Feb. 26, 1929. 1,703,207

L. M. PERKINS

REGULATOR

Filed May 5, 1927

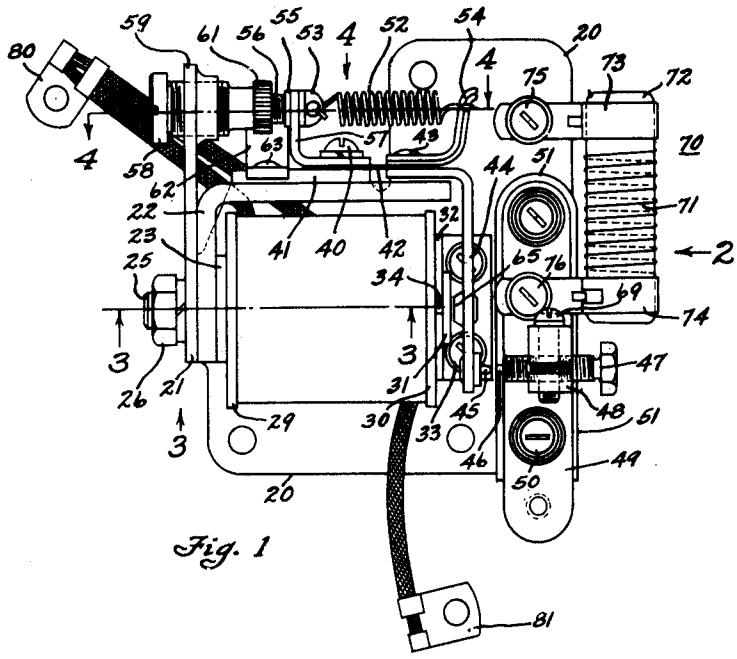


Fig. 1

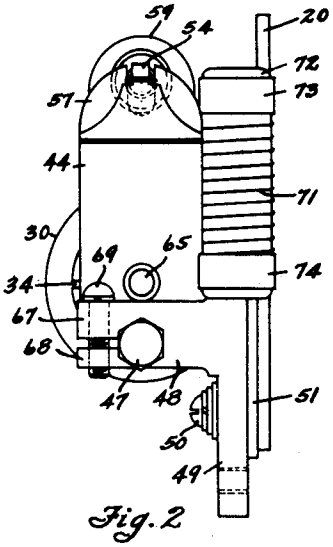


Fig. 2

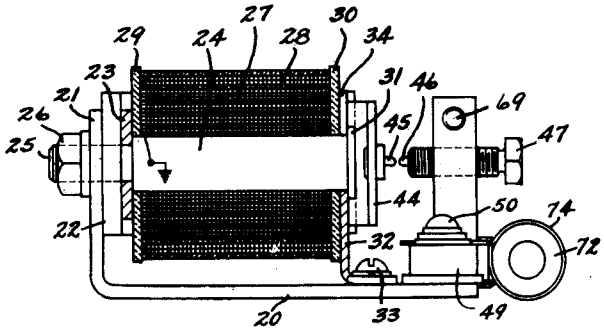


Fig. 3

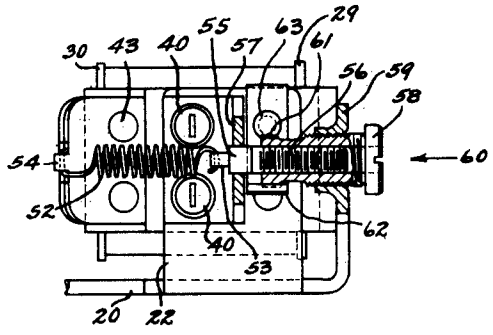


Fig. 4

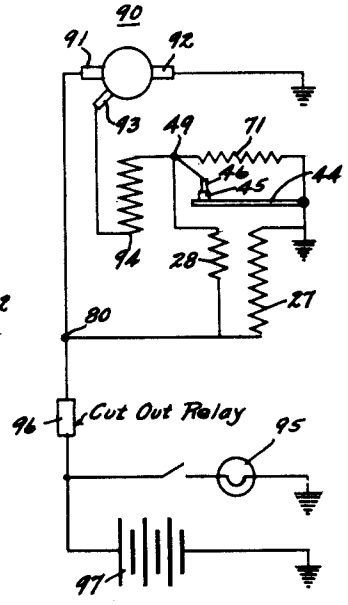


Fig. 5

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UNITED STATES PATENT OFFICE.

LAURENCE M. PERKINS, OF ANDERSON, INDIANA, ASSIGNOR TO DELCO-REMY CORPORATION, OF DAYTON, OHIO, A CORPORATION OF DELAWARE.

REGULATOR.

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This invention relates to the regulation of variable speed generators, especially generators used for supplying current for lighting, battery charging or other purposes.

One of the objects of the present invention is to provide a regulator of the vibratory type which is simple in construction and can be manufactured economically. A further object is to provide manually operable means for closely adjusting the regulator in a facile manner. Another object is to provide for automatically adjusting the regulator so as to compensate for variations in environment temperatures.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a plan view of a regulator embodying the present invention;

Fig. 2 is a side view looking in the direction of the arrow 2 of Fig. 1;

Fig. 3 is a side view, partly in section, looking in the direction of the arrow 3 of Fig. 1, the section being taken along the line 3—3 of Fig. 1;

Fig. 4 is a side view, partly in section, looking in the direction of the arrow 4 of Fig. 1, the section being taken along the line 4—4 of Fig. 1; and

Fig. 5 is a wiring diagram illustrating the electrical connections of the regulator with a generator and storage battery.

Referring to the drawings, 20 designates a frame formed preferably of sheet metal and providing a post 21 which supports an L-shaped bracket 22 of magnetizable material, a magnetizable washer 23 and a magnetizable core 24. The core 24 includes a threaded portion 25 of smaller diameter than the core 24. The portion 25 cooperates with a nut 26 to secure the parts 22 and 23 to the post 21. The core 24 supports windings 27 and 28, which are suitably insulated as shown and are located between non-conducting discs 29 and 30. One end of the core 24 is provided with a head 31. Between the head 31 and the washer 30, the core 24 is supported by a bracket 32 attached by screws 33 to the base 20. The bracket 32 is provided with a hole for receiving the core 24 and with a notch 34 extending from the upper edge of the bracket 32 to the central hole in order to reduce the effect of eddy currents.

Screws 40 attach post 41 integral with the base 20 and a leaf spring 42 to the bracket 22. The free end of the spring 42 is attached by rivets 43 to an angle-shaped armature 44, supporting adjacent its free end a contact 45 adapted to engage a stationary contact 46 carried by the end of a screw 47 which is threaded through a block 48 integral with a bracket 49. Screws 50 secure to the frame 20 the bracket 49 and a non-conducting plate 51 which insulates the bracket 49 from the frame 20.

The contact 45 is held normally in engagement with the contact 46 by a spring 52, having one end attached to a relatively stationary eye 53 and the other end attached to the free end of a bi-metallic thermostatic element 54, which is secured by the rivets 43 to the spring 42 and the armature 44. The eye 53 is preferably integral with a head 55, having a cylindrical shank 56. The head 55 is rectangular in cross section and is received by a suitable notch in a bracket 57, which is secured by the screws 40 to the bracket 22. The bracket 57 allows the head 55 to move endwise, but prevents rotation thereof. The shank 56 is threaded and is received by a centrally located tapped hole in a screw 58. The screw 58 has a threaded exterior received by a tapped hole in an extension 59 of the post 21. The pitches of the exterior and interior threads of the screw 58 are different, so that endwise movement of the shank 56 may take place by turning the screw 58. For example, the exterior threads of the screw 58 may have a pitch of 32 threads per inch, and the pitch of the interior threads of the screw 58 may be 24. Therefore, if the screw 58 is turned clockwise looking in the direction of the arrow 60 in Fig. 4, the sleeve will move 1/32 of an inch toward the left, while the shank 56 is moved relative to the screw 58 the amount of 1/24 of an inch. Therefore, the eye 53 will move toward the right, as viewed in Fig. 4, to the amount of 1/96 of an inch, or approximately .010 inch. In this manner the tension of the spring 52 may be adjusted to a very fine degree. In order to maintain the screw 58 in the desired position of adjustment, the screw is provided with a knurled flange 61, which cooperates with the free end of a leaf spring 62, at-

tached by a rivet 63, which is used for securing the plate 41 to the bracket 22. If the tension of the spring 52 is increased the maximum voltage of the generator will be increased, and vice versa.

In order that the contact 45 may be located the same distance from the frame 20 as the contact 46, the holes provided in the leaf spring 42 for receiving the screws 40 are elongated in a direction at right angles to the axis of the core 24. If the screws 40 are loosened the armature 44 may be moved sidewise relative to the core 24 so as to locate the contact 45 the same distance from the frame 20 as the contact 46. In this position the armature may be secured by tightening the screws 40. The screws 50 of course thread into holes tapped in the frame 20. The holes in bracket 46 for receiving the screws 50 are much larger than the shanks of the screws 50, so that, when screws 50 are loosened, the bracket 49 may be shifted sidewise and endwise, to align the contact 46 with the contact 45.

The movement of the armature 44 toward the core head 31 is limited by the striking of a non-magnetic rivet 65, attached to the armature 44, upon the core head 31.

The normal air gap between the armature 44 and the core 24 may be varied by turning the screw 47, which is retained in adjusted position by tightening about the screw 47 two clamp arms 67 and 68. A screw 69 passes through a plain hole in the clamp arm 67 and into a threaded hole in the clamp arm 68.

A resistance unit 70 comprises a resistance wire wound about a non-conducting tube 72. The ends of the wire 71 are attached to terminal clips 73 and 74, which support the tube 72. Clip 73 is attached by screw 75 to the frame 20. The clip 74 is attached by screw 76 to the bracket 49.

One end of the coil 27 is grounded upon the core 24 and the other end is attached to a terminal 80. One end of the coil 28 is attached to the terminal 80, and the other to a terminal 81, which is secured to the conducting plate 49 by a screw (not shown) used to attach a conductor connected with the field winding of the generator.

Referring to the wiring diagram shown in Fig. 5, it will be seen that the terminal 80 is attached to a main brush 91 of the generator 90. The other main brush 92 is grounded. The third brush 93 is connected with the field winding 94, in turn connected with the bracket or terminal plate 49. The terminal 80 may be connected with a battery 97 and with an electric lamp or other electrical translation device 95 by cutout relay 96.

Referring to Fig. 5, the operation of the device will now be described: When the voltage across the brushes 91 and 92 is below a predetermined critical value, the magnetism produced by the coils 27 and 28 is insufficient to attract the armature 44 and separate the contacts 45 and 46; therefore normally the resistance wire 71 is short circuited. When the generator voltage reaches a predetermined value, the magnetism produced by the coils 27 and 28 will be sufficient to effect attraction of the armature 44 toward the core 24 and to separate the contact 45 from the contact 46. Since the short circuit normally made by these contacts is interrupted, there will be a reduction in current in the dynamo field winding 24 due to the resistance offered by the resistance unit 71. Consequently the voltage across the generator brushes 91 and 92 will be reduced below the critical value at which the contacts open, and the voltage impressed upon the coils 27 and 28 will be reduced so that their magnetism will be no longer sufficient to maintain the armature 44 in attracted position. Therefore the contacts will be closed by the spring 52. When this occurs, the resistance 71 will be short-circuited, thereby causing the current flowing through the field winding 94 to increase. If the speed of the generator is such that it tends to generate a voltage above the critical voltage, the contacts will be separated again. This cycle of operations will be repeated at a relatively rapid rate as long as the generator tends to produce a voltage above a predetermined value. The more rapidly the armature 44 can be made to vibrate the more effective the apparatus will be in maintaining a desired maximum voltage of the generator at a uniform value. The coil 28 aids in making the action of the armature more vigorous. Normally, the coil 28 is in parallel with the coil 27, and both coils aid in magnetizing the core 24. When the contacts 45 and 46 open a voltage appears across the resistance 71, thus reducing the net voltage applied to the coil 28 and even reversing it thereby weakening the magnetization of the core 24. The voltage which appears across the resistance 71 when the contacts open is believed to be due to the inductance of the field 94, forcing the field current to flow through the resistance 71 with very little decrease in value during the short interval that the contacts 45 and 46 are open.

Quite obviously changes in temperature in the windings 27 and 28 would affect their resistance, and hence, would vary the operation of the regulator were it not for the bimetallic thermostatic element 54 which bends to shorten or elongate the spring 52 with variations in temperature. The bending takes place in such a manner that the operation of the regulator will remain substantially constant over a relatively wide range of temperatures and corresponding resistance changes in the regulator windings.

By using the frame 20 as a negative or ground terminal for the movable contact 45, the coil 27 and the resistance unit 70, and by using the bracket 49 as a terminal for the stationary contact 46, the resistance unit 70, and the coil 28, the electrical connections are simplified. When the regulator is used on an automobile, the frame 20 is usually metallically connected with the chassis frame of the vehicle to which the battery and generator are grounded. There remain but two connections to be made with wires, namely, a connection with the terminal clip 80 and the non-grounded terminal of the generator, and a connection with the bracket 49 and the field winding of the generator.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A vibratory regulator comprising, in combination, a metal frame; an electro-magnet comprising a core attached to the frame and two windings surrounding the core; a common terminal to which one end of each winding is connected; a ground connection between the core and an end of one of the windings; a metal bracket insulatingly supported by the frame, said bracket providing a terminal for an end of another of the windings mentioned; a stationary contact metallically supported by the bracket; a movable contact carried by an armature metallically supported by the frame; a spring urging the movable contact into engagement with the stationary contact; and a resistance unit comprising a resistance coil, an insulating body supporting the resistance coil, terminal members each attached to an end of said coil and each supporting one end of the insulating body, one of the terminal members being attached to the insulated bracket and the other to the frame.

2. A vibratory regulator comprising, in combination, a frame, an electromagnet supported by the frame; a movable armature cooperating with the magnet; a circuit breaker controlled by the armature; a helical coil spring for urging the armature away from the magnet; manually adjustable means for connecting the spring with the frame, and thermostatically adjustable means on the armature for connecting the spring with the armature.

3. A vibratory regulator comprising, in combination, a frame, an electromagnet supported by the frame; a movable armature cooperating with the magnet; a circuit breaker controlled by the armature; a helical coil spring for urging the armature away from the magnet; means for connecting the spring with the frame; and means responsive to temperature for connecting the spring with the armature and for automatically varying the tension of the spring.

4. A vibratory regulator comprising, in combination, a frame, an electromagnet supported by the frame; a movable armature cooperating with the magnet; a circuit breaker controlled by the armature; a helical coil spring for urging the armature away from the magnet; means for connecting the spring with the frame; a bimetallic thermostat member attached to the armature and having a part connected with the spring and movable substantially in the direction of the axis of the spring.

5. A vibratory regulator comprising, in combination, a frame, an electromagnet supported by the frame; a movable armature cooperating with the magnet; a circuit breaker controlled by the armature; a helical coil spring connected with the armature and frame for urging the armature away from the magnet; and manually operable means for adjusting the tension of the spring and comprising a screw threadedly connected with the frame, a rod attached to the spring having a screw thread connection with said screw of different pitch than the pitch of the threads of the connection between the screw and the frame, and means for preventing turning of the rod while permitting it to move endwise.

6. A vibratory regulator comprising an L-shaped magnet frame; a core carrying windings and extending from one leg of the magnet frame and parallel to the other leg; an L-shaped armature having one leg extending transverse to the core and the other leg parallel to the core and located in overlapping spaced relation to the leg of the magnet frame which is parallel to the core; a leaf spring hinge attached to the last mentioned leg of the armature and extending along but spaced from the leg of magnet frame which is parallel to the core; a sheet metal supporting frame having a flat base, a flat post extending therefrom and attached to the core and first mentioned leg of the magnet frame, and a flat post extending from the base of the supporting frame at right angles to the first mentioned post and attached to the second mentioned leg of the magnet frame and to the leaf spring hinge and maintaining the leaf spring hinge and magnet frame leg in spaced relation; a circuit breaker operated by the armature; and a spring for urging the armature away from the magnet.

7. A vibratory regulator comprising in combination, a frame, an electromagnet supported by the frame, a movable armature cooperating with the magnet, a circuit breaker controlled by the armature, a spring

for urging the armature away from the magnet, means for connecting the spring with the frame, and means carried by the armature and having a spring connected thereto, said means being responsive to temperature variations for varying the stress of the spring.

8. A vibratory regulator comprising in combination, a frame, an electromagnet supported by the frame, a movable armature cooperating with the magnet, a circuit breaker controlled by the armature, a spring for urging the armature away from the magnet, a manually adjustable means for connecting one end of the spring to the frame, a thermostatically adjustable member carried by the armature and having the other end of the spring connected therewith, said member being automatically movable by temperature changes to vary the stress of the spring.

9. A vibratory regulator comprising in combination, a frame, an electromagnet supported by the frame, a bracket carried by the frame, an armature hingedly attached to the bracket, a member slidably and non-rotatably carried by the bracket, a differential-screw adjusting means supported by the frame and connected with the said member, a bi-metallic arm automatically adjustable by temperature variations, carried by the armature, and a spring interposed between the member and bi-metallic arm, the adjustment of either member or arm varying the stress of said spring.

10. A vibratory regulator comprising in combination, a frame, an electromagnet supported by the frame, a movable armature cooperating with the magnet, a spring cooperating with the armature, and a manually adjustable means for variably stressing the spring, said means comprising two screw-threadedly connected members one of which is operatively connected with said spring and the other of which is screw-threadedly connected with a stationary part, and means for preventing rotation of the first-mentioned screw-threaded member.

In testimony whereof I hereto affix my signature.

LAURENCE M. PERKINS.