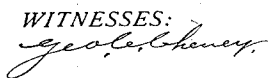


1,302,121.

2 SHEETS—SHEET 1.

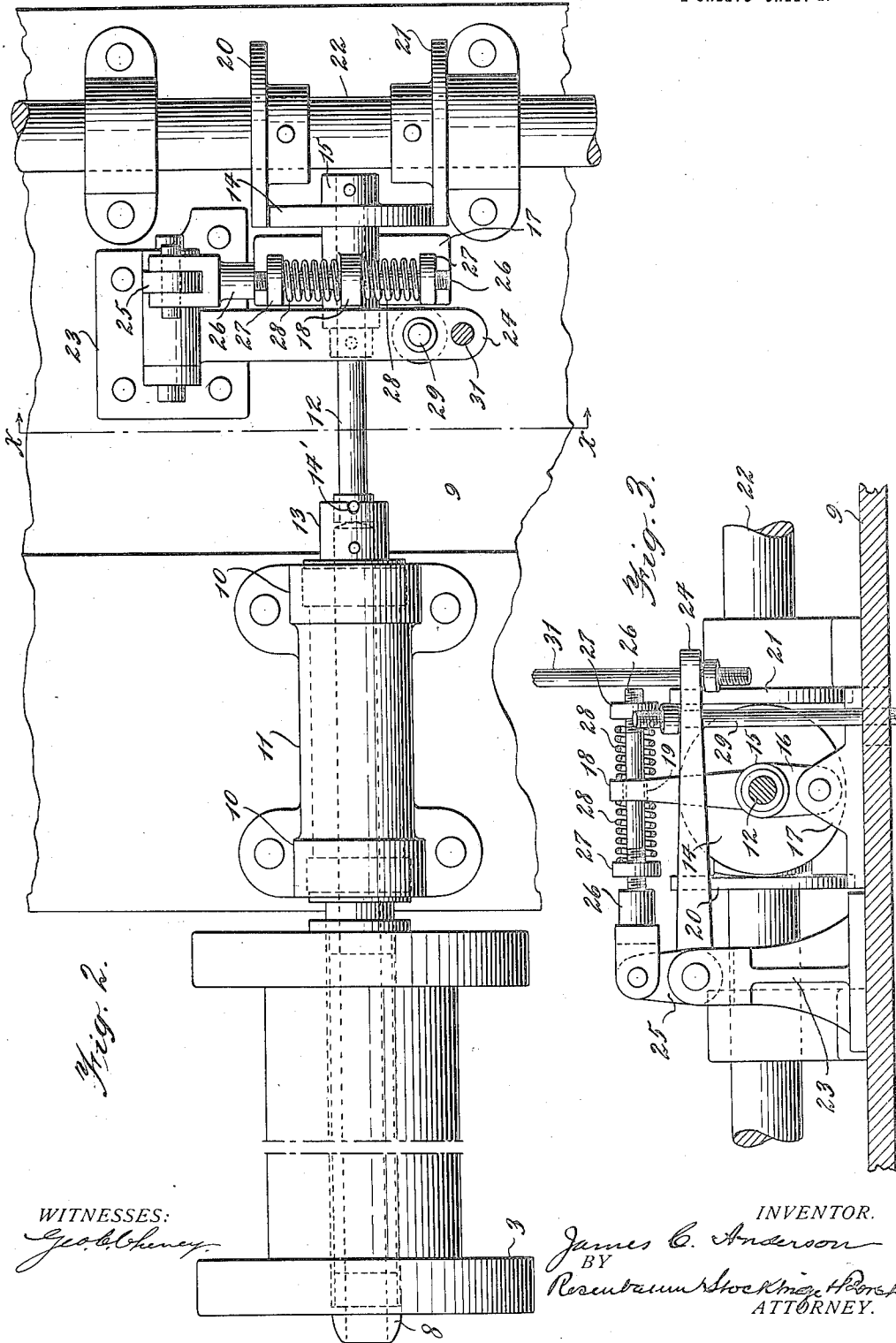


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WINDING MACHINE.
APPLICATION FILED MAR. 25, 1918.

1,302,121.

Patented Apr. 29, 1919.
2 SHEETS—SHEET 2.



UNITED STATES PATENT OFFICE.

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WINDING-MACHINE.

1,302,121.

Specification of Letters Patent.

Patented Apr. 29, 1919.

Application filed March 25, 1918. Serial No. 224,440.

To all whom it may concern:

Be it known that I, JAMES C. ANDERSON, a citizen of the United States, residing at Rutherford, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Winding-Machines, of which the following is a full, clear, and exact description.

This invention relates to winding machines of that particular character in which strands, threads, wires or webs are drawn from a supply spool and wound upon a mandrel or spindle, the force to rotate the supply spool being exerted through the strand.

The primary object of the invention is to provide means for preventing breakage of the strand by reason of variations in strain or tension caused by various conditions of momentum or inertia of the supply spool.

In the ordinary winding machine where the strand is drawn by a winding spindle from a freely mounted supply spool, it is customary to provide a brake or retarding device of some character to supply the necessary tension and to prevent overrunning of the spool and the consequent accumulation of slack in the strand when the winding spindle is brought to rest. An ordinary brake shoe applied and released automatically by variations in tension of the strand is an example of the kind of brake which has generally been used and is effective under many circumstances. When, however, the material subjected to the winding and unwinding operation, is of material, such as fine metallic wire, a full spool of such material requires, by reason of its inertia, considerable force to bring it from a condition of rest to normal speed or to increase its speed at any time during the unwinding operation, so that unless the acceleration is accomplished gradually, the strand through which the force is exerted and which has relatively low tensile strength, may be broken. Under such circumstances, therefore, it becomes necessary, not only to provide means for applying a force to the supply spool which opposes the pull of the strand as occasion arises, but to provide means for applying a force which positively augments the pull of the strand whenever required.

The object of this invention, therefore, is to provide means whereby a force other than the tension of the strand may be automati-

cally applied to the supply spool, when required, to aid the pull of the strand in overcoming the inertia of the spool, thereby saving the strand from strains which might otherwise break it. The invention also comprehends the provision of means whereby a force other than that of the tension of the strand may be automatically applied either to accelerate or retard the spool and thereby decrease or increase the tension on the strand with the result of maintaining as nearly as possible a uniform tension of strand throughout the winding operation. In other words, the invention consists in providing means for applying a force independent of the pull of the strand to either positively accelerate or retard the supply spool as distinguished from all previous mechanisms which provide only for positive retardation of the spool.

Proceeding to a more detailed description of the invention, reference will be made to the accompanying drawings, in which:

Figure 1 is a side elevation partially in section of a portion of the winding machine equipped in accordance with my invention;

Fig. 2 is a plan of the supply spool mounting and mechanism for transmitting extraneous power thereto; and

Fig. 3 is a section taken along the line $x-x$ of Fig. 2.

The mechanism illustrated is a portion of a machine for winding very fine copper-wire into electro-magnet coils, the wire being ordinarily insulated with varnish or a compound of similar nature which is applied and hardened by a baking process. The winding spindle upon which is usually wound a plurality of coils simultaneously, is indicated at 1 and is understood to be power-driven at high speed. To each of the coils wound on the spindle 1, a strand 2 leads from a supply spool 3. The illustration shows but one of these supply spools, this being sufficient to disclose the invention involved. To the rear and slightly above the winding spindle, is a feed rod 4 carrying upon a suitable bracket 5 fixed thereto two guide rolls 6 and 7. The feed rod is supposed to reciprocate in the direction of its length in order to form superposed layers of the convolutions on the spindle. The supply spool 3 is ordinarily of considerable size and when filled with the fine wire is quite heavy. This spool is fixed upon the overhanging end of a shaft 8

mounted horizontally on a part 9 of the frame and has bearings 10, 10 in an elongated bracket 11 fixed to said frame. The inner end of shaft 8 connects by means of a flexible joint with a short shaft 12, the said flexible joint consisting of a sleeve 13 into which both shafts extend, shaft 8 being pinned to the sleeve and shaft 12 having a cross pin 14' engaging with notches in the end of the sleeve. The free extremity of shaft 12 carries a friction disk 14 and is sustained in a floating bearing 15 having a downward extension 16 which is pivoted on an axis parallel to the shaft in a bracket 17 secured to the base 9. This bearing also has an upwardly extending arm 18 provided with an aperture 19 at its extremity. The friction disk 14 stands between and in a plane perpendicular to two friction disks 20 and 21 which are carried by a shaft 22 having suitable bearings in the frame and adapted to be driven continuously by power supplied in any suitable manner. The distance between the disks 20 and 21 is only slightly greater than the diameter of the disk 14 so that by slight lateral movement of the shaft 12 disk 14 can be thrown out of engagement with one of the disks 20, 21, and into engagement with the other, thereby transmitting the rotary force of shaft 22 in one direction or the other to the shaft 12 and to any degree, depending upon the pressure which the disk 14 is caused to exert upon the particular disk with which it may be frictionally engaged. The structure thus far described is thus adapted to either aid or oppose the rotation of the supply spool which is normally in one direction and caused by the pull exerted by the winding spindle 1 through the strand 2.

To one side of the shaft 12, and fixed to the base 9, is a bracket 23 in the upper end of which is pivoted a bell crank lever having a horizontal long arm 24 and a perpendicular short arm 25, the latter being in the plane of the arm 18 projecting upward from the floating bearing of shaft 12. To the upper end of the short arm of the bell-crank is pivoted a horizontal rod 26 which passes through the aperture 19 in the upper end of arm 18, and between each face of arm 18 and two adjustable nuts 27, 27, respectively, are interposed compression coiled-springs 28, 28. From this construction, it will be seen that by rocking the bell-crank arm 24, the upper end of arm 18 is swung from side to side upon its pivot in bracket 17 and disk 14 is thereby carried into contact with one or the other of the disks 20, 21. The force applied to the arm 24 of the bell crank is multiplied in its effect upon the disks by the difference in length of the arms of the bell-crank. The outer end of arm 24 is engaged by a depending rod 29 leading through the frame 9 and carrying

a weight 30, which, as can be seen, is normally applied to forcing disk 14 into engagement with disk 21. The rod 29 merely passes through an orifice in the end of arm 24 and is held therein by a nut. There is also in engagement with the outer end of arm 24 another rod 31 leading upward to the extremity of an arm 32 to which it is pivoted at 33; the arm 32 is pivoted at 34 to a part of the frame 35 and leads in a substantially horizontal position to a point immediately above the supply spool 3 where it is provided with a guide roller 36 over which the wire or strand 2 passes on its run from the guide roller 6 to the supply spool. It will be seen from this construction that downward motion of the arm 32 upon its pivot will raise the arm 24 of the bell-crank against the pull of weight 30, such movement serving to swing disk 14 out of contact with disk 21 and into contact with disk 20.

The operation of the mechanism is as follows: Shaft 22 is constantly running in one direction, power to drive it being taken from any rotating member whether part of the machine itself or separate therefrom. The winding spindle 1 is power-driven and rotates at high speed, drawing the wire from the supply spool and winding it in successive superposed layers until the coils are completed, whereupon the rotation of the spindle is stopped, the strands leading to each coil are cut, the finished coils removed from the spindle, the ends of the strands again attached to the spindle and the winding resumed. While the winding is proceeding normally, the roller 36 is floating in the upper half of its vertical movement, under which condition the disk 14 is being held in contact with disk 21 by the action of weight 30. These two disks are then rotating in opposite directions at their point of contact, disk 14 being rotated by the pull of the strand upon the supply spool. Hence, the rotary effort of shaft 22 is exerted to retard the spool and impart a certain normal tension to the wire. If, by reason of any irregularity the spool should pay-off the wire faster than the winding spindle is taking it up, the weight 30 would increase the pressure of disk 14 against disk 21 and add a further retarding force to the spool and restore the normal tension to the wire. Likewise, at the finish of a winding operation or on any occasion when the winding spindle is slowed down and stopped, the diminishing tension on the wire permits roller 36 to rise to the limit of its travel and the weight 30 to bring to bear a maximum rotative effort of shaft 22 to oppose the forward momentum of the supply spool and bring it quickly to a stop, thus preventing excessive slack or entanglement of the wires.

On the other hand, if during normal wind-

ing the drag of the supply spool increases slightly, the increased tension thus applied to the strand is instantly relieved by the yielding of the roller 36 downward which results in releasing the pressure of disk 14 upon disk 21, thus reducing the amount of retardation upon the spool so that the final result of the retarding force acting against the strain on the wire will be a mean position of the arm 32, which will be maintained so long as conditions remain normal. The action thus far described is that of an automatic brake and has been utilized heretofore in machines of this character, although never applied by the particular means herein described, so far as known.

In the winding of magnet coils, the turning out of any product by a winding machine or the performance of any winding or unwinding operation, it is manifestly desirable that there shall be as little delay and wasted time as possible, so that in stopping and starting the machine at the finish of one winding operation and the commencement of another, it is important that the machine shall come to a quick stop and when again started, shall at once or promptly resume its normal speed. This, however, cannot be done when the strand is delicate and the spool and contents are heavy, without creating excessive slack in the strand in stopping, or, breaking the strand in starting, and to gain the desired end it is essential to provide some means for offsetting the effect of the momentum or inertia of the supply spool and thereby maintain a substantially uniform strain upon the strand. It will be seen that to merely release a brake which is normally applied with more or less force to the supply spool, will not afford the required relief of strain upon the strand due to the inertia of the spool when starting from rest, and that the only way in which such strain can be offset is by accelerating the spool by some force not exercised through the strand. Hence, in the present machine, when the winding commences from a condition of rest, the roller 36 is at once drawn by the excessive strain to the lower limit of its stroke, which results in swinging the disk 14 entirely out of contact with disk 21 and into contact with disk 20. The rotation of disks 14 and 20 at their point of contact is then in the same direction, with the result that the power of shaft 22 augments the pull of the strand, accelerates the rotation of the supply spool and relieves the strand from the excessive strain which might otherwise break it. It will be seen that in this operation, the drag or strain upon the wire is due to the tendency of the supply spool to remain at rest and this tendency varies with the weight of the spool and its contents. The shaft 22 is a source of power other than the pull of the strand, which can be

applied by mechanism equivalent to that shown, to either accelerate or retard the rotation of the spool, automatically, as may be required, to maintain a uniform tension upon the strand. It will be seen that the springs 28 on each side of arm 18 permit of movements of the arm 32 after contact between the disks has been made to vary the pressure.

Since the invention in its broadest aspect contemplates the idea of applying a retarding or an accelerating force independent of the pull of the strand, to the supply spool, it is evident that the invention is not restricted to any particular mechanism for accomplishing this. The two disks 20 and 21 and the disk 14 with their associated shafts constitute a well known mechanical movement which has been adopted for the purpose of carrying out this invention, and it is understood that any suitable modification thereof might be adopted without departing from the spirit of my invention.

It is desired also to point out that while the machine in which the invention has been embodied in the present disclosure, is a winding machine primarily, the novel features herein claimed have reference more particularly to an unwinding machine. The retardation or boosting of the unwinding spindle, designated as the supply spool, may be utilized in a machine where no winding whatever takes place; so long as the strand or web is pulled from a supply spool or roller and its variations of tension are utilized to throw into action an accelerating or a retarding force or forces for the purpose described, the invention herein described is realized.

I claim:

1. In a machine for winding strands, the combination of a supply spool mounted to freely rotate, a winding spindle adapted to rotate the supply spool by pulling upon the strand leading therefrom, a source of power independent of the pull of the strand, and means for automatically applying said source of power to the spool in response to variations in the tension of the strand to either augment or oppose the pull of the strand.

2. In a machine of the character described, the combination of a supply spool, rotated by the pull of the winding spindle exerted upon the strand, a friction brake therefor, a source of power independent of the pull of the strand, and means for applying said power to accelerate the rotation of the spool.

3. In a machine of the character described, the combination of a supply spool and two sources of power, one operating through the strand leading from the spool to rotate the latter in a direction to pay-off the strand, and means for automatically ap-

plying the other source of power to the spool in response to variation in tension on the strand to either augment or oppose the effect of the first power source.

5 4. In a machine of the character described, a supply spool, a movable guide roller over which the strand leads from said spool, a system of levers actuated by said guide roller, a rotary power shaft, and a
10 friction clutching mechanism actuated by said system of levers for connecting the power shaft to drive the spool forward or backward.

5. In a machine of the character described, a shaft carrying a supply spool
15 from which the strand to be wound leads, a friction disk, two power driven friction

disks, and means whereby variations in tension of the strand will cause the first mentioned disk to engage one or the other of
20 the power driven disks, whereby the rotation of the first disk will be promoted or opposed.

6. In a machine for winding strands, the combination of a supply spool mounted to
25 freely rotate in response to the tension of the strand, a rotary power shaft, and a friction clutching mechanism responsive to variations in tension of the strand for connecting the power shaft to retard the spool
30 or drive it forward.

In witness whereof, I subscribe my signature.

JAMES C. ANDERSON.