F. H. BULLINGER.

ELECTRIC CONTROLLING APPARATUS.

APPLICATION FILED AUG. 18, 1917.

1,423,907.

Patented July 25, 1922.

2 SHEETS—SHEET 1.

Fig: 1.

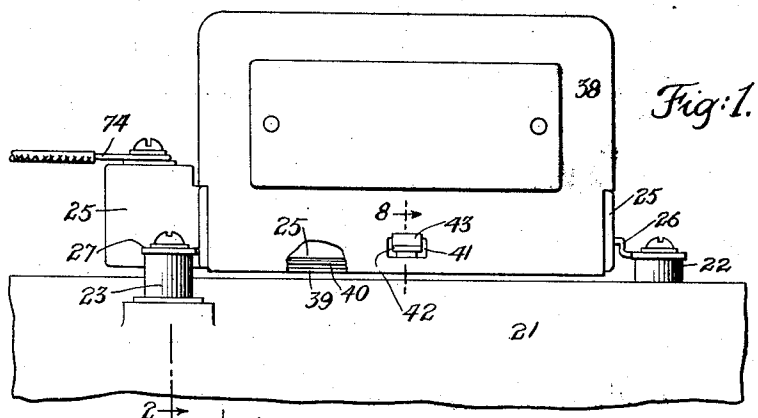


Fig: 2.

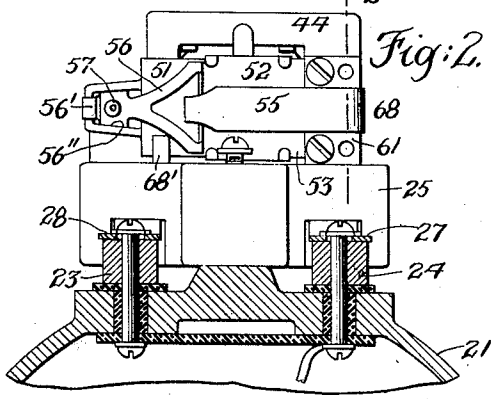


Fig: 5.

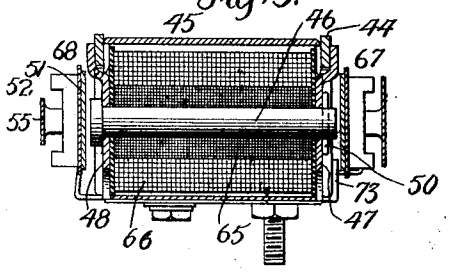


Fig: 3.

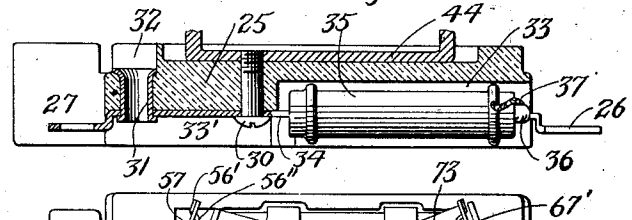
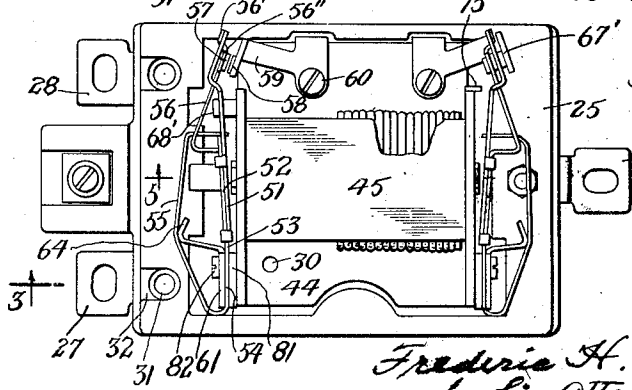


Fig: 4.



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2 SHEETS—SHEET 2.

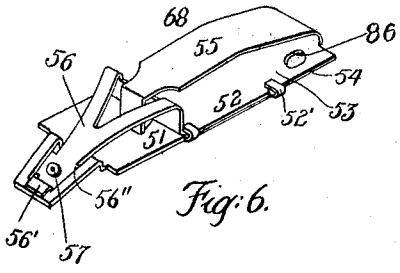


Fig: 6.

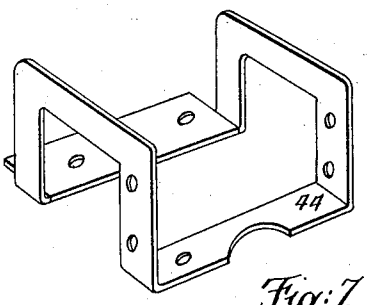


Fig: 7.

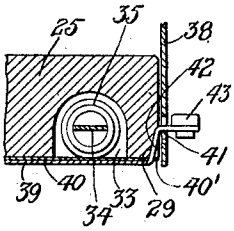


Fig: 8.

Fig: 9.

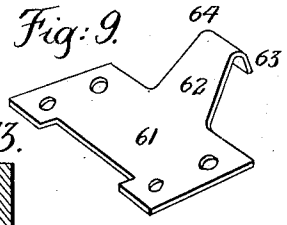


Fig: 13.

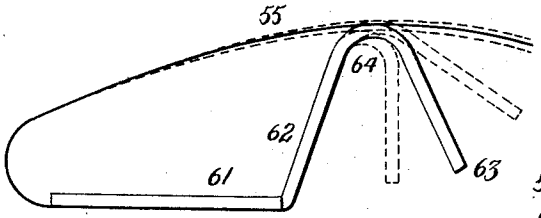
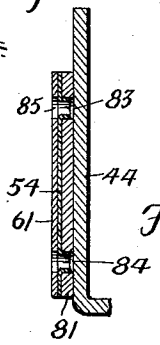


Fig: 10



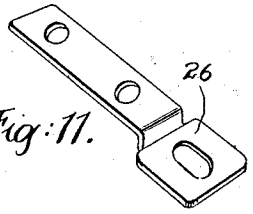


Fig: 11.

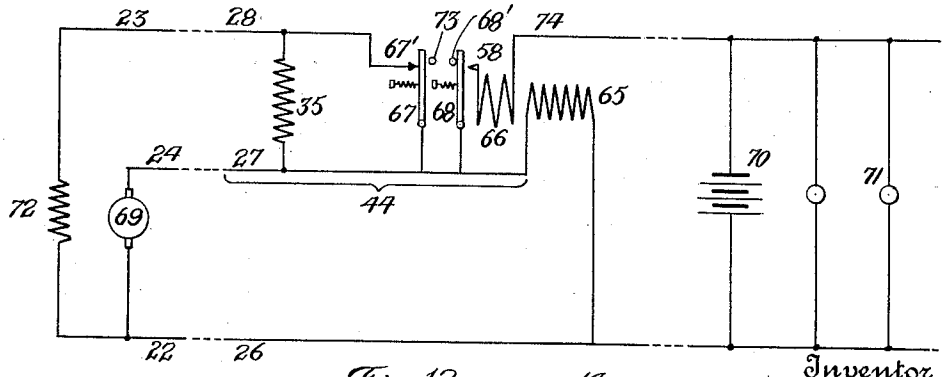


Fig: 12.

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UNITED STATES PATENT OFFICE.

FREDERIC H. BULLINGER, OF YONKERS, NEW YORK, ASSIGNOR TO WARD LEONARD ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC CONTROLLING APPARATUS.

1,423,907. Specification of Letters Patent. Patented July 25, 1922.

Application filed August 18, 1917. Serial No. 186,863.

To all whom it may concern:

Be it known that I, FREDERIC H. BULLINGER, a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Electric Controlling Apparatus, of which the following is a specification.

The principal object of my invention is to provide new and improved apparatus for controlling the electric current delivered by a variable speed generator. Other objects of my invention have to do with providing improved means for mounting the controller in such a system of electric control; also for mounting a resistance unit in the controller; also for assembling the controller and its cover and securing them in desired relation; my invention also involves an improved circuit controlling armature construction and improved means for adjusting the spring tension on such an armature. All these objects and others will be made apparent in the following specification and claims, taken in connection with the accompanying drawings in which one specific embodiment of my invention is illustrated. The invention is defined in the appended claims.

Referring to these drawings, Fig. 1 is a side elevation showing my improved controller mounted on a dynamo electric generator; Fig. 2 is a cross section of the same taken on the line 2 of Fig. 1 looking in the direction of the arrow; Fig. 3 is a section of the controller base taken on the line 3 of Fig. 4 looking in the direction of the arrow; Fig. 4 is a top plan view of the controller without the cover; Fig. 5 is a vertical axial section of the controller without its base, taken on the line 5 of Fig. 4 looking in the direction of the arrow; Fig. 6 is a perspective view of a contact carrying armature; Fig. 7 is a perspective view of the main magnetic frame of the controller; Fig. 8 is a fragmentary cross section on the line 8 in Fig. 1 looking in the direction of the arrow; Fig. 9 is a perspective view of an adjustable stop for regulating the spring tension on one of the contact carrying armatures; Fig. 10 is an elevation of the same adjustable stop; Fig. 11 is a perspective view of one of the terminal-supports for the controller; Fig. 12 is a simplified wiring diagram, and Fig. 13 is a detail section on the line 13 of Fig. 2.

In the embodiment of my invention which is illustrated in the drawings, I have shown the casing 21 for a dynamo electric generator, such as may be mounted on an automobile and driven by the automobile engine for charging a storage battery and furnishing electric current for various purposes. Upon this generator casing 21 in the same horizontal plane, but not in the same straight line are three generator terminals 22, 23 and 24, of which the terminal 22 is conductively connected to the generator frame 21, but the other two terminals 23 and 24 are insulated therefrom as shown in Fig. 2. The terminal 23 is connected to the generator field winding and the terminal 24 is connected to the armature winding, all as indicated diagrammatically in Fig. 12. These three terminals 22, 23 and 24 also serve as supports for the regulator base 25, which is made of suitable insulating material. This base 25 has three terminals 26, 27 and 28 secured firmly in recesses on its underside and projecting therefrom as shown in Figs. 3 and 4. The terminal 26 as an example is shown in perspective in Fig. 11. The terminal 28 is similar but the terminal 27 is specially constructed and is shown in longitudinal section in Fig. 3. It is conductively connected by the screw 30 to the regulator frame member 44, and further secured to the base 25 by the tubular rivet 31, which is headed down in the recess 32.

A chamber 33 is made in the underside of the base 25 and the extension 34 of the terminal 27 lies across this chamber 33. On the extension 34 is mounted the tubular enameled resistance unit 35, one terminal of which 37, is soldered to the end of the extension 34 at 36. The attachment 36 not only makes a conductive connection but serves to retain the resistance unit 35 on the extension arm 34.

A rectangular box like cover 38 is provided for the controller, with perforations in 41 on each side. A bottom sheet metal plate 39 has two opposite ears 42 adapted to enter the respective holes 41. The ears 42 lie in notches 29 in the edges of the insulating base 25. Above the bottom plate 39 is a

sheet of insulating material 40, with notches at 40′, to be engaged by the ears 42 so as to hold the parts in proper relation. Lead seals 43 through perforations in the ends of the ears 42 hold the parts in assembled relation as shown in Fig. 8.

The main magnetic frame 44 is shown in perspective in Fig. 7. The magnetic circuit is further completed by the bridging piece 45. The magnetic core 46 has a head at one end and is secured by a cotter pin 50 at the other end. There are two windings on the core 46, an inner fine wire winding 65 and an outer coarse wire winding 66 retained at the ends by the brass plates 47 and 48.

At each end there is a contact carrying movable armature designated generally in Fig. 12 by the reference numerals 67 and 68. These are very nearly alike, so that a detailed description will be given only for the armature 68. It consists of a magnetically permeable main part 51, combined with a piece of spring sheet bronze, attached at 52 by the bent over lugs 52′. This sheet of bronze is extended at 54 and fastened under the clip 61 so that the intermediate part 53 serves as a flexible hinge support for the armature 51. An extension 55 serves as a spring tending to retract the armature 51 from the core 46. Another extension 56 has projections 56′ and 56″ adapted to act as stops relatively to the free end of the armature 51. This extension 56 carries a contact making button 57. The coacting stationary contact button 58 is mounted on the bracket 59 secured to the base 25 by the screw 60.

The clip 61 is shown in perspective in Fig. 9 and in elevation in Fig. 10. It has a projecting tongue 63, which is thinner than its base part 62, and with the intermediate part 64 bent in an elbow and pressing against the spring 55. This clip 61 with its tongue 63 is made of suitable metal for bending so that by this means the tension of the spring 55 can be adjusted, as will be more fully explained later.

The circuit connections are shown in Fig. 12 where the corresponding elements are indicated by the same reference numerals as in the earlier figures of the drawings. Referring to Fig. 12, when the generator 69 is at rest or running very slowly, the spring tension on the armatures 67 and 68 will hold them in the positions shown in the diagram; but with increasing speed, the current through the shunt coil 65 will create a magnetic attraction that will first draw the armature 68 against the contact 58, whereupon a circuit will be completed from the generator 69 to the battery 70 and lamps 71 in parallel, and the current flowing through the series coil 66 will add to the attraction produced by the shunt coil 65 and hold the armature 68 securely against the contact 58. The increased magnetic attraction due to the two coils 65 and 66 acting conjointly will draw the armature 67 away from its contact 67′ thus throwing the resistance 35 in series with the generator field winding 72 and weakening the field. This weakening of the field will cut down the current delivered by the generator 69 so that the combined attraction of the coil 65 and 66 will be insufficient to hold the armature 67 against the stop 73 and the armature 67 will fall back against the contact 67′, cutting out the resistance 35, and permitting an increase of current through the field winding 72, whereupon the same cycle of operation of the armature 67 will be repeated and so on in succession. All the time the armature 68 will be closed against the contact 58. Thus the current delivered to the battery 70 from the generator 69 will be pulsatory, rising when the armature 67 is closed against the contact 67′, and falling when open. When the speed of the generator 69 dies down, the current through the coils 65 and 66 will decrease until the armature 68 will open against its stop 68′ thus cutting off the battery 70 from the generator 69. If the battery 70 should start to discharge back through the generator, the reverse flow of current through the coil 66 would hasten this action by opposing and killing the effect of the current in the shunt coil 65.

The terminals 26, 27 and 28 are stamped of sheet metal and hence are inexpensive to manufacture, less expensive than turned and machined contact blocks would be. These terminals 26, 27 and 28 have a certain amount of flexibility, so that they prevent stressing the insulating base 25 in mounting it upon the generator frame 21. They are resilient so that they afford a yielding support for the regulator on its base 25, thus the regulator will be protected from the jars and vibrations that would otherwise be communicated to it from the generator on which it is supported.

The single piece of spring sheet bronze 52—55 has the following functions: (1) It serves to give the flexible hinge support at 53 for the armature 51, (2) the portion 55 acts as a retractile spring and cooperates with the tongue 64 for adjustment, (3) the portion 56 carries the contact button 57 and the stops 56′ and 56″ permit a slight relative displacement of the button 57, but this displacement is definitely limited in extent; the effect is to break the contacts at 57, 58 with an abrupt hammer blow. Also the relative movement of the button 57 causes a slight rubbing of the contacts 57 and 58 so that they are kept bright and in good condition. The armature 67 is similar to 68, except that it closes on the back contact 67′, and therefore no special detailed description need be given, except that the spring for the armature 67 is wider and stiffer than for

the armature 68 and that they are adjusted somewhat differently, as will be described later.

The spring 55 for the cutout 68 is designed so that its tension is nearly constant and hence the increased magnetic pull due to the approach of the armature to the core serves to hold the cutout firmly closed after initial closure, in spite of any jarring to which the apparatus may be subjected. On the other hand, the spring for the vibrator 67 is made so that as the armature approaches the core, the tension of this spring in opposition to the magnetic pull increases nearly, but not quite as much as the magnetic pull. Hence after closure the vibrator will open readily upon a moderate drop in the ampere turns from the value that was sufficient to cause its closure.

The back-stop 68′ and the front-stop 73 for the respective armatures 68 and 67 are adjustable in position by bending with pliers. Thus the range of movement of the armatures may be determined. This adjustment is made after assembling, and at the same time each of the metal tongues 62—63 is adjusted by bending so as to determine the tension of the respective springs 55 for the armatures 67 and 68. By bending the tongue 62—63 at its root, where it joins on the main attaching part 61, the effect on the spring is considerable, but a finer adjustment is secured by bending the tip 63. Because of the taper of the tongue 62—63, this bending of the tip 63 produces no change in the part 62 and only a very slight change at the knee 64. Once adjusted, the tongue 62—63 is permanent, and will not get loose as might be the case with a set screw. The construction is inexpensive, for the member 61 is easily stamped from sheet metal. Once adjusted at the factory, these regulators will not ordinarily require any readjustment, on account of the permanence of the initial adjustment by bending of the tongues 62—63.

The part 54 of the bronze piece 52—55 is clamped to the frame member 44 between the two plates 61 and 81 by means of the screws 82 passing through registering holes. The holes 86 in the member 52—55 are elongated with their major axes parallel and transverse to the hinge axis at 53. In assembling the device, the parts are assembled with the screws 82 loosely in place and the piece 52—55 is moved until the buttons 57 and 58 are brought in registry. This movement may be translatory or rotatory as facilitated by the elongated holes 86. When the buttons 57 and 58 are in registry, the screws 82 are tightened permanently. Then a small punch is driven through the registering holes 85 and 83 in the plates 61 and 81; this punches the bronze through to form a boss as shown at 84 in Figure 13, and thus a definite permanent registering adjustment of the buttons 57 and 58 is secured. This adjustment for position of the bronze piece 52—55 is made before the adjustment for spring tension by bending tongue 62—63, heretofore described.

The chamber 33 is continuous with the recess 33′, thus forming a passage extending all the way through from end to end of the base 25, so that the heat generated by the resistance unit 35 and communicated to the surrounding air is rapidly removed by ventilation through the passage 33′—33.

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

1. In a circuit controller armature, a permeable member, and a sheet metal member fastened thereto at a middle portion of said sheet metal member and having one portion disposed to serve as a hinge support, one end portion to carry a contact button and the other end portion to serve as a retractile spring.

2. In a circuit controlling armature, a permeable member, and a sheet metal member fastened thereto and having one portion disposed to serve as a hinge support, and an end portion bent over outside said permeable member and having its end engage said permeable member to serve as a retractile spring.

3. In a circuit controlling armature, a permeable member, and a sheet metal member fastened thereto at a middle portion of said sheet metal member and having one end portion disposed to carry a contact button, and the other end portion to serve as a retractile spring.

4. In a circuit controlling armature, a permeable member with an extension at one side, a resilient sheet metal member fastened to the permeable member and having an extension adjacent to the first mentioned extension and carrying a contact button, these two extensions having interengaging stops whereby the button may be moved over a definite limited range relatively to the permeable member, said sheet metal member having another extension on its opposite side adapted to be fastened to a fixed support and thus afford a hinge connection thereto for the permeable member and being further extended and bent around the permeable member and engaging the same to act as a retractile spring therefor.

5. In a circuit controlling armature, a permeable member with an extension at one side, a resilient sheet metal member fastened to the permeable member and having an extension fastened to a fixed support thus affording a hinge connection thereto for the permeable member, and a further extension bent around the permeable member and engaging the same to act as a retractile spring therefor.

6. In a circuit controlling armature, a permeable member with an extension at one side, a resilient sheet metal member fastened to the permeable member and having an extension adjacent to the first mentioned extension and carrying a contact button, these two extensions having interengaging stops whereby the button may be moved over a definite limited range relatively to the permeable member, said sheet metal member having another extension on its opposite side adapted to be fastened to a fixed support and thus afford a hinge connection thereto for the permeable member.

7. In combination, a contact carrying movable armature, a retractile leaf spring therefor, and a stationary element having a projection bearing against said spring, said projection being bendable to adjust the tension of said spring.

8. In combination, a contact carrying armature, a support to which said armature has a hinge connection, a leaf spring fixed on said support and extending therefrom with its end engaging said armature, and a tongue fixed at its root on said support and engaging said spring, said tongue being adapted to be bent to adjust the tension of the spring.

9. In combination, a contact carrying armature, a support to which said armature has a hinge connection, a leaf spring fixed on said support and extending therefrom with its end engaging said armature, and a tongue fixed at its root on said support and extending therefrom with an intermediate bend, said bend lying against said spring and said tongue being adapted to have said bend modified to adjust the tension of the spring.

10. In combination, a contact carrying armature, a support, a leaf spring fixed on said support at one part thereof and engaging said armature at another part, a metal tongue fixed at its root to the support and with its intermediate part bent and lying against an intermediate part of said spring, said tongue being thinner at its tip and adapted to be bent at various points along its length so as to adjust the tension of the spring to any desirable degree.

11. In combination, a contact carrying armature, a fixed contact to cooperate therewith, a sheet metal member fastened to the armature and extending therefrom to serve as a hinge support therefor, and having a hole in the extended portion, a screw passing with considerable clearance through said hole to facilitate adjustment of the armature for registering of the contacts, a fixed member engaged by said screw and a hole in said member with a boss projected therein from the sheet metal member after said adjustment so as to secure permanency thereof.

12. In combination, a contact carrying armature, a fixed contact to cooperate therewith, a sheet metal member fastened to the armature and extending therefrom to serve as a hinge support therefor, a fixed member, means to clamp said sheet metal member thereto after the contacts have been brought in registry, said fixed member having a recess adjacent to said sheet metal member, and said sheet metal member having a portion thereof bent into said recess after adjustment and clamping whereby proper permanent registry of the contacts is assured.

13. In combination, a contact carrying armature, a fixed contact to cooperate therewith, a sheet metal member fastened to the armature and extending therefrom to serve as a hinge support therefor, and having two holes each elongated transversely to the line joining said holes, a fixed support, two plates on respective sides of the extended portion of the sheet metal member, screws to clamp said plates and said member between them to said fixed support after adjustment for registry of the contacts, said plates having two sets of registering holes therethrough, and the metal of said member being punched through at said holes after the parts have been clamped by said screws.

14. In combination, a contact carrying armature, a fixed contact to cooperate therewith, a sheet metal member fastened to the armature and extending therefrom to serve as a hinge support therefor, a fixed member, and means to clamp said sheet metal member thereto after the contacts have been brought in registry, said fixed member and said sheet metal member having means to be established after clamping to insure permanent registry of said contacts.

15. The method of assembling the contact carrying armature having a thin sheet metal member to serve as a hinge support, which consists in loosely securing said member, then adjusting the parts for registry of the contacts, then deforming the metal to secure permanence of registry and clamping the loose parts tightly together.

FREDERIC H. BULLINGER.