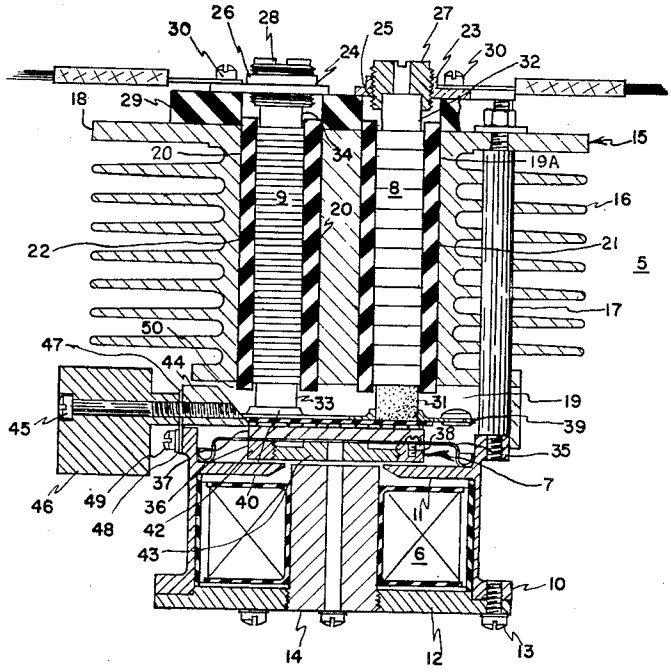
Feb. 4, 1958 W. G. NEILD 2,822,452

CARBON PILE REGULATOR

Filed March 31, 1955

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FIG. 1



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FIG. 2

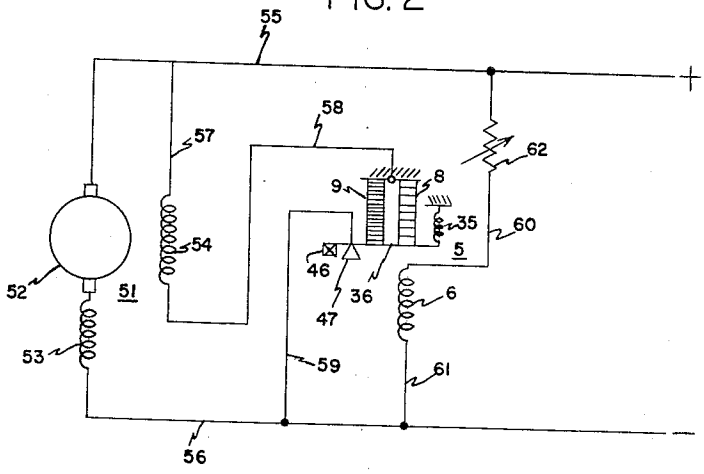
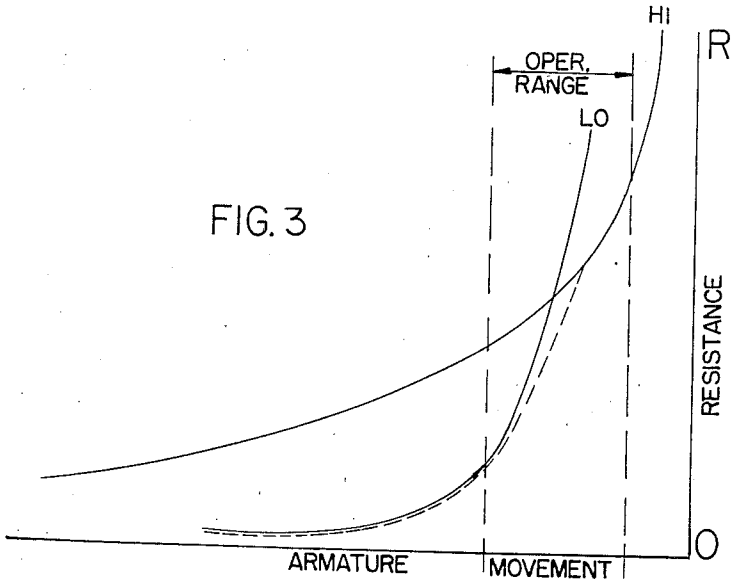


FIG. 3



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CARBON PILE REGULATOR

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Application March 31, 1955, Serial No. 498,272

1 Claim. (Cl. 201—51)

The present invention relates to electrical regulators and more particularly to carbon pile type regulators.

Heretofore, carbon pile regulators have been limited by the resistance range of the pile and by the wattage dissipation. In order to secure the higher resistance necessary for operation under some conditions, the lower range of resistance of the pile would be too high for operating where a minimum resistance was required. To select a pile that would satisfy the minimum resistance requirement, the maximum resistance would be too great for operation where a high resistance was required.

The present invention provides a carbon pile regulator that combines the characteristics of a high resistance, high elongation carbon pile with a relatively low resistance, low elongation carbon pile using a single actuating system. A new combined carbon pile is provided that has the desirable high resistance advantage of the high resistance pile and the low resistance advantage of the lower resistance carbon pile, thus greatly extending the range of the regulator.

In addition to extending the resistance range, there is a gain in the wattage dissipating capacity of the regulator. Past experience indicates that beyond a certain pile length there is very little gain in the heat dissipating ability of the regulator due to the tendency of the carbon pile to "pack" at the fixed end. By using the two carbon piles, when maximum wattage exists, both piles combine to dissipate the heat. While the low resistance pile dissipates the greater percentage of the total watts, the dissipation will be less than that of a single pile under the same total wattage condition. Hence, the double pile regulator can be rated up in watts and still not exceed the maximum permissible carbon pile temperatures.

It is an object of the invention to provide an improved carbon pile regulator.

Another object of the invention is to provide a novel carbon pile regulator having a wide resistance range.

Another object of the invention is to provide a novel regulator capable of going from a relatively low resistance value to a relatively high resistance value.

Another object of the invention is to provide a novel regulator with improved wattage dissipation.

Another object of the invention is to provide a regulator with improved wattage and resistance characteristics.

The above and other objects and features of the invention will appear more fully hereinafter from a consideration of the following description taken in connection with the accompanying drawings wherein one embodiment of the invention is illustrated by way of example.

In the drawings:

Figure 1 is a cutaway view of a regulator embodying the invention.

Figure 2 is a schematic diagram of a regulator system embodying the invention.

Figure 3 is a graph illustrating the principle of the invention.

Reference is now made to Figure 1 of the drawing wherein a carbon pile regulator is indicated generally by the numeral 5. The regulator 5 has an electromagnetic coil 6, armature assembly 7, low resistance carbon pile 8 and high resistance carbon pile 9. The coil 6 is surrounded by a casing 10 of a suitable ferromagnetic material. The casing 10 has a flange 11 extending inward and forming the pole face for the electromagnetic assembly. A bottom plate 12 is secured to the casing 10 by screws 13 or in any other suitable manner. A core member 14 of a suitable ferromagnetic material is screw-threaded to the plate 12 and projects into the coil 6.

A carbon pile housing 15 having heat radiating fins 16 is secured to the casing 10 by post 17. The housing 15 has a plate 18 formed integral therewith and a counterbore portion 19. Mounted in the housing 15 and extending longitudinally therein are tubes 19A and 20 of a suitable non-conducting material. The tube 19A carries carbon disc 21 forming the carbon pile 8 and the tube 20 carries carbon disc 22 forming the carbon pile 9. Cap members 23 and 24 having threaded portions 25 and 26 adapted to receive pile adjusting screws 27 and 28 are insulated from the plate 18 by insulating member 29 and secured thereto by screws 30. The carbon pile 8 is carried between contact plugs 31 and 32. The carbon pile 9 is carried in like manner between conduit plugs 33 and 34.

The armature assembly 7 has a diaphragm type spring 35 seated on member 11 of the housing 10. An armature plate 36 is positioned on the side of the spring 35 adjacent to the core 14. On the opposite side of the spring 35, a clamping plate 37 is positioned so that the spring 35 is clamped between the plates 36 and 37 by suitable fastening screws 38. Cup-shaped members 39 and 40, adapted to hold contact plugs 31 and 33, respectively, are mounted on the plate 37 by screws or other suitable means. An insulating member 41 insulates the members 39 and 40 from the plate 37. The armature plate 36 comprises a ring-like section 42 secured by the screws 38 and a center section 43. The sections 42 and 43 are adapted to be screw-threaded together.

A member 44 is secured to the clamping plate 37 by screws (not shown). Secured to the member 44 by screws 45 is a counterbalance 46. One side of a spring-like member 47 is clamped between the member 44 and counterbalance 46. The other side of the member 47 is secured to the casing 10 by clamping member 48 and screws 49. An opening 50 is provided in the housing 15 for the member 44.

Reference is now made to Figures 2 and 3 of the drawing for an explanation of the operation of the invention. In Figure 2 the regulator 5 is illustrated diagrammatically in a generator system wherein corresponding parts have been assigned the same reference numerals as in Figure 1.

A generator is indicated generally by the numeral 51 and has an armature 52, series field winding 53, and shunt field winding 54. One terminal of the armature 52 is connected to load bus 55 . The other terminal of armature 52 is connected through the series field winding to load bus 56. One end of the shunt field winding 54 is connected by conductor 57 to the bus 55. The other end of the winding 54 is connected by conductor 58 to one end of the carbon piles 8 and 9 of the regulator 5. The other end of the carbon piles 8 and 9 are connected by a conductor 59 to the bus 56.

The regulator 5 is shown diagrammatically herein as including the armature 36 pivoted at 47 and biased by the spring 35 in a direction for decreasing the resistance of the carbon piles 8 and 9. Opposing the spring 35 is the electromagnetic control winding 6. One end of the

winding 6 is connected by a conductor 60 to the bus 55. The other end of the winding 6 is connected by a conductor 61 to the bus 56. A variable resistance 62 may be inserted in the conductor 60 to regulate the voltage setting of the windings.

The resistance and elongation characteristics of a carbon pile are determined by the number of carbon discs and their thickness. A pile made up of many thin discs will have a higher resisitance and greater elongation than one of the same length made up of a few thick discs. By proper selection of the disc, carbon piles may be made up having the resistance characteristics illustrated by the "Hi" and "Lo" curves of Figure 3, wherein resistance is plotted as a function of armature movement.

The two carbon piles 8 and 9 are actuated by the common armature 36 and are electrically connected in parallel. The high resistance pile 9 has a greater elongation than the low resistance pile 8. From the curves of Figure 3, it can be seen that at the high speed no load condition, or high resistance condition, only the high resistance pile is in the circuit and the low resistance pile is open. As the total resistance of the regulator is decreased, the low resistance pile makes contact and enters into the circuit. The resultant resistance characteristics of the two piles in parallel are shown by the dashed line curve. As the regulator resistance decreases, the low resistance pile picks up more and more of the load and at the low speed, full load condition, it is carrying most of the load. Although the low resistance pile opens as the regulator resistance increases, it is in parallel with the high resistance pile, hence it always has a resistance connected across it, therefore, never breaks an inductive load. Thus, any arcs drawn in the low resistance pile will be of very low wattage, non-inductive and hence not destructive.

Thus, it can be seen that a regulator, such as described herein, would have a longer life in that the high resistance carbon pile would break all the transient arcs, while the low resistance carbon pile would do the bulk of the regulating. Further, the transition from one pile to the other is gradual and there is no abrupt break.

Although only one embodiment of the invention has been illustrated and described, various changes in the form and relative arrangement of the parts, which will now appear to those skilled in the art, may be made without departing from the scope of the invention.

What is claimed is:

An electric regulator comprising a housing, a first plurality of compressible carbon discs forming a first carbon pile having one resistance characteristic, a second plurality of compressible carbon discs forming a second carbon pile having a different resistance characteristic, an armature operably connected so as to adustably compress said carbon piles, a diaphragm type spring for biasing said armature in a first direction, and electromagnet for biasing said armature in the opposite direction in opposition to said spring, and means connecting said carbon piles in parallel whereby a third resistance characteristic is obtained.

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