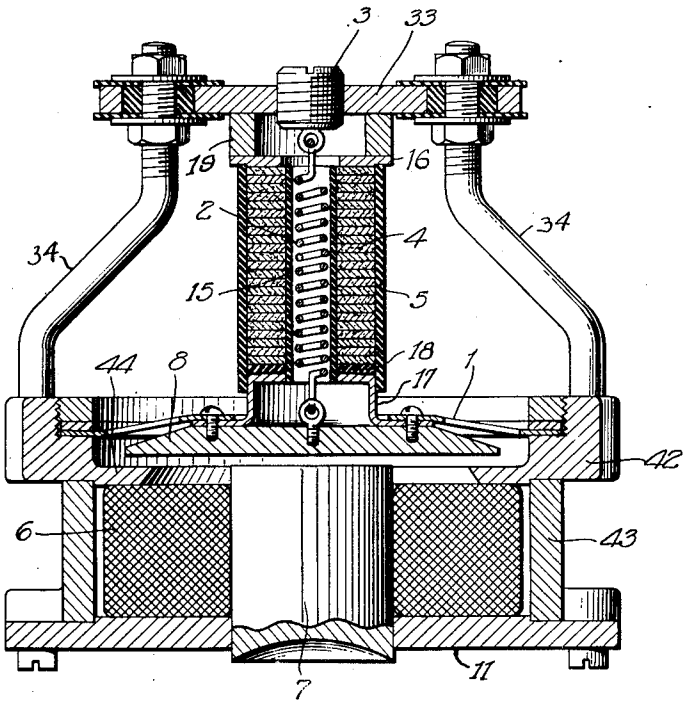
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ELECTROMAGNETIC APPARATUS

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INVENTOR.

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ELECTROMAGNETIC APPARATUS

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2 Claims. (Cl. 201—51)

This invention relates to electromagnetic apparatus, and particularly to the control of the action of an electromagnetically actuated rheostat.

In Patent No. 2,268,718, granted to Frederick Newton on January 6, 1942, there is disclosed a rheostat of the carbon pile type, in which the carbon pile is subjected to the difference between two forces of a magnitude large in relation to the pressure needed to vary the pile resistance over its useful range, these forces being derived from the pull of an electromagnet, the excitation of which is dependent on the regulating effect, and from an opposing spring.

As is well known, for constant excitation the pull of an electromagnet of usual design upon its armature depends on the length of the air gap between them and, subject to variation of the stray field and other disturbing factors, varies inversely as the square of the air gap length. In the Newton patent provision is made for a counter-balancing force which follows basically the same law of variation as the magnet pull, and the difference between these two forces of like characteristic is utilized as the regulating force.

This counter-balancing force is provided by a spring or beam which rests tangentially against an abutment attached to the electromagnet, with which abutment the spring is brought into surface contact over a continuously increasing length by movement of the armature towards the electromagnet. As the spring wraps upon the abutment, the length of spring subjected to further bending as the armature moves further toward the electromagnet continuously decreases.

An object of the present invention is to provide a carbon pile apparatus in which the forces counterbalancing the magnet pull are due to the provision of features differing from those of the Newton patent above referred to.

This and other objects of the invention will become apparent from inspection of the following specification when read with reference to the accompanying drawing wherein is illustrated the preferred embodiment of the invention. It is to be expressly understood, however, that the drawing is for the purpose of illustration only, and is not designed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

According to this invention the "wrapping" spring of the Newton patent is eliminated, and in lieu thereof I provide a resilient suspension for the armature 8, said resilient suspension comprising, first, an elastic diaphragm 1, and secondly, an externally adjustable tensioning spring 2; the diaphragm 1 being a concave disc of elastic metal, such as spring steel, which is apertured at angularly spaced intervals (in addition to its central aperture) to provide the effect of radial arms connecting its central portion with its outer periphery, the central portion being fastened to armature 8, and the periphery being clamped against an annular shoulder on frame-piece 42, supporting cross-head 33, as in the Newton patent. Frame-piece 42 has an inwardly extending rim 44 constituting a pole-piece, and forming, with armature 8, fixed core 7, base 11 and shell 43, the magnetic circuit energizable by flow of current through coil 6.

The carbon pile 4 is supported between armature 8 and cross-head 33, and the maximum compression of the individual carbon washers, one against the other, is regulable by the turning of the spring-carrying screw 3 which is threadly received in cross-head 33; also by the raising or lowering of cross-head 33 upon its crooked stanchions, on which it is adjustably received, as shown.

If, for the initial adjustment of spring 2, the magnet flux is such that its attracting force counterbalances the combined pull of spring 2 and diaphragm 1, any increase in the electric potential across the terminals of coil 6 will tend to depress the armature 8, thus increasing the resistance at the terminals (not shown) of the carbon pile. Conversely, should the electric potential across the coil 6 be reduced, the elastic tension of the diaphragm 1, added to that of spring 2, will increase the pressure in the carbon pile, thus reducing its electric resistance and correspondingly affecting the circuit (not shown) to be regulated.

It will be noted that the operation of the apparatus is similar to that of the Newton regulator above mentioned. However, the apparatus according to the invention has very important advantages over the Newton apparatus, due to the fact that the diaphragm has an initial own tension at rest, and hence a capacity of natural vibration at a high frequency and with a small amplitude; also, due to the regulating spring 2, which is of great length and whose axis coincides with the axis of the apparatus, can be readily controlled from the exterior by a turning of slotted screw 3, also by the shifting of cross-head 33.

As cross-head 33 and spacers 16 and 19 are all insulated from stanchions 34, as shown, any

of these may be used as the point for attachment of a terminal wire for the carbon pile 4; the opposite terminal wire being preferably inserted through a slot (not shown) in outer insulating sleeve 5, adjacent the lowermost carbon washer of the pile. Between said lowermost carbon washer and the armature extension 17 there is interposed a washer 18 of insulating material, and a sleeve 15 of insulating material is interposed between the carbon pile and the spring 2. Outer sleeve 5 may be omitted, if desired.

What is claimed is:

1. In a carbon pile apparatus, the combination, with a carbon pile, of an electromagnet including a frame having arms extending therefrom and a cross-head carried thereby, said cross-head acting as an abutment for said pile at one end thereof, an armature having abutment with said pile at the other end thereof, and resilient means for suspending said armature in spaced relation to said electromagnet, said resilient means including a diaphragm rigidly clamped to both said armature and said frame, and having an initial tension tending to urge said armature away from said electromagnet.

2. In a carbon pile apparatus, the combination, with a carbon pile, of an electromagnet including a frame having arms extending therefrom and a cross-head carried thereby, said cross-head acting as an abutment for said pile at one end thereof, an armature having abutment with said pile at the other end thereof, resilient means for suspending said armature in spaced relation to said electromagnet, said resilient means including a perforated diaphragm having a fixed area of contact with said frame, and having an initial tension tending to urge said armature away from said electromagnet, and additional tensioning means suspended from said cross-head and disposed along the axis of said carbon pile.

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