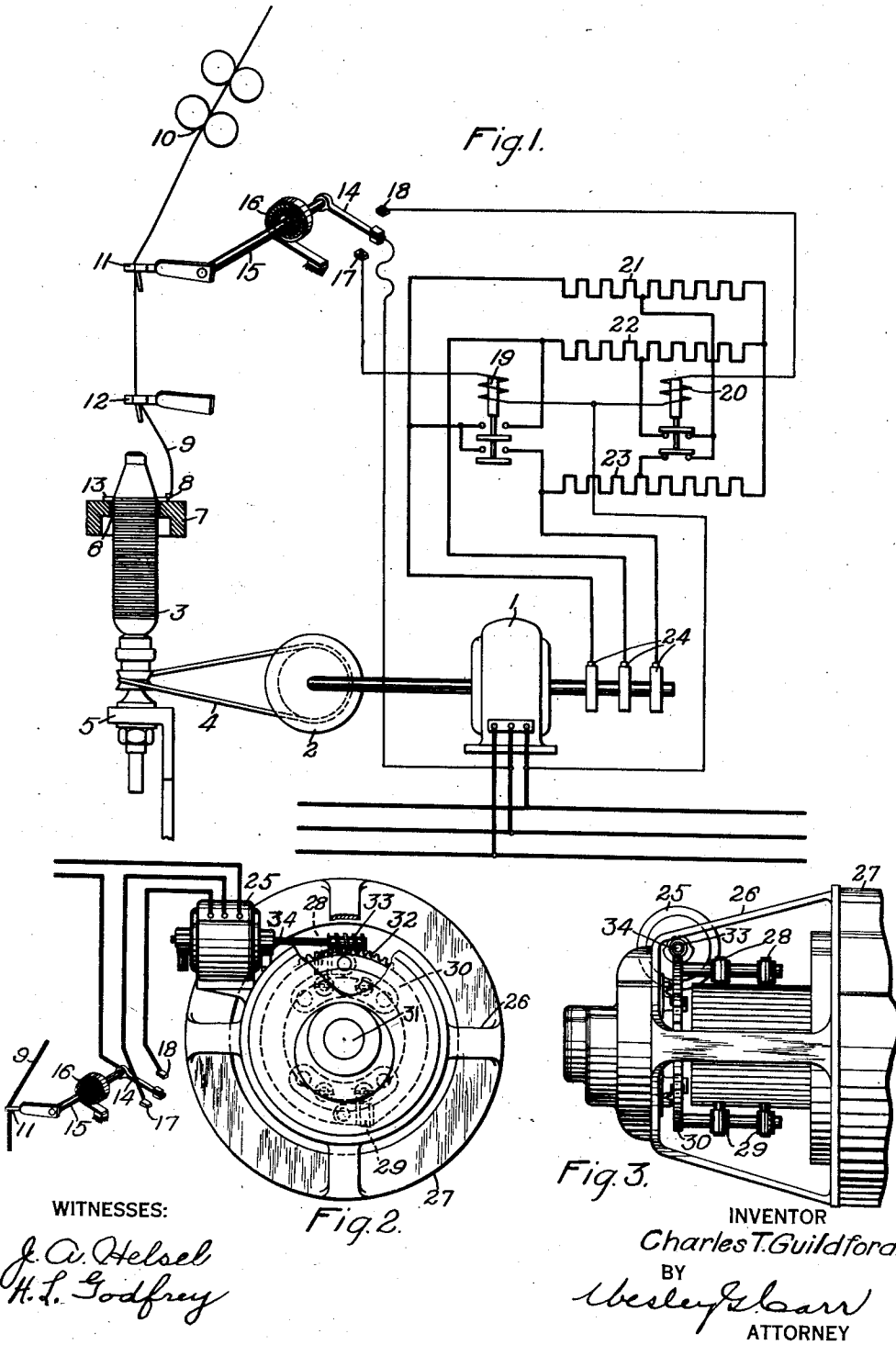


C. T. GUILDFORD.  
CONTROL SYSTEM.  
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1,412,518.

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# UNITED STATES PATENT OFFICE.

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## CONTROL SYSTEM.

1,412,518.

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*To all whom it may concern:*

Be it known that I, CHARLES T. GUILDFORD, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Control Systems, of which the following is a specification.

My invention relates to control systems for devices requiring automatic speed control and it has special relation to electrically-operated spinning machinery.

The object of my invention is to provide a control system that will automatically vary the speed of a driving motor to overcome any variation in the yarn tension from a predetermined value.

It is well known to those acquainted with the art of spinning that the tension of the yarn varies during the spinning process. This variation in the tension of the yarn is due to the fact that the force necessary to overcome the traveller and guide-eye friction is, for the most part, dependent upon the diameter of the bobbin.

In making a "filler build," for an upward motion of the ring rail, the diameter of the bobbin decreases and, as a result, the force that must be exerted by the yarn to overcome the traveller friction increases. For a downward motion of the ring rail, the diameter of the bobbin increases, with the result that the tension on the yarn decreases.

By maintaining the tension of the yarn substantially constant, the number of breakages may be greatly reduced, with the result that a better grade of yarn is produced, a greater weight of yarn is wound on the bobbin, and an increase in production is secured.

The most common means in use to-day in which an attempt is made to maintain the tension of the yarn or thread substantially constant is to vary the speed of the spindle by mechanical means to correspond to the position of the ring rail as the yarn is being wound on the bobbin. The control system used in connection with this method is not sensitive directly to variations in the tension of the yarn but must be adjusted mechanically to vary the speed of the spindle between certain predetermined limits, with the result that the variations in speed

may not entirely compensate for the variations in tension.

According to my invention, I provide a control system which is directly controlled by the tension of the yarn and which automatically varies the speed of the spindle to maintain the yarn tension substantially constant. The arrangement comprises a central shaft with a spring attached thereto, and arms mounted on both ends of said shaft, one arm acting as a guide for the thread, and the other arm as a contactor.

Movement of the contactor arm controls the speed of the driving means, either by varying the external resistance in the motor circuit of the driving motor or by changing the position of the brushes on a driving motor of the A. C. commutator type.

Fig. 1 is a diagrammatic view of the producing parts of a ring-frame spinning machine and of associated electrical circuits and apparatus embodying my invention.

Fig. 2 is a view, partially in end elevation and partially in vertical section, of a modified system of control, that is, also, sensitive to variations in the yarn tension, the spinning apparatus being omitted.

Fig. 3 is a side elevation of the brush-shifting mechanism shown in Fig. 2.

Referring to Fig. 1, an alternating-current motor 1 is directly connected to a drum 2 from which a plurality of cops or spindles 3 (only one of which is shown) are operated, in the usual manner, by a belt 4. Each spindle 3 is rotatably mounted upon a fixed rail 5 and projects upwardly through an opening 6 in a ring rail 7 having an eye or guiding member 8 through which the yarn 9 is threaded.

The yarn 9, after passing the last pair of rolls 10, is brought forward over a guide 11 and then down through a guide 12, which is a part of the spindle frame, and the guide-eye 8 which is free to move on a ring 13.

The guide arm 11 and contact arm 14 are rigidly fastened to a shaft 15, movement of which is resisted by a spring control 16. The contact arm 14 coacts with contact members 17 and 18 to effect the operation of contactors 19 and 20. Resistors 21, 22 and 23 are connected to slip rings 24 of the driving motor 1.

Referring to Figs. 2 and 3, a brush-shift-

ing motor 25 is rigidly mounted upon a bracket 26 of a driving electric motor 27. A set of brushes 28 and 29, rigidly fastened to a movable ring 30, concentric with a shaft 31, may be moved through a considerable arc by means of a worm-wheel segment 32, attached to the ring 30 and a cooperating worm 33 which is mounted on the shaft 34 of the brush-shifting motor 25.

The operation of the apparatus shown in Fig. 1 is as follows: Having determined the maximum speed of the spindle and the tension of the yarn necessary for the best quality, the spring 16 is so adjusted that the contact arm 14 is midway between contact members 17 and 18. The spinning process may now be started and, by reason of the rising and falling motion of the ring rail 7, the yarn 9 is wound on the bobbin 3 in successive layers. By reason of the fact that the tension on the yarn 9 decreases for a falling motion of the ring rail 7, with a resulting increase in the diameter of the bobbin 3, the contact arm 14 is actuated by the spring 16 to engage contact member 17, thus closing the circuit of the actuating coil of contactor 19. The contactor 19 shunts a portion of the external rotor resistors 21, 22 and 23 and thereby increases the speed of the motor 1 to maintain the tension of the yarn substantially constant.

When the ring rail 7 moves upwardly, the tension on the yarn 9 increases, with the result that the contact arm 14 is actuated out of engagement with the contact member 17 and into engagement with contact member 18, thus closing the circuit of the actuating coil of contactor 20.

The contactor 20 normally shunts a portion of the resistors 21, 22 and 23. Therefore, on breaking the circuit of the actuating coil of relay 19 by reason of the movement of contact arm 14 out of engagement with contact member 17, a certain amount of resistance is inserted in the rotor circuit, thus causing an initial decrease in the speed of the driving motor 1. When contact arm 14 engages contact member 18, the circuit of the actuating coil of contactor 20 is closed, thus breaking the normal shunt connection of contactor 20, and inserting the entire resistors 21, 22 and 23 in the rotor circuit and, as a result, causing a still further decrease in the speed of the driving motor 1.

In the system of control shown in Figs. 2 and 3, the position of the brushes 28 and 29 are directly controlled by the tension of the yarn 9.

As the tension of the yarn or thread decreases for a falling motion of the ring rail 7, contact arm 14 is actuated by the spring 16 to engage contact member 17, thus closing the circuit of the motor 25. On closing the circuit of motor 25, the brushes 28 and 29 are moved through an arc sufficient to

produce an increase in speed of the driving motor, necessary to maintain the yarn tension substantially constant.

Upon an increase in the tension of the yarn 9, caused by an upward motion of the ring rail 7, the contact arm 14 is actuated out of engagement with contact member 17 and into engagement with contact member 18, thus reversing the direction of the current through the motor 25, and as a result, the brushes 28 and 29 are moved back through an arc sufficient to produce a decrease in speed of the driving motor necessary to maintain the tension of the yarn 9 substantially constant.

Thus, it is evident that the movement of the contact arm 14 and the resultant change in speed of the driving motor 1 or 27 is directly dependent on the tension of the yarn.

The particular advantage of this control system resides in the fact that the yarn tension may always be maintained at a predetermined value and that the speed of the driving motor is directly dependent upon the tension of the yarn.

My invention is, of course, not restricted to use with spinning machines alone, but may find various other commercial applications to other devices in which the tension of yarn is used to control the speed of a driving means whereby said tension will be maintained constant.

I claim as my invention:

1. A control system comprising a dynamo-electric machine, a bobbin driven thereby, a ring rail for winding a thread on said bobbin, and means responsive to the variations of thread tension accompanying the ring-rail movements for varying the machine speed.

2. A control system comprising a dynamo-electric machine, a bobbin driven thereby, a ring-rail having a movement parallel to the axis of said bobbin for winding a thread thereon, and means responsive to the variations of the thread tension accompanying the ring-rail movements for periodically varying the machine speed.

3. A control system comprising a dynamo-electric machine, a bobbin driven thereby, a ring rail for winding a thread on said bobbin, and means responsive to the thread tension for increasing the machine speed when the ring rail travels in one direction accompanied by a decrease of the thread tension and for decreasing the machine speed when the ring rail travels in another direction accompanied by an increase of the thread tension.

4. A control system comprising a dynamo-electric machine, a bobbin driven thereby, a ring-rail having a vertical movement parallel to the axis of said bobbin for winding layers of thread thereon, and means responsive to the thread tension for increasing the

machine speed when the ring rail falls accompanied by a decrease of the thread tension and for decreasing the machine speed when the ring rail rises accompanied by an increase of the thread tension.

5 5. A control system comprising a dynamo-electric machine, a bobbin driven thereby, a ring rail for winding a thread on said bobbin, a switching device having positions respectively corresponding to an increase and a decrease of machine speed, and a spring serving to actuate said switching device to the speed-increasing position to increase the thread tension upon a movement of said  
10 ring rail in one direction, said device being actuated to the speed-decreasing position to decrease the thread tension upon a movement of said ring rail in another direction.

6. A control system comprising a dynamo-electric machine, a bobbin driven thereby, 20 a ring-rail having a movement parallel to the axis of said bobbin for winding a thread thereon, a switching device having positions respectively corresponding to an increase and a decrease of machine speed, and 25 a spiral spring serving to actuate said switching device to the speed-increasing position to increase the thread tension upon a downward movement of said ring rail, said device being actuated to the speed-decreasing position to decrease the thread tension upon an upward movement of said ring rail.

In testimony whereof, I have hereunto subscribed my name this 23rd day of June, 1920.

CHARLES T. GUILFORD.