T. W. THOMAS.

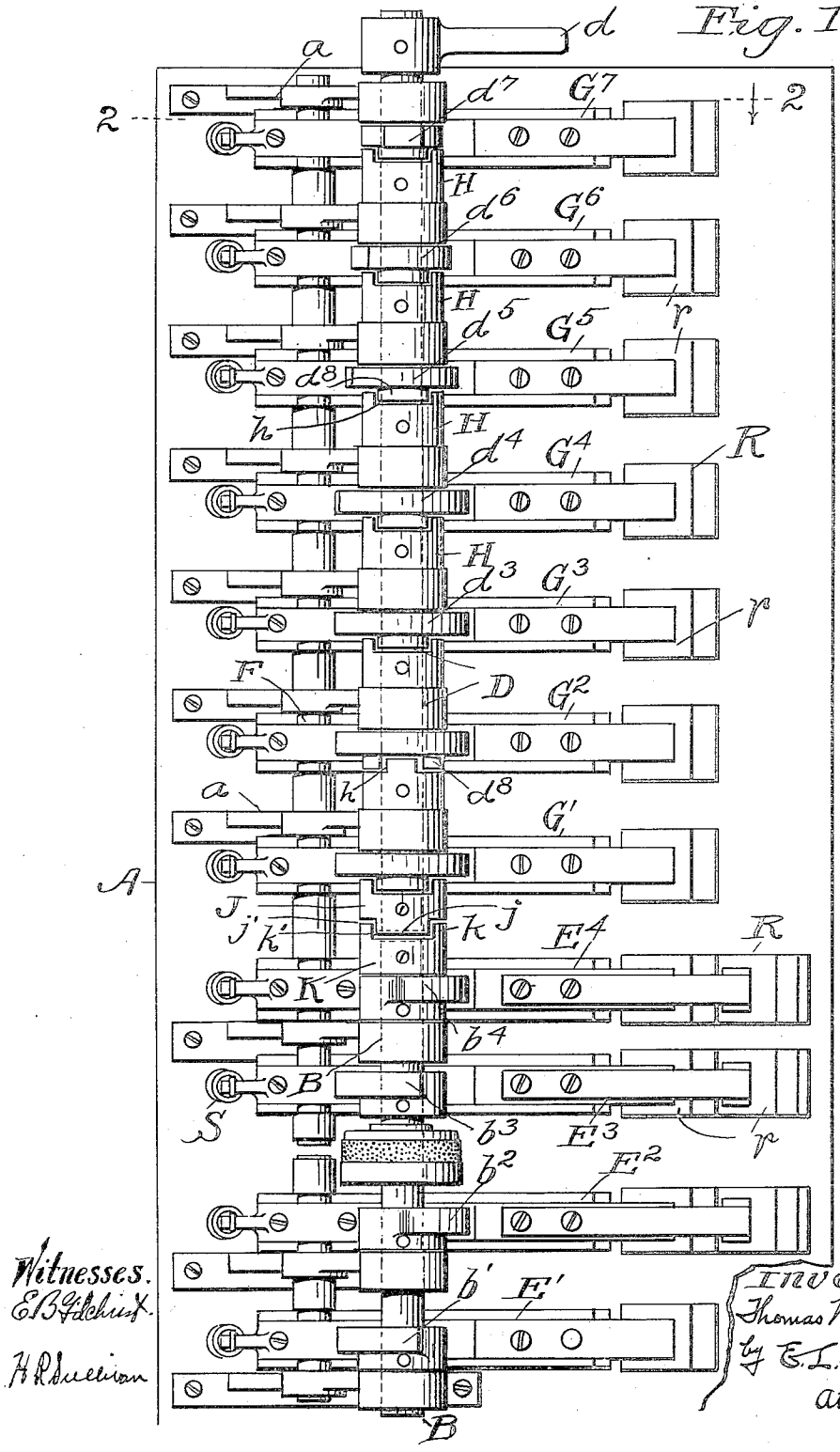
QUICK BREAKING ELECTRIC SWITCH MECHANISM.

APPLICATION FILED FEB. 4, 1910. RENEWED JAN. 29, 1912.

1,021,016. Patented Mar. 26, 1912.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

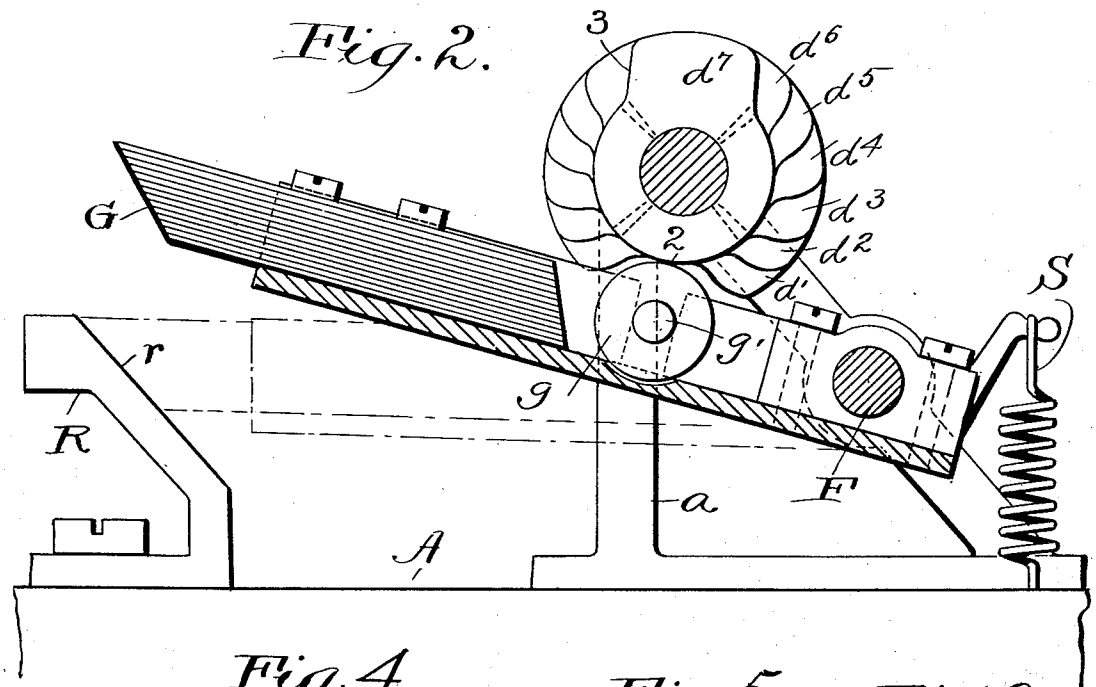


Fig. 4.

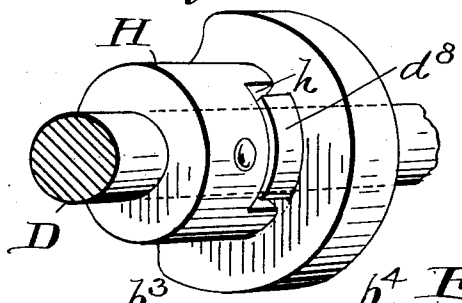


Fig. 5.

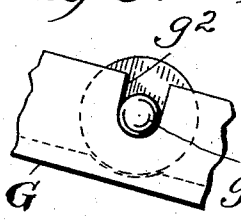


Fig. 6.

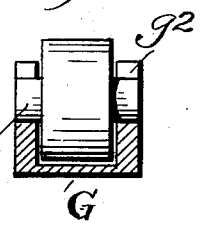
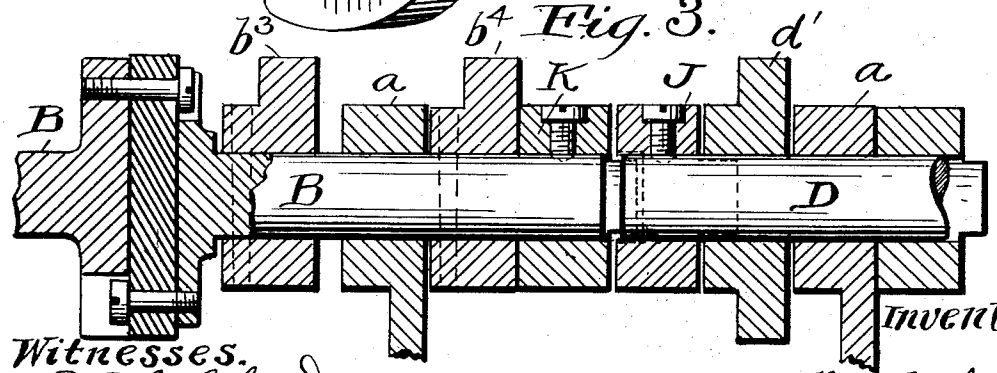


Fig. 3.



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UNITED STATES PATENT OFFICE.

THOMAS WARREN THOMAS, OF CLEVELAND, OHIO, ASSIGNOR OF NINETY ONE-HUNDREDTHS TO HOLLEY G. WELLMAN, OF CLEVELAND, OHIO.

QUICK-BREAKING ELECTRIC-SWITCH MECHANISM.

1,021,016. Specification of Letters Patent. Patented Mar. 26, 1912.

Application filed February 4, 1910, Serial No. 542,106. Renewed January 29, 1912. Serial No. 674,200.

To all whom it may concern:

Be it known that I, THOMAS W. THOMAS, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Quick-Breaking Electric-Switch Mechanism, of which the following is a full, clear, and exact description.

The object of this invention is to provide a quick breaking electric switch, particularly suitable for use as a part of an electric controller on cars driven by electric motors; and also to provide such a combination of such switches and their operating mechanism as to constitute an exceedingly cheap, simple and efficient controller for the described use.

The invention consists in the combinations of parts shown in the drawing, and hereinafter described and pointed out definitely in the claims.

Figure 1 represents an elevation of a controller embodying the invention. Fig. 2 represents a transverse sectional view taken in the plane indicated by line 2—2 on Fig. 1. Fig. 3 is a longitudinal sectional view of a part of the adjacent ends of two shafts employed in the device. Fig. 4 is a perspective view showing the operative connection between the shaft D and a typical cam thereon. Fig. 5 is a side view of that part of one of the switch levers which carries the friction roller; and Fig. 6 is a transverse sectional view of one of the switch levers, the section passing through the bearing of the switch roller thereof.

The apparatus, arranged to constitute an electric street car controller, includes a base A and a plurality of brackets *a* fixed thereto. In these brackets two alined shafts B and D are rotatably mounted. The shaft B is made of two parts which are insulated from each other by the insulating disk to which the two parts of said shaft are connected. The shaft B is formed of two insulated sections in order to avoid short-circuiting some part of the motor winding or windings. In this case the positive and negative connections of the motor armature are designed to be controlled by two switch levers which are actuated by cams carried by shaft B, one of the switch levers and its cam being on one side of the insulating disk and the other switch lever and its cam being on the opposite side of said disk. Four cams b', b^2, b^3, b^4, adapted for severally operating the switch levers E′, E², E³, E⁴, are fixed to said shaft B, two cams to one part and two to the other part of said shaft. On the shaft D several cams are loosely mounted, said cams being indicated by d', d^2, d^3, d^4, d^5, d^6, d^7, which cams are respectively associated with the switch levers G′, G², G³, G⁴, G⁵, G⁶, G⁷. The shaft D is the operating shaft; and the operating handle *d* is fixed to it.

The switch levers in both series referred to are alike. They are all hung on the rod F, which is parallel with the shafts B and D, and is supported in the brackets *a*, *a*. The front end of each lever has a longitudinal channel in which are secured a plurality of copper plates G, the front ends of which are beveled to correspond with the beveled contact face *r* of the associated fixed contact bracket R. A roller *g* lies between the sides of the channeled lever; and the trunnions g' of said roller are set in U-shaped notches g^2 in the upper edges of the sides of the lever. Each roller is adapted to be engaged by one of the cams referred to. A spring S is connected with the rear end of each switch lever in both series, and said spring acts to draw said rear end downward, whereby the roller *g* is held against the operative face of the associated cam, with the contact plates G as far removed as possible from the associated contact bracket R.

All of the cams of the *b* series are fixed to the shaft B, and are arranged thereon so that as said shaft is turned they operate in the desired sequence upon the associated levers E′ to E⁴. The switch levers E′ and E⁸ are those which, when moved to the closed position, connect the motor in a circuit which includes all of the resistance which the apparatus employs, and in such manner as to drive the motor in the forward direction. These two levers are closed and opened simultaneously and they control what may be called the first speed forward. The levers E³, E⁴ control in like manner the first speed backward, and the cams b^2, b^4, which operate these switch levers, are so placed on the shaft that they operate them

simultaneously. When the shaft B is turned in one direction, the levers E′, E³ are closed; and when said shaft is turned in the opposite direction from the neutral point the levers E², E⁴ are closed.

As previously stated, the power to turn shaft B is applied to shaft D, and the torque transmitting connection between these two shafts is such that each is permitted a limited rotary movement independent of the other. This is due to the fact that the connection between them is by means of a jaw clutch or its equivalent, which jaw clutch includes a collar K fixed to the shaft B and provided with projecting jaws *k* and intermediate recesses *k′*; and a collar J fixed to shaft D having jaws *j* and intermediate recesses *j′*. The jaws of each collar project into the recesses of the other collar, but said jaws are shorter than the distance between the ends of the recesses, as shown, so that, as stated, each shaft is permitted a limited rotary movement independent of the other. This limited movement is of no particular consequence, good or bad, when the shaft is being turned to close the switch levers, but it is essential to the desired operation when the shaft D is turned in the direction which will cause the opening of said switch levers.

All of the cams in the *b* series and the *d* series are alike in that each has a raised portion 1 and a depressed portion 2, and that these portions are united by surfaces which are as abrupt as the circumstances will permit. The cams of the *d* series differ from each other in that the raised portions are of different circumferential lengths. Each of the cams in the *d* series is, as stated, loosely mounted on the shaft D and each is connected with the shaft by a jaw clutch similar to that which connects the two shafts. That is to say, that each cam has jaws d^8 which project into recesses *h* in a collar H fixed to the shaft. When all of the switches are open, the cams d^2 to d^7, inclusive, have their raised portions extending equal distances to both sides of the same radial plane.

The switch G′ is that which connects the apparatus with the source of electric current. Its raised portion is longer circumferentially than any of the others, and therefore when the shaft D is turned in either direction the switch lever G′ is first moved down into contact with its associated contact bracket R. The next switches to be moved by reason of the placing of the cams are either the two switches E′, E³, or the two switches E², E⁴, depending upon the direction in which the shaft D is turned. Then, as the shaft D continues to turn the switches G², G³, G⁴, G⁵, G⁶, G⁷, will be closed in that order. The closing of these switches has the effect only of cutting out resistance sections from the motor circuit. Now, to open the switches the shaft is turned in the opposite direction, and they will open in precisely the reverse order. As soon as any cam is turned so as to carry its high part out of engagement with the associated roller *g* and one of the abruptly inclined surfaces 3 into engagement therewith, the associated spring S will abruptly swing the lever to the position shown in Fig. 2, and will do that even if the shaft D be stopped when it has carried the cam to the position described, because the switch lever, as soon as it is permitted to be moved by its spring, will move and by engaging with the beveled surface 3 of the cam will turn it on the shaft D as far as may be necessary, which movement is possible because of the permissible independent movement of the cam upon said shaft. The instantaneous movement of the switches in the opening direction is not, therefore, dependent upon the rapid turning of the shaft D. It may be turned just as slowly as possible, but when any cam has been carried to the position stated, the lever G, under the influence of its spring will move to the opening direction and will turn the cam back in so doing. The levers of the G series will all be opened before shaft D has turned shaft B backward far enough to bring to the switch lever releasing position the two cams of the *b* series thereon which were in use to close the switch levers. When, however, these cams are moved so as to carry their inclined faces 3 in contact with the associated rollers on the switch levers, these levers will fly open and, by their action upon the inclined faces of the associated cams, will turn shaft B backward.

If the shaft D be turned in the opposite direction to produce the backward turning of the motor the cams being symmetrical, as stated, will operate in precisely the same order as before described, except that it will be the pair of levers E², E⁴, which will be closed instead of the levers E′, E³. All the other levers will be closed by their cams in the order stated, and will subsequently be opened abruptly in the order stated by the backward turning of shaft D, however slowly it may turn.

It has not been thought necessary to show diagrammatically the various circuits which are controlled by the several switches. The manner of forming these circuits to suit the requirements of the work in hand is thoroughly well understood, and need not differ in any essential respect from the circuits controlled by the controllers heretofore produced.

It has not been thought necessary here to describe the advantages which come from electric controller mechanism in which the circuits are broken abruptly irrespective of the speed at which the operator moves his control lever. That is also well understood in this art.

It will be understood that the specific embodiment of the invention shown is not essential to the generic invention, as set forth in the claims. While it is essential that the several cams and the principal operating shaft shall be capable of a slight independent rotary movement, the particular form of clutches shown is not essential to permitting this mode of action. So also the form and specific arrangement of many of the described parts may be varied without departure from the invention as defined by the claims.

Having described my invention, I claim:

1. In a quick breaking electric switch, the combination of a rotatable operating shaft, a switch lever pivotally supported independently of said shaft and adjacent thereto, a spring for moving the lever in one direction, a cam rotatably mounted on said shaft for actuating said lever to close the switch, and a torque-transmitting mechanism intermediate of said shaft and cam, which permits a limited rotary movement of the cam on the shaft.

2. In a quick breaking electric switch, the combination of a rotatable operating shaft, a switch lever pivotally supported independently of said shaft but adjacent thereto, a spring for moving the lever in one direction to close the switch, a cam rotatably mounted on said shaft for moving the lever in the opposite direction to close the switch, and a collar fixed to said shaft, the approximate faces of said collar and the hub of the cam having respectively a recess, and a jaw which enters said recess, the length of the jaw being less than the distance between the ends of the recess, whereby the cam has a limited rotary movement on the shaft.

3. In a quick breaking electric switch, the combination of a rotatable operating shaft and an alined shaft, together with a torque-transmitting mechanism between said shafts which permits a limited rotary movement of the alined shaft relative to the operating shaft, a series of cams on said operating shaft having switch closing portions of different arcuate lengths, a series of switch levers arranged adjacent said cams and adapted to be operated successively thereby, a plurality of cams on said alined shaft and having switch closing portions of equal arcuate lengths, and switch levers arranged adjacent said last named cams and adapted to be operated simultaneously thereby.

4. In a quick breaking electric switch mechanism, the combination of two electric switch levers, springs for moving the same in one direction, a rotatable operating shaft, an alined rotatable shaft composed of two parts rigidly connected but insulated from each other, two cams respectively fixed to the two parts of said shaft for operating the two switch levers, and a torque-transmitting mechanism intermediate of said shafts which permits a limited rotary movement of the cam-bearing shaft relative to the operating shaft.

5. In an electric controller, the combination of an operating shaft, a plurality of cams loosely mounted thereon, torque-transmitting mechanisms intermediate of said shaft and cams, which mechanisms permit independent movement of the cams short arcual distances relative to said shaft, a plurality of switch levers adapted to be respectively operated by said cams, springs for moving said levers in one direction, and fixed contact plates adapted to be engaged by the several switch levers.

6. In an electric controller, the combination of an operating shaft, a plurality of cams loosely mounted thereon, torque-transmitting mechanisms intermediate of said shaft and cams, which mechanisms permit independent movement of the cams short arcual distances relative to said shaft, a plurality of switch levers adapted to be respectively operated by said cams, springs for moving said levers in one direction, fixed contact plates adapted to be engaged by the several switch levers, a rotatable shaft which is alined with the operating shaft and is composed of two parts which are rigidly connected but insulated from each other, torque-transmitting mechanism intermediate of said shafts which permit a limited rotary movement of the latter shaft relative to the operating shaft, two cams fixed to each part of the latter shaft, four spring actuated switch levers adapted to be operated by said cams, and contact brackets adapted to be engaged by said switch levers.

7. In an electric controller, the combination of an operating shaft, a plurality of cams loosely mounted thereon, which cams have high parts of different arcual lengths, and are so arranged that the high parts of all the cams project substantially equal distances on both sides of the same radial plane, torque-transmitting mechanisms intermediate of said shaft and cams, which mechanisms permit independent movement of the cams short arcual distances relative to said shaft, a plurality of switch levers adapted to be respectively operated by said cams, springs for moving said levers in one direction, fixed contact plates adapted to be engaged by the several switch levers, a rotatable shaft which is alined with the operating shaft and is composed of two parts which are rigidly connected but insulated from each other, torque transmitting mechanism intermediate of said shafts which permit a limited rotary movement of the latter shaft relative to the operating shaft, two cams fixed to each part of the latter shaft, four spring actuated switch levers adapted

to be operated by said cams, and contact brackets adapted to be engaged by said switch levers.

8. In a quick breaking electric switch, the combination of an operating shaft, a cam loosely embracing the same, torque transmitting mechanism intermediate of said cam and shaft which permits a limited rotary movement of the cam on the shaft, a pivoted switch lever carrying a friction roller for engagement with said cam, a spring operating on the lever to hold said roller in engagement with the cam, said lever being channeled in the upper surface of its front end, and a plurality of superposed contact plates secured in the channeled end of said lever and having their ends beveled, and a fixed contact bracket having a beveled surface for the engagement of the beveled ends of said plates.

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

THOMAS WARREN THOMAS.

Witnesses:

H. R. SULLIVAN,

WM. A. SKINKLE.