

No. 894,563.

PATENTED JULY 28, 1908.

W. C. YATES & G. W. CRAVENS.

STARTING RHEOSTAT.

APPLICATION FILED NOV. 9, 1905.

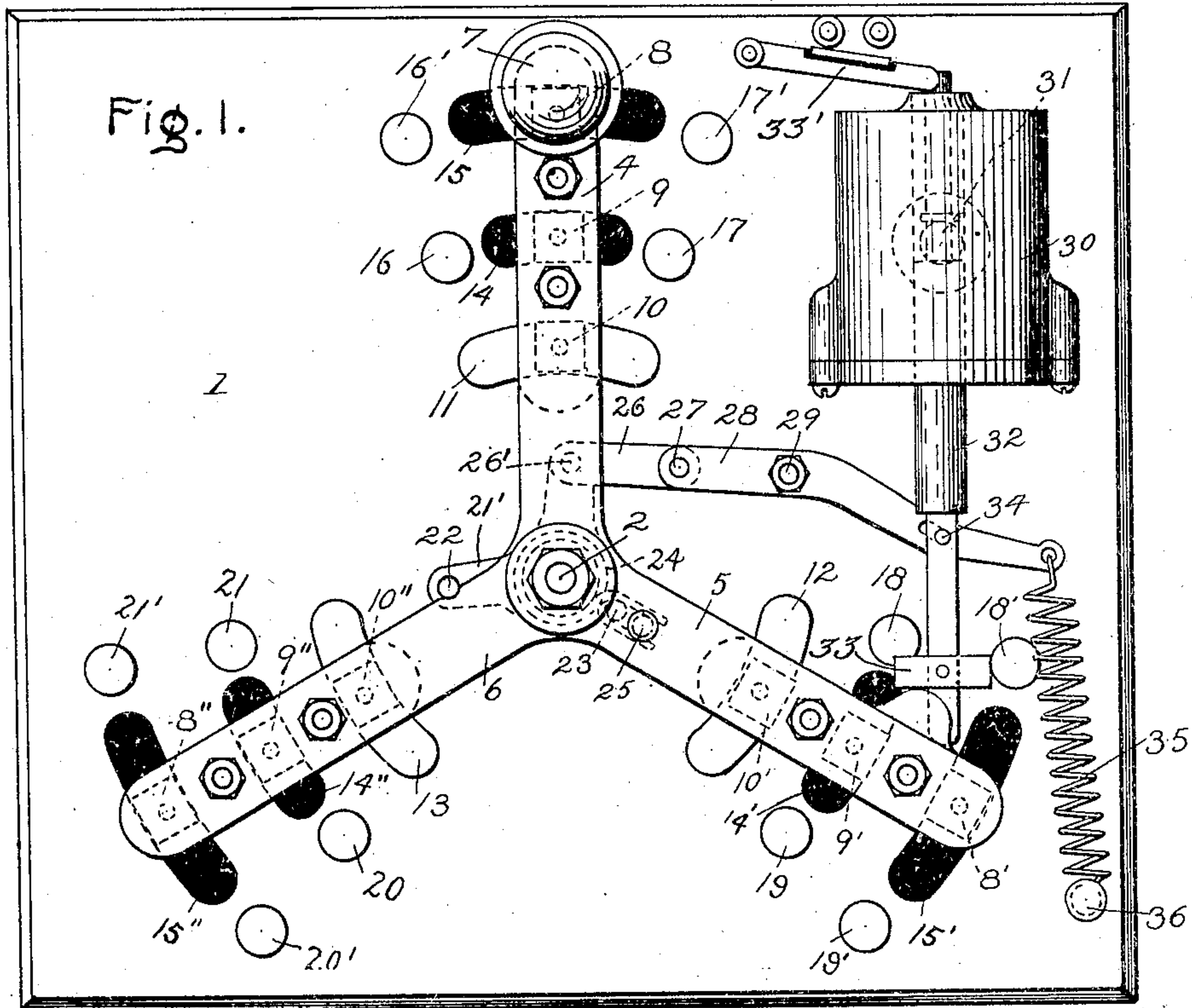
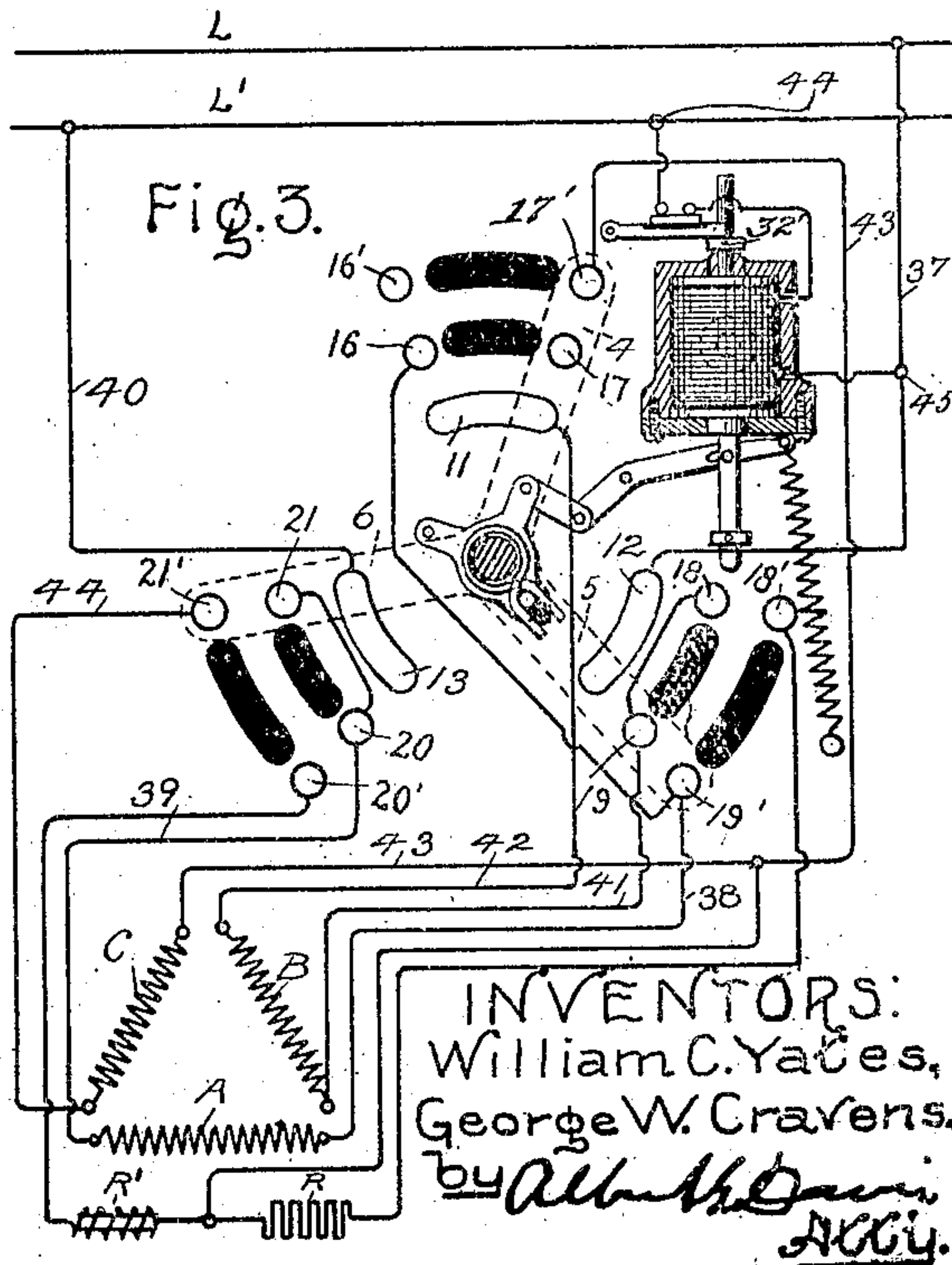
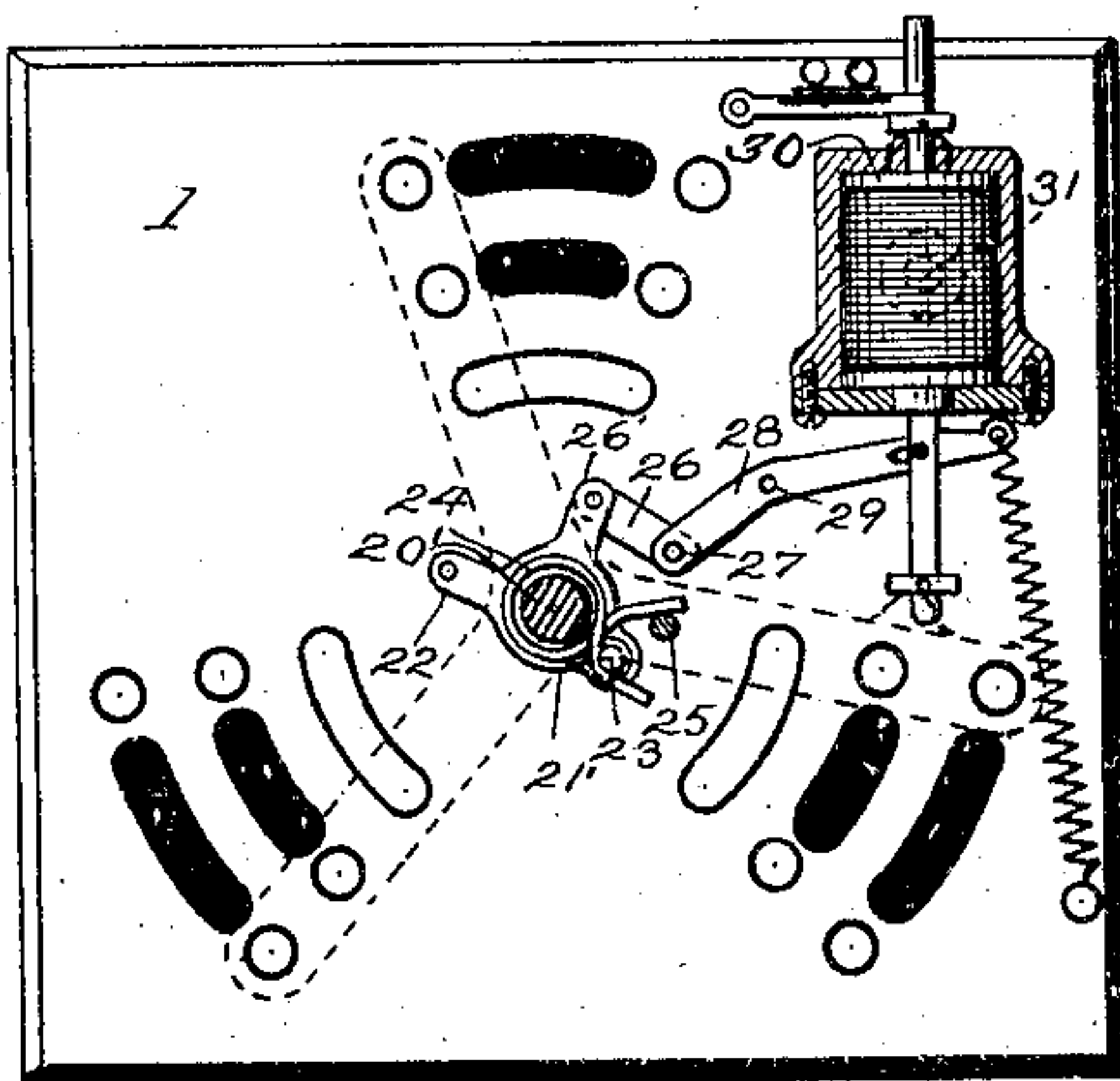


Fig. 2.



WITNESSES:

J. Ellis Allen.  
Margaret E. Strolby

INVENTORS:  
William C. Yates,  
George W. Cravens,  
by *Albert H. Davis*  
ATTY.



# UNITED STATES PATENT OFFICE.

WILLIAM C. YATES AND GEORGE W. CRAVENS, OF SCHENECTADY, NEW YORK, ASSIGNORS  
TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## STARTING-RHEOSTAT.

No. 894,563.

Specification of Letters Patent.

Patented July 28, 1908.

Application filed November 9, 1905. Serial No. 286,498.

*To all whom it may concern:*

Be it known that we, WILLIAM C. YATES and GEORGE W. CRAVENS, citizens of the United States, residing at Schenectady, 5 county of Schenectady, State of New York, respectively, have invented certain new and useful Improvements in Starting-Rheostats, of which the following is a specification.

This invention relates to the control of alternating current motors and has for its object the provision of a device for starting 10 motors of the induction type and bringing them up to running speed in a reliable, safe and efficient manner.

15 More specifically our invention relates to the starting of single phase motors of the induction type. This type of motor, as is well known, will not start from rest without the employment of special starting devices, such 20 as auxiliary starting winding or phase splitting devices connected in the motor circuit, or both. Devices of this character are designed to be in circuit only for a short period during which the motor is being brought up 25 to synchronism and if left in circuit too long will become overheated. Means have therefore been employed for changing the connections so as to cut out these auxiliary starting devices. In the case of motors with three- 30 phase windings, which are to be operated on single-phase current, it has been the practice to use a triple-pole double-throw switch which, when thrown in one position starts the motor with its windings Y-connected 35 with the addition of a resistance-reactance device for producing a displaced phase at the third terminal. After the motor has been brought up to speed, the switch is thrown into the opposite position which cuts out the 40 resistance-reactance device and places the motor with its windings delta-connected directly on the line. With an arrangement of this character there is nothing to prevent the operator from throwing the switch into the 45 starting position and leaving it there, or from throwing the switch into the running position directly, without passing through the starting position. Moreover, this type of device provides no means for throwing the 50 switch into the off position on failure of voltage so as to protect the motor upon the return of voltage to the line.

In a case filed by William C. Yates, October 18, 1905, Serial No. 283,247, a switch for 55 starting induction motors in the above de-

scribed manner is disclosed, together with means for preventing the operator from throwing the switch into the starting position and leaving it there, or from throwing the switch into the running position directly 60 without passing through the starting position. There is also disclosed means for throwing the switch into the off position on failure of voltage so as to protect the motor upon return of voltage to the line. In this 65 case however, there is no means for preventing the operator from throwing the controlling arm to the starting position and letting it swing back to the off position without throwing it over to the running position. In 70 that event, after the motor had stopped, the operator would be able to throw the arm to the running position directly with the motor at a standstill.

In carrying out our invention this difficulty is overcome by providing means where- 75 by the arm, which is initially biased to off position, as it is moved to starting position has its bias changed so as to be biased toward running position, so that if the operating handle should be released when the 80 starting conditions are established, the arm will not return to the off position but will go over to running position.

Our invention consists therefore in the features of construction and in the arrangement 85 and combination of elements hereinafter set forth and particularly pointed out in the claims annexed to and forming a part of this application. 90

In the drawing, Figure 1 is a plan view of a starting device embodying our invention; Fig. 2 is a similar view showing the controlling arm in starting position; and Fig. 3 is a 95 diagram of circuits with the controlling arm in running position.

Referring to the drawing, 1 is an insulating base of slate or soapstone provided with three sets of contacts having a controlling member pivoted for engagement therewith. 100 This controlling member is pivoted at 2 and comprises three branch arms 4, 5 and 6 arranged 120 degrees apart, the former having a handle 7 for operating the same. The controlling member is provided with contacts 8 105 9 10, 8' 9' 10' and 8'' 9'' 10'', three of each of the branches respectively, the contacts on each branch being electrically connected together but insulated from the arm and from the contacts on the other branches. The 110



contacts 10 10' 10'' engage respectively with the conducting segments 11, 12 and 13, while the remaining contacts engage respectively with the insulating segments 14 14' and 14'', 15 15' and 15''. These contacts are made when the controlling arm is in the off position, but if the arm is moved either to the left or right, the contacts pass off of the insulating segments but remain in contact with the conducting segments. Arranged one on either side of each of the insulating segments are the contact studs 16, 17, 18, 19, 20, 21, and 16', 17', 18', 19', 20' and 21' so that as the arm is moved in either direction from the center, it passes from the insulating segments into engagement with these studs so as to make electrical connections between the studs which are in radial alinement, and the adjacent segments. That is, when the arm is moved to the right, the studs 17 17' will be in electrical connection with segment 11 and likewise for each arm.

The controlling arm is normally biased to the off position shown in Fig. 1, and we provide means whereby when the arm is moved to the starting position this bias is changed so that it will be spring-pressed towards the running position. The controlling arm is mounted on the shaft 20' and beneath the same is a collar 21' mounted for movement independent of the arm and provided with three lugs one of which carries a pin 22 for preventing the movement of the controlling arm to the right. The second lug also has a pin 23 engaged by one end of the spring 24 coiled about the shaft 20, the other end of the spring being in engagement with a pin 25 mounted upon arm 5. The third lug has pivoted thereto a link 26 at 26', the opposite end of which is pivoted at 27 to a lever 28 pivoted in the base at 29. A no-voltage release magnet 30 is pivoted to the base at 31 and is provided with a core 32 having a collar 33 engaging a lug on arm 5. The lever 28 is pivoted to the extension at 34 and a spring 35 having one end fixed to the base at 36, and the other end secured to the free end of lever 28 draws the core out of the solenoid when the latter is deenergized. The pivotal points 26', 27 and 29 are so arranged that when the controlling arm is in the off position they are in alinement and the controlling arm cannot be moved to the right since the arm 6 engages the pin 22 which cannot be moved because of the alinement on the pivotal points. The arm may, however, be moved to the left and in so doing the core 32 is forced up by branch arm 5 into the magnet 30 carrying with it the outer end of lever 28. The upper end of the core carries a collar 32' which as it rises engages a switch arm 33' to close the circuit of solenoid 30 when the core reaches its upper position. This movement of the arm also depresses pivotal point 27, drawing collar 21' around to the right and

carrying with it the pin 22. This movement also carries the pin 23 around to the right away from the pin 25, placing a tension upon the spring 24 so that the end of the spring which engages the pin 25 tends to force the arm also around to the right. If, therefore, when the arm is moved into the position shown in Fig. 2, the handle should be released, it will immediately move over to the position shown in Fig. 3 in response to the tension of the spring. Upon failure of voltage the spring 35 will withdraw the core which in turn will force the arm into the off position.

In Fig. 3 we have shown the running connections for a motor with three-phase winding which is run on a single-phase circuit. The arrangement of the connections for starting a motor of this type is no part of our invention and we shall, therefore, not attempt to describe the circuits in detail. Let it suffice, therefore, to say that when the running conditions are established as shown in Fig. 3, current passes from the line at L, through conductor 37 and segment 12 to arm 5, thence to stud 19' and conductor 38 through winding A, conductor 39, studs 20 and 21, arm 6, segment 13 and conductor 40, back to line at L'. At the same time, there is a parallel circuit beginning with arm 5 through stud 19, conductor 41, winding B, conductor 42, segment 11, arm 4, stud 17', conductor 43, winding C, conductor 44, stud 21', arm 6, segment 13 and conductor 40, back to line. The resistance-reactance R R' is cut out of circuit since it has terminals at studs 18' and 20' which are not in circuit. The no-voltage release magnet is connected across the line from 44 to 45 through switch 33'.

The operation of our device will readily be understood from the foregoing description. When it is desired to start the motor, the arm is moved to the left; in fact, it cannot be moved in any other direction until it is first moved to the left. This movement raises the core 32 which is maintained in a raised position by the energizing of the magnet 30. The pin 22 is removed from the path of the arm 4 which can now be moved to the right or running position. In case the operator should attempt to leave the arm in starting position, it will not return to the off position, but will be carried over to the running position by the tension of spring 24. Upon failure of voltage, the spring 35, acting through lever 28, will shift the collar 21, so that the arm will return to the off position.

What we claim as new and desire to secure by Letters Patent of the United States, is:

1. The combination with a switch having a bias to a neutral position between two operative positions, of means for changing the bias thereof so as to automatically move it to one of the operative positions.

2. The combination with a starting switch



having a bias to an off position between its starting and running positions, of means for changing the bias thereof to the running position.

5 3. The combination with a switch having a neutral position between two operative positions, of means for biasing the same to one of the operative positions as it is moved toward the other operative position.

10 4. The combination with a switch having a bias to a neutral position between two operative positions, of means for changing the bias to one of the operative positions as it is moved toward the other operative position.

15 5. The combination with a starting switch having a bias to an off position between its starting and running positions, of means for changing the bias thereof to the running position as it is moved toward the starting position.

20 6. The combination with a starting switch having a bias to an off position between its starting and running positions, means for changing the bias thereof to the running position, and electrically controlled means for maintaining said latter bias.

25 7. The combination with a starting switch having a bias to an off position between its starting and running positions, means for changing the bias thereof to the running position, a no-voltage magnet, and means controlled thereby for maintaining said latter bias.

8. The combination with a switch having a bias to a neutral position between two operative positions, of means for preventing the movement thereof to one of the operative positions without first being moved into the other operative position, and means for changing the bias from the neutral position to one of the operative positions.

9. The combination with a switch having a bias to a neutral position between two operative positions, of means for preventing the movement thereof to one of the operative positions without first being moved into the other operative position, means for changing the bias from the neutral position to one of the operative positions, and electrically controlled means for maintaining said latter bias.

10. The combination with a starting switch having a bias to an off position between its starting and running positions, means for changing the bias thereof to the running position, means for preventing movement to the running position without first being moved to the starting position, a no-voltage magnet, and means controlled thereby for maintaining said latter bias.

In witness whereof we have hereunto set our hands this 8th day of November, 1905.

WILLIAM C. YATES.

GEORGE W. CRAVENS.

Witnesses:

BENJAMIN B. HULL,

MARGARET E. WOOLLEY.