H. KAETKER.

ELECTRIC CURRENT CONTROLLER.

APPLICATION FILED OCT. 8, 1909.

1,037,016.

Patented Aug. 27, 1912.

2 SHEETS—SHEET 1.

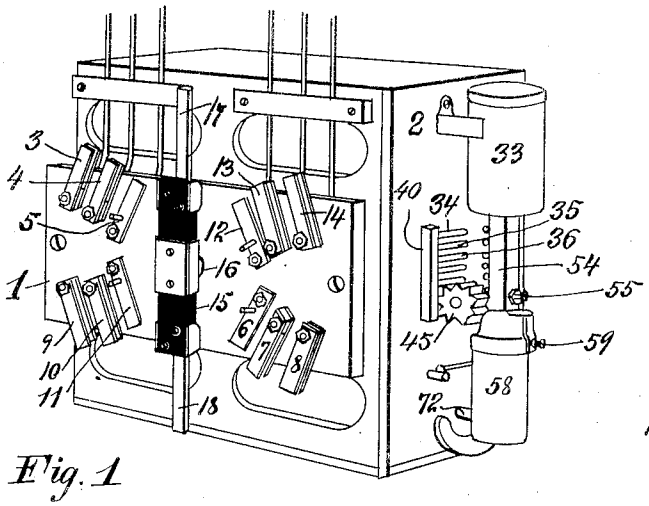
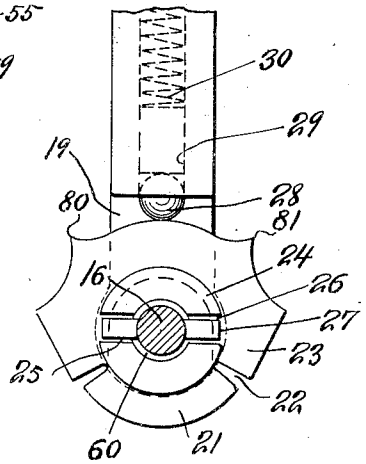


Fig. 1

Fig. 4



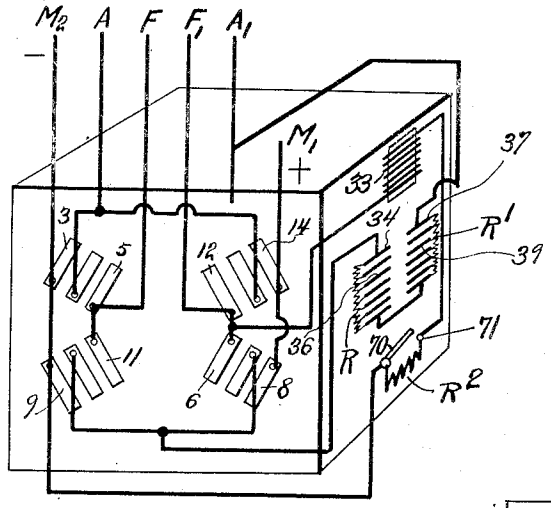


Fig. 2

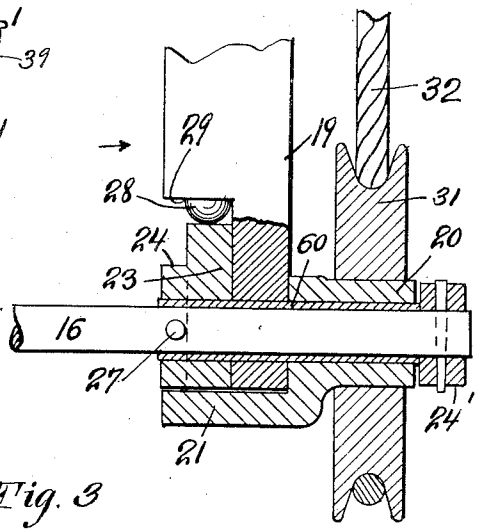


Fig. 3

Witnesses
Thomas Howe
[illegible]

Henry Kaetker Inventor
By his Attorneys
[illegible]

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2 SHEETS—SHEET 2.

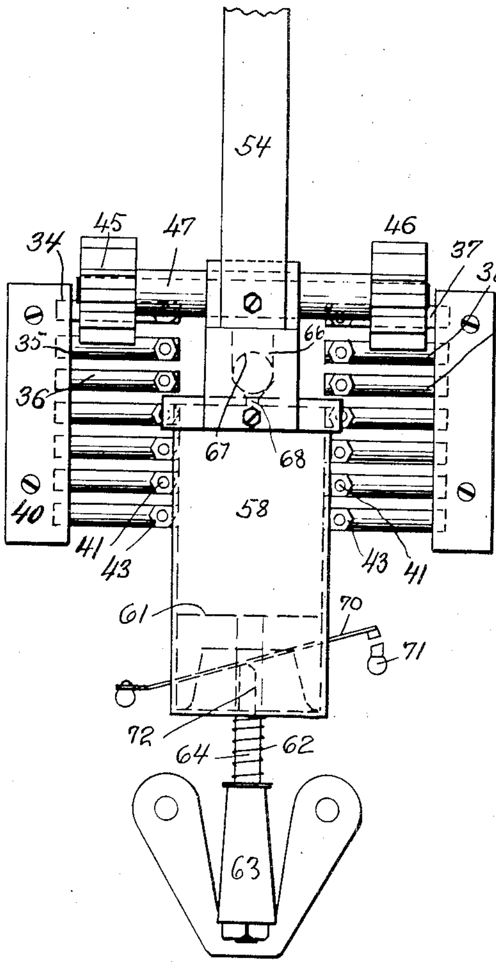

Fig. 5.

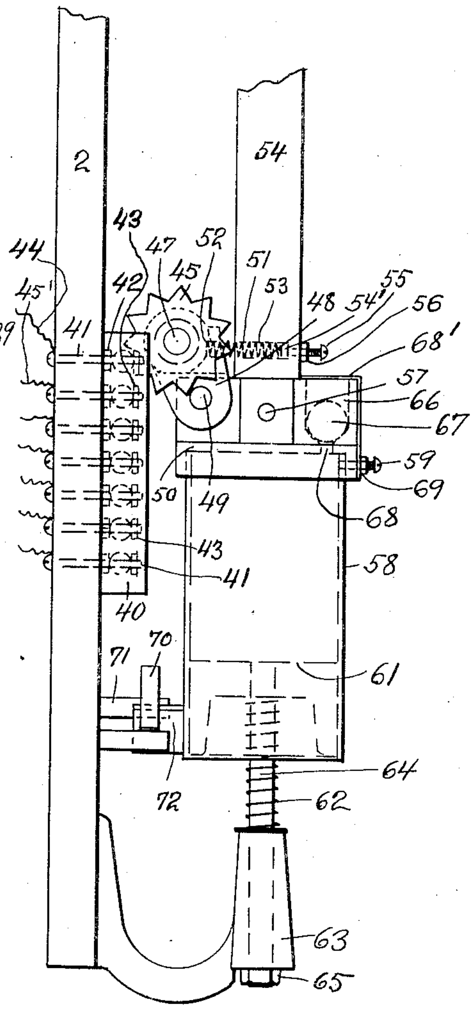

Fig. 6

Witnesses
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By his Attorneys
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UNITED STATES PATENT OFFICE.

HENRY KAETKER, OF CINCINNATI, OHIO.

ELECTRIC-CURRENT CONTROLLER.

1,037,016. Specification of Letters Patent. Patented Aug. 27, 1912.

Application filed October 8, 1909. Serial No. 521,760.

To all whom it may concern:

Be it known that I, HENRY KAETKER, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Electric-Current Controllers, of which the following is a full, clear, and exact specification.

This invention relates to electric current controllers.

The general object of the invention is to provide apparatus of the character described which shall have a minimum number of parts, be compactly arranged, be durable and operate efficiently.

Specifically, one object of the invention is to provide rack and pinion contacts, wherein the current will not pass between a pinion and its bearing, thereby reducing the resistance in circuit and preventing damage of the bearing and destruction of the lubrication by arcing or heating where large currents are employed.

A further object of the invention is to so construct the rack contacts that they will be prevented from injury, will be prevented from accidentally contacting with extraneous bodies, will be securely held in position and easy to assemble, dissemble and electrically connect.

A further object of the invention is to provide improved means for regulating the operation of the moving parts, whereby the speed of such parts is modified and shocks and jars are prevented.

Other objects of the invention will appear hereinafter.

In the accompanying drawings, which illustrate the invention, Figure 1 is a perspective view of apparatus embodied in the invention. Fig. 2 is a diagram showing the electric circuits thereof. Fig. 3 is a central longitudinal section of the operating mechanism for the reversing switch contacts. Fig. 4 is an end view of the apparatus shown in Fig. 3 looking in the direction of the arrow. Fig. 5 is a front elevation of the rack and pinion contacts with mechanism for regulating the movement thereof. Fig. 6 is a side elevation of the apparatus shown in Fig. 5.

Referring to drawings, the structure there shown comprises a box-like structure suitable for inclosing the resistances of the controller, or other parts, which includes the insulating slabs 1 and 2, upon which electrical connections are mounted. Upon the slab 1 are mounted the stationary contacts of the starting, stopping and reversing switch. These stationary contacts consist of the clips 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14. The movable member of this switch consists of an insulating block 15, fixed to the shaft 16, and carrying at its ends the conducting knife blades 17 and 18, which are adapted to engage with the stationary clip contacts before referred to. As shown in the drawing the switch is in open or off position, the movable switch member being in its central position and the knife blades being out of engagement with any of the switch clips. When the movable switch member is turned in one direction from the position shown in the drawing, the movable knife blade 17 will come into engagement with and connect together the clips 3, 4, and 5, and at the same time the knife blade 18 will engage with and connect together the diagonally opposite clips 6, 7 and 8. In a similar way, if the switch member is turned in the other direction from its central position the knife blade 17 will engage with and connect together the clips 12, 13 and 14, while at the same time the knife blade 18 will connect together the clips 9, 10 and 11.

The shaft 16 to which the movable member of the switch is fixed, extends through the box before referred to and upon the opposite side of the box from the switch member is located the means for securing proper movement of the shaft. This apparatus comprises a suitable support 19 within which the shaft 16 is rotatably mounted. On the outside of the support 19 a sleeve 20 is rotatably mounted upon the shaft 16 and from this sleeve a projection 21, which is integral with the sleeve 20, extends into a recess 22 formed in the cam 23. A collar 24' pinned to the outer end of the shaft 16 serves to maintain the parts in proper position. The cam 23 is rotatably mounted upon the shaft 16 and is upon the opposite side of the support 19 from the sleeve 20. A boss 24 extends from the cam 23, and in this boss are slots 25 and 26 adapted to receive the pin 27 which extends through the shaft 16. The pin and slots are of such relative size that there is a lost motion between the two. Bearing upon the periphery of the cam 23 is a plunger 28, which may take the form of a hardened steel ball, this plunger being guided in a socket 29 formed in the support

19, said plunger being pressed toward the cam by a spring 30. This spring-pressed plunger operates upon the cam to fix the positions of the switch arm and to move that arm quickly from one position to another. Preferably, a bushing 60 surrounds the shaft 16. The apparatus shown is especially adapted for controlling the motors of electric elevators and as a convenient means for operating the shaft 16, and the switch arm carried thereby. As shown, this means comprises a sheave 31 around which passes a rope 32 which may extend into the elevator car so as to be within convenient reach of the operator.

As is well known, it is desirable in starting most motors to graduate the current supplied to them. In the present case this graduation is effected by means of a resistance which is inserted in the circuit at the start, and is gradually cut out of the circuit as the motor speeds up. The regulation of the resistance is accomplished by means of an electromagnet 33 which is suitably supported upon slab 2. The contacts whereby varying amounts of resistance are included in the armature circuit of the motor, are of the rack and pinion type. Two racks are shown, one rack comprising a series of copper rods 34, 35, 36, and so forth, and the other comprising a series of copper rods 37, 38, 39 and so forth. The copper rods of the set comprising the bars 34, 35, 36, and so forth, are supported in a bar 40 of insulating material such as fiber, which is securely fastened at each end to the slab 2 by screws, each of the bars having one end inserted within the bar 40. Each of the copper rods is securely held in the insulating bar by means of bolts or screws as 41, each of which extends through the slab 2 and passes through one of the rods of the rack and is clamped thereto by nuts 42 and 43, one on each side of the rod. It will be noted that in thus securing the copper rods of the rack in the insulating bar the whole is securely fastened to the slab 2. The electrical connections are made from the rods of the rack through the screws 41 to conductors 44, 45′, etc., which are entered underneath the heads of the screws at the back of the slab 2. The rack comprising the rods 37, 38 and 39 is mounted and secured in a precisely similar manner to that described in connection with the other rack. Both racks are, however, arranged so that the insulating supporting bars are at the outside, while the copper rods extend inwardly therefrom, the other and inner ends of the copper rods being fastened by screws as 41 and nuts 42 and 43. In order that the desired electrical connections can be established with the copper rods, conducting pinions 45 and 46 are adapted to roll over the respective racks and to make successive contact with the copper rods thereof. These pinions have a common spindle or shaft 47 of conducting material to which the pinions are fixed and this shaft is rotatably mounted in an arm 48, which is pivoted at 49 to a cap 50. The arm 48 is pressed by a spring 51 toward the racks so that good contact between the racks and pinion will be secured, this spring entering within a socket 52 in the arm 48, and a socket 53 in the rod 54 which is connected with the plunger of the solenoid 33. The solenoid and plunger may be of any suitable construction, as is well understood. The tension of the spring 51 is rendered adjustable by a screw 55, which passes from the front side of the rod 54 into the bottom of the socket 53, where it engages block 54′ serving as a bearing for the spring. Any particular adjustment of the spring tension may be fixed by means of a lock nut 56.

The cap 50 is fixed to the end of the plunger rod 54 by means of a pin 57 and forms a head for a dash pot cylinder, this cylinder being formed by entering one end of the sleeve 58 within a recess in the bottom of the cap and securing it therein by means of set screws 59. The dash pot piston 61 is adapted to slide within the cylinder 58, with a tight fit, and the piston rod 62 is adapted to slide through a support 63, which is supported by the slab 2. A spring 64 tends to maintain the piston in an elevated position, while the upward movement is limited by a nut 65 screwed upon the piston rod and located below a support 63. In the head 50 is a valve chamber 66, within which is a ball valve 67 controlling a port 68 leading into the interior of the dash pot cylinder. The construction of the valve is such that when the ball is seated a very slight amount of air may enter through the port 68, so that the dash pot member 58 and the contact pinions connected thereto, can move upwardly only at a slow rate under the pull of the solenoid. When, however, the plunger and contacts are descending the air can pass through the valve quite freely so that the downward movement of the pinions may be more rapid. In order that the ball 66 may not jump out of the valve chamber a cover 68′ is provided for the same which may take the form of the angular plate shown, one leg of which extends over the valve chamber, and the other leg extends down alongside the head and may be secured by a nut 69 upon one of the screws 59.

For the purpose hereinafter set forth a spring contact 70 is mounted upon the slab 2 and is adapted to engage with the stationary contact 71 also mounted upon the slab 2. From the cylinder 58 a projection 72 extends beneath the spring contact 70. When the dash pot cylinder is in its lowest position the projection 72 will be out of engagement with the contact 70 and by reason

of its elasticity the contact 70 will be in engagement with the contact 71. When, however, the dash pot cylinder is near its uppermost position the projection 72 comes into engagement with the contact 70 and, lifting it, breaks the connection between it and the contact 71.

Referring to Fig. 2, the conductors M_1 and M_2 lead respectively to the plus and minus sides of the supply circuit. The conductors A and A_1 lead respectively to the terminals of the motor armature, and the conductors F F_1 lead respectively to the terminals of the shunt field. Of course where it is thought advisable to use a series field, either alone or in conjunction with the shunt field, such an arrangement would be readily availed of in a well known manner. In this Fig. 2 the starting resistance for the motor is indicated at R R^1 while the resistance R^2 is connected between the contacts 70 and 71 for a purpose as will hereinafter appear.

The operation of the apparatus may now be set forth as follows: With the parts in the position as shown in Fig. 1, if the movable member of the reversing switch is thrown so that the blade 17 engages with the clips 3, 4 and 5, these clips will be connected together, as will also the clips 6, 7 and 8. This will operate to connect the conductors F and F_1 from the shunt field of the motor, respectively, to the supply conductors M_1 M_2. The one terminal of the armature will be connected through the conductor A_1, the resistance R′ and R with one of the supply mains as M_1, while the conductor A from the other terminal of the armature will be connected with the other supply conductor as M_2. Also, the solenoid 33 will have one terminal connected with one of the supply conductors as M_1, while the other terminal of the solenoid will be connected through the switch contact 70 with the other supply conductor as M_2. The solenoid 33 being energized, the plunger 54 will be drawn upwardly, its movement being regulated by the dash-pot, and the pinions 45 and 46 will roll upon their respective contact racks and make successive engagement with the successive rods of the racks as the plunger moves upwardly. This will operate to reduce the resistance included in the armature circuit, and permit the voltage applied to the armature terminals to be gradually increased in a manner as is well understood. When the pinions 45 and 46 are in engagement with the rack contacts 34 and 37 all of the armature resistances R, R′ will be short-circuited, and the armature will be connected directly to the supply conductors. As the pinions 45 and 46 near their uppermost position the contacts 70 and 71 will be separated, as before described, and the resistance R^2 will be inserted in series with the solenoid. It will be thus seen that the full voltage of the supply conductors is applied to the terminals of the solenoid at the start when the greatest magnetomotive force is required, and by the insertion of the resistances R^2, after the plunger has been raised to its uppermost position, heating of the solenoid is prevented, and still sufficient magnetomotive force is provided to maintain the plunger in its uppermost position. When it is desired to stop the motor the movable member of the switch is thrown in the position as shown in Fig. 1 when the circuits of the armature and field of the motor and of the solenoid 33 are broken. When the circuit of the solenoid is broken, the plunger with its pinions will descend to their lowermost position, as shown in Fig. 1, in readiness for another starting operation. In its descent the plunger and the portion of the dash-pot connected thereto may come against the piston 61. If this piston were rigidly mounted, shock or breaking of the parts might occur. According to the present invention, however, the cushioned mounting of the piston prevents this. With the parts in the position as shown, if it be desired to operate the motor with the opposite direction of rotation from that obtained with the connections just described, the movable member of the reversing switch will be thrown in the opposite direction, and the knife-blades 17 and 18 come respectively into engagement with the groups of contacts formed on the one hand by the clips 9, 10 and 11, and on the other by clips 12, 13 and 14. Thus, connections and operations will be similar to those before described in connection with the opposite direction of rotation, except that the currents through the armature and field will be relatively reversed.

To refer more particularly to the operation of the apparatus by which the movable switch members are operated, in the position of the switch member as shown in Fig. 1, the plunger 28 will rest upon the middle portion of the cam 23, as shown in Fig. 4. When the sleeve 20 and projection 21 are turned, say, in a clock-wise direction, as viewed in Fig. 4, the projection 21 will come upon the left-hand shoulder upon the cam 23 which will turn therewith. This last cam will turn without moving the movable switch member from its central position until the lost motion between the pin 27 and the boss 24 is taken up, when the shaft 16 and the switch member thereon will turn with the members 20, 21 and 23, until the plunger 28 has mounted upon and just passed the left-hand projection 80 upon the cam 23. The pressure of the plunger will

then cause the cam 23, the shaft 16 and the switch member to move quickly, and the knife blades 17 and 18 will be driven quickly into their respective clips, the lost motion between projection 21 and cam 23 permitting this. The plunger 28 will then rest in the hollow of the cam at the left of the point 80, and hold the switch in the position to which it has been turned. In opening the switch, the operation is the reverse. If it be desired to close the switch in a reverse direction of operation, the parts being in the position shown in Figs. 1 and 4, the cam 23 will be turned in a counter-clock-wise direction through the instrumentality of the sleeve 20 and projection 21, the projection 21 coming against the right-hand shoulder of the cam 23, the lost motion between the pin 27 and the boss 24 will be taken up, the shaft 16 and movable switch arm will be moved with the cam 23, the plunger 28 will mount the projection 81, and upon passing the same will quickly throw the switch blades into contact with the clips. When the plunger rests in the cam hollow at the right of the point 81, the switch will be held in this position to which it has been turned. In returning the movable switch member to its off position from its position of contact in either direction of rotation of the motor, the circuit will be quickly broken by a sudden withdrawal of the switch blades from the switch clips, by reason of the action of the spring pressed plunger 28 upon the cam point 80 or 81, according to the direction in which the switch is thrown.

The parts are so constructed and arranged that after the projection 21 has moved in either direction a sufficient amount to cause the switch blades to enter the clips to the desired extent, it will come against the support 19 so that no effort of the operator in pulling on the rope can move it farther. It is thus impossible for the operator to force the blades against the bases of the clips and the liability of derangement or breakage of the apparatus, which would otherwise exist, is avoided.

While the invention has been illustrated in what is considered its best embodiment, it may be embodied in other structures without departing from its spirit, and is not therefore limited to the structure shown.

What I claim is:

1. In an electric current controlling apparatus, the combination with a slab, of stationary contacts mounted thereon, an electromagnet comprising a solenoid and a plunger, movable contacts adapted to engage with said stationary contacts and movable with said plunger, a dash pot for regulating the movement of said plunger, the cylinder of said dash pot being secured to said plunger, a bracket secured to said slab having a hole through which the piston rod of said dash pot is adapted to slide, and a spring interposed between said piston and said bracket.

2. In an electric controlling apparatus, the combination with a slab of an electromagnet mounted thereon, comprising a solenoid and a plunger, contact racks upon said slab, and parallel to the direction of movement of said plunger, a plurality of conducting pinions adapted to engage with said racks, a shaft on which said pinions are mounted, an arm having pivoted connection with said plunger, said shaft being rotatably mounted at one end of said arm, a spring adapted to press said pinions toward said racks, a dash pot for regulating the movement of said plunger, one of the members of said dash pot being carried by said plunger, and the other by said slab, and a spring interposed between the dash pot member carried by said slab and its support, and electrical circuit connections for forming a circuit through said racks, pinions and shaft independent of said arm.

3. In an electric controlling apparatus, the combination with movable and stationary contacts, of a movable member upon which said movable contacts are mounted, a dash pot for regulating the speed of said movable member, said dash pot being adapted to retard movement in one direction more than in the other, and means adapted to cushion said dash-pot and movable member when they are moved in the direction in which said dash-pot exerts the less retardation.

In testimony whereof I affix my signature, in presence of two witnesses.

HENRY KAETKER.

Witnesses:

A. L. HERRLINGER,

EDW. T. DIXON.