Nov. 2, 1943. L. R. NIXON 2,333,269

ELECTRIC REGULATOR

Filed March 9, 1942 2 Sheets-Sheet 1

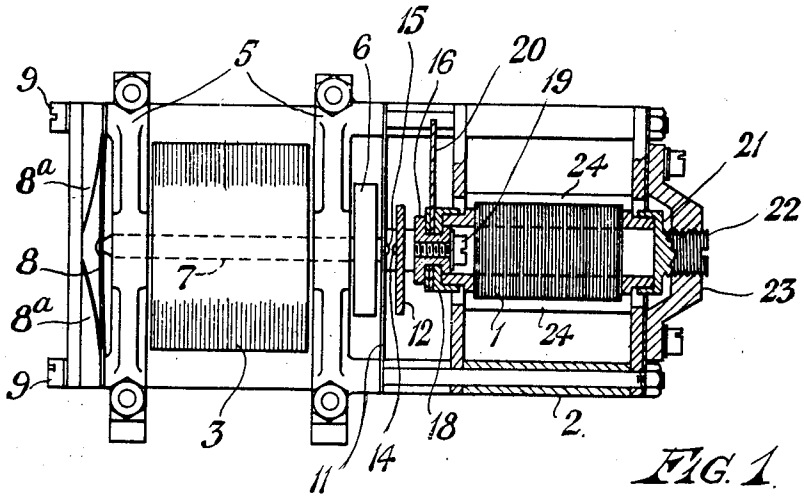


FIG. 1.

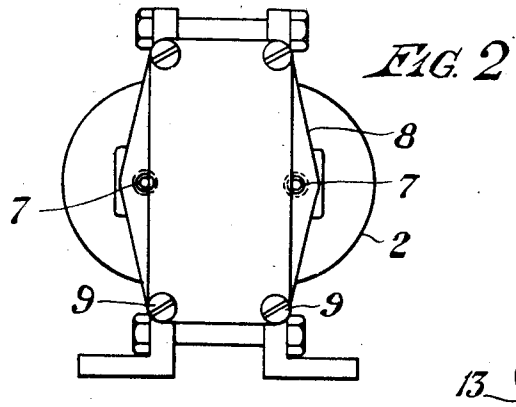


FIG. 2.

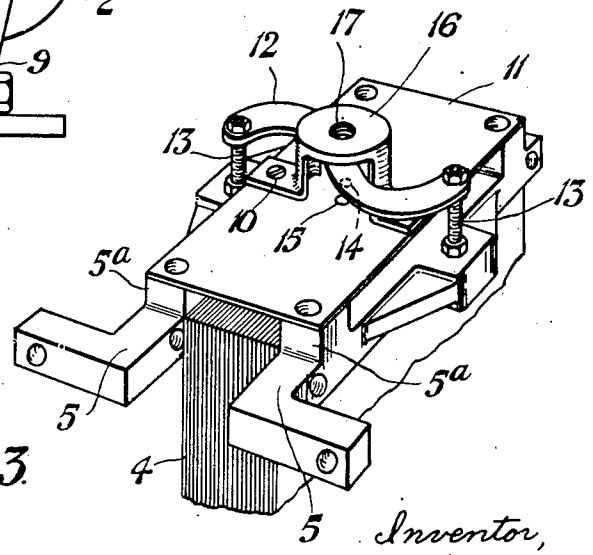


FIG. 3.

Inventor,
Leslie R. Nixon
by Sommers & Young,
Attorneys

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ELECTRIC REGULATOR

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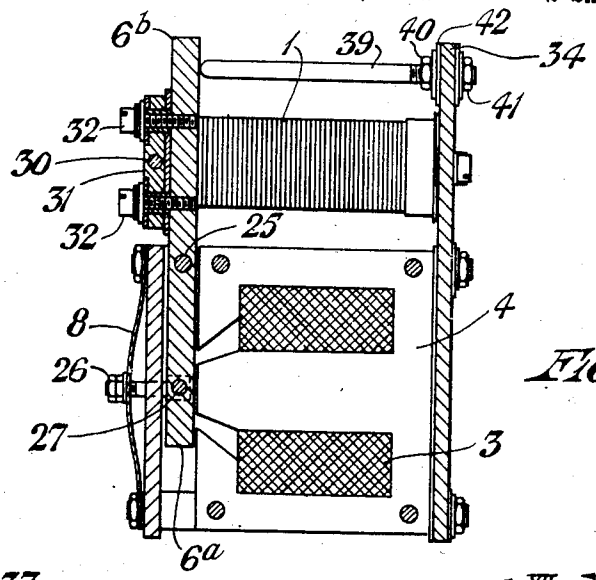


FIG. 4

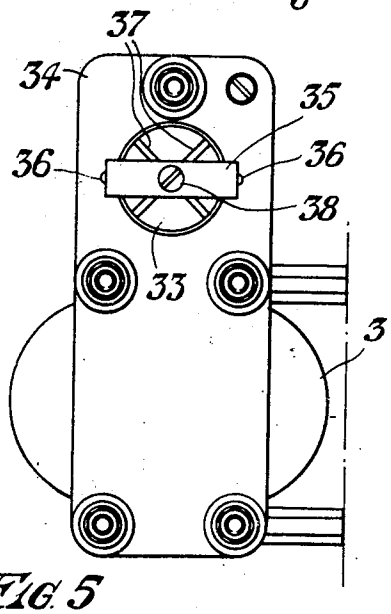


FIG. 5

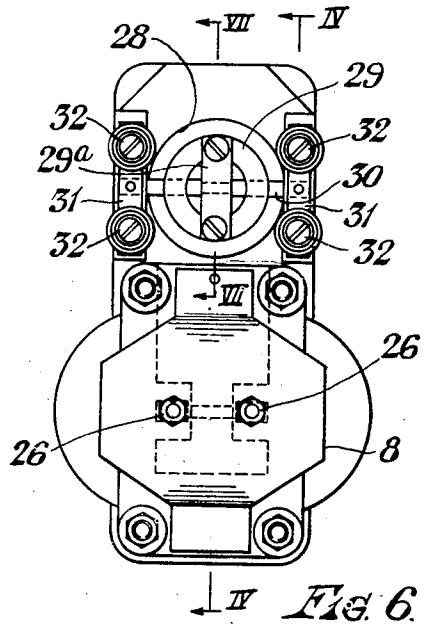


FIG. 6

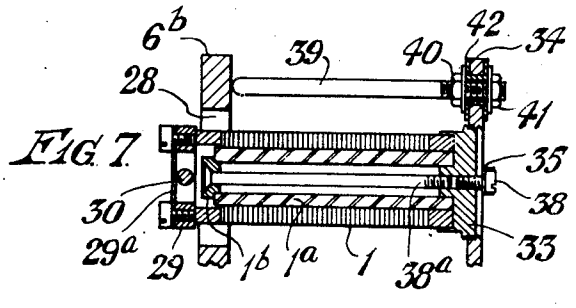


FIG. 7

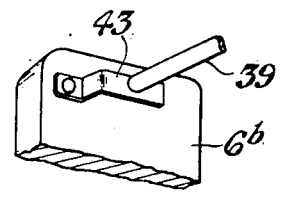


FIG. 8.

Inventor,
Leslie R. Nixon
by Sommerer & Young,
Attorneys

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UNITED STATES PATENT OFFICE

2,333,269

ELECTRIC REGULATOR

Leslie Reginald Nixon, New Eltham, London, England, assignor to J. Stone & Company Limited, Deptford, England, a company of Great Britain

Application March 9, 1942, Serial No. 434,021
In Great Britain March 5, 1941

3 Claims. (Cl. 201—51)

This invention comprises improvements in and connected with regulators of the carbon pile type wherein compression of the pile is varied by a magnet operating against a spring arrangement which is advantageously devised so that its characteristic is more or less matched with the magneto-motive force characteristic.

The present invention has for its objects, the provision of a visual resetting indicator whereby the condition of the regulator can be readily observed and readjusted, as for example upon the replacement of the worn carbon discs in the pile.

According to this invention, a visual resetting device comprises an adjustable element co-operative with or with means associated with, the armature of the magnet when the latter is de-energized, the pile being adjustably mounted so that at any time subsequent to the original setting of the regulator, the pile may be adjusted by the aid of the visual resetting device so that the conditions attained by the original setting are restored by the visual resetting. The resetting device thus acts as a gauge which shows the relation of the pile with the unattracted armature of the magnet when the various initial adjustments have been made for determining the maximum compression produced upon the pile by the matched spring, which compression is relieved by the magnet when the latter is energized. This visual resetting device, which serves as a gauge as aforesaid, may take any one of several forms, as will appear from examples hereinafter to be described.

In order to enable the invention to be readily understood, reference is made to the accompanying drawings wherein:

Figure 1 is a side elevation partly in longitudinal section of a carbon pile regulator fitted with one form of visual resetting device in accordance with these improvements.

Figure 2 is a view as seen from the left hand end of Figure 1.

Figure 3 is a perspective view to a larger scale of the inner end portion of the magnet yoke of Figure 1 and the visual resetting means mounted thereon.

Figure 4 is a sectional side elevation of another construction of carbon pile regulator and of a modified visual resetting means provided therefor, the section being taken on the line VII—VII in Figure 6.

Figure 5 is an elevation as seen from the right hand end of Figure 4.

Figure 6 is an elevation as seen from the left hand end of Figure 4.

Figure 7 is a central longitudinal sectional elevation of the carbon pile and resetting means seen in Figure 4.

Figure 8 is a detail view illustrating a slight modification of the resetting means of Figure 7.

In the regulator seen in Figure 1, a carbon pile 1 is supported horizontally on a suitable base or frame 2 and in axial alignment with the coil 3 of the electromaget. The magnet yoke may be composed of an assemblage of stampings 4, Figure 3, which are held tightly between two pairs of clamps 5, supported on the frame 2 and disposed one pair at each end of the coil 3. The armature 6 is a simple plate or clapper and is supported within the influence of the poles of the magnet by means of two parallel rods 7. These rods extend rearwardly through the coil 3 and are connected at their rear ends with a blade or plate spring 8 which may be secured at both ends to the base 2' by screws 9, as seen in Figures 1 and 2. The spring 8 when flexed to the left hand in Figure 1 may wrap itself against shaped surfaces 8^a so as to increase in stiffness, for the well-known purpose of matching the spring characteristic with the electro-magnet characteristic. The front ends of the rods 7 may be extended beyond the clapper armature 6 and rigidly connected at 10, Figure 3, with a flexible strip or plate 11, which may be a spring strip or plate, having both ends rigidly connected with supports such as projections 5^a on the clamps 5. The strip or plate 11 serves primarily for supporting the front ends of the rods 7 and the armature 6 in correct position in relation to the magnet poles, the rear end of the rods 7 being supported by the spring 8. If the strip or plate 11 is made of spring metal, its springiness may be utilised for reinforcing the action of the spring 8. In any event, the parts are adapted for supporting the armature 6 so that its parallelism with the pole faces is maintained. The action of the spring 8 is to move the armature 6 rightwardly in Figure 1 to put the pile 1 under compression, as hereinafter explained. The coil 3 when energized causes the armature 6 to be attracted leftwardly and to oppose the spring 8 so that compression of the pile 1 is reduced.

The forward pair of clamps 5 serves as a mounting for an adjustable bridge piece 12 as seen clearly in Figure 3. Adjustment of this bridge piece 12 is effected by screwing its clamping nuts along screw threaded supporting pillars 13. The bridge piece 12 straddles the spring strip or plate 11 and at its middle it has a point or pro-

jection 14 directed towards a centre point 15 on the strip or plate 11. On the latter, which is rigidly connected with the armature 6 as aforesaid, there is mounted a bridge piece 16 formed centrally with a screw threaded hole 17. As will be seen from Figure 1, the inner collecting plate or presser plate 18 of the pile 1 is connected with the bridge piece 16 by means of a screw 19 screwing into the hole 17, electrical connection being made with the plate 18 by means of a terminal arm 20. The outer or forward collecting plate 21 at the right hand side of Figure 1 is mounted by means of an adjustment screw 22 in a suitable terminal bracket 23 insulatedly mounted on the framing. The carbon discs or rings constituting the pile 1 may be guidingly supported by a cage of insulation rods 24, Figure 1.

When the regulator is prepared for use, any necessary adjustments of the spring 8 or pile 1 are made so that test shows a required maximum compression of the pile by the spring 8, when the electro-magnet is de-energized. The adjustable bridge piece 12 is then adjusted so that the points 14 and 15 just touch one another and without force when the electro-magnet is de-energized. If any variation in the length of the carbon pile 1 takes place due to shrinkage in service or due to a new set of discs or rings having to be fitted this may result in the opening up of a gap between the points 14 and 15 or in the tight closing of the gap so that the points 14 and 15 are forcibly pressed together when the magnet is de-energized. In such circumstances, the regulator can be correctly re-set by adjusting the screw 22 which shifts the pile 1 bodily rightwardly or leftwardly in Figure 1 until the points 14 and 15 again just make contact when the electro-magnet is de-energized.

When voltage is applied to the coil 3, the attraction of the armature 6 may cause a small gap to open between the points 14 and 15, and when normal current passes through the coil 3 this gap is increased as the armature 6 further approaches the poles of the magnet and reduces the pressure of the spring 8 upon the pile. In any event, when the regulator starts to come within its normal working range, there is a visible gap between the points 14 and 15. If the pile shrinks in service, the length of such gap at the start of the working range will become reduced. The working range, however, will not be interfered with until the gap at the start of the working range is reduced to zero. There is, therefore, a definite shrinkage allowance for the pile before any interference with the working resistance range is encountered. If it is desired that the aforesaid allowance for shrinkage should be increased before adjustment becomes necessary, then the points 14 and 15 can be initially set to a definite initial gap with the coil 3 unexcited. Alternatively, the adjustable bridge piece 12 may be made with a degree of flexibility, so that even if there is interference at the points 14 and 15 within the working range of the regulator, the reduction of maximum working force or compression on the pile 1 will be quite small.

The visual resetting device provided by the points 14 and 15 allows the regulator to be reset to its original condition of adjustment without the use of a voltmeter or other instrument and without having to put the regulator into circuit.

According to the modification illustrated in Figures 4 to 7 a visual resetting device is applied to a regulator wherein the electro-magnet comprising a coil 3 and laminated magnet yoke 4 operates upon a pivoted clapper armature 6^a, the carbon pile 1 being disposed alongside the magnet. The armature 6^a, which may rock about a pivot pin 25 or about any other suitable hinge device, has an extension 6^b for operating upon the pile 1. A plate spring 8 bearing with its ends against a fixed frame part, is operative against nuts 26 of hinge bolts pivotally connected with the armature at 27 and constantly tends to pull the armature 6^a away from the magnet poles and thereby to cause the extension 6^b to apply compression to the pile 1. In order that the extension 6^b may apply pressure to the pile 1 as uniformly as possible, the said extension 6^b is formed with a hole 28, Figures 6 and 7, surrounding one end of the pile. This end of the pile is engaged by a presser ring 29 which is pivotally carried by a pin 30 extending diametrically through it, the ends of the pin 30 being pinned in blocks 31 which are fixed by pairs of screws 32 to the sides of the extension 6^b. The ring 29 is mounted so as to turn stiffly about the pin 30. For this purpose, the ring 29 has fixed to it diametrically a bowed spring blade 29^a which as seen in Figure 7, presses frictionally against the pin 30. Moreover, and as seen in Figure 6, the spring blade 29^a engages with a reduced middle portion of the pin 30 so as to prevent movement of the ring 29 endwise of the pin. Owing to the pivoted mounting of the ring 29, the latter can always press flatly and evenly against the pile 1 in spite of the tilting of the armature 6^a and its extension 6^b in operation. The opposite end of the pile is supported by a disc 33 which is adjustably screwed into the frame plate 34, as seen clearly in Figure 7. This disc may be locked in any desired position of adjustment by means of a spring blade 35 (see also Figure 5), extending diametrically across the disc 33 and engaging at its ends with recesses 36 which prevent it from turning. This blade 35 can be pulled down to the outer face of the disc 33 and held in engagement therewith by a set screw 38 screwed centrally into the disc 33. As will be understood from Figure 7, the screwing in or out of the disc 33 causes the pile 1 to move bodily either to the left or to the right and thus increases or diminishes the initial compression applied by the armature extension 6^b under the stress of the spring 8. In this construction, the rings of the pile 1 are supported on a central tube 1^a of insulating material having one end engaged with a central boss on the disc 33. The other end of the tube 1^a receives an annular plug 1^b and a long screw 38^a engaging this plug passes through the tube 1^a and is screwed into the disc 33 for securing the tube in place. The resetting device in this arrangement is constituted by a gauge pin 39 which by the aid of nuts 40 and 41 and insulation washers and bushing 42 is insulatedly and adjustably mounted on the frame plate 34. When the regulator has been initially set to a desired working condition on the test bench, by adjusting the spring 8 by its nuts 26 and the pile 1 by its disc 33, the gauge pin 39 is then set by suitable adjustments of its nuts 40 and 41 until its point or rounded end just touches the surface of the armature extension 6^b. Thereafter, if the length of the pile 1 should lessen due to wear of the carbon rings, so that the extension 6^b presses hard against the pin 39, or if the said length should increase due to the insertion of new rings or of a new pile, so that a gap appears between the extension 6^b and the pin 39, the disc 33 is adjusted for resetting the pile and for restoring the initial condition wherein the arma-

ture extension 6b just presses lightly against the pin 39.

If desired, and as shown in Figure 8, the armature extension 6b may be fitted with a flexible attachment 43 for the gauge pin 39 to press against. This provides for a pile shrinkage allowance in the same way that this could be provided for by giving the bridge piece 12. Figures 1 to 3, a degree of flexibility, as was explained in the description of those figures. The resetting device of Figures 4 to 8 acts in all respects in an analogous manner to that described with reference to Figures 1 to 3, and therefore needs no further elucidation.

Two of these magnets can be arranged to operate a single pile to form a duel regulator combination. In this case, one magnet would be excited by current and the other by voltage. Also, in this case, the stop provided by the adjustable bridge piece would have to be made rigid. One arrangement would be to mount a magnet system at each end of the pile so that deflection of the armature of either system would elongate the pile. The rigid stop would effectively prevent the armature of the system not in control from following up when the force on the pile is relieved by the other system.

I claim:

1. Carbon pile type regulator comprising in combination, a resistor pile, a loading spring operative for compressing said pile, an electromagnet comprising a clapper type armature operative against said loading spring, pile adjusting means operative for bodily moving the pile to vary the effect of said loading spring, and an adjustably mounted gauge extending into close and indicative relation with said armature and being thereby adapted for visibly showing the state of adjustment of said pile.

2. Carbon pile type regulator comprising in combination a pile, an electromagnet comprising a clapper type armature operative for decompressing said pile, a loading spring operative on said armature for compressing said pile, transmitting means connected with said armature and operatively engaging said pile, pile-adjustment means operative for moving the pile bodily in relation to said transmitting means, and an adjustable gauge device extending into close and indicative relation with said transmitting means and being thereby adapted for visibly showing the settings attained by operating said pile-adjustment means.

3. Carbon pile type regulator comprising in combination a pile, an electromagnet comprising a clapper type armature and operative for decompressing said pile, a loading spring operative on said armature for compressing said pile, transmitting means connected with said armature and operatively engaging said pile for effecting said compressing and decompressing thereof, pile-adjustment means operative for moving the pile bodily in relation to said transmitting means, a flexible abutment device on said transmitting means, and an adjustably mounted gauge device extending into close and indicative relation with said flexible abutment device and being thereby adapted for visibly showing the settings attained by operating said pile-adjustment means.

LESLIE REGINALD NIXON.