

Sept. 12, 1933.

V. G. APPLE

1,926,419

CONTROLLER

Filed Jan. 16, 1930

2 Sheets-Sheet 1

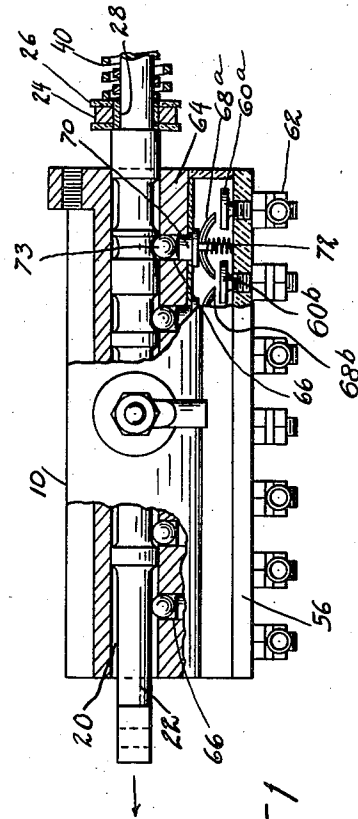
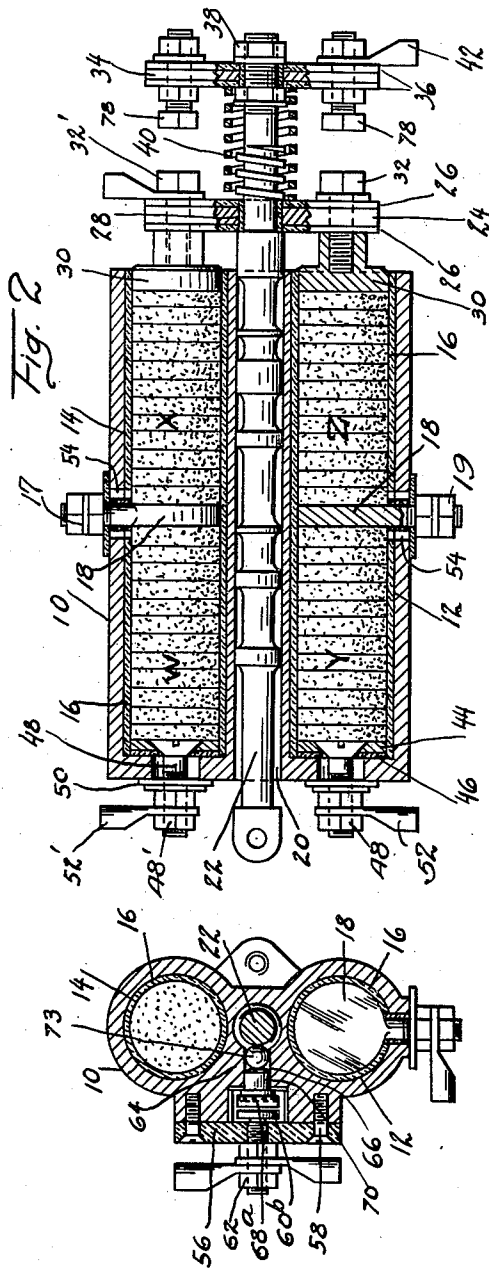


Fig. 3

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2 Sheets-Sheet 2

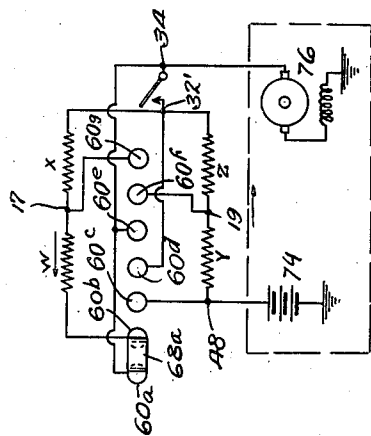


Fig. 5

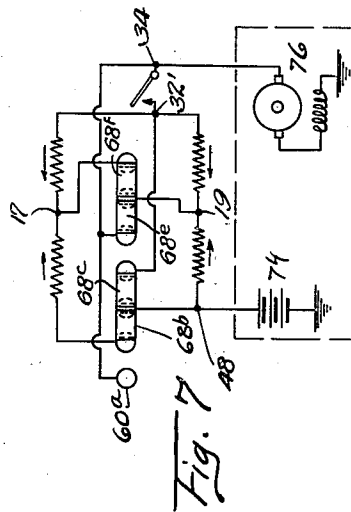
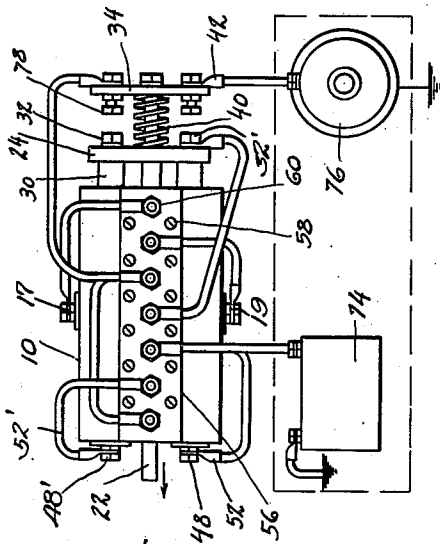


Fig. 7



UNITED STATES PATENT OFFICE

1,926,419

CONTROLLER

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Application January 16, 1930. Serial No. 421,328

5 Claims. (Cl. 201—51)

My invention relates to a controller element for an electric circuit and has particular reference to a device whereby varying resistances may be inserted in the circuit of an electric brake hook-up.

An object of my invention is to provide a controller which will permit the utilization of a large resistance range, and be capable of handling comparatively large amperages. The use of various types of electric brakes is quite prevalent, and I particularly contemplate a controller element which may be governed entirely by the pressure exerted by an automotive vehicle operator upon the conventional brake pedal.

Various means of changing the amount of resistance in any circuit have been utilized hitherto, but in my controller device I have incorporated a plurality of independent resistance elements and in addition to varying the resistance in each of these I have devised means for varying the manner in which they are placed in circuit and thereby varying the total resistance.

Various other objects and meritorious features of my invention will be apparent from the following description taken in conjunction with the drawings wherein like numerals refer to like parts throughout the several figures and wherein:

Fig. 1 is a partial cross section through my cam rod and switch elements,

Fig. 2 is a longitudinal section through my cam rod and resistance element,

Fig. 3 is a cross section through one of my switch elements,

Fig. 4 is a schematic diagram of the controller with connections and associated apparatus, and Figs. 5, 6, and 7 are circuit diagrams of electric connections.

I have illustrated my controller as embodying a casing 10 which is provided with two tubular compartments 12 and 14, each of which is insulated from the casing by a lining 16. Each of these tubular compartments is divided into sections W, X, Y and Z by a terminal plate 18 which is provided with terminal facilities 17 and 19, and each of the sections contains a pile of carbon discs. While I have disclosed the use of carbon disc piles as constituting my resistance elements, it is to be understood that other resistance elements may be utilized with equal success.

Through the center of my casing member 10 there is an axial bore 20 through which the cam rod 22 is designed to slide. Slidable along the end of this cam rod is a plate 24. This plate is insulated from the rod by means of the plates 26 and the bushing member 28 supports the plugs

30 which bear on the carbon piles in the tubular compartments. These plugs 30 are secured to the plate assembly as specified by means of the nuts 32 and 32' and function to compress the piles of carbon discs as tension in cam rod 22 is increased. Nut 32' also provides a terminal facility.

A second plate 34, insulated by means of plates 36 and secured to cam rod 22 by means of the nut 38 provides a seat for the spring member 40, the other end of which bears against the plate assembly comprised of plates 26 and 24. This plate 34 also carries the terminals 42.

At the opposite end of my controller member are seated the conducting plates 44 which are insulated from the housing 10 by means of the washers 46. These plates contact the bolts 48 and 48' which, in turn, are insulated from the housing 10 by washers 50, and support the terminals 52 and 52'.

It is to be noted that the terminal plate 18, which functions to partition each of the tubular compartments to provide four independent resistance units is so arranged in slots 54 in the outer periphery of the casing member 10 as to be slidable to some extent with relation thereto.

Secured to the base of my controller element is an insulation plate 56 which is held in place by means of the screws 58. A plurality of contacts 60A to 60G, each of which is threaded through the insulation plate 56 and carries at its outer extremity means 62 for securing a terminal, extend throughout the length of the controller unit and are located in alignment with the axial bore 20.

One wall 64 of the axial bore 20 is provided with a plurality of apertures 66 which are in alignment with the contact members above specified. A series of studs 70 which carry the contact bridge plates 68A to 68F is inserted in each of these bores and normally held in the position illustrated in Fig. 1 by means of the spring 72 which surrounds the stem of the stud 70 and is seated against the inner side of the casing wall.

A contact bridge plate, arranged as just described, is located between each of the contacts and normally retained in a position to maintain an open circuit through the contact members 60. Seated in the apertures 66 and upon the stud members 70 is a ball 73. This ball bears against the external periphery of the camming rod 22 and transmits the camming action of the said rod as it moves axially in its bore to the stud 70 and thus bridges the contacts 60.

The end of the camming rod opposite the plates

24 and 36 is provided with means which may be linked up with some mechanical linkage connected with the customary brake operating pedal.

The operation of my controller unit when utilized in conjunction with a brake pedal will be apparent from the above description and a brief study of the circuit diagrams disclosed in Figs. 5, 6, and 7. In Figs. 4 I have illustrated, somewhat diagrammatically, the controller unit hooked up with a conventional storage battery 74 and an electric motor 76 which latter may be of the type used to provide power for vehicle brakes.

As illustrated, there are four stages of operation of my controller device, thus providing four different resistances which are ordinarily incorporated in the electric circuit during the application of the brakes. The first stage is illustrated by the diagram shown in Fig. 5 wherein each of the carbon pile resistance units is connected up in series with the motor. It will be apparent from inspection of Fig. 5 that the current from battery 74 enters the controller through terminal 48 and flows through the carbon piles Y, Z, X, and W consecutively, thence to contact 60—B and across the bridge plate 68—A to contact 60—A, and finally back through terminal plate 34 and through motor 76 to ground. Upon further movement of the cam rod 22 in the direction of the arrow the cam rod will function to shift the contacts which are bridged by the plates 68 in such a way that the circuit disclosed in Fig. 6 will result. It is obvious from this diagram that there are two parallel circuits, each comprising two carbon pile units, thus dividing the maximum resistance in half. The circuit may be traced in Fig. 6 with little difficulty. From the battery 74 the current flows to the terminal 48, at which point it splits. One of the divisions flows through carbon piles Y and Z to terminal 32', thence to contact 60D, across switch blade 68D to contact 60E, and thence out through terminal plate 34 and through the battery. The other division in the circuit carries the current from terminal 48 to contact 60C, across switch plate 68B to contact 60B and thence through carbon piles W and X to join the other division in the circuit at terminal 32', from which point it flows to the motor as already indicated with respect to the first division in the circuit.

Upon further movement of the cam rod in the direction of the arrow a circuit such as the one illustrated in Fig. 7 will result.

Under these conditions each of the four resistance units is connected up in parallel and the result is that the resistance incorporated in the circuit to the electric motor is but one quarter of the maximum resistance, or the resistance as illustrated in Fig. 5. This circuit may be traced readily from the battery 74 to the terminal 48. At this point the circuit splits to send a portion through carbon pile Y, thence to contact 60F, across switch plate 68E to contact 60E and thence to terminal plate 34. The other split from this point leads to contact 60C at which point there is a secondary split. One of these directs the current across plate 68B to contact 60B, thence through carbon pile W to terminal 17, on to contact 60G, across plate 68F to contact 60F where it again finds the main line to cross plate 68E and thence to the terminal plate 34 and on to the motor. The other portion of the secondary split which occurs at contact 60C directs the current across plate 68C to contact 60D, thence to terminal 32' at which point the circuit divides to go through the carbon piles X and Z re-

spectively to terminals 17 and 19, from which point they are directed back to the contact 60F, across plate 60E etc., on to terminal plate 34, the motor, and ground.

Upon still further movement of the cam rod the contact members 78 will bear upon the contact members 32 and thus all of the carbon pile resistance will be short-circuited, or shunted out of circuit, and the entire flow of current or maximum amperage which may be derived from any given voltage will be permitted to flow to the electric motor 76.

It will thus be seen that I have provided four distinct power values which may be utilized to apply the brakes through an electric motor, or any electro-magnet device, and it is obvious that any number of predetermined resistances may be inserted in the circuit by the means illustrated. As illustrated, it will likewise be noted that during the period in which the respective carbon piles are brought into circuit in various relations of series and parallel each of the carbon piles is being compressed to decrease the resistance in each respective pile. By virtue of this two phase variation, one of which involves consecutive shifts from one circuit to the other and the other of which involves a constant decrease of resistance in each individual unit, a very wide range of electric power transmission is secured. It will be clearly seen that as the tension rod 22 is pulled axially through the controller the spring 40 will be urged against the insulation plate 26 to gradually increase the pressure exerted through plungers 30 upon the carbon piles. Furthermore, the insertion of these resistances is in direct ratio to the pressure exerted upon the foot pedal of the vehicle by reason of the cam rod being directly actuated by some mechanical connection with the brake pedal itself against increasing tension in spring 40. By making spring 40 as powerful or as light as desired, a corresponding powerful or light effort exerted on the brake pedal will produce the same ratio of applied force to the brakes.

It will be readily understood that the camming action produced by the axial sliding movement of rod 22, and consequent making and breaking of the various switches, may be utilized to establish any desired circuits, reverse circuits, etc., as well as to vary the manner in which resistance units are included in the circuit.

Having illustrated a preferred embodiment of my invention various other modifications will become apparent to those skilled in the art and for that reason I intend to limit myself only within the scope of the appended claims.

I claim:

1. Control means for an electric brake circuit comprising a casing having a plurality of insulated casings, carbon discs in each of the said casings, each of said tubular casings being open at one end and seating a plunger therein, terminal contacts carried by each of said plungers, terminal contacts arranged at the opposite extremity of each of said piles of carbon discs, a plurality of make and break contacts extending along the length of said casing, a cam shaft axially slidable through said casing and adapted to draw said plungers in unison therewith, and means controlled by the axial movement of said cam shaft for opening and closing the make and break contacts whereby the circuit relationships between said carbon piles is varied.

2. Control means for an electric circuit comprising a casing having a plurality of open ended

tubular insulation members, a pile of carbon discs in each of said tubular members, contact terminals at the closed end of each of said tubular members, a cam rod slidable axially of said casing, plungers secured to said cam rod and adapted to slide axially of said tubular members, terminal contacts carried by each of said plungers, a plurality of contact members extending throughout the length of said casing, a plurality of apertures within said casing in alignment with said contact members, said apertures extending through to the cam shaft, balls seated in each of said apertures bearing upon said cam shaft, a plurality of contact bridge members seated on said balls and contact bridging members, and means for retaining said ball and contact bridging members normally spaced from said contacts.

3. A control member for an electric circuit comprising a casing, a plurality of independent carbon piles supported within said casing, a tension rod slidable axially through said casing, a plurality of switch elements in said casing operable to include the resistance units in circuit in various arrangements of series and parallel, means constituting a portion of said tension rod cooperable with said switch elements to actuate the same on movement of the rod, and means associated with

said rod responsive to axial movement of the rod to increase the pressure in said carbon piles.

4. Control mechanism for an electric circuit comprising a casing, a plurality of carbon pile resistance units supported therein, a tension rod axially slidable through said casing, switch elements axially spaced within said casing responsive to movement of said tension rod to include said carbon piles in circuit in different arrangements of series and parallel, and means operable on movement of said rod to vary the compression within each of said piles.

5. A control member for an electric circuit comprising a casing, a plurality of independent resistance units supported within said casing, a tension rod slidable through said casing including a plurality of longitudinally spaced cam faces, a plurality of movable switch blades positioned in said casing at longitudinally spaced intervals corresponding to said cam faces and in operative relation thereto, said switch blades being operable upon actuation by said cam faces to include said resistance units in circuit in various arrangements of series and parallel.

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