Aug. 6, 1946. W. G. NEILD 2,405,514

CARBON PILE VOLTAGE REGULATOR

Filed March 8, 1944

Fig. 1.

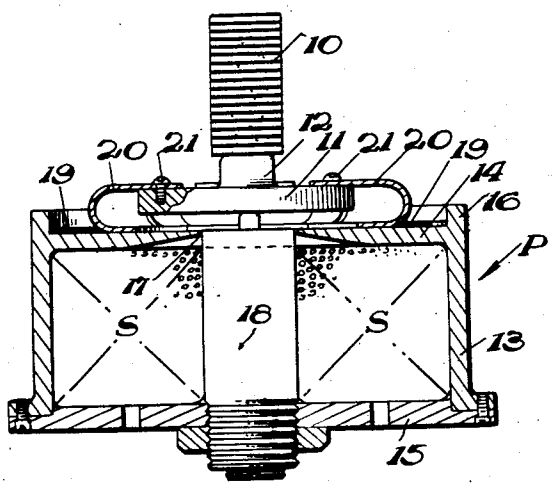


Fig. 2.

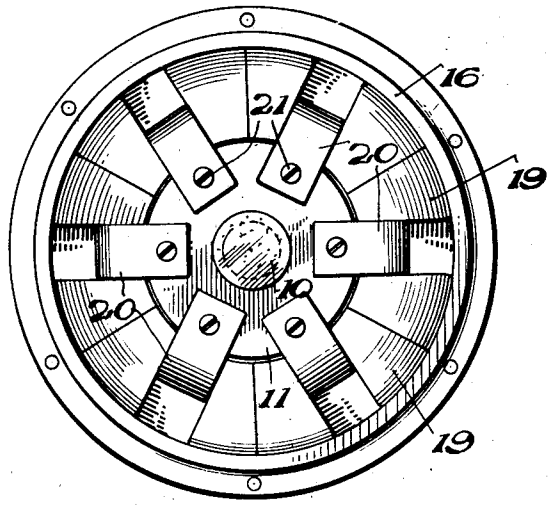
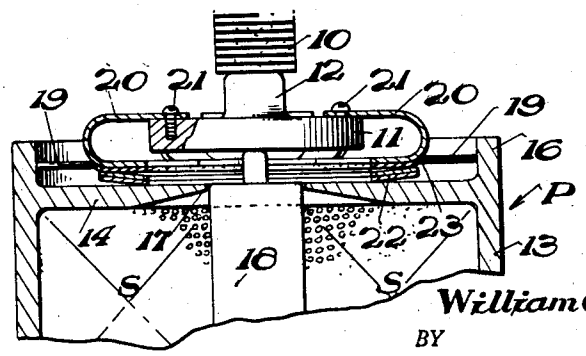


Fig. 3.



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Patented Aug. 6, 1946

2,405,514

UNITED STATES PATENT OFFICE

2,405,514

CARBON PILE VOLTAGE REGULATOR

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Application March 8, 1944, Serial No. 525,585

4 Claims. (Cl. 201—51)

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This invention relates to carbon pile electric regulators and is concerned primarily with the means provided for varying the pressure on the carbon pile.

A carbon pile voltage regulator is ordinarily associated with a generator for the purpose of controlling the voltage across the generator. Such a carbon pile regulator includes a carbon pile made up of a plurality of carbon discs and which is connected in series with the field of the generator. As the pressure on the carbon pile varies, the strength of the field is correspondingly varied and the generator regulated.

It is now common practice to employ magnetically actuated means for varying the pressure on the carbon pile. Such magnetic means comprises a magnetic pot, including a core, and which pot houses the usual solenoid coil. An armature which is disposed in operative relation to one end of the carbon pile is arranged to be affected by changes in the magnetic force generated by the solenoid. Inasmuch as this solenoid is connected across the generator the strength of the magnetic field which it produces will vary in accordance with variations in the voltage of the generator.

It is now a well recognized and accepted fact that the magnetic force on the armature must be opposed in some manner, and this is usually accomplished by spring means. Thus, when the spring means and the magnetic force actually balance, the armature is held immovable and the resistance of the carbon pile remains constant. However, when the magnetic force changes, due to changes in the voltage, the armature is affected to be moved and thus vary the pressure on the carbon pile.

Inasmuch as the magnetic force which is effective on the armature varies inversely as the square of the distance across the gap between the armature and the core, it becomes necessary to provide spring means, the resistance of which will vary to a corresponding degree to maintain the desired balance between the spring force and the magnetic force and leave the regulating range undisturbed.

An important object of this invention is the provision, in a carbon pile electric regulator of the character aforesaid, of novel spring means for this purpose.

More in detail, the invention has as an object the provision, in a carbon pile voltage regulator, of an armature, a magnetic pot, and a substantially U-shaped spring, one end of which is anchored to the armature and the other end of which engages the top of the pot. In carrying

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this idea out in a practical embodiment, the invention contemplates the use of a plurality of such springs which may be equi-angularly shaped about the circular armature and which springs serve to maintain the armature in proper position.

An important phase of the invention resides in the construction of these springs which are designed so that the resistance which they offer increases with movement of the armature towards the magnetic pot, and the degree of increase is substantially the same as the increase in magnetic force on the armature as the latter approaches the pot.

Yet another object of the invention is the provision, in a carbon pile voltage regulator of the character aforesaid, of novel spring means of the type noted, which also includes instrumentalities for properly positioning the springs and armature carried thereby with respect to the pot. This end is achieved by stamping each spring from a metal blank, so as to leave portions of the blank which do not function as springs, but simply as positioning means.

Various other more detailed objects and advantages of the invention such as arise in carrying out the above noted thoughts in a practical embodiment will in part become apparent and in part be hereinafter stated as the description of the invention proceeds.

The invention, therefore, comprises a carbon pile voltage regulator, including an armature that is held in operative position by a plurality of U-shaped springs. One end of each spring is anchored to the armature, while the other end bears against the magnetic pot. Instrumentalties are also associated with the springs for maintaining them and the armature in proper position with respect to the pot.

For a full and more complete understanding of the invention, reference may be had to the following description and drawing, wherein:

Fig. 1 is a side view, partly in section and partly in elevation, of those portions of a carbon pile voltage regulator with which this invention is concerned;

Fig. 2 is a plan view of the construction shown in Fig. 1; and

Fig. 3 is a fragmentary showing similar to Fig. 1 of a modification.

Referring now to the drawing, wherein like reference characters denote corresponding parts, and first more particularly to Figs. 1 and 2, the carbon pile of a carbon pile voltage regulator is shown at 10. While the invention is described

as applied to a voltage regulator, it will be understood that it might just as well be applied to any electric regulator which embodies, as an essential element, a variable resistance. Also, while the resistance which is varied is illustrated and described as a carbon pile, it could obviously take the form of a pile of discs of any material such as a metal having the properties which would suit it to this particular use.

The pile 10 is made up of a plurality of carbon discs in accordance with customary practice. The function of the regulator is to vary the pressure on the pile 10. For this purpose an armature 11 carries an abutting member 12 which engages with, or is connected to, one end of the pile 10.

In the form of the invention illustrated in the drawing, the pile 10, armature 11 and magnetic pot about to be described, are illustrated as circular, although this is intended to be no limitation on the invention. Obviously, the circular formation could be deformed without departing from the spirit of the invention.

A magnetic pot is referred to in its entirety by the reference character P and is shown as comprising a cylindrical wall 13, which carries a top wall 14 and a bottom wall 15. It will be noted that the cylindrical wall 13 projects above the top wall 14 a slight distance to provide a peripheral flange 16.

The top wall 14 is formed with the usual central opening 17, and a cylindrical core 18 upstands from the bottom wall 15 and has its top end located in the opening 17. A solenoid indicated at S is positioned in the pot P about the core 18.

The armature 11 is held in position by a plurality of spring assemblies, each of which is of substantially the same construction as the other. Thus, only one of these spring assemblies is herein described for the purposes of this specification. Each spring assembly comprises a base 19, from which is struck a tongue or leaf 20 that is bent up and over into U-shaped formation. The free extremity of each tongue 20 is anchored to the upper face of the armature 11 in any preferred manner, as by the screw fastening elements shown at 21.

It will be noted that the bases 20 conform in shape to the cylindrical formation of the pot P, and their outer peripheral edges engage the flange 16. Thus, each spring assembly is positioned and serves to maintain the armature 11 in proper position.

It is particularly important to note that the spring device thus described provides a convenient and novel means for mounting the armature which device is of such simplicity in construction as to be readily adapted for manufacture and installation at low cost.

In the operation of the device, the tongue spring members are so arranged that as the armature 11 approaches the top of the core 18, the magnetic force of the latter varies inversely as the square of the distance between the armature and the top of the core. The resistance offered by the springs 20 must vary commensurate with these changes in the magnetic force. The springs being of the cantilever type may be so designed as to have this property.

While the operation of the above-described mechanism is believed to be obvious, it may be briefly outlined by noting that the solenoid is connected across the generator, while the carbon pile 10 is in series with the field of the generator. Normally, the magnetic force offered by the magnetic pot P is counter-balanced by the springs 20, and the armature is held immovable to maintain constant the resistance of the pile 10. As the voltage across the generator varies, there is a corresponding change in the coils of the solenoid S to effect a change in the magnetic force. The armature 11 is moved by this change in the magnetic force, and thus the pressure on the carbon pile 10 is varied, which in turn varies the field strength of the generator.

Referring now more particularly to Fig. 3, where there is illustrated a modified form of the invention in which provision is made for temperature compensation, a thermostatic ring 22, which may be of the well known bimetal structure, is positioned on the top 14 of the magnetic pot about the opening 17.

A washer 23 may engage the ring 22, and this washer 23 carries U-shaped springs which are anchored to the armature 11 in the manner above described. It is evident that the conical formation of the bimetallic ring 22 provides for a change in the relative position of the armature assembly coincident with variations in temperature.

While two embodiments of the invention are hereinbefore set forth, it is to be clearly understood that the invention is not to be limited to the exact constructions illustrated and described, because various modifications of these details may be provided in putting the invention into practice within the purview of the appended claims.

What is claimed is:

1. In a carbon pile electric regulator including a carbon pile and a magnetic pot having a top surrounded by a peripheral flange, an armature assembly for regulating said carbon pile, comprising an armature, a base plate of circular shape positioned within said peripheral flange and adjacent said top and flange, a series of tongue portions formed integral with said plate and projecting therefrom in a U-shaped formation, said U-shaped tongue portions extending radially inward of said base plate and having the free ends thereof fastened to said armature so as to flexibly support said armature relative to said carbon pile and magnetic pot.

2. In a carbon pile electric regulator including a carbon pile and a magnetic pot having a top surrounded by a peripheral flange, an armature assembly for regulating said carbon pile, comprising an armature, a base plate of circular shape positioned within said peripheral flange and adjacent said flange, a series of tongue portions formed integral with said plate and projecting therefrom in a U-shaped formation, said U-shaped tongue portions extending radially inward of said base plate and having the free ends thereof fastened to said armature so as to flexibly support said armature relative to said carbon pile and magnetic pot, and temperature responsive means for adjustably positioning said base plate with relation to the top of said magnetic pot.

3. In a carbon pile electric regulator including a carbon pile and a magnetic pot having a top surrounded by a peripheral flange, an armature assembly for regulating said carbon pile, comprising an armature, a base plate of circular shape positioned within said peripheral flange and adjacent said flange, a series of tongue portions formed integral with said plate and projecting therefrom in a U-shaped formation, said

U-shaped tongue portions projecting inwardly of said base plate, screw members for adjustably fastening the free ends of each of said tongue portions to said armature so as to flexibly support said armature relative to said carbon pile and magnetic pot.

4. In a carbon pile electric regulator including a carbon pile, a magnetic element, and an armature assembly for regulating said carbon pile, comprising an armature, a base plate carried at one end of said magnetic element, a plurality of

tongue members formed integral with said base plate and projecting therefrom in a substantially U-shaped formation, each of said tongue members having end portions positioned in spaced relation to said base plate and extending inward of said base plate, and means fastening each of the end portions of said tongue members to said armature so as to flexibly support said armature in relation to said carbon pile and magnetic element.

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