

C. E. CARPENTER.
STARTING DEVICE.
APPLICATION FILED MAY 17, 1907.

981,612.

Patented Jan. 17, 1911.

Fig. 1

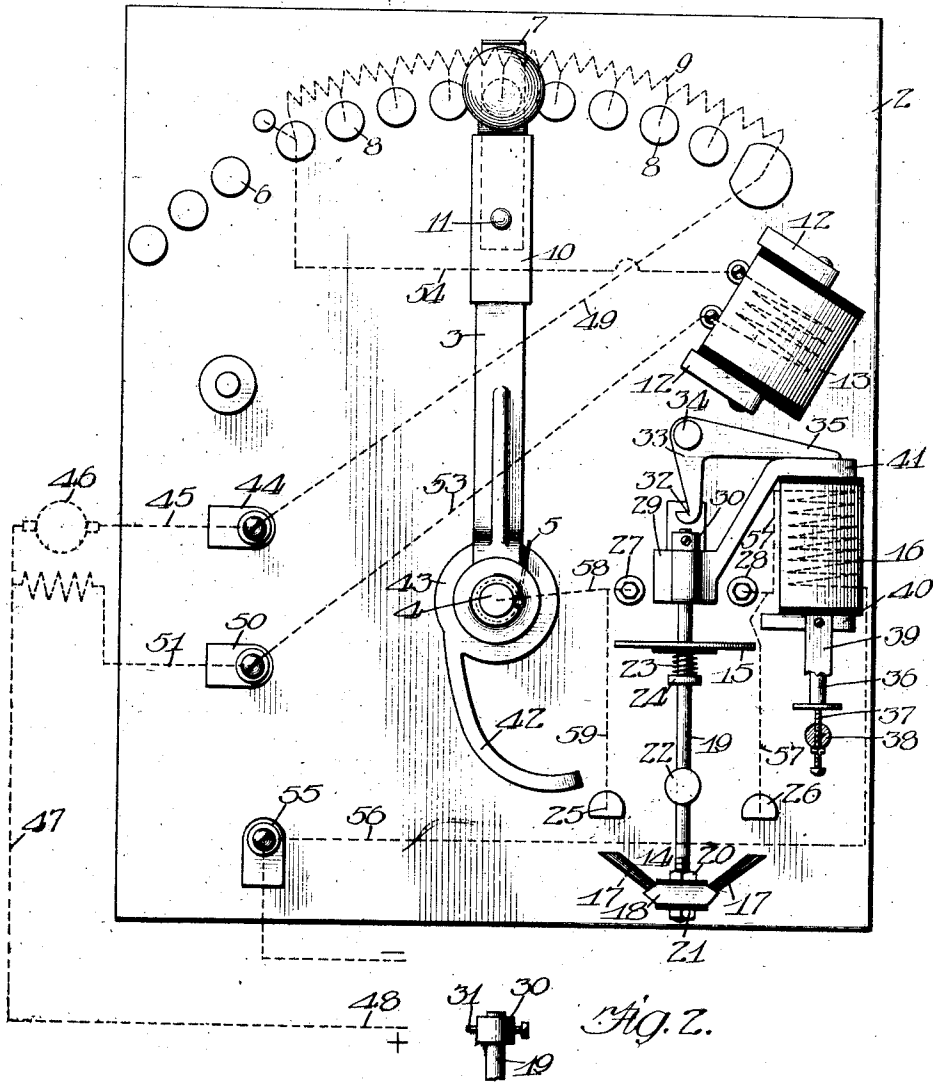


Fig. 2.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES E. CARPENTER, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented new and useful Improvements in Starting Devices, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to starting devices for electric motors and has for its object the provision of means operating under predetermined conditions in connection with the starting means of the motor for opening the circuit through the motor as long as the predetermined conditions exist.

I have illustrated in the accompanying drawings one embodiment of my invention for the purpose of disclosing the same, and in said drawings: Figure 1 is a front elevation of a starting box embodying my invention, having also indicated thereon a diagrammatic circuit arrangement. Fig. 2 is a perspective view of a portion of the rod on which the main switch is mounted.

In the embodiment of the invention illustrated, the various parts of the starting device are mounted upon a suitable base or panel 2 formed of slate or like insulating material. The movable element of the motor controlling device comprises an arm 3 pivoted upon a stud 4 projecting from the panel 2. One end of a coiled spring 5 bears against the arm and the other end of the spring is stationarily connected to the base or panel, whereby the spring will have a tendency to move the arm to the "off" position or to a position where it rests upon the last of the dead contact buttons 6, which are secured circularly upon the base 2. The arm is provided with a spring contact brush 7 arranged to sweep over and make contact with a plurality of contact buttons 8 circularly arranged upon the base 2, and connected with sections of a resistance 9 which may be mounted upon the rear of the panel 2. The arm 3 is provided with an armature 10 pivotally secured thereon by a bolt 11 and arranged to be held when moved into engagement therewith by the pole pieces 12 of a magnet 13, secured upon the base 2 at the limit of the "on" position of the arm 3. A circuit breaker is also mounted upon the base 2 and comprises a main switch 14, an

auxiliary switch 15 and an overload magnet 16. The main switch 14 comprises a pair of brushes 17 preferably formed of laminations or strips of copper secured in a cup 18 mounted upon a vertically movable rod 19. The cup may be secured in any suitable manner but I have here illustrated it as being secured between a pair of nuts 20 and 21 screwed upon the end of the rod 19. The rod extends through an opening in a stud 22, which aids in guiding the same and carries the auxiliary switch 15, which in the present instance takes the form of a disk resiliently supported upon a coiled spring 23 carried by the rod 19 on a collar 24. The brushes 17 are arranged, when the switch is closed, to bridge a pair of stationary contacts 25 and 26 and the disk 15 is arranged to bridge a pair of stationary contacts 27 and 28. The disk 15 is arranged to engage the contacts 27 and 28 prior to the engagement of the brushes 17, with the contacts 25 and 26 but due to the resilient mounting thereof the rod 19 will continue in its upward movement until the brushes 17 engage the contacts 25 and 26. The upper end of the rod 19 extends through a bracket 29 and is provided with a collar 30 having a small projection 31 arranged to be engaged by a catch 32 formed on one end 33 of the bell crank lever, pivoted at 34 to the base or panel 2. The opposite arm 35 of the bell crank lever is adapted to extend to a position immediately above the core 36 of the magnet 16, whereby when the core 36 is raised, the arm 35 will be raised, disengaging the catch 32. The core 36 in its lower position rests upon an adjusting screw 37 extending through a stud 38, secured upon the base and a calibrating strip 39 for the core is secured at one end to the stud 38, and at its opposite end to one of the pole pieces 40 of the magnet 16. The opposite pole piece 41 of the magnet 16 is connected with the bracket 29 whereby the bracket forms an extension thereof, and it will be noted that the contact 28 of the circuit breaker is arranged in the magnetic circuit of the poles of the magnet 16, which circuit extends from the pole piece 40 to the bracket 29 and thence to the opposite pole piece 41.

The circuit breaker is set by a curved arm 42 extending from the hub 43 to the arm 3, arranged when the arm 3 is moved to the

first of the dead contacts 6 to engage beneath the collar 24 and raise the rod 19 until the catch 32 engages and supports the circuit breaker in a closed position.

5 One binding post 44 of the starting device is connected by conductor 45 with one terminal of the armature 46 of the motor, the opposite terminal of which is connected by conductor 47, with the positive side 48 of the line. The binding post 44 is also connected
10 by a conductor 49 with the last of the contact buttons 8. A second binding post 50 of the starting device is connected by a conductor 51 with one terminal of the shunt field winding of the motor, the opposite terminal of which is connected with the conductor 47. The binding post 50 is also connected by the
15 conductor 53 with one terminal of the winding of the magnet 13, the opposite terminal of which is connected by conductor 54 with the first of the live contacts 8. A third binding post 55 of the starting device is connected by the conductor 56 with one terminal of the winding of the overload magnet 16, the opposite terminal of which is connected
20 by a conductor 57, with the stationary contact 28 of the circuit breaker, and with the main switch contact 26. The stationary contact 27 of the circuit breaker is connected by conductor 58 with the arm 3 and by conductor 59 with the main switch contact 25.

In operation, assuming that the arm 3 is on the last of the dead contacts 6, in order to start the motor the arm is moved to the left
25 as far as it will go, when the short arm 42 will engage the collar 24 lifting the rod 19, and closing the main switch 17 and auxiliary switch 15. The catch 32 will engage the projection 31 on the collar 30, and retain the rod in a raised position. The circuit breaker being closed, the arm 3 is moved to the right until it engages the first of the contacts 8, when circuit will be established from the positive side 48 of the line, by conductor
30 47, through the armature 46, by conductors 45 and 49, through all of the resistance 9, across the arm 3, by conductors 58 and 59, across the switch 14, by conductor 57 through the overload magnet 16, by conductor 56, and thence to the negative side of the line. The field circuit will also be established from conductor 47, through the field, and by conductors 51 and 53, through the retaining magnet 13, thence by conductor 54, to the first of the contacts 8, and by the arm 3 to the negative side of the line. The motor
35 thus starts with all resistance in the armature circuit and as the arm 3 is moved to the right, the armature resistance 9 is gradually cut out until the arm reaches its full "on" position, when it will be retained in that position by the retaining magnet 13. In event of an overload, the core 36 of the magnet 16 will be attracted and engaging
40 the arm 35 will kick the catch 35 loose per-

mitting the circuit breaker to open and thereby open the circuit through the motor and at the same time deenergizing the magnet 13, permitting the arm 3 to move back to its "off" position, when, to start the motor again, it will be necessary to repeat the above described operation. Also if when the motor is started the arm 3 is moved too rapidly or if the motor does not start and the operator continues to move the arm to full speed position, the current would increase to the point where the plunger 36 would be attracted to unlatch the rod 19 and open the circuit.

When the arm 3 is moved to its "off" position, that is, on the last of the dead contacts 6, a closed loop is established from one terminal of the armature by conductors 45 and 49, through the resistance 9 by conductor 54, through the winding of the magnet 13, and by conductors 53 and 51, through the field 52 to the opposite terminal of the armature. This takes up the field discharge. Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. The combination with the movable element of a controller, of a circuit breaker comprising a longitudinally movable member carrying the switch contacts thereof, a retaining device for the circuit breaker, and an electromagnet responsive to an abnormal increase in current in the motor circuit for releasing said retaining device, said circuit breaker being adapted to be set by the movement of the movable element of the controller.

2. The combination with a movable arm of a controller, of a slidably mounted circuit breaker arranged to be set by said arm when in a predetermined position, said circuit breaker having a main and an auxiliary contact, a retaining device for said circuit breaker, and means responding to abnormal increase in current in the motor circuit for releasing the same.

3. The combination with the movable element of a controller, of a slidably mounted circuit breaker having a main and an auxiliary contact, an electromagnet responding to abnormal increase in current in the motor circuit for releasing said circuit breaker and means operated by said movable member for setting said circuit breaker.

4. The combination with the movable element of a rheostat, of a circuit breaker comprising a switch and an electromagnet responsive to an abnormal increase in current in the motor circuit for releasing said switch, said electro-magnet having pole pieces for disrupting the arc formed upon the opening of said switch, said switch being arranged to be mechanically set by said rheostat element.

5. The combination, with the movable member of a rheostat, of a circuit control-

ling switch arranged to be mechanically set by said member when in initial position, said switch having main and auxiliary contacts, and an overload magnet adapted to release said switch, said magnet having pole pieces for disrupting the arc formed upon the opening of said switch.

6. The combination with the movable member of a controller, of a retaining device for the same responding to abnormal decrease in current in the motor circuit for releasing said movable member, and a circuit breaker adapted to be set by said movable member comprising a longitudinally movable member carrying a switch contact, means to normally hold the switch closed, and an electro-responsive device operating under abnormal increase in current in the motor circuit to release said second mentioned movable member.

7. The combination with a movable member of a controller of a circuit breaker comprising stationary contacts and a movable element carrying a main contact and an auxiliary contact adapted to abut against said stationary contacts, said auxiliary contact being resiliently mounted to cause said contacts carried by said element to engage and disengage their stationary contacts in inverse order, said movable element of the circuit breaker being arranged to be operated by said controlling member when in a predetermined position, means for retaining said movable element of the circuit breaker in operative position, an electro-responsive device for causing said means to release said movable element of the circuit breaker under predetermined conditions.

8. The combination with the movable member of a controller, of a retaining electro-magnet for said movable member responding to abnormal decrease in the motor circuit for releasing said movable member, a circuit breaker comprising a vertically movable rod and a contact thereon adapted to be closed by said movable member, a catch adapted to engage the rod when the contact is closed, and a device responding to abnormal increase in current in the motor circuit for releasing the same.

9. The combination with the movable member of a controller, of a circuit breaker adapted to be set thereby and comprising a longitudinally movable member carrying a main and auxiliary switch contact, a retaining device for said vertically movable member adapted to normally hold the contacts closed and an electro-responsive device operating under abnormal increase of the motor current for disconnecting said retaining device.

10. The combination with the movable member of a controller, of a circuit breaker comprising a sliding rod having a main and an auxiliary contact thereon, a retaining de-

vice for said circuit breaker responding to abnormal current in the motor circuit for releasing the same, and means operated by said movable member of the controller only when the movable member is in an "off" position for setting said circuit breaker.

11. The combination with the movable member of a controller, of a circuit breaker comprising a vertically movable rod, a main and auxiliary switch contact carried by said rod adapted to be successively closed by the movement of said rod, a catch for retaining said rod in its raised position and an electro-responsive device responding to an abnormal increase in the current of the motor circuit for releasing said catch.

12. The combination with a movable member of a controller, of a circuit breaker comprising a vertically movable rod, a pair of switch contacts carried by said rod and adapted to be successively closed by the raising of the same, a catch for retaining said rod in its raised position, an electro-responsive device responding to abnormal increase in the current of the motor circuit for releasing said catch and a projection carried by the movable member of the controller for raising said rod, operative only when the movable member of the controller is in its "off" position.

13. The combination with a movable member of a controller, of a resistance controlled thereby, a retaining magnet for said movable member connected in the field circuit of the motor, a switch for controlling the armature circuit of said motor comprising a vertically movable member carrying a main and an auxiliary contact, a retaining device for said vertically movable member, an electro-magnet connected in the armature circuit of the motor and responding to an abnormal increase in current for releasing said retaining device, and an arm carried by the movable member of the controller for raising said vertically movable member, operative only when the movable member of the controller is in an "off" position.

14. The combination with a motor of a resistance therefor, a movable arm for controlling said resistance, a switch comprising a vertically movable rod carrying a main and an auxiliary switch contact thereon adapted to be successively closed upon the raising of said rod, a projection on the movable member of the controller for raising said rod operative only when the movable member is in an "off" position, a retaining catch for holding said vertically movable member in a raised position, an electro-responsive device connected in the armature circuit and adapted upon an abnormal increase of current in the armature circuit for releasing said catch, and a retaining magnet for said movable member of the controller connected in the field circuit of the motor

for retaining said arm in its "on" position and adapted upon abnormal decrease of current in the field circuit to release said movable member; said first mentioned retaining magnet having polar extensions between which one of the contacts of the circuit breaker is arranged, for disrupting the arm formed by the opening of said contact.

15. The combination with the movable member of a controller and an extension on said member; of a circuit breaker comprising a rod, an auxiliary and a main contact carried by said rod adapted to be successively closed upon the movement of said rod in one direction, a latch for engaging said rod when the contacts are closed, an overload magnet for disengaging said latch upon an abnormal current, said extension on the movable member adapted to close said contacts only when the member is in "off" position.

16. The combination with the movable member of a controller, and an extension on said member; of a circuit breaker comprising a vertically movable rod, an auxiliary and a main contact carried by said rod adapted to be successively closed, a latch for engaging said rod when the contacts are closed, said extension on the movable member adapted to close said contacts only when the member is in "off" position, and an overload magnet adapted to respond to an abnormal increase of current to disengage the latch, the pole pieces of said magnet being so arranged as to disrupt the arc formed by the opening of said auxiliary switch.

17. The combination with the movable member of a controller, a spring tending to return said member to initial position, an extension on said movable member, an electromagnet to retain said member in its "on" position and adapted upon abnormal decrease of current to release said movable member, of a circuit breaker comprising a vertically movable rod, an auxiliary and a main contact carried by said rod adapted to be successively closed, a latch for engaging

said rod when the contacts are closed, said extension on the movable member adapted to close said contacts only when the member is in "off" position, and an overload magnet adapted to respond to an abnormal increase of current to disengage the latch, the pole pieces of said magnet being so arranged as to disrupt the arc formed by the opening of said auxiliary switch.

18. In combination, an electromagnet and a longitudinally movable member carrying a switch contact, said magnet having a pole piece forming a guide for said member and another pole piece so disposed as to cause said magnet to disrupt the arc formed upon the opening of said switch contact.

19. In a circuit breaker, in combination, a longitudinally movable member carrying a switch, means for retaining said member in position to close said switch, and an overload magnet adapted to respond to release said member, said magnet having a pole piece forming a guide for said member and another pole piece so disposed as to cause said magnet to disrupt the arc formed upon the opening of said switch.

20. The combination with the movable element of a rheostat, of a circuit breaker arranged to be set by said element when in a predetermined position, comprising a longitudinally movable member, and a switch carried thereby, means for retaining said member in position to close said switch, and an overload magnet for releasing said member, one of the pole pieces of said magnet forming a guide for said member, and the other pole piece thereof being so disposed as to cause said magnet to disrupt the arc formed upon the opening of said switch.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

CHARLES E. CARPENTER.

Witnesses:

J. J. HORTON,

ROBERT LEWIS AMES.