V. G. APPLE.

CURRENT REGULATOR FOR DYNAMOS.

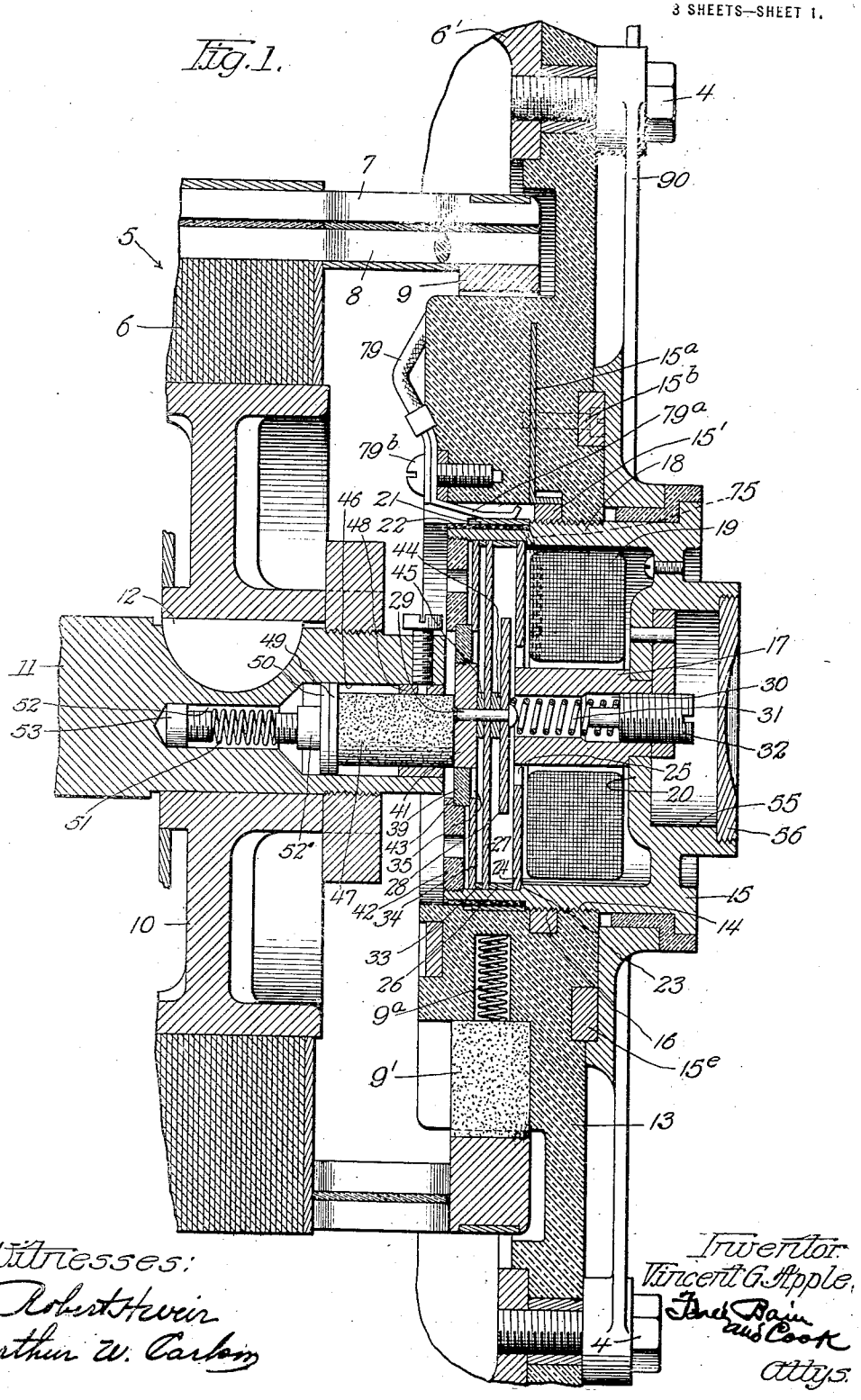
APPLICATION FILED FEB. 14, 1918.

1,354,713.

Patented Oct. 5, 1920.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

Robert Hewin

Arthur W. Carlson

Inventor

Vincent G. Apple,

Fisher, Bain and Cook

Attys.

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3 SHEETS—SHEET 2.

Fig. 7.

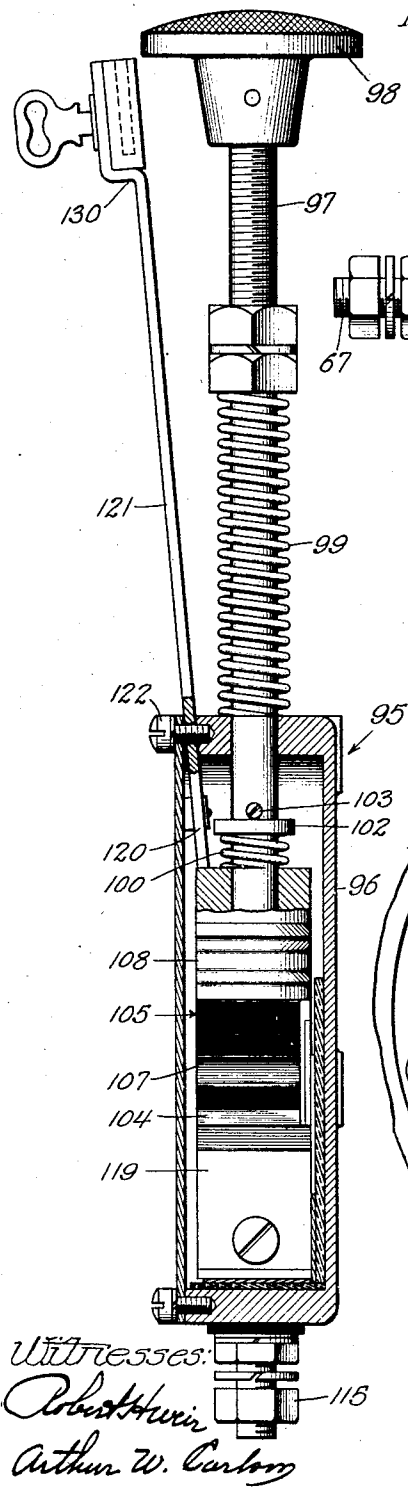


Fig. 8.

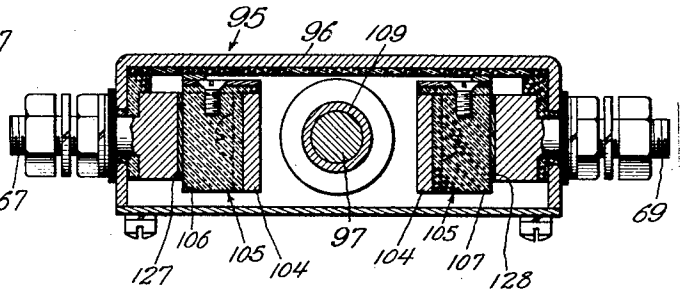
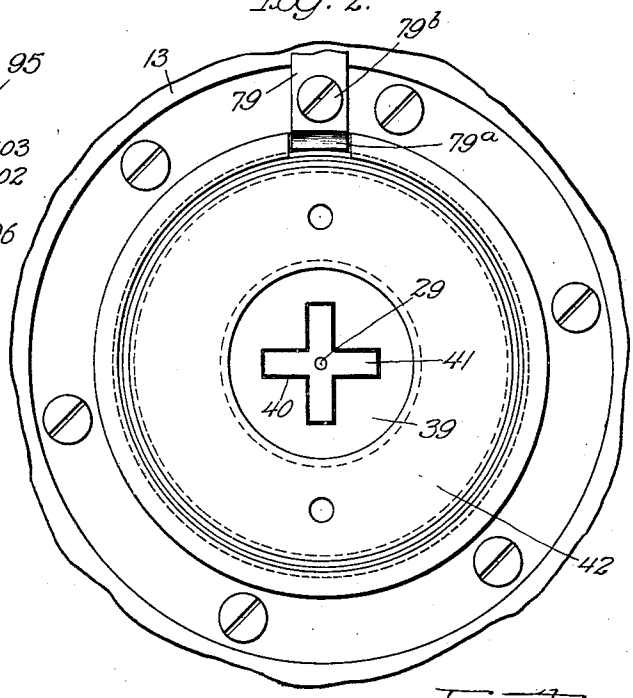


Fig. 2.



Witnesses:
Robert Irwin
Arthur W. Carlson

Inventor:
Vincent G. Apple.
Fowler Bain & Cook
Attys.

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3 SHEETS—SHEET 3.

Fig. 5.

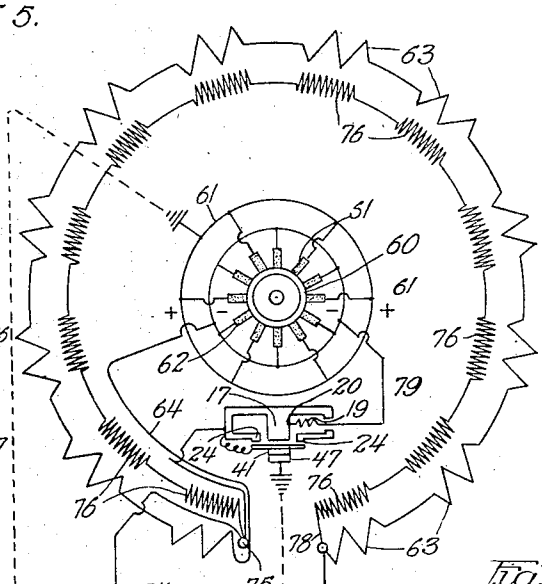


Fig. 6.

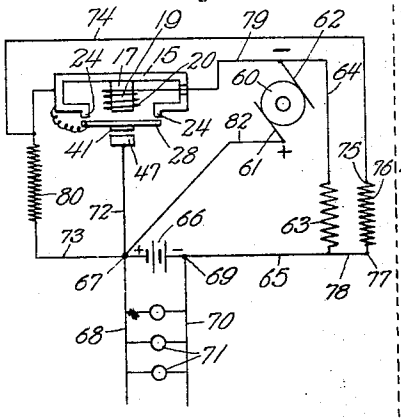


Fig. 3.

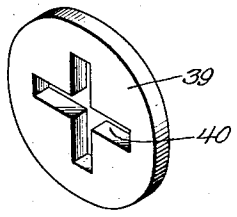
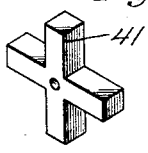
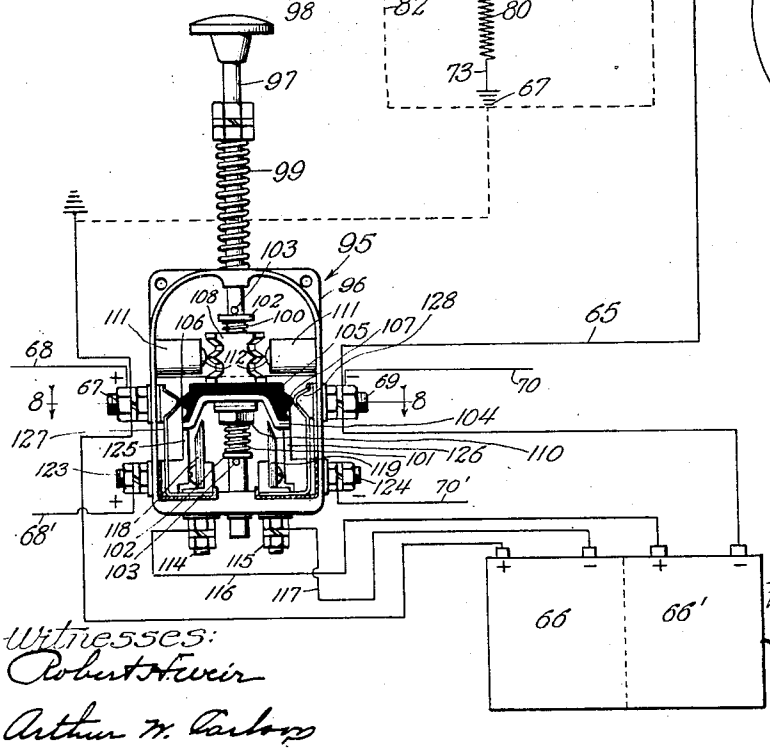


Fig. 4.





Witnesses:
Robert H. Weir
Arthur M. Carlson

Inventor:
Vincent G. Apple
Brice Clair & Box

Attys:

UNITED STATES PATENT OFFICE.

VINCENT G. APPLE, OF DAYTON, OHIO.

CURRENT-REGULATOR FOR DYNAMOS.

1,354,713. Specification of Letters Patent. Patented Oct. 5, 1920.

Original application filed April 23, 1917, Serial No. 163,803. Divided and this application filed February 14, 1918. Serial No. 217,147.

To all whom it may concern:

Be it known that I, VINCENT G. APPLE, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Current-Regulators for Dynamos, of which the following is a specification.

The invention relates to improvements in construction and operation of dynamo electric machines and has especial reference to structures of this character in which there is incorporated with the machine an automatic current regulator.

One of the objects of the invention is to provide a current regulator for a dynamo electric machine which is capable, in cooperation with a moving part of the dynamo, to regulate the current produced by the machine to maintain it substantially constant under varying conditions of speed and operation.

Another and more specific object of the invention is to provide a regulator of the character referred to, which is self contained and which is adapted to be inserted in and removed from the end plate of a dynamo electric machine without leaving trailing wires and other separable or projecting connections extending therefrom.

Other and further objects of the invention will become readily apparent, to persons skilled in the art, from a consideration of the following description when taken in conjunction with the drawings wherein—

Figure 1 is a central sectional view taken in a horizontal plane showing parts of the armature and field of a dynamo electric machine with the regulator inserted in the end plate of the dynamo.

Fig. 2 is an end view of the regulator looking at the inner end.

Fig. 3 is a perspective view of a contact supporting disk of insulating material.

Fig. 4 is a similar view of the vibrating contact, supported by the disk.

Fig. 5 is a diagram of circuits showing a special switch well adapted for use in connection therewith.

Fig. 6 is a simplified schematic arrangement of circuits without the switch.

Fig. 7 is an enlarged side view of the switch; and

Fig. 8 is a cross sectional view of the switch taken on line 8—8 of Fig. 7.

In all of the views the same reference characters indicate similar parts.

Dynamo electric machines are frequently used as motors for starting internal combustion engines of automobiles and alternatively, as electric generators, when driven by said engines, for charging storage batteries and participating, in conjunction with the batteries, to furnish current for translating devices that may be associated with the vehicle.

When functioning as a generator,—jointly with the battery—owing to the irregularity of the engine speed, it is desirable to limit the current producing quality of the dynamo, or to maintain it substantially constant, so that jointly or serially the electromotive-forces of the dynamo and battery will not be varied to an appreciable extent or increased to a dangerous degree.

When dynamo is directly connected to the power shaft of an engine, it is advisable to so design the structure that the usual hand crank may be available in the event of any default of the automatic starter.

The automatic governor for control of the current, should be dependable, self contained and must, furthermore, be staunch, reliable and stable in operation and well qualified to withstand harsh and unusual usages to which it will be subjected.

The present embodiment provides a current regulator for operation conjointly with the moving part of the dynamo, that is so organized that it may readily, quickly and bodily be removed from the dynamo frame and replaced, interchangeably, with the starting crank of the engine and subsequently returned to its place in the frame without changing or disturbing its adjustment, and without the necessity of separating or making any other electrical connections.

In the present embodiment, as exemplified by the drawings: The armature 5 is assumed to be supported on the end of the shaft 11 of the engine of an automobile. The core 6 which is mounted on the spider 10 carries the conductors 7 and 8 that are connected to segments of the commutator 9. Brushes 9′ are radially guided in grooves in the insulating plate 13 and are yieldingly held against the inner face of the commutator by the centrifugal action of the armature supplemented by the springs 9ª. 10 is a spider

of a dynamo electric machine for supporting the armature 5 carried upon the engine-dynamo shaft 11 and supported rotatively thereon by a key 12. 13 is the front plate of a dynamo electric machine made, preferably, of insulating material. The dynamo front plate 13 is fastened to the front end of the magnetic frame 6′ of the dynamo by cap screws 4—4 and is provided with a threaded perforation 14 that is coaxially arranged with the shaft 11. The casing 15, of the current regulator, is also provided with a threaded portion 16 for coöperation with the threaded portion 14 in the frame member. The frame member 15 of the casing, is, preferably, made of iron or soft steel, which may be subsequently electroplated, if desired, and is provided with a central perforated paramagnetic core 17. Between the annular wall 18 of the casing and the core 17 is an electric coil 19, having, in the present embodiment, one of its terminals 20 connected directly to the casing and the other terminal connected to an insulated ring 21, which surrounds the inner hub of the casing and is insulated therefrom by a circular ring of insulating material 22. Near the inner end of the casing is an internal shoulder 23 against which rests a perforated diaphragm or flat ring 24, preferably of magnetic material, which is provided with a perforation 25 somewhat larger in diameter than the diameter of the core 17. The core 17 projects through the perforation 25 until its front face is in the same transverse plane with the outer surface of the plate 24. A spacing ring 26 separates the disk 24 from a yielding diaphragm 27. A disk armature 28, necessarily of magnetic material, is secured to the center of the diaphragm 27, as by a pin 29, and is normally in inductive relation with the core 17 and the magnetic plate 24. The path of magnetic flux, produced by the energized coil 19, is through the core 17, the frame 15 of the regulator, through the magnetic plate 24 and the bridging armature 28, to the core 17, thus attracting the armature 28, toward the plate 24 and the core 17, when the coil 19 is energized. The core 17 is hollow, or in other words, is provided with an axial bore 30 in which is centrally located an open helical spring 31 which rests against the armature 28, and is in adjustable relation within the core 17 by a screw 32. When the screw 32 is rotated clockwise, the tension of the spring 31 is thereby increased, therefore, it requires a larger current, and a greater magnetic strength, to be produced by the coil 19, to attract the armature 28, than is required when the spring 31 is weaker.

A spacing ring 33 separates the disk 27 from another relatively stationary disk or flat ring 34. The disk 34 is perforated, as at 35, and serves as a means for holding a relatively thick disk 39, of refractory insulating material, which is of smaller diameter, in its place. The insulating disk 39 may be of lava, or the like, more clearly shown in Fig. 3. It is provided with a cruciform, centrally disposed opening 40, to receive a cruciform contact member 41. The contact member 41 is guided in its axial movement in the opening 40, but is free to slide axially therein.

A clamping ring 42 is screw threaded on its outer periphery, and is provided with an annular shoulder 43 bounding the inner perforation thereof. The insulating disk 39, rests in the rabbet near the shoulder 43 of the ring 42 and against the surface of the disk 34 that bounds the perforation 35 therein.

Now it will be apparent that when the armature 28 is vibrated, in response to the change in the magnetic flux of the electromagnet, that the cruciform contact member 41 is axially moved with the armature, through the instrumentality of the connecting pin 29, and permitted to participate in such movement by reason of the fact that the cruciform contact 41 is slidably movable but guided in the cruciform perforation in the insulating supporting disk 39.

Separating washers 44 and 45 surround the pin 29 and separate the armature 28 from the flexible disk 27 and the latter disk from the contact 41, so that there will be no mutual interference of the parts when they are vibrated by the effect of the electromagnet. The end of the engine-armature shaft 11 is axially bored eccentrically to its axis, as at 46. Located in the center of this bore, and freely slidable therein, is a carbon or composition rod or cylinder 47, the front end of which rests upon a ring 48, the rear portion being guided by the disks 49—50. The rear part of the rod 47 rests upon a disk of insulating material 49 which abuts against a disk 50. The rear end of the rod 47 is supported by these disks and is yieldingly pressed forwardly by a spring 51 which is located in a smaller, coaxially-arranged perforation 52 in the end of the shaft 11. Screw threaded buttons or ends 52′ and 53 may be employed for increasing the effective length of the spring 51 so as to vary the amount of pressure exerted by it against the carbon rod 47, in its contact with the insulating disk 39, or to compensate for the wear of the cylinder 47.

As the shaft 11 is rotated the carbon cylinder 41 sweeps over the face of the stationary disk 39, and at all times presents its front end surface in a constant vertical plane for contact with the cruciform contact piece 41, which is axially movable through the disk 39. When the armature 28 is attracted by the electro-magnet, against the

yielding influence of the spring 31, the cruciform contact member 41 is withdrawn from its electric connection with the front end of the carbon rod or cylinder 47, but the rod 47 cannot follow the contact member 41 because it abuts against the confronting surface of the disk 39.

The wear on the front surface of the rod 47 is uniform, and inasmuch as it sweeps over the entire confronting surface or the face of the cruciform contact 41, the wear on such contact member is also uniform. Therefore the confronting surfaces 41 and 47 are always located in parallel vertical planes.

The casing 15 is provided with a recess 55 in which the end of the spring adjusting screw 32 is contained and which is covered by a screw plate, or cover 56, which is removable only when access to the screw 32 is desirable.

The present invention is more particularly concerned with the regulation as an organization of parts and their mode of operation. The contact making features of the structure *per se*, form subject matter of another application filed, herewith, Serial No. 217,155 which has since resulted in Patent No. 1,302,622 granted May 6, 1919, the present application being divided from Serial No. 163,803, filed April 23, 1917 by Vincent G. Apple, in which said original application parts of the device herein shown, were disclosed but were not specially claimed, other parts of which were claimed, but were required to be divided from the original application.

In Fig. 6 of this application there is shown a simplified diagram of circuits in which the regulator is especially adapted, in which 60 is the dynamo having a positive brush 61 and a negative brush 62 with a series field 63 connected by a wire 64 to the negative brush and by wire 65 to the negative terminal of a storage battery 66. The other terminal 67, of the storage battery, is connected to a wire 68 while the terminal 69 of the storage battery is connected with a wire 70 and between the wires 68 and 70 are translating devices 71 requiring substantially constant electrical potential. The terminal 67 of the storage battery is connected by a wire 72 to the rotating contact 47 of the regulator, and is also connected by wire 73 through resistance 80 to the wire 74 that is connected to the end 75 of the shunt field winding 76 of the dynamo. The other end, 77, of the shunt, is connected to the wire 65 by the wire 78. A wire 79 is connected to the negative brush 72 of the commutator of the dynamo and is connected to the coil 19 of the regulator. The other end of the coil 19 is connected to the frame 15 of the governor or regulator, as at 20. A resistance coil 80 is connected to the frame 15, as at 67, and to the point 75 where it is connected to the shunt field terminal. The positive brush 61 of the dynamo is connected by wire 82 to the ground or terminal 67.

When the dynamo is functioning as a generator the current through the series field 63 is in the opposite direction to that which it would be when it is functioning as a motor and thus assists the regulator in maintaining the current substantially constant under varying speed of the armature. When operating as a motor it assists the magnetizing effect of the shunt field 76, increasing the torque effort, but when operating as a generator it tends to decrease the magnetic effect produced by the shunt field 76. By this means in conjunction with the vibrating contacts, between the members 41 and 47, the current produced by the dynamo is maintained substantially constant.

The spring pressed strip 79^a is secured to the plate 13 by a screw and makes electrical connection with the insulated ring 21 which is connected, as at 75, with the magnet coil 19. The brass threaded ring 15′ is connected with the embedded strip 15^a and this strip is connected to the frame of the machine or "ground" by the metal ring 15^b through the license plate holder 90, the screws 4 and the frame 6′.

The switch 95 is shown to illustrate one means for connecting the cells of battery 66 and 66′ in series when the dynamo is used as a motor to start the engine and to subsequently connect them in parallel relation when the batteries are being charged by the dynamo. This switch will be more specifically described and claimed in connection with the electric circuit shown, in an application to be hereafter filed.

The casing 96 contains a vertically reciprocatable push rod 97 having a push knob 98 on its upper end for application of pressure by the foot of the operator. A spring 99 holds the rod normally in its elevated position.

Two other springs 100 and 101 surround the rod, being confined thereon by the washers 102 and pins 103 and freely slidable on the rod and between these springs is a switch closing bar 104 and a bar of insulating material 105. The latter is provided with projections 106 and 107 and above these bars and secured to them is a notched block 108. This block is provided with a screw threaded collar 109 which passes through the bars 104 and 105. A nut 110 secures the bars and the block together. On each side of the notched block, in housings 111 are spring pressed balls 112 which engage the notches and indicate to the operator the position of the bars 104 and 105 with reference to their coöperating switch elements.

Terminals 114 and 115 of the switch are

connected by wires 116 and 117, respectively, and are connected to the positive terminal of the battery 66′ and to the negative terminal of the battery, or series of cells, 66, respectively. Vertically extending spring contacts or brushes 118 and 119 are connected to the terminals 114 and 115, respectively, and when the bar 104 is depressed the positive and negative terminals of the batteries 66 and 66′ are connected together.

When the rod 97 is depressed to its greatest extent the bar 104 joins these terminals as a condition precedent to operating the dynamo as a motor to start the engine. After the engine has been started the rod 97 is released and the parts are moved from their depressed position by the spring 99 but further movement is arrested by a latch 120 (Fig. 7) which is a part of a lever 121 which is pivoted to the casing at 122.

In this position, shown in Fig. 5, circuit is now opened between wires 68′ and 70′, 116 and 117 and the batteries are in parallel relation with the translating devices 71, over the wires 68 and 70, from the binding posts 67 and 69. The binding posts 123 and 124 are now connected together by the resilient tongues 125 and 126 and these wires include the igniting devices between them and the ground just as the wires 68 and 70 contain the other translating devices. Resilient tongues 127 connect the terminals 114 and 115 to the terminals 67 and 69, respectively, by operation of the projections 106 and 107 on the bar 105. When it is desired to open all circuits the lever 121 may be kicked toward the plunger rod, whereupon the spring will raise the vertically movable switch elements.

A lock 130 is placed on the upper end of the lever arm 121, which may be used to lock said arm in vertical position under the head or button 98, which will prevent use of the switch until it has been unlocked and the lever moved out of the path of said head.

The drawings, especially Fig. 1, clearly show my regulator and its mode of operation will be manifest from the foregoing description and the circuits as outlined and explained.

Having described my invention, what I claim is:—

1. A current regulator comprising a casing of magnetic material; an axially disposed magnet core, within the casing; a magnet coil surrounding the core; a flat ring of magnetic material contacting the walls of the casing and through which the core projects; an armature confronting the flat ring and core; a disk diaphragm fixed at its edges and on which the armature is mounted and an axially moving contact member moved by the diaphragm.

2. A current regulator comprising a casing of magnetic material; a perforate, axially disposed magnet core, within the casing; a magnet coil surrounding the core; a flat ring of magnetic material contacting the walls of the casing and through which the core projects; an armature confronting the flat ring and core; a diaphragm on which the armature is mounted; a contact member, moved by the diaphragm, and an adjustable spring inside the core and bearing on the armature.

3. A current regulator comprising a casing of magnetic material; a perforate, axially disposed magnetic core within the casing; a magnet coil surrounding the core; a flat ring of magnetic material contacting the walls of the casing and through which the core projects; an armature confronting the flat ring and core; a diaphragm on which the armature is mounted; a contact member moved by the diaphragm; an adjustable spring inside the core and bearing on the armature; a screw in the outer end of the core to adjust the spring and a cover closing the end of the casing containing the adjusting screw.

4. In combination with a dynamo electric machine having an end plate with an axially disposed opening substantially concentric with the shaft of the armature thereof; of a current regulator insertible in said opening; a magnetically movable current-responsive contact carried by the regulator and a contact rotated by the shaft of the armature to regulate the current.

5. In combination with a dynamo electric machine having an end plate, with an axial opening concentric with its axis; of a current regulator insertible in said opening; a contact axially movable by the regulator and a coöperating contact rotatable by the shaft.

6. In combination with a dynamo electric machine having an end support crossing its axial plane; means concentric with its shaft to support a current regulator; a current regulator mounted on said support; a contact axially movable by the said regulator and a coöperating contact rotatable by the shaft through an eccentric path.

7. In combination with a dynamo electric machine having an axially perforated plate crossing its axis, of a current regulator, insertible in said perforation, comprising an annular casing of magnetic material; a centrally disposed core therein; a coil surrounding the core; an armature responsive to the electro-magnet within the casing; a contact, axially moved by the armature; a support for said contact to prevent transverse movement thereof; and a spring pressed contact rotatable by said shaft and bearing against said support.

8. In combination with a dynamo electric machine having an axially-perforated internally-threaded plate, crossing its axis, of

a current regulator comprising an annular casing of magnetic material externally threaded, for insertion in said perforation; a centrally disposed core therein; a coil surrounding the core; an armature responsive to the electro-magnet within the casing; a contact axially moved by the armature; a support for said contact to prevent transverse movement of said contact and a cooperating contact rotatable by the shaft of the dynamo electric machine through an eccentric path.

9. In a current regulator, a casing of magnetic material having a centrally disposed core; a coil surrounding the core; an armature responsive to the core; a flexible diaphragm upon which the armature is mounted; an axially movable contact mounted on said diaphragm at the axis thereof and a coöperating rotatable contact confronting and having its axis eccentric to said axially movable contact.

In testimony whereof I hereunto set my hand.

VINCENT G. APPLE.