L. A. ALEXANDER.

MACHINE FOR WINDING MOTORS.

APPLICATION FILED AUG. 11, 1909.

1,053,962.

Patented Feb. 25, 1913.

3 SHEETS—SHEET 1.

Fig1.

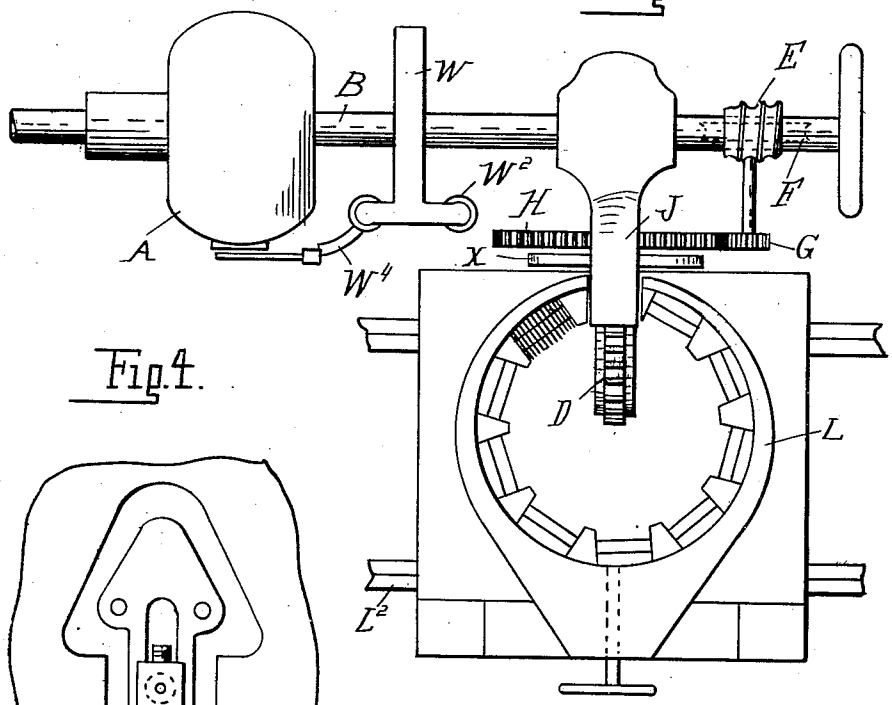


Fig4.

Fig3.

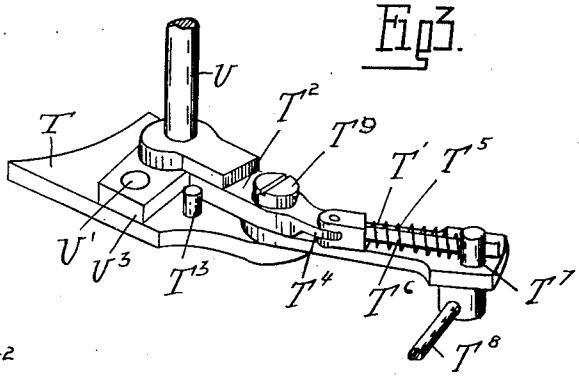
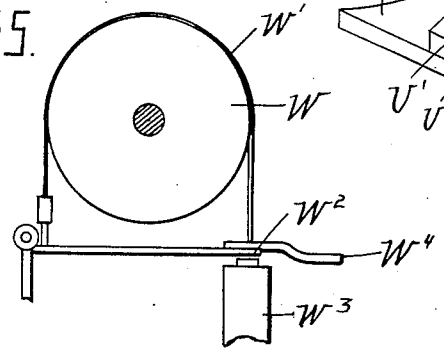


Fig5.



Witnesses

W. E. Ford

J. J. Belknap

Inventor

Louis A. Alexander

By Whittemore Hulbert & Whittemore

Attys

L. A. ALEXANDER.

MACHINE FOR WINDING MOTORS.

APPLICATION FILED AUG. 11, 1909.

1,053,962.

Patented Feb. 25, 1913.

3 SHEETS—SHEET 2.

Fig. 2.

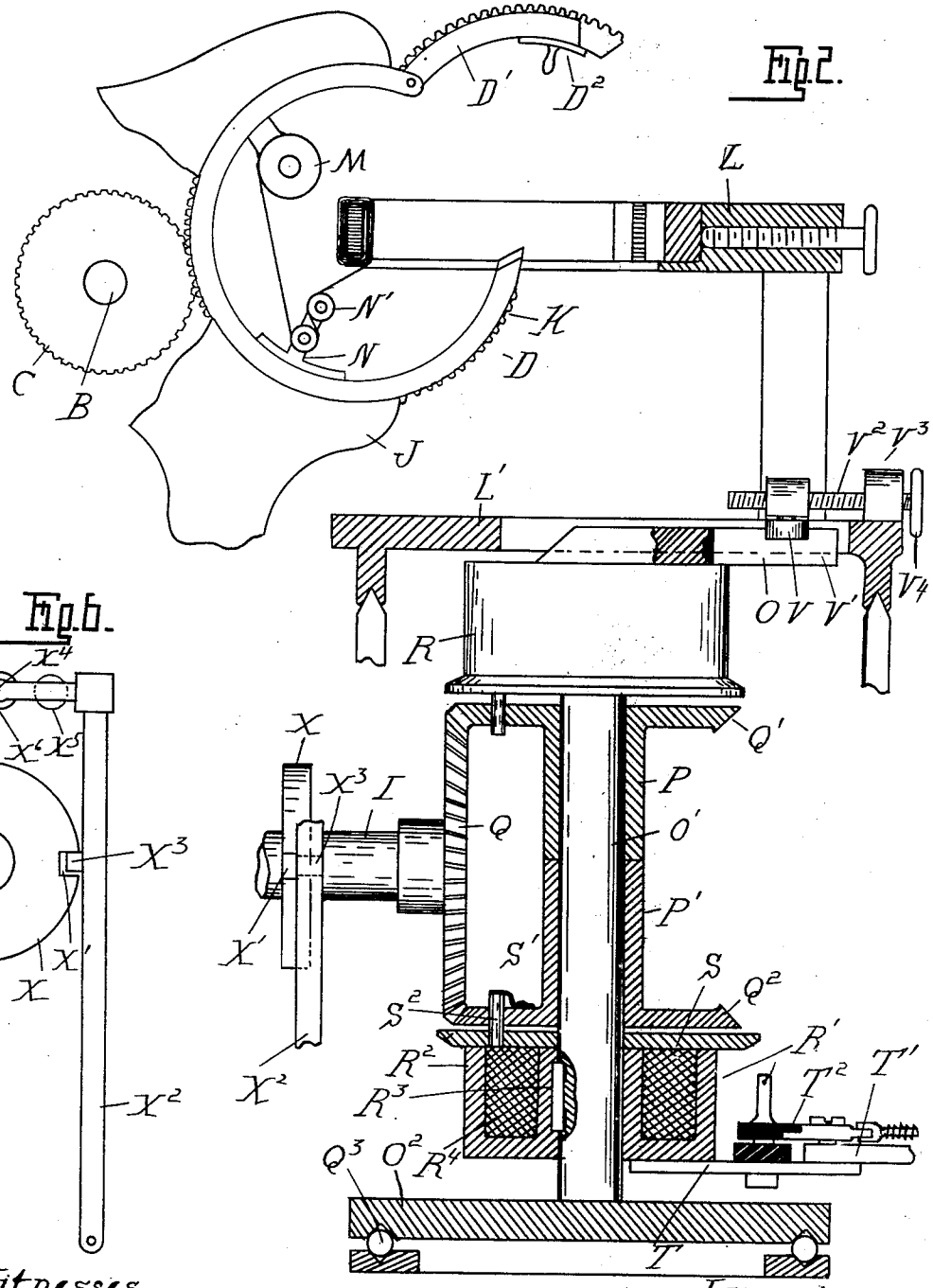


Fig. 6.

Witnesses

W. C. Ford

C. F. Belknap

Inventor

Louis A. Alexander

By Whittemore Hulbert & Whittemore

Atty's

L. A. ALEXANDER.

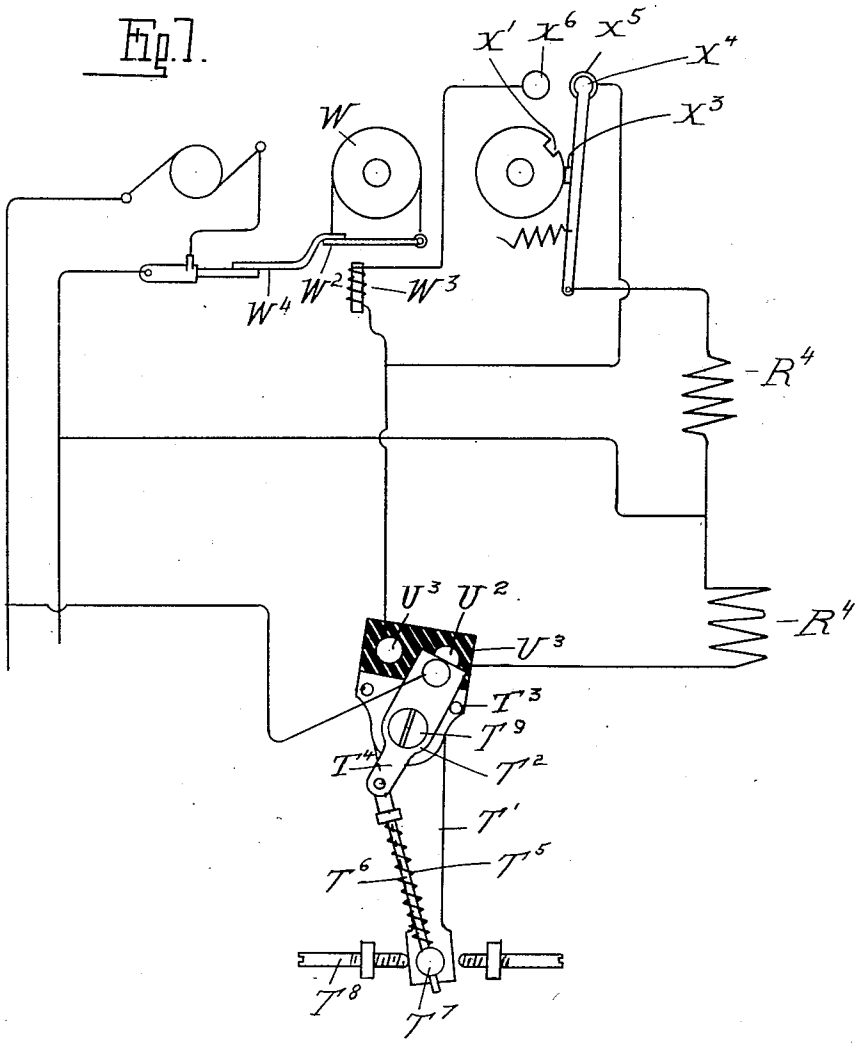
MACHINE FOR WINDING MOTORS.

APPLICATION FILED AUG. 11, 1909.

1,053,962. Patented Feb. 25, 1913.

3 SHEETS—SHEET 3.

Fig. 1.



Witnesses
W. C. Ford
W. F. Bilkney

Inventor
Louis A. Alexander
By Whittemore Hulbert & Whittemore
Atty's

UNITED STATES PATENT OFFICE.

LOUIS A. ALEXANDER, OF TOLEDO, OHIO, ASSIGNOR TO THE F. BISSELL COMPANY, OF TOLEDO, OHIO, A CORPORATION OF OHIO.

MACHINE FOR WINDING MOTORS.

1,053,962. Specification of Letters Patent. Patented Feb. 25, 1913.

Application filed August 11, 1909. Serial No. 512,343.

To all whom it may concern:

Be it known that I, LOUIS A. ALEXANDER, a citizen of the United States of America, residing at Toledo, in the county of Lucas and State of Ohio, have invented a certain new and useful Improvement in Machines for Winding Motors, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to winding machines, and is more particularly designed for use in the winding of insulated wire upon an annular core in the construction of Gramme ring armatures.

In the winding of motors, it is essential that a definite number of turns of wire should be placed in each coil, and that it should be uniformly wound with the successive convolutions as nearly parallel as possible and confined within definite space limits. Furthermore, as the core is an unbroken ring, the winder must necessarily be of annular form, and provision must be made for quickly engaging and disengaging the winder from the core. In constructing a machine which will fulfil the necessary conditions there are certain difficulties to be overcome—first, the engagement and disengagement of the winder with the core; second, the guiding of the wire as it is being wound so as to form uniform layers; third, the stopping of the winding when the required amount of wire has been placed in the coil, and, fourth, the reversal at the end of the layer without any hesitation in the motion, as this would allow the wires to pile in the corners. The mechanism must be so arranged that the wear of the parts from constant use will not allow the machine to hesitate on the end of the stroke for the above reason, and this last difficulty is inherent in any form of purely mechanical movement. These difficulties I have overcome by the peculiar construction, arrangement and coöperation of the parts of my machine as will be more fully hereinafter set forth.

In the drawings—Figure 1 is a plan view; Fig. 2 is a sectional side elevation; Fig. 3 is a perspective view of the electric switch; Fig. 4 is a plan showing the adjustable connecting means for adjusting the movement of the carriage; Fig. 5 is an elevation of the brake; Fig. 6 is an elevation of the controlling switch therefor; and Fig. 7 is a diagram illustrating the arrangement of the electric circuits.

In general construction, my machine comprises a driver—such as the motor A, from which motion is transmitted through a shaft B and gear C to the annular winder D. Motion is also transmitted through a step-down train of gearing—such as the worm gear E, shaft F, pinion G, and gear wheel H to a shaft I, for actuating the coöperating parts of the mechanism.

The winder D comprises a ring journaled in a segmental bearing J, and provided on its periphery with gear teeth K which mesh with the gear C. The ring is formed with a hinged segment D′ which, when open, will permit of engagement or disengagement of the core to be wound, which latter is supported by a segmental holder L cut away to provide clearance for the winding. The hinge segment D′ of the ring is provided with a locking latch D^2 on its inner face which, when in engagement, will hold the ring in unbroken form.

M is a bobbin or spool holder upon the ring D for carrying the wire, and N is an arm carrying sheaves N′, over which the wire is fed and guided.

In the winding of the coils, there must be a relative reciprocatory movement of the core and the winder, as the successive layers of wire are deposited, and this reciprocation must be at a constant velocity without any delay at the point of reversal. The ordinary mechanism employed for a reciprocating movement—such, for instance, as a crank and pitman, are inadequate—first, because the velocity is not uniform, and, second, on account of slight lost motion occurring at the point of reversal. This would result in the piling up of the wire during the winding, instead of depositing it in uniform layers, which would be very objectionable. With my improved construction I have attained the desired results by providing two separate drivers moving in opposite directions at the same time and uniform velocity, together with instantaneously operating clutches by which the driven part may be alternately coupled to said driver, so arranged so that any amount of wear on the various parts will in no way affect the accuracy of the reversal.

As shown, the holder L is the member which is reciprocated, and this is mounted upon a carriage L′ supported in ways L^2

O is a rock arm for imparting the reciprocatory movement to the carriage L′. which is connected to a rock shaft O′ mounted upon a base O^2 supported on a ball bearing Q^3. Upon this shaft are sleeved two rotary members P P′, which are driven constantly in opposite directions at uniform velocity preferably through the medium of a bevel gear wheel Q on the shaft I which meshes with bevel gear teeth Q′ Q^2 on the members P P′.

R R′ are clutch members secured to the shaft O adjacent to the members P P′ respectively and adapted to be alternately and instantaneously engaged therewith.

To obtain the desired instantaneous operation of the clutches, they are preferably of the magnetic type, and consist of a case formed of magnetic material, having annular pole pieces R^2 and R^3, and an intermediate energizing coil R^4.

S is a disk-shaped armature, which is normally held in slight frictional engagement with the pole pieces R^2 and R^3, and is coupled to rotate with the adjacent sleeve member P or P′. The frictional contact is maintained by the tension of the spring S′ in the sleeve member, which bears on the end of the pin S^2 on the armature, said pin engaging an aperture in said sleeve member and constituting the coupling connection for the same with the armature.

The construction just described is such that when the coils R^4 are not energized the sleeve members P P′ will revolve in opposite directions without imparting movement in either direction to the shaft O′. When, however, one of the coils R^4 is energized the corresponding armature will be instantaneously locked to the magnetic member, and, as the latter is fixed upon the shaft O′, this shaft will instantaneously receive motion, which will rock the arm O and will move the carriage L′. This movement will continue without interruption until the magnet is deënergized, and the opposite magnet is energized, upon which there will be an instantaneous reversal and uniform movement in the opposite direction. The timing of the reversal is dependent upon the opening and closing of the electric circuits which are controlled by an electric switch. This switch is preferably operated by a rock arm T secured to the shaft O′, and is constructed as follows: T′ is an extension arm pivotally connected to the arm T. T^2 is a movable contact member also pivoted to the arm T, and carrying an insulated terminal contact U of the electric circuit. U′ and U^2 are coöperating contact members secured to an insulator support U^3 mounted on the arm T. T^3 are stops on opposite sides of the contact member T^2 and secured to the arm T, which stops serve to limit the movement of the contact arm T^2. T^4 is an extension of the arm T^2 on the opposite side of its pivot, and T^5 is a spring upon a link T^6, which is connected to the arm T^4 and slidably engages an abutment T^7 in the spring at the outer end of the arm T′. T^8 are adjustable stops on opposite sides of the outer end of the arm T′ for limiting its movement.

The above described construction constitutes a snap switch, which may be accurately timed in its operation by proper adjustment of the stops T^8. The switch is operated— first, by the movement of the arm T, which is rocked with the shaft O′. This movement of the arm T will carry with it the pivot T^9 to which the arm T′ and contact member T^2 are pivoted, but, by reason of the stops T^8, the outer end of the arm T′ is held stationary. This will cause a change in the angular relation of the link T^6 and arm T^4, compressing the spring T^5 and continuing until said link T^6 and arm T^4 have just passed the position of exact alinement. During this movement, the contact member T^2 is also moved, but the contact U, which is bearing upon one of the coöperating contacts U′ U^2 will not be moved sufficient to break its connection until the position of alinement of the link T^6 and arm T^4 is reached. Immediately following this, the tension of the spring T^5 will cause the snapping of the arm T^4 through the remainder of its movement, breaking one circuit and establishing the other, and thereby correspondingly deenergizing and energizing the magnets R^4. While the operation of the switch controls the timing of the reversal, the amplitude of movement imparted to the carriage L′ and holder L is dependent upon the length of the rock arm O. To provide adjustment of this movement, the rock arm O is coupled to the carriage L′ by an adjustable pivot. As shown, this pivot V engages a slot V′ in the arm O, and is radially adjustable with respect to said arm by engaging with a threaded stem V^2 secured in a bearing V^3 on the carriage, and rotated by a thumb wheel V^4. This construction permits of altering the radial length of the arm O and correspondingly increasing or decreasing the amplitude of movement of the carriage.

With the mechanism thus far described, it will be understood that during the rotation of the winder ring D the holder L, for the core, will be reciprocated and the amplitude of movement and timing of reversals is adjusted so as to deposit uniform layers of wire in the coil about the core. To limit the amount of wire thus wound, movement of the mechanism must be arrested, and this is preferably accomplished by a brake W upon the main shaft B. This brake is preferably

electrically operated, and, as shown, consists of a brake strap W′, embracing a brake wheel on the shaft, and having one end connected with the armature W^2 of an electric magnet W^3. The parts are so adjusted that whenever the magnet is energized the strap will be tightened upon the drum sufficiently to overcome the inertia of the mechanism as well as the driving force of the motor and stop the operation. The motor circuit is preferably simultaneously opened to the operation of a trip arm W^4 on the armature W^2, which actuates a suitable circuit controlling switch, not shown. The operation of the magnetic brake is timed by any suitable mechanism driven from the shaft B, but, as shown, the control mechanism is arranged upon the shaft I. Specifically, this mechanism consists of a disk X mounted on said shaft I, which has arranged in its periphery one or more notches X′. X^2 is a lever having a projection X^3 bearing against the periphery of the disk X, and X^4 is an electric contact carried by the free end of the lever X^2. This contact is normally against a contact X^5, and is separated from another contact X^6, the parts being in this position as long as the projection X^3 contacts against the periphery of the disk X, but, whenever in the rotation of the disk, one of the notches X′ registers with the projection, the lever is permitted to move, breaking the contacts X^4 and X^5 and closing the contacts X^4 and X^6. The contacts X^4 and X^5 are included in the circuits of one coil R^4, while the contacts X^4 and X^6, when closed, cut in the brake magnet W^3 in series with said magnet R^4. Consequently, whenever this latter circuit is closed the brake will be operated, which will arrest further movement of the mechanism.

In the complete operation of the machine, the core to be mounted is first placed in engagement with the holder L′, being inserted into the winding ring D by opening the hinge segment D′ thereof. The segment is then closed and locked, and a bobbin of wire to be wound is engaged at M, the end of the wire being drawn about the sheaves N′. The motor A is then set in operation which, through the transmission train, will revolve the winder D and simultaneously rotate the sleeves P P′ in opposite directions upon the shaft O′. One of these sleeves will be coupled to the shaft by its electro-magnetic clutch R, and thus motion will be communicated to the rock arm which moves the carriage L′ upon the ways L^2. The rate of this movement is such that during each complete revolution of the winder the carriage moves a distance equal to the thickness of the wire, and consequently the wire will be wound uniformly in a close coil from one end to the other. Upon reaching the end of the first layer, the snap switch, operating automatically in the manner above described, will deënergize the coupling magnet and energize the opposite magnet instantaneously reversing the direction of movement of the shaft O′ and rocking the arm O so that the carriage and workholder will be moved in the opposite direction and the second layer of wire wound on the coil. This operation continues until the required number of turns of wire are wound, at which time the notch X′ in the disk X will register with the projection X^3, permitting the movement of the lever X^2 and the closing of the magnetic brake circuit. This circuit is not, however, closed until the snap switch reverses to energize the particular magnet R^4 with which the brake magnet W^3 is in series, and thus motion is arrested at the end of a complete layer of the coil, and not the instant that the lug X^3 drops into the notch X′. The operator then adjusts the core in its holder into a position for receiving another coil, another bobbin of wire is placed in the winder, and the operation repeated, this continuing until the entire core is wound. The hinge segment D′ is then opened, the wound core removed, and another core placed in engagement with the holder.

What I claim as my invention is:

1. The combination with a winder and a workholder, of means for laterally reciprocating the one with respect to the other comprising a reciprocatory member, two constantly driven members traveling in opposite directions, and means for alternatively coupling said driven members to said reciprocatory member.

2. The combination with a winder and a workholder, of means for laterally reciprocating the one with respect to the other, comprising two constantly driven oppositely-traveling members, a reciprocatory member adapted for alternative connection with said driven members, and automatic means for simultaneously reversing the engagement between said reciprocatory member and driven members at the limits of the reciprocation.

3. The combination with a winder and a workholder, of means for reciprocating the one with respect to the other, comprising two members constantly driven in timed relation to the rotation of said winder, and in opposite directions, an adjacent rotary member, means connected with said member for translating the movement thereof into a reciprocatory motion, and automatic alternatively-operating clutches for coupling said oppositely rotating members respectively with said adjacent rotary member.

4. The combination with a winder and a workholder, of means for laterally reciprocating the one with respect to the other,

comprising two oppositely-rotating members constantly driven in timed relation to the movement of the winder, a reciprocatory carriage, a member for actuating the same, and means for alternatively coupling said oppositely-rotating members with said carriage-actuating member.

5. The combination with a winder and a workholder, of means for reciprocating the one with respect to the other, comprising two oppositely-traveling members constantly driven in timed relation to the rotation of said winder, a carriage for the reciprocatory member, mechanism for actuating said carriage in opposite directions respectively by said oppositely-traveling members, and means automatically operating at the limits of travel of said carriage for simultaneously disconnecting said carriage-actuating member from one of said driven members and for connecting the same with the other of said driven members.

6. The combination with a winder and a workholder, of means for reciprocating the one with respect to the other, comprising two oppositely-traveling rotary members constantly driven in timed relation to the movement of said winder, a carriage for the reciprocatory member, a rotary member for actuating said carriage, and a pair of electro-magnetic clutches for alternatively coupling said oppositely-driven members with said carriage-actuating member.

7. The combination with a winder and a workholder, of means for reciprocating the one with respect to the other comprising a carriage for the reciprocatory member, a rock arm for actuating said carriage, two oppositely-traveling rotary members driven in timed relation to the movement of said winder, electro-magnetic clutches for alternatively coupling said oppositely-driven members with said rock arm, a switch controlling said clutches, and means automatically operating at the limit of movement of said rock arm and carriage for automatically reversing said switch.

8. The combination with a winder and a workholder, of means for reciprocating the one with respect to the other, comprising a carriage for the reciprocatory member, a rock shaft, a rock arm on said rock shaft, having a radially-adjustable engagement with said carriage, two members sleeved upon said rock shaft constantly driven in opposite directions in timed relation to the movement of said winder, clutches for alternatively coupling said oppositely-driven members with said rock shaft, and means automatically operating at the limits of the movement of said rock shaft for reversing said clutches.

9. The combination with a winder and a workholder, of means for reciprocating the one with respect to the other comprising a carriage, two oppositely-rotating members sleeved upon said rock shaft and driven in timed relation to the movement of said winder, a pair of electro-magnetic clutches for respectively coupling said oppositely-driven members with said rock shaft, a switch for alternatively energizing said magnetic clutches, and automatic means for reversing said switch at different points in the movement of said rock shaft.

10. The combination with a winder and a workholder, of means for reciprocating the one with respect to the other, comprising two members constantly driven in opposite directions in timed relation to the movement of said winder, a carriage for the reciprocatory member, means for alternatively coupling said carriage with said oppositely-driven members and for periodically automatically reversing the coupling, a brake for arresting movement of the entire mechanism, and means automatically operating after a predetermined number of revolutions of said winder for actuating said brake.

11. The combination with a winder and a workholder, of means for laterally reciprocating the one with respect to the other, comprising a reciprocating member, two constantly driven members traveling in opposite directions, and electrically operated means for alternately coupling said driven members to said reciprocating member.

12. The combination with a winder and a workholder, of means for laterally reciprocating the one with respect to the other comprising a reciprocating member, two constantly driven members traveling in opposite directions, electrically operated means for alternatively coupling said driven members to said reciprocating member, and electrically operated means operating after a predetermined number of revolutions of said winder for arresting movement of the entire mechanism.

13. The combination with a winder and a workholder, of means for reciprocating the one with respect to the other comprising a reciprocatory member, two constantly driven members traveling in opposite directions, means for alternatively coupling said driven members to said reciprocatory member, and means for checking said driven members at a predetermined point in the travel of said reciprocatory member.

In testimony whereof I affix my signature in presence of two witnesses.

LOUIS A. ALEXANDER.

Witnesses:
ARTHUR W. BUNER,
H. F. WEINECKE.