C. E. CARPENTER.

MOTOR CONTROLLING DEVICE.

APPLICATION FILED MAY 9, 1907.

983,976.

Patented Feb. 14, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

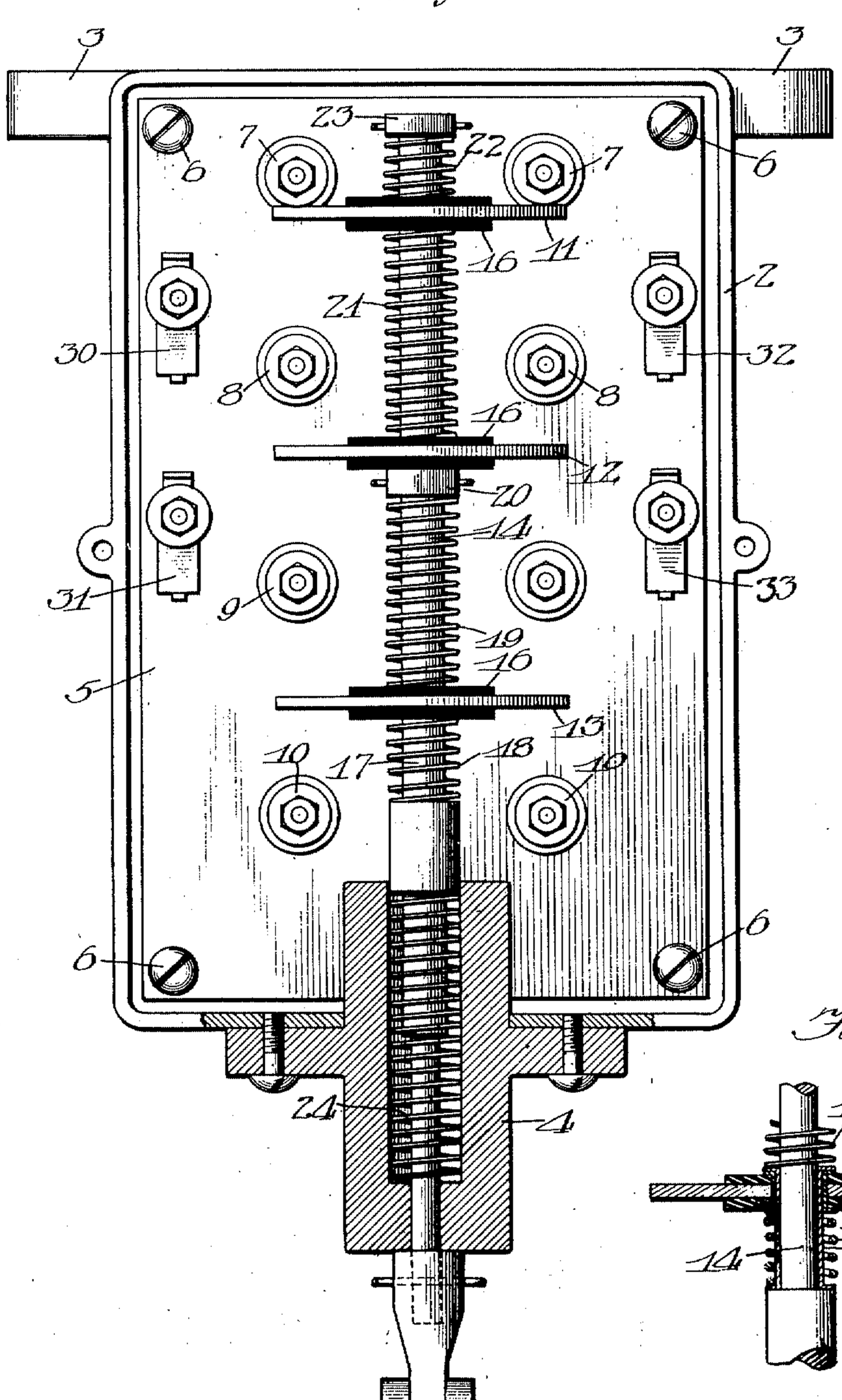

Fig. 2.

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Fig. 3.

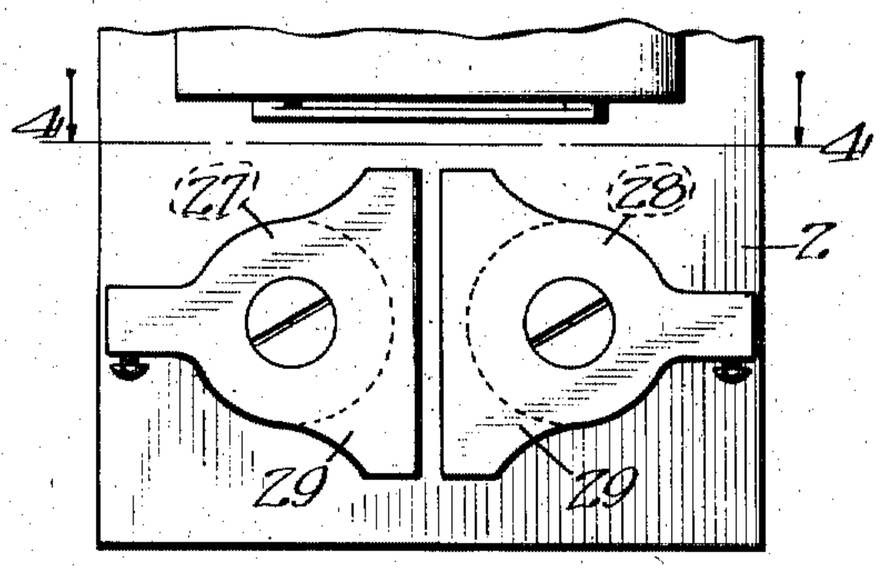


Fig. 4.

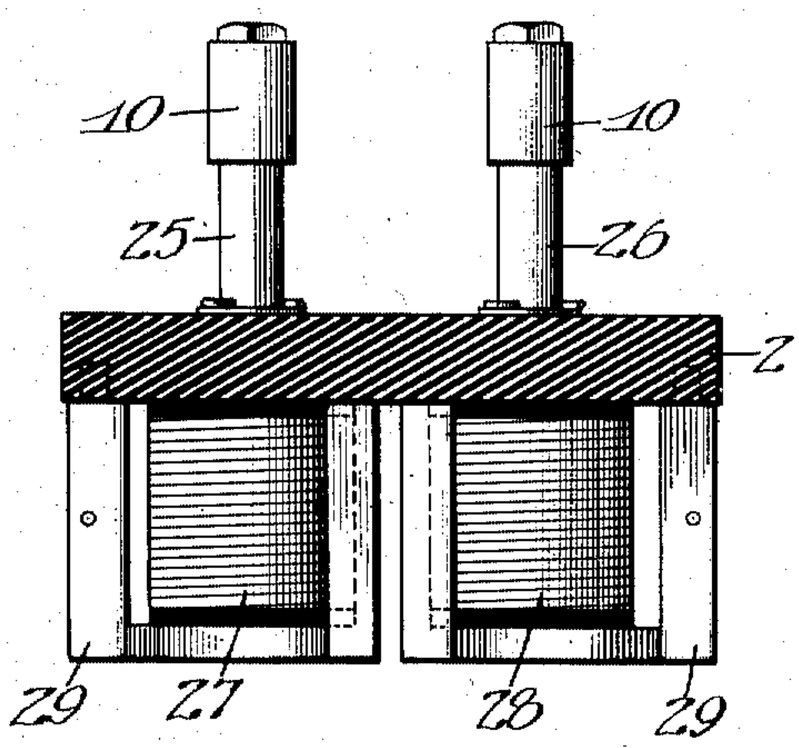
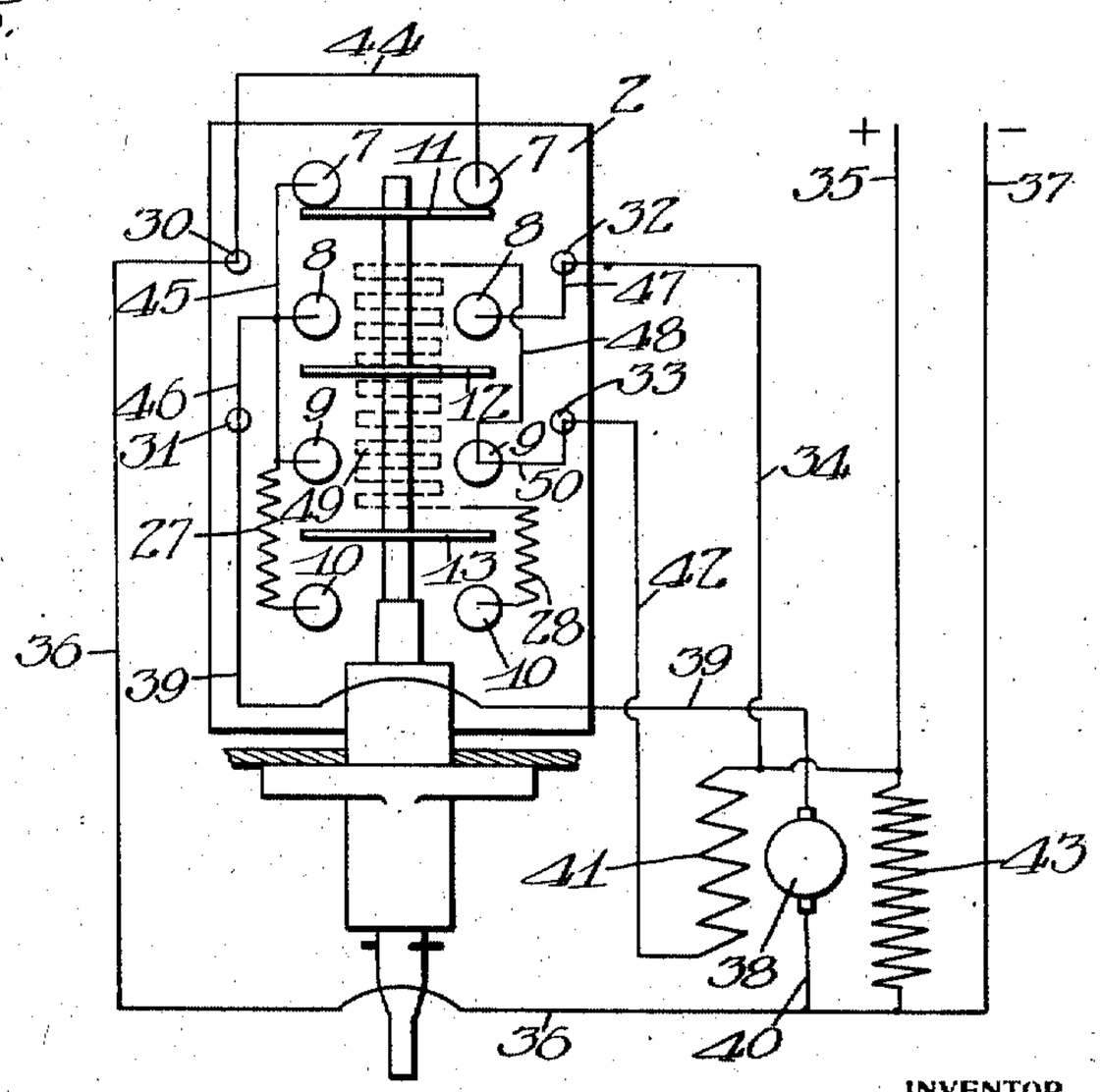


Fig. 5.



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MOTOR-CONTROLLING DEVICE.

983,976. Specification of Letters Patent. **Patented Feb. 14, 1911.**

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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, in the county of New York and State of New York, have invented new and useful Improvements in Motor-Controlling 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 improvements in devices for controlling electric motors, one of the objects of my invention being to provide a compact, efficient, and durable device for controlling the starting, stopping and speed of an electric motor.

Another object of my invention is to provide a switch for controlling an electric circuit which shall have means for insuring a quick break between its contacts, whereby the switch can not be partially opened and maintained at this point, causing a continued and destructive arc at the switch contacts.

For the purpose of illustrating my invention I have shown one embodiment thereof in the accompanying drawings.

In said drawings: Figure 1 is a front elevation of my motor controlling device. Fig. 2 is a detail section showing the manner of mounting one of the switch members. Fig. 3 is a rear view of the magnets. Fig. 4 is a section on the line 4—4 of Fig. 3, and Fig. 5 is a diagrammatic view of the circuit arrangement of the embodiment of my invention illustrated.

In the preferred embodiment of my invention I provide a suitable casing 2, which may be formed of iron or any other indestructible material, for inclosing the various parts of the controller, provided with a removable cover (not shown) to permit access to the interior thereof. Suitable securing lugs 3 are provided at the top of the casing by which the same may be supported in position. The lower end of the casing is provided with an opening through which extends a removable bushing 4, having an opening therein to accommodate the operating rod of the controller.

Mounted within the casing is a suitable panel or base 5, which may be formed of slate, soapstone or like insulating material, and upon which the various operating parts of the controller are mounted. This base or panel may be secured in position within the casing 2 by means of screws or bolts 6. The front face of the base or panel is provided with a plurality of pairs of contacts, 7, 8, 9, and 10. The pairs of contacts are arranged to be bridged by switch members 11, 12, and 13 which may take the form of metallic disks suitably mounted upon and insulated from a vertically extending rod 14, which passes through the bushing 4, and at its lower end is connected with an operating pedal 15 of a sewing machine or the like. The disks 11, 12 and 13 are loosely mounted upon the rod 14 and insulated therefrom by suitable insulating bushings 16. The disk 13 is formed of iron and is resiliently supported in position upon the rod 14, upon a brass sleeve 17, and rests upon a coiled spring 18 interposed between the bottom of the disk and a flange on the sleeve. The coiled spring 19 bears against the top of the sleeve and a collar 20, secured upon the rod. The disk 12 rests upon the collar 20, and has interposed between it and a sleeve for the disk 11 similar to the sleeve 17, a coiled spring 21, whereby the disk is held in normal position. The disk 11 is mounted upon a sleeve and has a coiled spring 22 interposed between it and a flange on the top of the sleeve. A stop collar 23 prevents the sleeve of the disk 11 from coming off the rod. The disposition of the disks upon the rod with respect to their contacts is such that when the rod is moved downward the disk 13 will be the first to engage its contacts. The disk 12 will next bridge the pair of contacts 9 and the disk 11, which normally bridges the pair of contacts 7, will lastly bridge its pair of contacts 8. When the rod 14 is raised, the order of opening of the switches will be inverse to their order of closing. Viz:—the switch member 11 will open first, then the switch member 12 and lastly the switch member 13. This action is obtained by making the normal distance between the pair of contacts 8 and the disk 11 greater than the normal distance between the pair of contacts 9 and the disk 12, which distance is greater than the distance between the pair of contacts 10 and the disk 13. The rod 14 is raised to normal position by a coiled spring 24 interposed between a shoulder on the rod and a shoulder formed in the bushing 4.

The pair of contacts 10 are mounted upon projecting poles 25 and 26 of a pair of magnets mounted upon the rear of the panel or base 2, suitable openings in the panel being provided to accommodate the poles 25 and 26 of the magnets. The poles are provided with windings 27 and 28, respectively, also mounted upon the rear of the base or panel 2. The opposite pole pieces 29 of the windings 27 and 28 are preferably triangular in shape with the bases of the triangle adjacent and an air gap is formed between the pole pieces at the base of the triangles. This electrically insulates the pole pieces but due to the size of the pole pieces at this point, the resistance in the magnetic circuit caused by the air gap is materially reduced. The disk 13 is preferably formed of iron and when the rod 14 is raised to open the switches the magnetic attraction of the poles 25 and 26 will retain the disk 13 in closed position until the spring 18 is compressed. The upward movement of the rod under the influence of the spring 24 moves the shoulder thereof into engagement with the bottom of the sleeve 17 and kicks the disk 13 loose when it will fly up under the action of the spring 18 to open the circuit. This prevents holding the disk near the contacts 10 which would cause a continued arc at this point. The base or panel 2 is provided with suitable binding posts 30, 31, 32 and 33 by which the proper electrical connections may be made with the motor and with the supply mains.

The circuit arrangement of the controlling device is more particularly shown in the diagrammatic view illustrated in Fig. 5. As illustrated in this figure the binding post 32 is connected by the conductor 34 with the positive side 35 of the supply mains and the binding post 30 is connected by conductor 36 with the negative side 37 of the supply mains. One terminal of the armature 38 of the motor is connected by conductor 39 with the binding post 31, the opposite terminal thereof being connected by the conductor 40 with the conductor 36. One terminal of the series field winding 41 of the motor is connected by conductor 42 with the binding post 33, the opposite terminal of said winding being connected with the supply main 35. The shunt field winding 43 of the motor is connected between the positive side 35 of the supply main and the conductor 36. One of the pair of contacts 7 is connected by conductor 44 with the binding post 30, while the opposite contact of this pair is connected by a conductor 45 with one terminal of the winding 27. The binding post 31 is also connected by a short conductor 46 with the conductor 45, and with one of the pair of contacts 8. The opposite of the pair of contacts 8 is connected by conductor 47 with the binding post 32. One of the pair of contacts 9 is connected with one terminal of the winding 27 while the other is connected by conductor 48, with one terminal of the armature resistance 49 and by a short conductor 50, with the binding post 33. The opposite terminal of the armature resistance 49 is connected with one terminal of the winding 28 and one of the pair of contacts 10 is connected with the opposite terminal of the winding 28, while the opposite of the pair of contacts 10 is connected with one terminal of the winding 27.

In operation the rod 14 is moved downwardly, thereby moving with each of the disks 11, 12 and 13. The distance between the disk 13 and its pair of contacts 10 being the shortest, this disk will bridge its contacts first and close the circuit from the positive side 35 of the line, through the series field 41, by conductors 42, 50, and 48, through the resistance 49, through the winding 28, across the disk 13, through the winding 27, by conductors 45, 46 and 39, through the armature and by conductor 40, to the negative side 37 of the line. The motor is thus started with the resistance in circuit. A continued downward movement of the rod 14 causes the disk 12 to bridge the contacts 9, the coiled spring 19 permitting this downward movement of said rod even though the contact 13 has been closed. The bridging of the contacts 9 short circuits the resistance 49 and increases the speed of the motor. A still further downward movement of the rod 14 will move the disk 11 into engagement with the pair of contacts 8 thereby short circuiting the series field winding and the motor will run at full speed. In stopping the motor the rod 14 is permitted to rise, thereby first opening the switch 11, then the switch 12. A further upward movement of the rod will not immediately open the switch 13 as the magnetic attraction of the pole pieces 25 and 26 will hold the disk until the spring 18 has been compressed and the shoulder on the rod 14 kicks the disk open, when it will be snapped up, thereby preventing the running of the motor on an arc formed between the disk 13 and its contacts 10. When the switches reach their final or normal position, the switch 11 will bridge the contacts 7, closing a circuit across the terminals of the armature 38, and causing the motor to stop quickly on account of the dynamic brake action.

It is obvious that instead of the switch 11 being arranged to short circuit the series field winding, it can be arranged to control an additional section of armature resistance if so desired.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In an electric switch, in combination, rigid stationary contacts, a movable mem-

ber, a rigid contact loosely mounted on said member and adapted to be moved thereby to bridge said stationary contacts, electro responsive means for magnetically holding said contacts in engagement, and means adapted to have energy stored therein upon movement of said movable member, to overcome the magnetic pull upon said bridging contact to quickly disengage the same from said stationary contacts upon a predetermined degree of movement of said movable member.

2. In a switch, the combination with a movable switch member, of a stationary contact, said contact forming a pole piece of an electro-responsive device, means for closing said switch and means adapted to have energy stored therein for opening said switch, said contact member being adapted to hold said switch closed until energy is stored in said opening means.

3. In a switch, the combination with a movable member, of a pair of stationary contacts adapted to be engaged by said member and forming the pole pieces of an electro-magnet, and means adapted to have energy stored therein for opening said switch, said contacts being adapted to hold the switch closed until the energy is stored in said opening means.

4. In a switch, the combination with a movable member, of stationary contacts adapted to be engaged thereby, said contacts forming the pole pieces of an electro-magnet and said switch forming the armature of said magnet and a spring adapted, when placed under tension, for opening said switch, said contacts being adapted to maintain the switch closed until the spring is placed under tension.

5. The combination with a movable member, of a switch member movably mounted thereon, a coiled spring resiliently supporting said switch member on said movable member and adapted, when placed under tension by said movable member, to open said switch member, and an electro-magnet for holding said switch member closed until said coiled spring is placed under tension.

6. The combination with a movable rod, of a switch member movably mounted upon said rod, a pair of contacts adapted to be bridged by said switch member and forming pole pieces of an electro-magnet, said switch member being adapted to form the armature thereof, and a coiled spring adapted, when placed under tension, to open said switch member, said contacts being adapted to retain said switch member in a closed position until the coiled spring has been placed under tension by said movable rod.

7. In a switch, the combination with a plurality of switch members, of means for successively operating said members, means adapted to have energy stored therein for opening one of said members at a predetermined time and an electro-responsive device for retaining said switch closed until energy is stored in said opening means.

8. In a switch, the combination with a plurality of switch members, of means for successively operating the same, a plurality of stationary contacts arranged to be engaged by said switches, the contact of one of said switches forming a pole piece of an electro-magnet, and means adapted to have energy stored therein for opening said switch, said energized contact being adapted to hold said switch closed until the energy is stored in said means.

9. The combination with a movable member, of a plurality of resiliently mounted switch members carried thereby and adapted to be successively operated by said movable member, a spring adapted to be placed under tension for opening one of said switches and an electro-magnetic means for retaining said switch closed until said spring is placed under tension.

10. In a switch, the combination with a movable member of a plurality of switch members carried thereby and adapted to be successively operated by said member to bridge a plurality of pairs of contacts, one pair of said contacts forming the pole pieces of an electro-magnet, and a spring adapted to be placed under tension for opening the switch member of said contacts, said contacts being adapted to retain said switch member closed until the spring is placed under tension.

11. The combination with a motor of a switch for controlling the same comprising a movable member and a plurality of switch members resiliently mounted thereon and adapted to be successively operated by said movable member, the first of said switch members being arranged, when closed, to complete the motor circuit, the second of said switch members being arranged when closed to change the circuit relations of said motor to increase the speed thereof, and the third of said switch members being arranged when closed to change the circuit arrangements of the motor to still further increase the speed thereof said third switch member adapted, when the switch is open, to close a circuit across the terminals of the armature, whereby the motor will act as a dynamic brake.

12. In a motor controlling switch, in combination, a longitudinally movable member, a plurality of switch members carried thereby and adapted to be successively operated by said movable member, the first of said switches when closed being arranged to complete the motor circuit, the second of said switches when closed being arranged to cut out the armature resistance of said motor and the third of said switches being ar-

ranged when closed to cut out the series field of said motor.

13. The combination with a motor, of a switch for controlling the same comprising a movable member, a plurality of switch members carried thereby and adapted to be successively operated by said movable member to vary the speed of the motor, one of said switch members, when the switch is open being adapted to complete a circuit across the armature terminals to cause the motor to act as a dynamic brake.

14. The combination with the motor, of a switch for controlling the same comprising a movable member and a plurality of switch members carried thereby, and successively operated by said movable member, the first of said switches being adapted when closed to complete the motor circuit, the second of said switch members being adapted when closed to change the circuit relations of the motor to increase the speed thereof, the third of said switch members being adapted, when in one position, to further change the circuit relations of the motor to further increase the speed thereof, and when in another position when the remaining switches are opened to complete a circuit across the armature terminals to cause the motor to act as a dynamic brake.

15. In a switch, the combination with a base, a rod longitudinally movably mounted thereon, a contact carried thereby, a stationary contact mounted on said base forming the pole piece of an electromagnet, said rod adapted to close the contacts when moved in one direction, and means to quickly break contact when the rod returns to normal position.

16. In a switch, the combination with a longitudinally movable member, a plurality of contacts resiliently mounted thereon, a plurality of stationary contacts adapted to be successively bridged by the contacts on the movable member, two of said stationary contacts forming the pole pieces of an electromagnet, and a spring adapted, when placed under tension, to quickly open the last contact held by the poles of the electromagnet.

17. In a switch, the combination with a supporting frame, of a longitudinally movably mounted member in said frame, a spring tending to return said member to its initial position, a plurality of contact disks loosely mounted on said member, springs interposed between said contact disks, a plurality of stationary contacts arranged in pairs, the pair of contacts first engaged by the movement of the member forming the pole pieces of an electromagnet, and a spring adapted to quickly open the pole contacts when the member is returned to initial position.

18. In a switch, the combination with a frame, a longitudinally movable member therein, a socket secured to one end of said frame adapted to receive one end of said movable member, a spring in the socket tending to keep said member in its initial position, a plurality of contacts arranged in pairs on said frame and insulated therefrom, a plurality of resiliently mounted switch members on said movable member adapted to successively engage the contacts, the pair of contacts first engaged by the movement of the member forming the pole pieces on an electromagnet, and means adapted to have energy stored therein to quickly open the switch member held by the electromagnet.

19. In a motor controlling device, in combination, a movable member, a switch resiliently mounted upon said movable member and adapted to be actuated thereby to close the motor circuit, and means actuated by said member upon continuous movement thereof to vary the motor speed at will after the motor circuit has been closed by said switch.

20. In a motor controlling device, in combination, a movable member having a plurality of switches resiliently mounted thereon for controlling the continuity of the motor circuit and the speed of the motor, said member upon continuous movement being adapted to successively close said switches to first close the motor circuit and thereafter vary the speed of the motor at will.

21. In a motor controlling device, in combination, a slidably mounted operating member, a switch resiliently mounted thereon and adapted to be actuated thereby to close the motor circuit and means adapted to be operated upon continuous movement of said operating member to vary the speed of the motor at will.

22. In a motor controlling device, in combination, a longitudinally movable member, a plurality of switch contacts, certain of the same being resiliently mounted upon said member, coöperating stationary contacts for said switch contacts, said switch contacts to control the continuity of the motor circuit and the speed of the motor, said member being movable to first close the motor circuit and upon continued movement to vary the speed of the motor at will.

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

CHARLES E. CARPENTER.

Witnesses:

I. J. HORTON,

ROBERT LEWIS AMES.