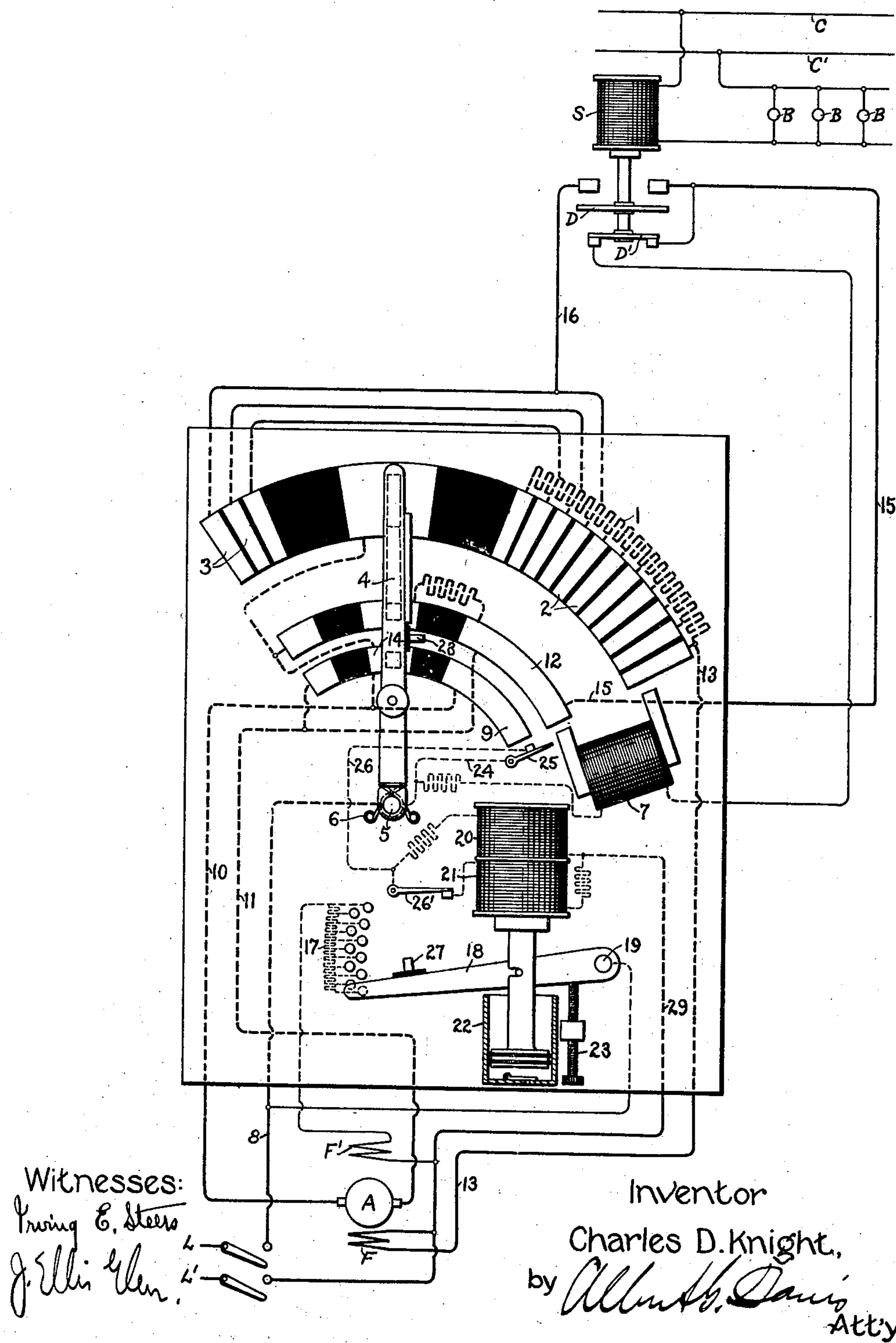


C. D. KNIGHT.
MOTOR CONTROLLING DEVICE.
APPLICATION FILED JAN. 21, 1907.

940,164.

Patented Nov. 16, 1909.



UNITED STATES PATENT OFFICE.

CHARLES D. KNIGHT, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MOTOR-CONTROLLING DEVICE.

940,164.

Specification of Letters Patent.

Patented Nov. 16, 1909.

Application filed January 21, 1907. Serial No. 353,198.

To all whom it may concern:

Be it known that I, CHARLES D. KNIGHT, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Motor-Controlling Devices, of which the following is a specification.

This invention relates to devices for controlling electric motor circuits and has for its object the provision of circuit controlling means whereby the motor may be stopped and started, and the speed varied in a reliable, safe and efficient manner.

In the operation of certain types of machines, it is highly desirable that the speed of the machine be beyond the control of the operator. It is also desirable that the speed itself be variable. This is particularly true of printing presses in which the work will sometimes permit of one speed and sometimes another, while the speed must be maintained constant during the performance of a specified piece of work.

In carrying out my invention, I provide means of connection with a starting rheostat whereby the speed will automatically be brought to a predetermined point as soon as the controlling element of the starting rheostat reaches a certain definite position, which will usually be the running position. I also provide means whereby the speed, which the motor will automatically assume may be varied and the arrangements are such that when the motor is started it will automatically come up to the speed at which it was running before it was last shut down. The most desirable method of varying the speed of the motor is by varying the field strength and it is necessary when the motor is started that the field be of maximum strength. I therefore provide means whereby when the line switch is closed, the field will be automatically brought to its maximum strength, and as soon as running conditions are established, the field strength will automatically be varied so as to give the desired speed.

In the accompanying drawing I have shown my invention embodied in a type of circuit controlling device best adapted for printing press control.

The particular printing press controller herein shown and described forms the subject matter of a patent issued to William C. Yates, No. 857,142. A detailed description

of this particular controller then is unnecessary since it forms no part of my invention. In general, however, it consists of a starting resistance 1 provided with a series of contact studs 2 and reversing studs 3, the latter being less in number than the former and being connected with the first three of the starting studs. The controlling arm 4 is pivoted at 5 and biased to the central position shown in the drawing by a double-acting spring 6 while a retaining magnet 7 is arranged to hold the arm 4 in running position in the usual manner. When the controlling arm 4 is moved to the right, the motor will be started cutting out the resistance 1 in the usual way until the magnet 7 is reached where the resistance is short-circuited. During the starting operation the direction of current will be as follows: from the line at L through the conductor 8, arm 4, conducting segment 9 thence by conductor 10 through armature A, conductor 11, conducting segment 12 to resistance 1 thence back to line L' through conductor 13 and series field F. Upon failure of voltage the arm will return to the off position in the usual way.

In order that the printing press or other machine with which this device is used may be "jogged" along at a low speed, a system of control is provided which is operative when the controlling arm is in the off position. This is accomplished by means of a series of push buttons B B B controlling a control circuit represented by the mains C C'. A solenoid S is arranged in this control circuit so that if any one of the buttons or switches B is operated, the solenoid will be energized. The core of the solenoid is provided with two contacts D D', each cooperating with a pair of contacts to control a separate circuit. Contact D' controls the circuit of the retaining magnet 7 so that when the push button is operated, the magnet 7 will be deenergized and allow the controlling arm to return to the off position. The contact D controls the armature circuit during the process of "jogging", so that when the button is pressed contact D will close the circuit and the direction of current will be as follows: from line L through conductor 8 to arm 4, conducting segment 14 thence through conductor 10, armature A, conductor 11, segment 12, conductor 15, contact D, conductor 16 through a portion of

the resistance 1 and conductor 13 to line at L' through the series field F. It will be noted that the motor, when controlled by the buttons B, has permanently in circuit a portion of the resistance so that the motor will be jogged along at a low speed. By actuating the button B again so as to de-energize the solenoid S, the circuit will be open so that the motor may be quickly stopped and started at a slow speed from various points around the machine where the buttons B may be located. The buttons will also stop the machine at any time when running at normal speed by deenergizing magnet 7.

The above described device is all shown and described in the application above referred to. In said case, however, the speed at which the machine could be operated is controlled by hand, and no provision was made against starting with a weakened field nor was there any means for keeping the speed regulation out of the operator's hands. To accomplish this result, I provide a speed regulating resistance 17 which I have shown in series with the shunt field F', the motor in this case being of the compound wound type although other types of motors may be used without departing from the spirit of my invention. The field resistance 17 is varied by a controlling member 18 pivoted at 19 so that if unrestrained it will always return by gravity or otherwise to the position shown in the drawing. In other words it has a bias away from the full field position. This arm is actuated by an electromagnet device having two windings 20, 21 and a dash-pot 22 is arranged to retard the arm as it moves downward in response to its bias. An adjusting screw 23 is arranged to engage the arm 18 so as to limit its movement as desired. This adjusting screw may, if desired, be beyond the control of the operator and only accessible to some person in authority. The coils 20 and 21 are energized from the line L through conductor 8, conductor 24, switch 25, conductor 26 thence through the two coils 20 and 21 in parallel and back to line through conductor 29. The coils being energized the arm 18 is raised until the field resistance 17 is all cut out. When this point is reached the switch 26' in the circuit of the solenoid 21 is opened by an insulated finger 27 on the controlling arm so that only one coil is acting on the core, but this is sufficient to hold it in a raised position. The motor is now started with the full field, either by means of the switches B or by moving the arm 4 toward running position. When operating by means of the switches, the field strength is not varied but when the controlling arm is moved over so as to give the motor full speed, it opens the circuit of the magnet 20 at the switch 25 when running conditions

are established, i. e., when the arm 4 reaches the retaining magnet 7, an insulated finger 28 opens the switch 25. Both solenoids being deenergized, the arm 18 will drop against the retarding influence of the dash-pot until it engages the screw stop 23. This movement of the arm will, of course, weaken the field of the motor, and in the present case, speed up the machine. It will thus be seen that I have provided means for automatically varying the speed of the motor so as to place it beyond the control of the operator, and at the same time the field of the motor will have full strength at starting.

While I have described my invention in connection with a particular type of motor, namely, one adapted for printing press control, and described in the previous application, it should be understood that it is in no sense limited to this particular application, it being shown in this connection principally for purposes of illustration. It should also be understood that many changes will suggest themselves to those skilled in the art, all of which will 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. The combination with an electric motor and a starting rheostat therefor, of means independent of said rheostat for causing the speed of said motor to be automatically and gradually varied a predetermined amount when the controlling element of the rheostat reaches a certain position and means for changing the amount of said variation.
2. The combination with an electric motor and a starting rheostat therefor, of means independent of said rheostat for automatically and gradually increasing the speed of said motor a predetermined amount when the controlling element of the rheostat reaches running position and means for varying the amount of said increase.
3. The combination with an electric motor and a starting mechanism therefor, of means for automatically and gradually varying the field strength of said motor when the starting mechanism occupies a certain fixed position and means for changing the amount of said variation.
4. The combination with an electric motor and a starting mechanism therefor, of a field resistance, means independent of said starting mechanism for automatically and gradually increasing said resistance when the starting mechanism reaches running position and means for varying the amount of said increase.
5. The combination with an electric motor and a starting rheostat therefor, of a field resistance, a controlling member therefor having a bias away from full field position,

and means controlled by the current for automatically moving said member to full field position.

5 6. A controlling device for electric circuits comprising a starting resistance, a controlling element therefor, a speed regulating resistance, means independent of said controlling element for automatically and gradually varying said latter resistance a predetermined amount when the starting element is moved to running position and means for changing the amount of said variation.

10 7. A controlling device for electric motors comprising starting mechanism, a field resistance having a controlling member biased to a predetermined position, and means controlled by the starting mechanism for automatically causing said controlling member to move to a second predetermined position and return in response to its bias.

20 8. A controlling device for electric motors comprising starting mechanism, a field resistance having a controlling member biased away from the full field position, and means controlled by the starting mechanism for causing said controlling member to automatically move to the full field position and return in response to its bias.

30 9. A controlling device for electric motors comprising starting mechanism, a field resistance having a controlling member biased away from the full field position, means for causing said controlling member to automatically move to the full field position, and means controlled by the starting mechanism for causing said member to return in response to its bias.

40 10. A controlling device for electric motors comprising a starting resistance, a controlling element therefor, a field resistance having a controlling member biased away from the full field position, an electromagnetic device for moving said member toward the full field position, and means for de-energizing said device when the controlling element of the starting resistance reaches running position.

50 11. A controlling device for electric motors comprising a starting resistance, a controlling element therefor, a field resistance having a controlling member biased away from the full field position, an electromagnetic device energized when the line circuit is closed for moving said member to full field position and deenergized allowing it to return in response to its bias when the controlling element of the starting resistance reaches running position.

60 12. A controlling device for electric motors comprising a starting resistance, a controlling element therefor, a field resistance having a controlling member biased away from the full field position, an electromag-

netic device for moving said member toward the full field position, means for partially deenergizing said device when the member reaches said position, and means for totally deenergizing the device thereby permitting the member to respond to its bias when the controlling element of the starting resistance reaches running position.

13. A controlling device for electric motors comprising a starting mechanism, a speed regulating resistance having a controlling member biased to a predetermined position, means controlled by the starting mechanism for automatically causing said controlling member to move from said predetermined position and return in response to its bias, and means for varying said predetermined position.

14. A controlling device for electric motors comprising a starting mechanism, a field resistance having a controlling member biased to a predetermined position away from full field, means controlled by the starting mechanism for causing said controlling member to automatically move to the full field position, and means for varying said predetermined position.

15. A controlling device for electric motors comprising a starting mechanism, a field resistance having a controlling member biased to a predetermined position away from full field, means controlled by the starting mechanism for causing said controlling member to automatically move to the full field position and return in response to its bias, and means for varying said predetermined position.

16. The combination with an electric motor and a starting rheostat therefor, of means whereby the motor may be controlled through a portion of the starting resistance with the controlling element in starting position, and means for causing the speed of said motor to be automatically varied a predetermined amount when the controlling member of the rheostat is moved from said position.

17. The combination with an electric motor and a starting rheostat therefor, of means whereby the motor may be controlled through a portion of the starting resistance when the controlling arm of the rheostat is in the off position, and means for causing the speed of said motor to be automatically varied a predetermined amount when the controlling member of the rheostat reaches running position.

18. The combination with an electric motor and a starting rheostat therefor, of a plurality of switches, means whereby the motor may be controlled through a portion of the starting resistance from said switches, and means for causing the speed of the motor to be automatically varied a predeter-

mined amount when the motor is brought up to running speed through said rheostat independently of said switches.

19. The combination with an electric motor and a starting rheostat therefor, of a plurality of switches and means whereby the motor may be controlled from said switches through a portion of starting resistance, a field resistance, a controlling member therefor biased away from the full field position, and means operating when the motor has been brought up to running speed through said rheostat and independently of said switches for causing said controlling member to automatically move to the full field position and return in response to its bias.

20. The combination with an electric motor and a starting rheostat therefor, of a plurality of switches and means whereby

the motor may be controlled from said switches through a portion of the starting resistance with the rheostatic controlling element in starting position, a field resistance, a controlling member therefor biased away from the full field position, means for causing said controlling member to automatically move to the full field position, and means for causing said member to automatically return in response to its bias when the controlling element of the starting rheostat reaches running position.

In witness whereof, I have hereunto set my hand this 19th day of January, 1907.

CHARLES D. KNIGHT.

Witnesses:

BENJAMIN B. HULL,
HULLEN ORFORD.