Feb. 19, 1929. 1,702,475

C. F. JAHNIG

COIL WINDING MACHINE

Filed June 27, 1925 3 Sheets-Sheet 1

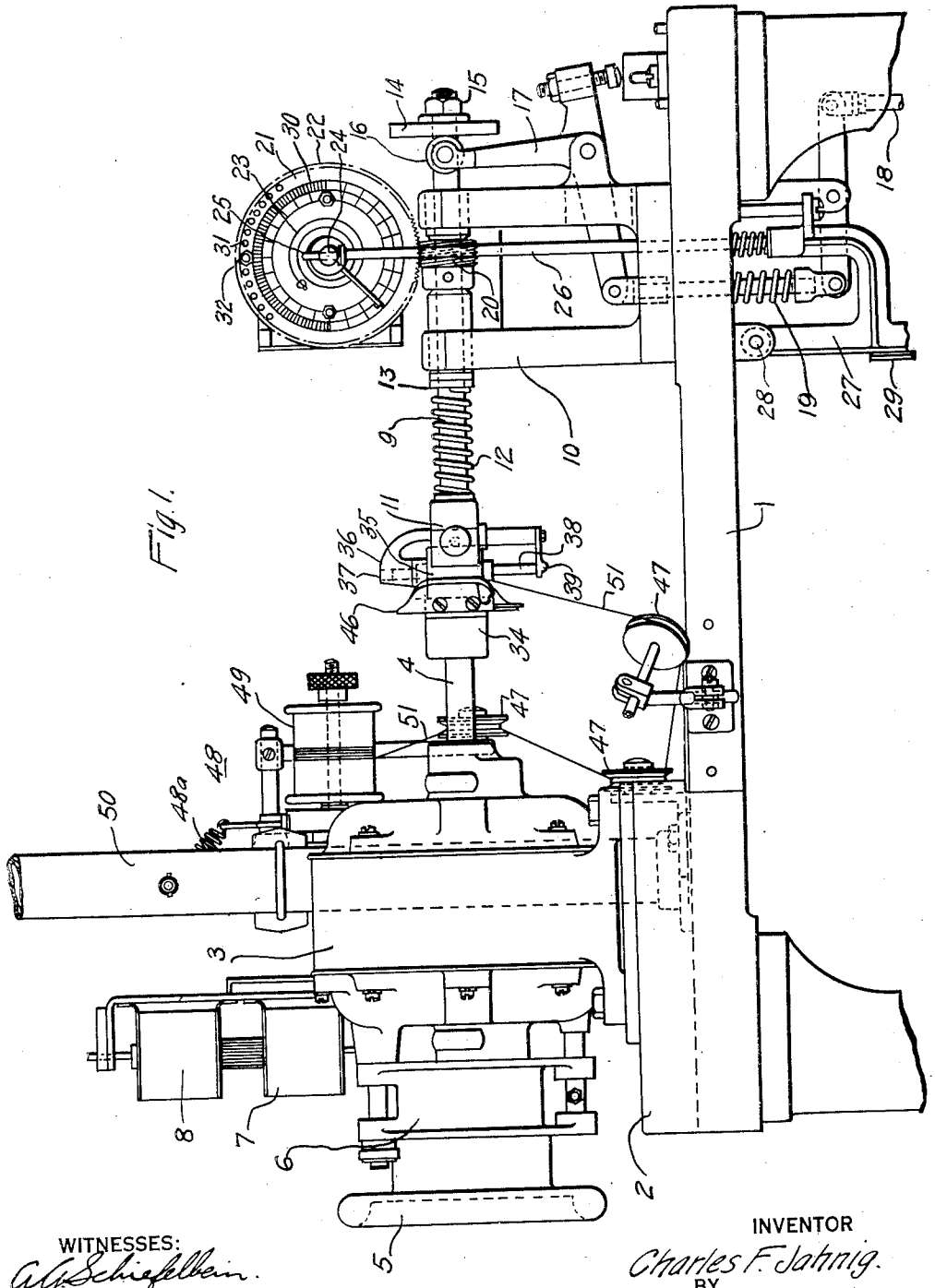


Fig. 1.

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COIL WINDING MACHINE

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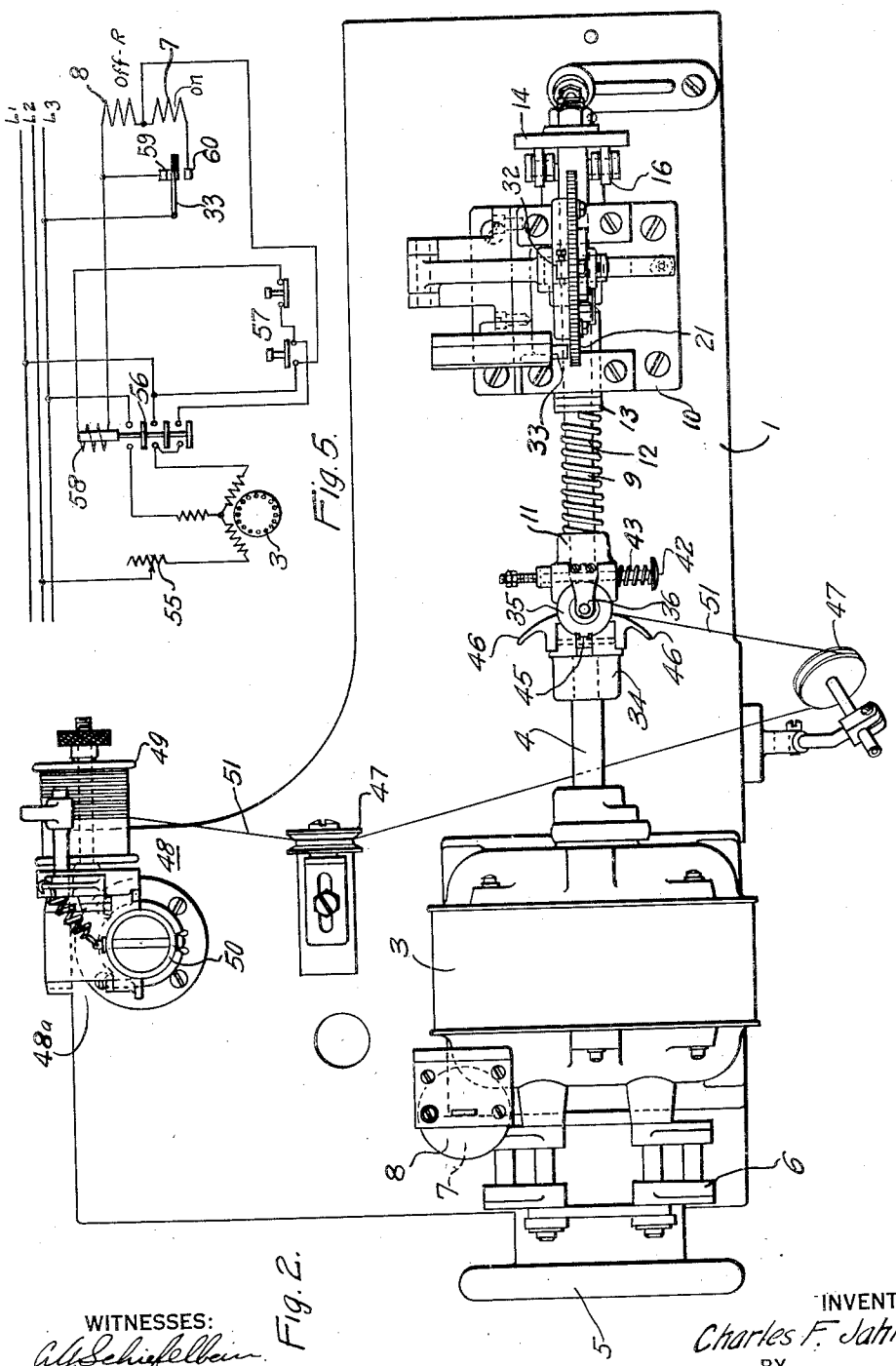


Fig. 5.

Fig. 2.

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COIL WINDING MACHINE

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Fig. 3.

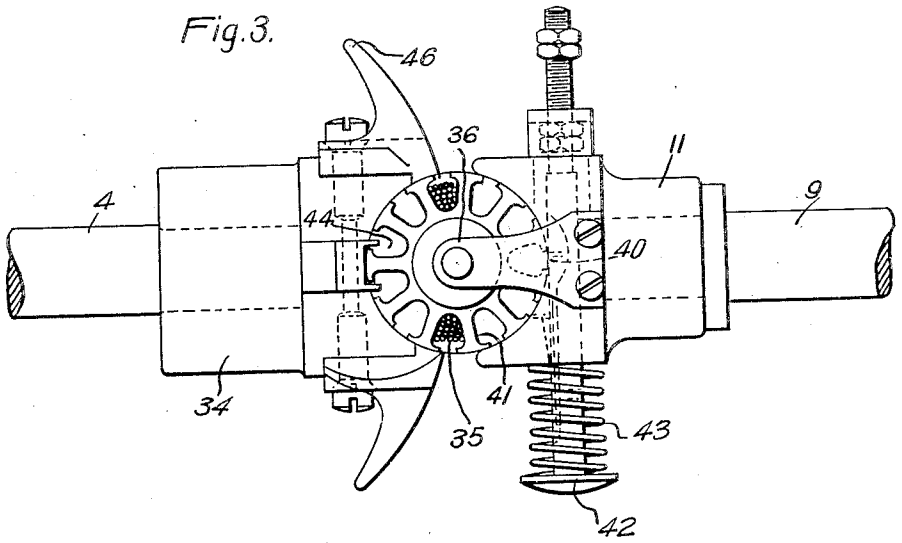
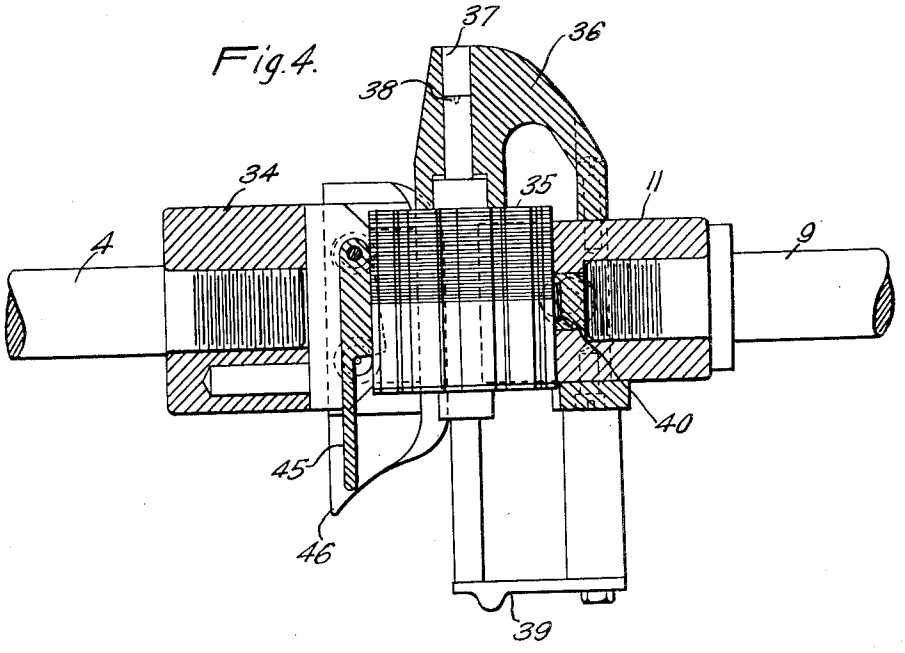


Fig. 4.



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UNITED STATES PATENT OFFICE.

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COIL-WINDING MACHINE.

Application filed June 27, 1925. Serial No. 39,910.

My invention relates to coil-winding machines and particularly to machines for winding coils in the armature cores of small motors.

It is one object of my invention to provide a coil-winding machine for winding armatures of dynamo-electric machines which shall be automatic in its function of winding a predetermined number of turns of insulated conductor wires in the slotted openings of the armature cores.

Another object of my invention is to provide a coil-winding machine of the above-designated character which shall provide uniform starting and running conditions of speed of the winding head and which shall have a uniform acceleration in the starting and stopping of the winding element.

Another object of my invention is to provide a coil-winding machine in which the maximum windng speed may be determined or prescribed for any particular range of work, that is, for any given size of coil or wire sizes, for example.

Another object of my invention is to provide a machine embodying means for securing an armature to be wound in such manner as to facilitate the winding of the armature coils thereon with great rapidity and at minimum cost.

Another object of my invention is the provision of means for ensuring accuracy in the number of turns of the windings by means of automatic regulation of a counter mechanism that cooperates with the motor circuit of the winding head to automatically deenergize the same.

Still another object of my invention is to provide an electrical control system in connection with the motor circuit and the start-and-stop mechanism which shall coordinate the several cooperating parts of the machine to stop the actuating mechanism in practically the same position each time, thus permitting the operator to properly bring out the coil leads for making electrical connections and for starting the next coil to be wound.

My invention contemplates the making of a semi-automatic coil-winding machine, that is of simple, durable, and compact construction, which shall comprise a minimum number of working parts and which is readily accessible for manipulation and operation and for the purpose of renewing the elements subjected to the greatest wear.

The several improved features of my device will become more apparent in the following detailed description of my invention taken in connection with the accompanying drawings, in which like reference characters designate like parts, and in which,

Figure 1 is a side elevational view of a coil-winding machine embodying the principles of my invention;

Fig. 2 is a top plan view thereof;

Figs. 3 and 4 are respective views in top elevation and longitudinal cross-section of a special chuck device, embodied in the machine shown in Figs. 1 and 2 for the purpose of securing the armature or coil form to be wound, and

Fig. 5 is a diagram of the electrical control system utilized in the operation of my device.

Referring to Fig. 1 of the drawing, the device illustrated therein comprises a stationary bed 1 having a winding head 2 mounted on one end thereof, which head comprises an electric motor 3 having an extended armature shaft 4 on one end thereof and a flywheel 5 on its other end, together with a brake mechanism 6 including a pair of magnet coils 7 and 8. The coil 7 is adapted to effect full application of the brake, while coil 8 maintains the brake in its "off" position.

A spindle 9 is mounted coaxially with the shaft 4, of the motor in a tail-stock 10 at the other end of the bed 1. The spindle 9 is provided with a portion of a chuck member 11 against the shoulder of which is disposed a coil spring 12, one end of which rests against a spacing collar 13 that acts as a thrust bearing against the face of the tail-stock 10. The other end of the spindle 9 is provided with a disc 14, which is secured thereto by a nut 15 to provide a relatively wide flange portion that is adapted for engagement with a roller 16 of a mechanical linkage 17, which terminates in a suitable pedal, (not shown) that is secured on a vertical rod 18. The linkage 17 is biased by a coil spring 19 bearing against the under side of the bed 1 to eliminate pressure on the roller 16, thus permitting the spindle 9 to assume a natural longitudinal position as determined by the coil spring 12.

The spindle 9 is further provided with a worm 20 between the vertical standards of

the tail-stock 10, and a worm gear 21 is suitably journalled for rotation transversely of the axis of the spindle 9, being adapted to interact at its periphery 22 with the worm 20. The wheel 21 is provided with a spiral or clock spring 23 by which it is biased in one direction against the teeth of the worm 20, so that when the worm 20 becomes disengaged, the gear 21 will rotate to its normal position by the unwinding of the spring 23.

The spring element 23 is secured at one end to a crank 24 that is normally held stationary by a pin 25, which is an extended portion of a vertical rod 26 terminating at a bracket 27 that is pivoted at a joint 28 on the under side of the bed 1. Any angular movement of the bracket 27, such as may be effected by pressure against its face 29, will disengage the wheel 21 from the worm 20, thus permitting the spiral spring 23 to unwind. The face of the gear 21 is provided with graduations 30 that correspond to a certain number of turns of the worm 20 and directly indicate the number of turns of wire. The latter is further provided with transverse openings 31, which are adapted to receive a stop 32 that cooperates with a contact finger 33, Figs. 2 and 5, for a purpose that will be hereinafter set forth.

The extended armature shaft 4 of the motor 3 is provided with a portion 34 of a chuck mechanism that cooperates with the portion 11 on the spindle 9 for the purpose of securing a coil form or armature 35 to be wound. (See Figs. 3 and 4.) The cooperating faces of the chuck members 11 and 34 are cylindrical in form and their size corresponds to that of the outer periphery of the armature 35. The member 11 is further provided with a bracket 36 having a top opening 37 for receiving one end of the armature shaft 38 and has a stop 39 at its lower end, upon which the lower portion of the armature shaft rests. The central portion of the cylindrical face of the member 11 is provided with an opening through which a spring finger 40 extends to constitute a stop or positioning element for the slotted openings 41 of the armature 35.

The spring member 40 is secured to a plunger 42 that is biased radially outward by a coil spring 43. This plunger is movable axially to provide movement of the spring finger 40 for the purpose of indexing the armature 35 to bring one of its webs or teeth in engagement with the slotted opening 44 of a thumb latch 45 that is pivoted in the portion 34 of the chuck. To index the armature 35 by means of the spring-biased plunger 42, it is necessary to push the latch 45 out of engagement with the armature.

The member 34 is further provided with wire guides or fins 46 for alining the wire with the slots 41 of the armature to be wound.

Associated with the chuck mechanism is a wire guide and tension device which comprises a series of wheels or pulleys 47 (Figs. 1 and 2) that are mounted in spaced relation on the bed of the machine and on the winding head, and a tension device 48 that is provided with means for carrying a wire supply reel 49, which is movably mounted on a vertical standard or support 50 that is secured to the bed member 1, the tension device 48 is provided with a spring element 48*a* that maintains the proper tension on the wire 51 which is carried from the reel 49 over the wheels 47 to the coil form or armature 35 that is mounted in the chuck device.

Referring to Fig. 5 of the drawing, the diaphragm shown therein illustrates the control circuit by means of which the machine is operated semi-automatically in connection with the winding motor and the counter mechanism. The driving motor 3 is a three-phase motor adapted to be connected to the supply conductors L^1, L^2 and L^3, as follows: through a rheostat 55 to the line L^2, and through switch 56 to the lines L^1 and L^3 and is controlled through a circuit comprising a "start-stop" push-button station 57 of a familiar type, actuating brake magnet coil 8, coil 58, contact member 59 and contact finger 33. In the opposite position of finger 33, the brake magnet coil 7 is substituted for the companion coil 8 in the above-traced circuit.

The operation of my device is briefly as follows:

An armature 35 to be wound is secured in the chuck members 11 and 34, as shown in the several figures of the drawing. The end of the wire from which the coil is to be wound is extended from the supply reel 49 over the wheels 47 as shown in Figs. 1 and 2 and is secured in the slot of the armature, two of which slots are in transverse alinement, as shown in Fig. 3.

The brake magnet coil 8 is initially energized to hold the brake 6 in its "off" position by reason of gear wheel 21 being disposed in its normal or zero position. This initial circuit of coil 8 extends from conductor L^3 through control finger 33, contact member 59, coil 8, and thence through station 57 to conductor L^1.

The motor 3 is then energized by closing the "starting" switch of push button station 57, Fig. 5, thus establishing the previously traced circuit.

The motor shaft 4 is thus actuated to rotate the chuck and the armature 35 held thereby, together with the spindle 9. The worm 20 and wheel 21 of the counter mechanism rotate until the proper number of turns of wire have been applied, whereupon the stop 32 engages the contact finger 33, Figs. 2 and 5, whereupon its normal contact with the contact member 59 is broken, thereby opening the circuit of actuating coil 58 of switch 56 to deenergize the motor, and to simultaneously deenergize the brake magnet

8, which has been holding the brake 6 in its "off" position during the operation of the winding head.

The brake is then applied by gravity and as the motor slows down to almost a standstill, contact is made by the finger 33 with the contact member 60, thus energizing the brake coil 7, which stops the motor almost instantly in practically the same angular position each time. The operator presses against the face 29 of the pivoted bracket 27 to release the spring on the counter device, which thereupon assumes its zero position and causes the contact members 33 and 59 to re-engage as shown in Fig. 5, thus putting the motor circuit in condition to permit re-starting as soon as the "starting" button is closed and releasing the brake mechanism to permit rotation of the winding head. The operator then steps on the pedal at the end of the rod 18 to operate the linkage 17, which effects a longitudinal movement of the spindle 9 against the tension of the coil spring 12, thus releasing the armature 35, which is indexed to bring its slots in a new position, by pushing the plunger 42, and simultaneously shifting the latch 45 out of position. The pedal is then released, thus securing the armature in its new position. This operation is repeated as often as necessary to complete winding the slots of the armature 35 or winding coil forms which may be secured by the chucking mechanism in place of the armature.

It is evident from the foregoing description of my invention that a coil-winding machine made in accordance therewith provides a simple and efficient means for semi-automatically winding the coils of armature or other coil forms at a minimum cost and in a uniform and efficient manner. The semi-automatic regulation of this machine assures an accurate number of turns independent of the attention of the operator and also a uniform quality of work, since the winding of the wire in the coil form is entirely regulated by the wire guide and tension device.

By means of the rheostat 55, shown in Fig. 5 and the fly-wheel 5, Fig. 1, together with the magnets 7 and 8 of the brake mechanism, a suitable speed and uniform acceleration for starting and stopping the winding head may be obtained, for a considerable range of wire sizes and coil sizes, and by forming the fly-wheel 5 as a hand-wheel, further assurance against breakage of the wire is provided by the personal attention of the operator, whose hands are free to be employed in the engagement of the hand-wheel.

Although I have described a specific embodiment of my invention, it will be obvious to those skilled in the art that various modifications may be made in the details of construction, the design and arrangement of the several cooperating parts and in the application of my device to the winding of various coil forms, without departing from the principles herein set forth.

I claim as my invention:

1. A coil-winding machine comprising a stationary bed member, a motor mounted thereon, a spindle journalled for rotation on said bed coaxially with the shaft of said motor, a work-holder mounted on said motor shaft and spindle and adapted to secure a coil form, a revolution counter associated with said spindle having contact members adapted to control the motor, a flywheel on said motor to provide uniform acceleration of the motor shaft at starting, a brake for said motor, means for holding said brake in its "off" position during the operation of said motor, and means for setting said brake at a predetermined time after opening the circuit of said motor.

2. A coil-winding machine comprising a stationary bed member, a motor mounted thereon, a spindle journalled for rotation on said bed coaxially with the shaft of said motor, a work-holder mounted on said motor shaft and spindle and adapted to secure a coil form, a revolution counter associated with said spindle having contact members adapted to control the motor, means for setting said counter for a predetermined number of turns of the spindle, and a stop mechanism controlled by said counter for stopping said spindle at a predetermined time after the motor has been deenergized.

3. A coil-winding machine comprising a stationary bed, a winding head and a spindle coaxially mounted on said bed, wire guide and tension means associated with said head, a counter mechanism for said spindle, and speed-regulating means for said head and spindle, said regulating means comprising a motor having a shaft extension, a flywheel and a brake, electromagnetic means for governing said brake, and control means for said motor comprising starting apparatus, a brake magnet and means for opening the motor circuit and subsequently energizing the brake magnet circuit.

4. In a coil-winding machine, the combination with a winding head, including a motor, of a spindle mounted coaxially therewith, a counter mechanism associated with said spindle and a speed regulating and control system for said motor, said system comprising starting apparatus, a pair of brake magnets, and a movable contact member for breaking the motor circuit and establishing circuits for said magnets, said system operating to deenergize the motor circuit and simultaneously deenergize the magnet that secures the motor brake in its released position and subsequently energize another magnet to lock the motor shaft.

5. A coil-winding machine comprising a stationary bed, a winding head comprising a driving motor, a brake mechanism for said

winding head, electromagnetic means for applying said brake and independent electromagnetic means for holding said brake in the released position, a spindle mounted coaxially with said winding head, a counter mechanism associated with said spindle, and a movable contact member adapted to be actuated by said counter mechanism to simultaneously deenergize the motor and the electromagnetic means for holding the brake in the released position and to subsequently energize the electromagnetic means for applying the brake.

6. In a stop-motion mechanism for coil-winding machines, a worm, a cooperating worm wheel in engagement therewith, an electrical contacting device, stops on said worm wheel adapted to cooperate with the contacting device, means for manually disengaging the worm wheel from the worm and resilient means for turning the worm wheel to a predetermined position when so disengaged.

7. In a stop-motion mechanism for coil-winding machines, a worm, a worm cooperating wheel, a movable bracket for supporting the worm wheel, an electrical contacting device, a stop member adjustably mounted on said worm wheel and disposed to cooperate with the contacting device, means for moving the worm wheel out of engagement with the worm and a spring for turning the worm wheel to its zero position.

In testimony whereof, I have hereunto subscribed my name this eighth day of June, 1925.

CHARLES F. JAHNIG.