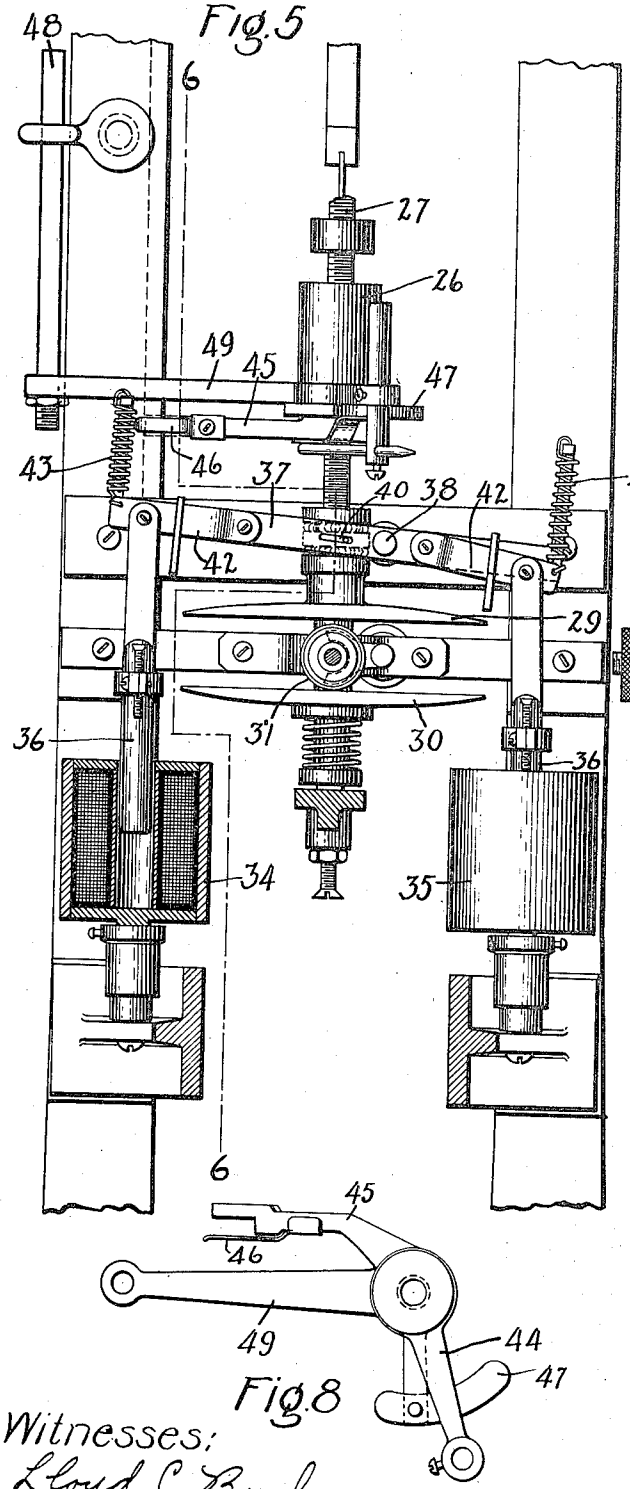


Fig. 6

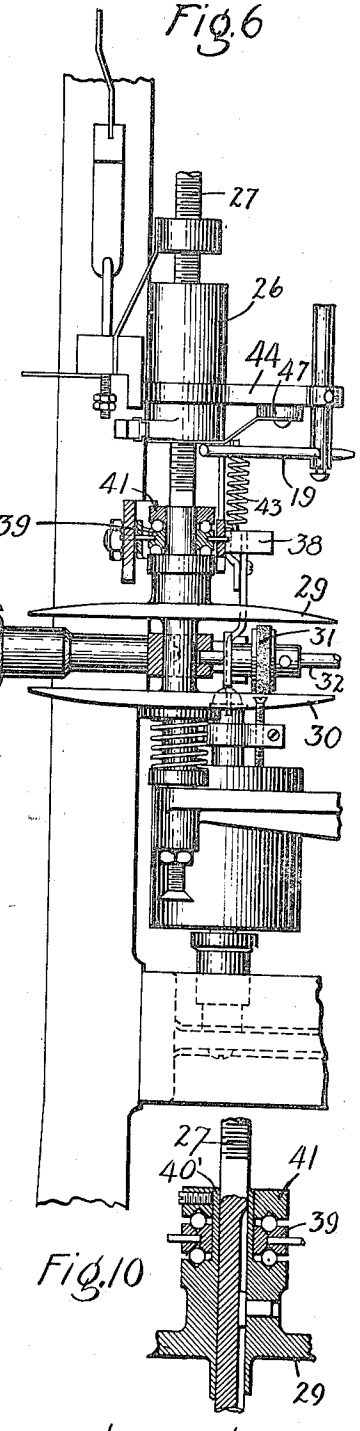


Fig. 8

Fig. 10

Witnesses:
Lloyd C. Burch
J. Ellis Glen

Inventor:
George H. Rupley.
By Albert G. Davis
Atty.

G. H. RUPLEY.

WINDING MACHINE.

APPLICATION FILED MAR. 25, 1907.

1,028,390.

Patented June 4, 1912.

5 SHEETS—SHEET 5.

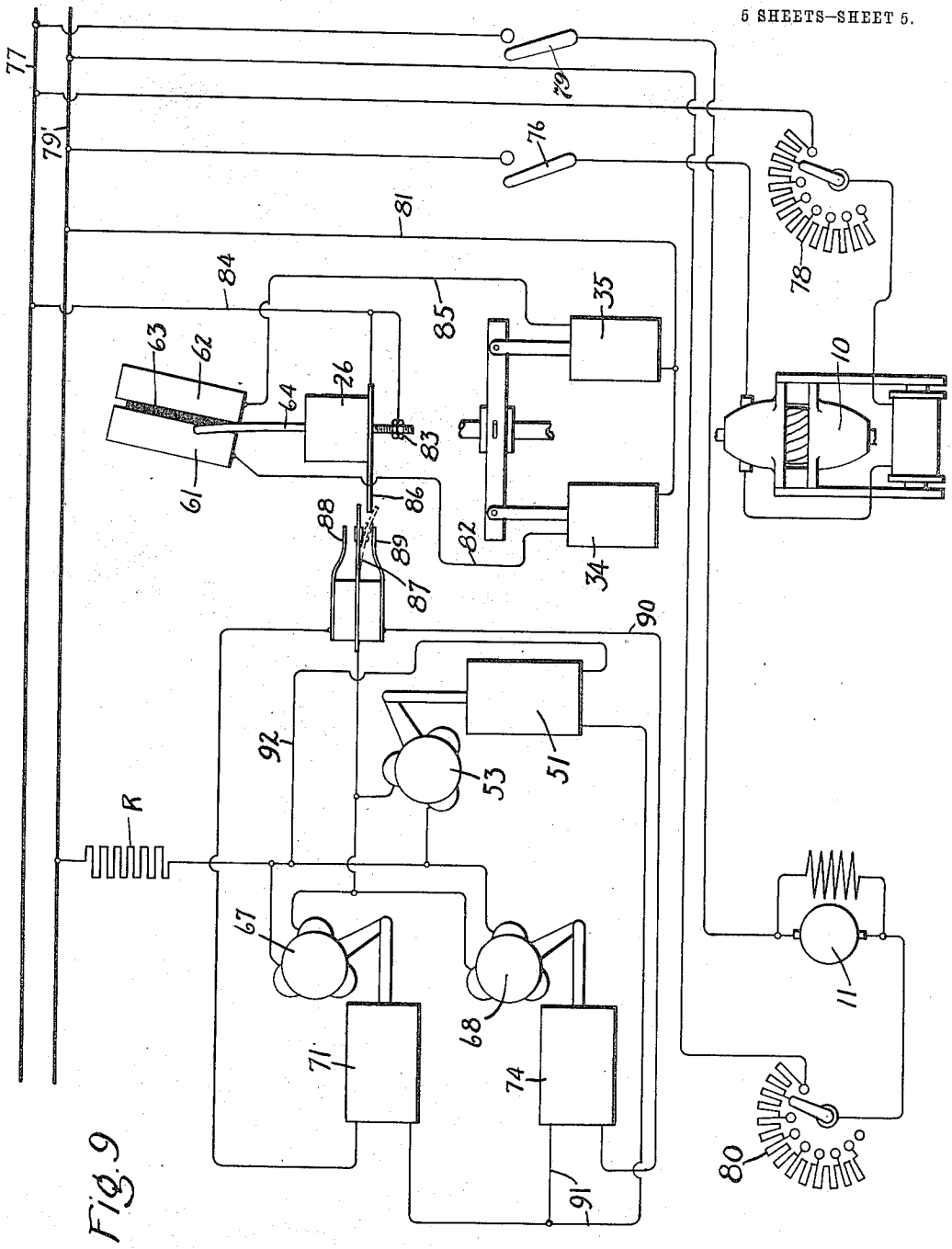


Fig. 9

Witnesses:
Lloyd C. Bush
J. Ellis Glen

Inventor:
George H. Rupley.
By Albert G. Davis
Att'y.

UNITED STATES PATENT OFFICE.

GEORGE H. RUPLEY, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

WINDING-MACHINE.

1,028,390. Specification of Letters Patent. Patented June 4, 1912.

Application filed March 25, 1907. Serial No. 364,317.

To all whom it may concern:

Be it known that I, GEORGE H. RUPLEY, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Winding-Machines, of which the following is a specification.

This invention relates to devices for winding or spooling of wire, thread or the like and has for its object the provision of a machine whereby the material may be rapidly wound on spools of different sizes and shapes in a reliable, accurate and efficient manner.

My invention relates more specifically to the winding of fine wires and threads which are easily broken and which, therefore, require a delicate machine in handling.

While my machine is capable of a wide range of uses and is in no sense limited to this application, it finds a particular field of usefulness in the spooling of fine wire in connection with an insulating machine. This machine forms the subject matter of my Patent No. 919,470 of Sept. 19, 1909. In order that fine wire may be insulated at a rapid rate, it is necessary that some provision be made for rapid spooling. I have found that a machine of this character may be very efficiently controlled by means of an electric current.

In carrying out my invention I attach the winding spindle directly to the armature of a series wound motor. The wire is positively fed to the winding spindle by means of another motor. The motor of the winding spindle is designed to take up the wire just as fast as it is fed and a very even tension is thus maintained. A machine of this type will handle two and three mil wire at the rate of from 400 to 600 feet per minute. Running at this rate of speed it is evident, especially with a copper wire heated, that the tension must be adjusted in a very even and delicate manner. I also provide electrically controlled means for varying the length of throw of the guiding device so as to give a taper end spool.

Other features of construction and objects of my invention will be made to appear in the course of the following specification, in which I have shown my invention embodied in a concrete form.

In the drawings in which the mechanism is shown and which embodies my features of novelty, Figure 1 is a front elevation of the machine; Fig. 2 is a side elevation of the same; Fig. 3 is a rear elevation of the upper portion of the machine showing the solenoids which control the switching mechanism; Fig. 4 is a side elevation of the same; Fig. 5 is an elevation partly in section of the mechanism for reversing the throw of the guide; Fig 6 is a side elevation of the same; Fig. 7 is a detail of the magnetic clutch mechanism; Fig. 8 is a detail of the mechanism for shifting the guide away from the spindle; Fig. 9 is a diagram of the circuit; Fig. 10 is a detail of the bearing collars; and Fig. 11 is a detail of the magnetic clutch showing the parts in two positions by means of full and dotted lines.

Referring to the drawings for a complete description of my invention, the machine may be said to consist broadly of a spooling mechanism driven by the motor 10 and the feeding mechanism driven by the motor 11. The spool or bobbin 12 from which the wire is unwound is positively driven by means of belts 13 and 14 and friction drive 15 and the feeding speed may be varied by means of screw 15′. When the armature shaft 16 is driven from the motor 11, the wire is positively fed off passing between tension rolls 17 thence to the insulating machine or to the winding spindle direct, depending upon the use to which the machine is to be put. The wire is fed to the winding spool 18 through the guide 19. The motor 11 may be of any desired type, such as a constant speed motor of the shunt wound type. The motor 10, however, is preferably a series wound motor having its armature vertically arranged and having the armature shaft 20 extending so as to receive a driving pinion 21 and a driving spindle 22 upon which the spool or bobbin is mounted. The armature of the motor 10 is secured to the frame work of the machine, which consists essentially of uprights 23 secured together at their upper ends, having a bracket 24 extending outward so as to form a bearing for the upper end of the driving spindle 22. The spindle runs on a screw center 25, which is mounted upon pivoted arm 25′ which is swung outward when it is desired to remove or insert a spool. The spindle 22 thus has a positive mechanical driving connection with the

armature of the motor 10, and its speed can only vary as the speed of the motor itself varies.

The guide 19 which feeds the wire to the spindle is carried by a head 26 having a screw engagement with a lead screw 27, the upper end of which has a bearing in the frame at 28 and to the lower end of which are secured a pair of friction disks 29 and 30. The friction gear 31 mounted upon a shaft 32 and driven from pinion 21 by gear 33, rotates between the two friction disks and engages either one, depending upon the position of the controlling parts. This will therefore drive screw 27 either in one direction or the other, and the head 26 carrying the guide will have a movement longitudinally of the spindle in both directions. The reversal of the screw is accomplished by means of a pair of solenoids 34 and 35, each having a movable core 36, the upper end of which is pivoted to a cross arm 37. This cross arm is pivoted at 38 to the frame of the machine and at its central portion is yoke-shaped so as to engage the collar 39 with a slot and pin connection 40. This collar is loose on sleeve 40′ and supported by ball bearings between bearing collars 41 which are keyed to the sleeve and rotate with the disks 29 and 30. The sleeve is integral with disks 29 and 30, and is splined to screw-shaft 27. The cores 36 are pivoted at their upper ends to the cross arm 37 through links 42 which are held in a raised position by springs 43. When one of the solenoids, as for instance 35, is energized, its core is pulled down to the position shown in Fig. 5. This movement causes the portion of the cross arm 37, provided with a pin and slot connection, to rise thereby carrying with it the collars 41 which in turn carry the lower friction disk 30 into operating engagement with the friction gear 31. Similarly when the solenoid 34 is energized and solenoid 35 deënergized, a driving connection is made with the friction disk 29. The springs 43 cause a yielding pressure between the gear and the disks. The manner of operating the solenoids will be hereinafter described.

In the winding of fine wire it is essential for the guide to be very close to the spool which is being wound, and as the spool gets larger the guide must, of course, be moved farther from the center. This operation I accomplish automatically by an electromagnetic mechanism. The guide 19 is adjustably secured to an arm 44 pivotally secured to the head 26, the guide member 45 having a guide clip 46 which slides up and down on the frame. The arm has a spring-pressed extension 47 which supports the outer end of the member 45. Arm 44 is connected with rod 48 by a link 49. The rod 48 is moved in and out from the frame by an electromagnetic clutch 50 and solenoid 51 (Figs. 3 and 4). The clutch consists of electromagnets 52 secured to a disk 53 sliding on a shaft 54. The disk 53 has an arm 55 pivoted at 56 to the core 57 of solenoid 51. Magnets 52 coöperate with a disk 57′ secured to the shaft 54, so that when the magnets are energized they will move up to the disk 57′ against the tension of the spring 69′ and then upon the energizing of the solenoid 51, the disk 53 is rotated carrying with it the magnets, the disk 57′ and the shaft 54, which in turn moves the rod 48 by means of the thread 54′ which slides nut 48′ in and out as shown in Fig. 4. When the magnets are deënergized the spring 58 returns the disk to its original position which may be adjusted by the screw 59. Shaft 54 may be turned by hand by means of the screw 60. The arrangement of circuits is such that the magnetic clutches and the solenoid are magnetized once during each throw of the guide, and the latter is moved outward from the center a distance equal to the thickness of the layer formed upon the spool. The guide thus maintains a fixed distance from the surface of the spindle, and a greater degree of smoothness of the layers is accomplished.

In the winding of fine wire and the like it is desirable that a taper ended spool be employed so as to prevent the last turn of the layer from sinking beneath the other turns and thus prevent the free unwinding of the spool. In order to adapt my machine for a taper spool I employ the mechanism shown in Figs. 3, 4 and 9. This mechanism consists of contact plates 61 and 62 forming terminals for the solenoids 34 and 35 respectively, the plates being separated by an insulating rib 63. A spring contact 64 is secured to the head 26 and moved back and forth thereby over the contact plates. The plates and the rib 63 are set at an angle to the direction of travel of the contact, which is bent inward and normally engages the rib at or about a point intermediate the ends of the rib. As the contact moves in one direction therefore from its central point, the rib will place the spring arm under tension by moving it laterally. As the contact moves along the rib the tension increases until the end of the rib is reached whereupon the contact will spring past the rib and on to the opposite contact plate thereby energizing the other solenoid, which reverses the direction of rotation of the screw. The contact is thereupon carried back in an opposite direction, and after it passes the central point of the rib again engages it and when the end of the rib is reached the contact again snaps over on the opposite contact surface, this operation continuing to automatically reverse the movement of the guide. In order to make each layer of wire

longer than the preceding one, as is necessary in the taper ended spool, I make each successive throw of the guide longer by automatically increasing the effective length of the rib. To accomplish this I form the rib in two parts 65 and 66 sliding to and from each other between the contact plates. Each section is independently operated by a magnetic clutch, the upper section being operated by clutch magnet 67 and the lower one by magnets 68. These two clutches are identical in construction and operation with the magnetic clutch mechanism described above. When the magnets 68 are energized they move longitudinally of the shaft 69 against the tension of a spring into engagement with the disk 70 keyed to the shaft 69. When the solenoid 71 is energized the disk upon which the magnets are mounted is given a partial revolution thereby rotating the shaft 69. This shaft 69 carries a screw-thread which engages with an adjustable nut 72 to which the section 65 of the rib is secured. In this way each time the magnets 67 and the solenoid 71 are energized the section 65 of the rib is moved outward, an increment which may be adjusted by means of the screw 73. In a similar way the lower section 66 is moved upward by a similar clutch magnet 68 and solenoid 74. The shafts 69 may be turned by hand by means of the screw-heads 75.

The arrangement of circuits and the mode of operation will now be described, particular reference being made to Fig. 9 of the drawings. To start the machine the switch 76 is closed whereupon current will flow from main 77 through rheostat 78, series motor 10, switch 76 and back to line at 79′, placing a tension on the wire. Switch 79 is then closed, whereupon current will pass through the shunt wound motor 11 having a rheostat 80 in series with its armature. The feeding device will thereupon be started and wire will be fed to the guide 19. The winding spindle upon which the spool 18 is mounted will also be started and the winding head 26 will start to move in one direction depending upon the position of the parts, as for instance downward. During a movement, as, for instance, downward, as shown in Fig. 9, the contactor 64 is in engagement with the plate 61 and solenoid 34 is energized as follows: from main 79′, conductor 81, solenoid 34, conductor 82, plate 61, contactor 64 to the terminal 83 carried by head 26 and conductor 84 back to line at 77. The solenoid 34 being energized the friction gear 31 is held in contact with the upper friction disk 29. The head 26 thus travels downward placing a tension upon the contactor arm 64 causing it to bend as shown in Fig. 9. When the end of the rib is reached the contactor will spring back into place and will then be in contact with the plate 62. This movement of the contactor deënergizes solenoid 34 and energizes solenoid 35 as follows: from main 79′ through conductor 81, solenoid 35, conductor 85, plate 62, contactor 64, terminal 83, conductor 84 and back to line. The energizing of solenoid 35 moves the friction wheel 31 into engagement with the lower friction disk 30 as shown in Figs. 5 and 6 thereby reversing the direction of rotation of the lead screw. The head thereupon starts to move upward and when the end of the rib is reached the cycle of operations is repeated.

The head 26 carries a finger 86 which engages a flexible contact 87 vibrating between the contacts 88 and 89. These contacts are mounted on the frame so that the finger 86 will engage contact 87 at a point intermediate the limits of travel of the head. These contacts control the circuits of the magnetic clutch 53 and solenoid 51 as well as the solenoids 71 and 74 and their corresponding clutches 67, 68 and 53. As the finger 86 travels downward, it will engage the spring contact 87 thereby energizing magnetic clutches 67, 68 and 53, which are in parallel, as follows: from main 77 to finger 86, thence through spring contact 87, coils of clutches 67, 68 and 53, in parallel and resistance R back to line at 79. The movement of the finger 86 continuing, spring 87 will be forced downward into engagement with the contact 89, as shown in dotted lines in Fig. 9. A circuit will thereupon be completed in addition to that above described through solenoids 51 and 74, as follows: from contact 89, conductor 90, solenoid 74, conductor 91, solenoid 51 and conductor 92 back to line. The energizing of the solenoid 74 causes shaft 69 to be rotated slightly thereby moving the upper section 65 of the rib outward. The energizing of the solenoid 51 causes the guide 19 to be moved backward from the spool as above described. The finger continuing to move, disengages with the contact 87 and deënergizes all of the solenoids and clutches. On its return movement a similar cycle of operations is gone through. In this way the guide will continue to move back and forth, each time moving a little farther, and as each additional layer is wound on the spool the guide is moved away from the spool a proper amount.

I consider that the driving of the winding spindle directly by means of a variable speed motor is an important feature of my invention since it allows the spindle to wind up only as fast as the wire is fed to it, and the speed of the motor is proportioned with the load,—that is, as the speed of feeding is varied, the speed of spooling will be automatically and proportionally varied, with-

out changing the tension on the wire to a noticeable extent. In other words, as the spool increases in size, the number of revolutions to maintain a fixed wire speed must be decreased. This decrease in speed the series motor brings about automatically, without varying the tension on the wire. Furthermore, the tension of the wire may be very accurately and simply adjusted by a variation of the current to the motor. By proportioning the speed of the guide or the leading speed to the speed of the spool, I obtain a layer winding, since the leading speed will be automatically varied to suit the speed of the spool. I also consider my electric control including the electromagnetic reversing mechanism as well as the arrangement for tapering the spools a very important and convenient one, especially where fine wire is being wound. It will, of course, be understood that while I have shown my invention in its preferred form, I do not intend to limit my invention to the specific construction or arrangement shown and described, since many changes and modifications will suggest themselves to those skilled in the art all of which come within the spirit of my invention in so far as they fall within the scope of the claims annexed hereto.

What I claim as new, and desire to secure by Letters Patent of the United States, is,—

1. A mechanism for winding wire and the like comprising an electric motor the speed of which varies with the load, a winding spindle driven thereby, and means for positively feeding wire to the spindle.

2. A mechanism for winding wire and the like comprising a motor the speed of which varies with the load, a winding spindle driven thereby, and a second electric motor for positively feeding wire to the spindle.

3. A mechanism for winding wire and the like comprising a series wound electric motor, a winding spindle having a direct mechanical driving connection therewith, and means for positively feeding the wire to the spindle.

4. A mechanism for winding wire and the like comprising a series wound electric motor, a winding spindle having a direct mechanical driving connection therewith, and independently driven mechanism for positively feeding the wire to the spindle.

5. A mechanism for winding wire and the like comprising a series wound electric motor, a winding spindle having a direct mechanical driving connection therewith, independently driven mechanism for positively feeding the wire to the spindle, and means for varying the feeding speed.

6. A mechanism for winding wire and the like comprising an electric motor, a winding spindle having a direct mechanical driving connection therewith, a movable guiding mechanism, an electrically controlled means for reversing the direction of movement thereof.

7. A mechanism for winding wire and the like comprising an electric motor, a winding spindle positively driven thereby, a movable guiding mechanism for the wire, and electromagnetic means controlled by the movement of the guiding mechanism for reversing the direction of movement.

8. A mechanism for winding wire and the like comprising a series wound electric motor, a winding spindle having a direct mechanical driving connection therewith, a guiding device, means for causing relative movement between the guiding device and the spindle longitudinally of the latter, means for reversing the direction of said movement, and an electric motor for positively feeding the wire to the spindle.

9. A mechanism for winding wire and the like comprising an electric motor, a winding spindle having a direct mechanical driving connection therewith, a guiding device driven by the motor, and electrically controlled means for reversing the direction of movement thereof.

10. A mechanism for winding wire and the like comprising an electric motor, a winding spindle having a direct mechanical driving connection therewith, a guiding device driven by the motor, a reversing mechanism therefor, and electromagnetic means controlled by the movement of said device for actuating said reversing mechanism.

11. A mechanism for winding wire and the like comprising an electric motor, a winding spindle having a direct mechanical driving connection therewith, a guiding device, means for causing a relative movement between said device and the spindle longitudinally of the latter, electrically-controlled means for varying the amount of said movement, and means for reversing the direction thereof.

12. A mechanism for winding wire and the like comprising an electric motor, a winding spindle having a direct mechanical driving connection therewith, a guiding device, means for causing a relative movement between said device and the spindle longitudinally of the latter, electromagnetic means for gradually increasing the length of said movement a predetermined amount, and means for reversing the direction thereof.

13. A mechanism for winding wire and the like comprising an electric motor, a winding spindle having a direct mechanical driving connection therewith, a guiding device, means for causing a relative movement between said device and the spindle longitudinally of the latter, means for reversing the direction of said movement, and electrically-controlled means for increasing

the length of movement a predetermined amount after each reversal.

14. A mechanism for winding wire and the like comprising a positively driven winding spindle, a guiding device, means for causing a relative movement between said device and the spindle longitudinally of the latter, an electromagnetic device for reversing the direction of said movement, an electromagnetic device for increasing the length of movement a predetermined amount, and connections whereby said devices are alternately operated.

15. A mechanism for winding wire and the like comprising a positively driven winding spindle, a guiding device movable longitudinally of the spindle, an electromagnetic device for reversing the direction of said movement, an electromagnetic device for increasing the length of said movement a predetermined amount, and means controlled by the guiding device for alternately operating said electromagnetic devices.

16. A mechanism for winding wire and the like comprising a positively driven winding spindle, a guiding device movable longitudinally of the spindle, an electromagnetic mechanism for reversing the direction of said movement, an electromagnetic mechanism for increasing the length of said movement a predetermined amount, and contacts carried by the guiding device for alternately operating said electromagnetic mechanisms.

17. A mechanism for winding wire and the like comprising a positively driven winding spindle, a guiding device movable longitudinally of the spindle and adjacent thereto, electromagnetic means for reversing the direction of said movement, and electromagnetic means for moving said guiding device away from the spindle a predetermined amount after each reversal.

18. A mechanism for winding wire and the like comprising a positively driven winding spindle, a guiding device movable longitudinally of the spindle and adjacent thereto, electromagnetic means for reversing the direction of said movement, electromagnetic means for increasing the length of said movement, and electromagnetic means for moving the guiding mechanism away from the spindle a predetermined amount after each reversal.

19. A mechanism for winding wire and the like comprising a positively driven winding spindle, a guiding device movable longitudinally of the spindle, a reversing mechanism for the guiding device, a pair of electromagnets for operating the reversing mechanism one for each direction, a switching contact operated by the guiding device, and connections whereby said switch energizes said magnets alternately.

20. A mechanism for winding wire and the like comprising a positively driven winding spindle, a guiding device movable longitudinally of the spindle and driven thereby, a reversing mechanism for the guiding device, a pair of electromagnets for operating the reversing mechanism each having a contact, a switch member operated by the guiding device and coöperating with said contacts, and means whereby said switch member is automatically shifted at a predetermined point from one contact to the other to cause a reverse movement of the guiding device.

21. A mechanism for winding wire and the like comprising a positively driven winding spindle, a guiding device movable longitudinally of the spindle, a reversing mechanism for the guiding device, a pair of electromagnets for operating the reversing mechanism each having a contact, a switch member coöperating with said contacts, and means whereby said switch member is automatically shifted at a predetermined point from one contact to the other to cause a reverse movement of the guiding device.

22. A mechanism for winding wire and the like comprising a positively driven winding spindle, a lead screw and mechanism for reversing the same, a guiding device driven in opposite directions thereby, an electromagnetic device for operating the reversing mechanism having circuit controlling contacts, a switch member coöperating with said contacts, and means whereby said switch member is automatically shifted at a predetermined point from one contact to the other to cause a reverse movement of the guiding device.

23. A mechanism for winding wire and the like comprising a positively driven winding spindle, a lead screw and mechanism for reversing the same, a guiding device driven in opposite directions thereby, a pair of electromagnets each having a contact, connections whereby the energizing of each magnet actuates the reversing mechanism, a switch member coöperating with said contacts actuated by the guiding device, and means whereby said switch member is automatically shifted at a predetermined point from one contact to the other to cause a reverse movement of the guiding device.

24. A mechanism for winding wire and the like comprising a winding spindle, a guiding device movable longitudinally thereof, and means for controlling the movement of the guiding device said means including an electromagnetic device having terminal contact surfaces, an insulating rib separating said surfaces, a switch element actuated by the guiding device and coöperating with said contact surfaces, and electromagnetic means for varying the effective length of said rib.

25. A mechanism for winding wire and the like comprising a winding spindle, a guiding device movable longitudinally thereof, and means for controlling the movement of the guiding device said means including an electromagnetic device having terminal contact surfaces, a switch element actuated by the guiding device coöperating therewith, an insulating rib separating said surfaces and arranged at an angle to the direction of movement of said switch element, and electromagnetic means for varying the effective length of said rib.

26. A mechanism for winding wire and the like comprising an electric motor, a winding spindle positively driven thereby, a lead screw driven by the motor, a reversing mechanism between the motor and the screw, a guiding device driven in opposite directions by the screw, an electromagnetic device for operating the reversing mechanism having circuit controlling contacts, a switch member coöperating with said contacts, and means whereby said switch member is automatically shifted at a predetermined point from one contact to the other to operate the reversing mechanism.

In witness whereof, I have hereunto set my hand this 22nd day of March, 1907.

GEORGE H. RUPLEY.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.