No. 675,293. Patented May 28, 1901.

O. H. & A. F. PIEPER.

CONTROLLER FOR ELECTRIC MOTORS.

(No Model.) (Application filed Aug. 27, 1898.)

2 Sheets—Sheet 1.

Fig. 1.

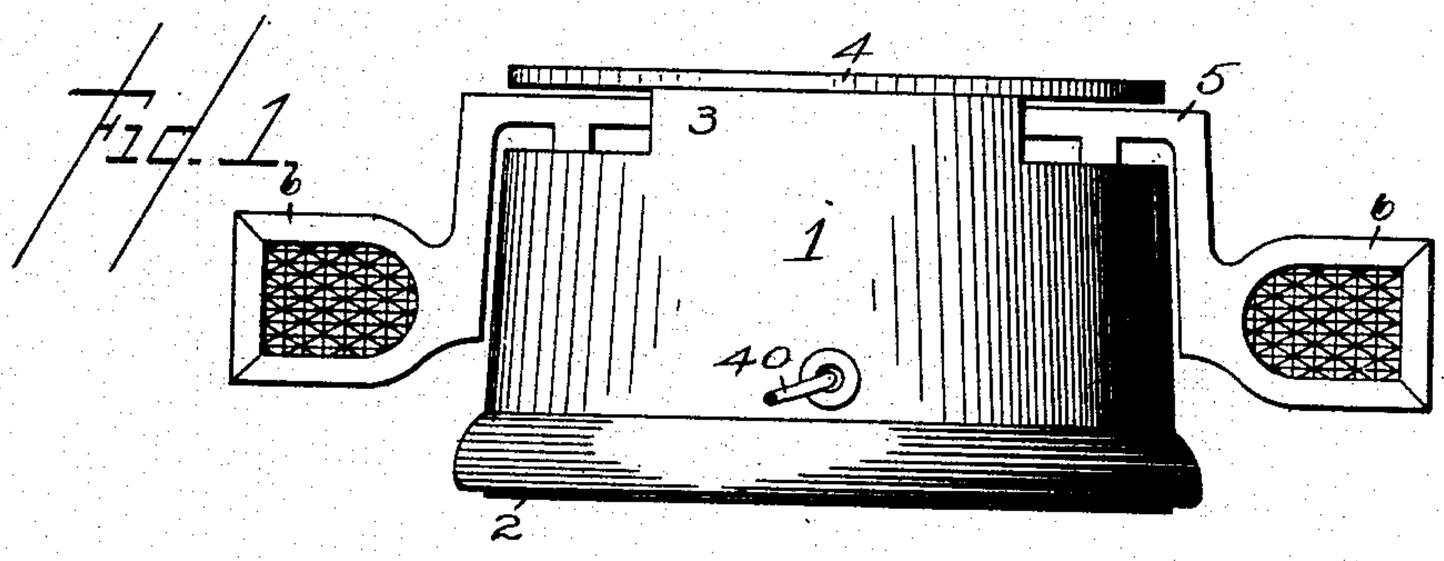


Fig. 2.

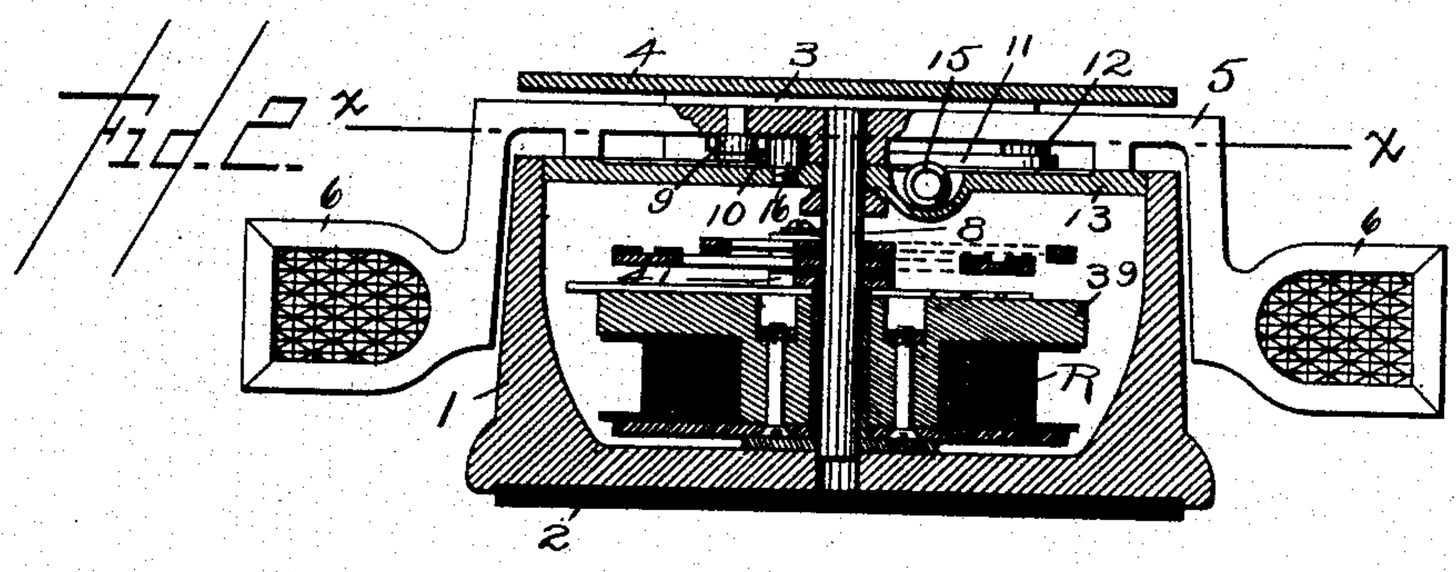


Fig. 3.

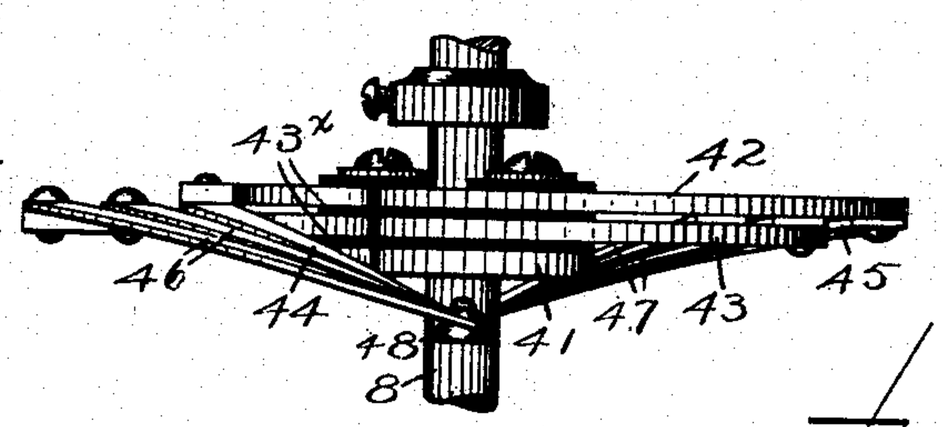


Fig. 8.

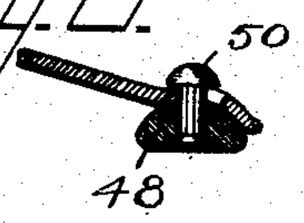


Fig. 9.

Fig. 10.

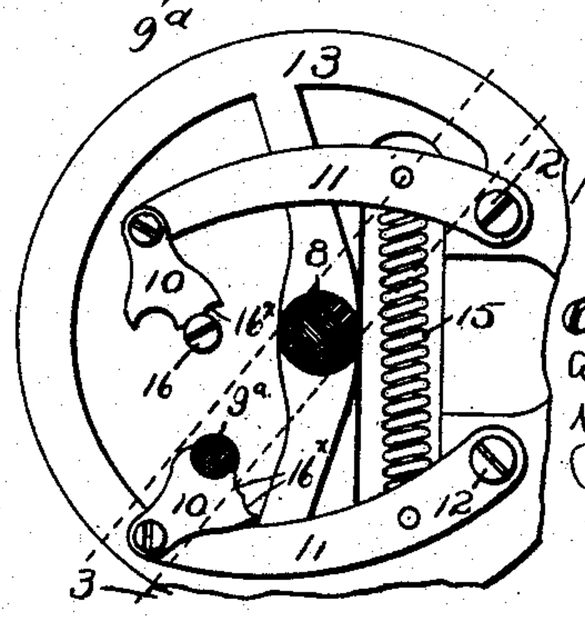
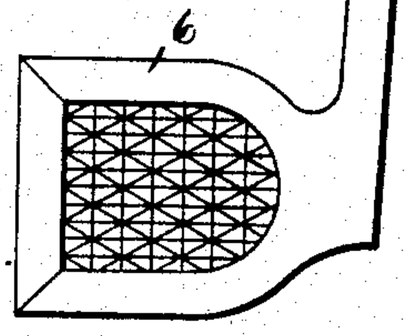


Fig. 4.



Witnesses.
Chas. F. Logan.
Willard Rich.

Inventors,
Oscar H. Pieper
Alphonse F. Pieper
by Church & Church
their
Attorneys.

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(No Model.) 2 Sheets—Sheet 2.

Fig. 4.

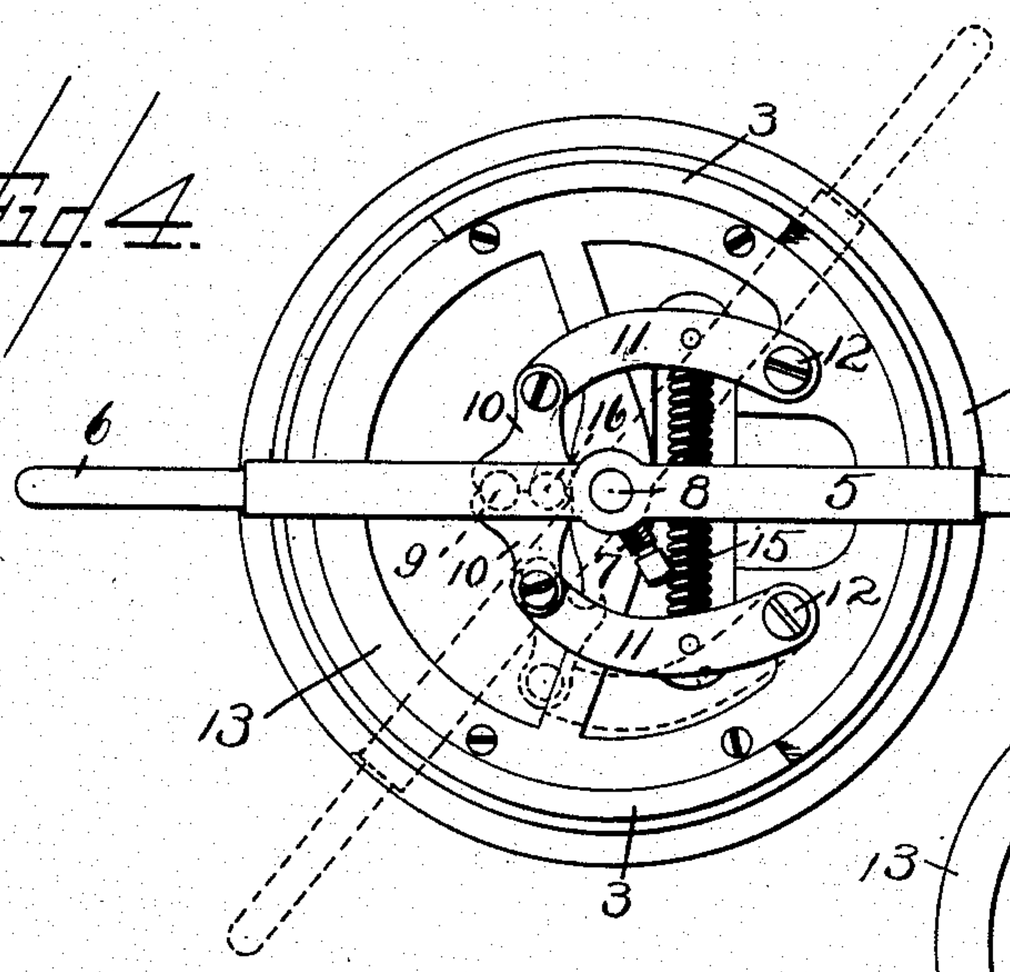


Fig. 7.

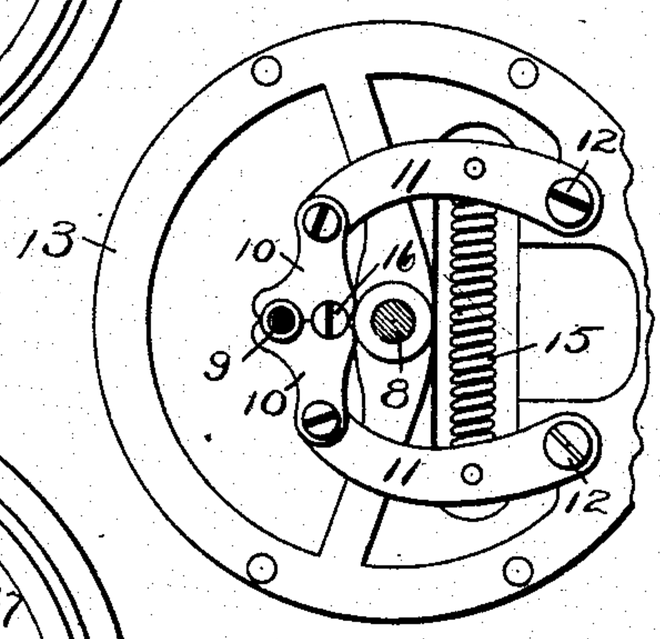


Fig. 5.

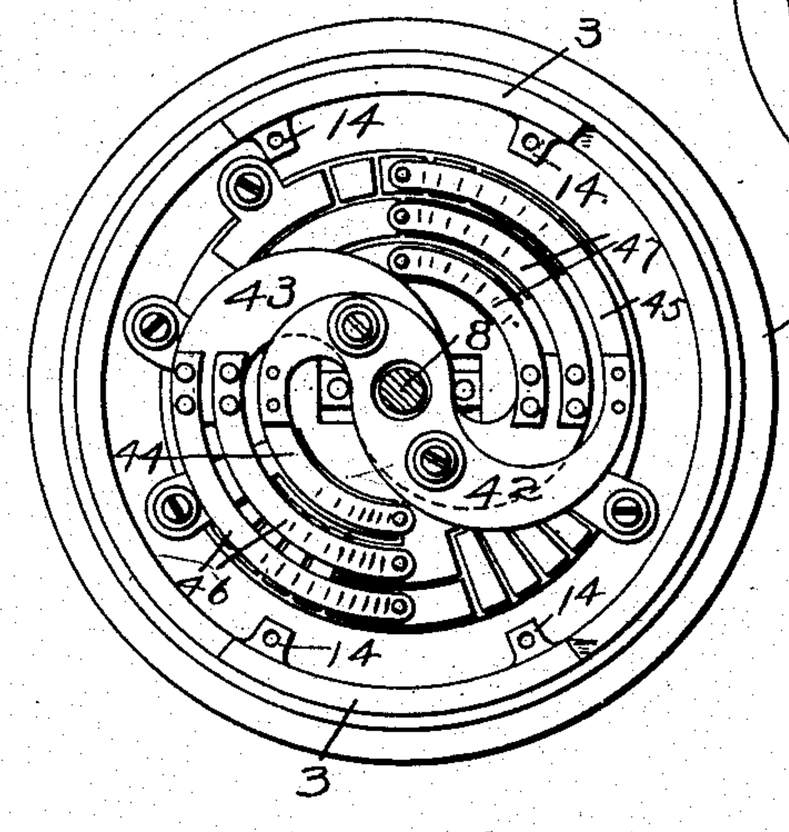
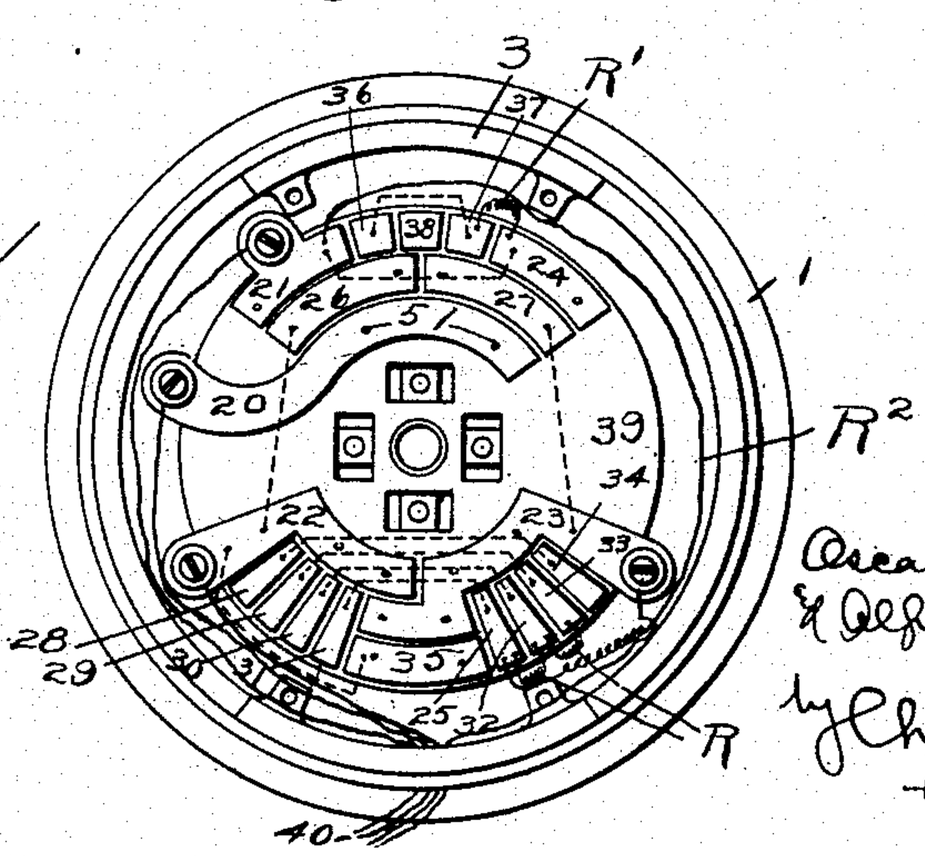


Fig. 6.



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Inventors
Oscar H. Pieper
& Alphonse F. Pieper
by Church & Church
their Attorneys

UNITED STATES PATENT OFFICE.

OSCAR H. PIEPER AND ALPHONSE F. PIEPER, OF ROCHESTER, NEW YORK.

CONTROLLER FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 675,293, dated May 28, 1901.

Application filed August 27, 1898. Serial No. 689,659. (No model.)

To all whom it may concern:

Be it known that we, OSCAR H. PIEPER and ALPHONSE F. PIEPER, of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Controllers for Electric Motors; and we do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

Our present invention relates to electrical switches or controllers particularly adapted for electrical motors and of the class shown in our prior patent, No. 541,500, adapted to control the operating of dental-engine motors and to be operated by the foot, although some of the improvements are well adapted for use in other forms of switches; and it consists in certain devices hereinafter described, the novel features being pointed out particularly in the claims at the end of this specification.

In the drawings, Figure 1 is a side elevation of a controller constructed in accordance with our invention; Fig. 2, a vertical sectional view of the same; Fig. 3, a side elevation of the oscillatory arbor and the contacts carried thereby; Fig. 4, a plan view of the controller with the top plate or cover removed; Fig. 5, a similar view with the plate carrying the lever-adjusting devices removed, showing the contacts; Fig. 6, a similar view with the movable contacts removed, showing the electrical connections; Fig. 7, a sectional view on the line $x\ x$ of Fig. 2; Fig. 8, a detail sectional view of the movable contacts; Fig. 9, a side elevation of one end of the lever and pedal, partly in section, showing a modification of the connection between it and the spring-actuating devices; and Fig. 10, a plan view similar to Fig. 7, showing the operation of the devices in Fig. 9.

Similar reference characters in the several figures indicate similar parts.

1 indicates the main casing of the controller, preferably constructed of metal, having a bottom-covering 2, of soft material, as rubber, and at the sides of the top flanges 3, to which the cover-plate is attached, slots being left on opposite sides for the passage of the double operating-lever 5, having the pedals 6 at the ends bent down toward the floor. The lever 5 is rigidly connected by a set-screw 7 to the upper end of a vertical oscillatory arbor 8, journaled in the center of the casing and carrying the contacts presently described.

As in our prior patent, the operating-lever is normally maintained in a central position by spring controlling devices and is connected with the movable electrical contacts in such manner that current may be supplied to the motor to operate it in different directions and at different speeds, depending upon the direction and extent of movement of said lever, the current being cut off when the lever is in its central normal position. In the present embodiment the lever 5 is provided upon its under side with a stud or roller 9, arranged to have a pivotal connection with recesses formed in the outer portions of links or plates 10, hinged to the ends of arms 11, pivoted at 12 on a plate 13, screwed to the lugs 14 on the casing. The arms 11 are drawn together by a spring 15, connecting them, as shown, and their approach is limited by a stop-pin 16 on the plate 13, which enters shallow grooves 17 in the proximate ends of the links 10. From this construction it will be seen that the lever is maintained by the spring in the central position and that when it is turned in either direction the stud 9 on the lever will cause one of the arms 11 to be moved against the tension of the spring; but the connection between the arm and link is such that the link will swing on the end of the arm as well as outward with the arm, and the resistance offered by the spring will not increase in the same proportion as it would if the spring acted directly upon the stud 9 on the controlling-lever, thereby enabling the lever to be moved easily and to have considerable latitude of movement without unduly increasing the tension of the spring. This feature is particularly advantageous when the controlling-lever is actuated by the sidewise movement of the foot of the operator, as in a device of this description. The operating-lever, it will be noticed, has both ends free and provided with the pedals or extensions near the floor, so that the operator may

manipulate the controller from either side of the dental chair without changing its position. The arms to which the spring is connected are spring-operated abutments, and as the movement of the outer ends is in a very flat arc they might be considered as moving in a straight line; but the lever between the pivot and stud and the links form toggles, which are straightened when the lever is moved to either side, the ends of flanges 3 serving in this construction as stops to limit the movement of the lever.

In the form of device shown in Figs. 2 and 4 the spring operates to move the lever to the central position with the current cut off from the motor, and the operator is required to keep his foot against the pedal to maintain the motor in operation; but in some instances it is desirable to provide means for holding the lever in position to keep the motor running at maximum speed, but will permit its ready release and actuation by the spring devices. This desirable result may be accomplished by locating the stud 9 on the lever nearer the arbor than is shown in Figs. 2 and 7, thus allowing the toggle-center to be operated across a straight line drawn through the arbor and the point of connection of the link with the spring-operated arm 11, so that the tendency of the spring will be to flex the toggle in the other direction and hold the lever against the flange 3, which latter serves as a stop. It is usually unnecessary to provide this locking feature for general use, and therefore in the construction in Figs. 2 and 4 it has been omitted, although its presence is a question of the relative positions of the pivots. To adapt the present structure so that it may be readily adjusted by the operator to either remain locked with the switch open or to close automatically at all times when pressure is removed from the pedal, we employ the arrangement shown clearly in Figs. 9 and 10, in which the stud or roller 9^a, corresponding to stud 9, is secured to a plate 17, located on the under side of the lever and adjustable longitudinally of the latter by means of the rod 18, passing through an aperture in the vertical portion, as shown, and in convenient position to be pushed in by the foot of the operator. In normal position the stud 9^a is moved outward on the lever to correspond with the position of stud 9 in the other figures, so that the lever may be turned to the extreme right or left position against the stop-flanges 3 and be returned by the spring; but when the operator wishes to hold the lever with the current turned on it is only necessary to press the rod 18 inward toward the oscillatory arbor, thus shortening the radius of the arc through which the stud 9^a moves and allowing said stud to pass beyond a straight line drawn through the pivotal center of the link and arbor, when the spring, operating through the arm, will hold the lever against the flange 3, as shown in dotted lines in Fig. 10. When the lever is turned back toward the central position, the spring will center it, as before, and the switch may be operated between the extreme positions in the usual manner.

The switch connections in the present construction are not essentially different from those shown in our prior patent referred to, the contact-plates 20 to 38, inclusive, being secured upon an insulated block 39 with portions in three concentric rows and the plates 20, 21, 22, and 23 connected to conductors leading in a cable 40 to the motor, and generator contact-plate 21 is connected by suitable wires to plates 24 and 25; plate 22 to plates 26 and 35; plate 23 to plate 27; plates 28, 29, 30, and 31 are connected to plates 34, 33, 32, and 25, respectively, and plates 25, 32, and 33 are connected in series through resistance-coils R; plates 36 and 37 are connected; a resistance-coil R′ is interposed between plates 24 and 37; plate 21 is also connected to plate 25 through resistance-coil R^2, all said connections being clearly shown in Fig. 6.

Mounted upon the arbor 8 is a double arm 41, to which are secured two superposed plates 42 and 43, insulated from each other and from the arm 41 by sheets $43^\times$ of insulating material, and the upper plate 42 is provided at one end with the spring-finger 44, adapted to make contact with the inner stationary plates 22 and 23, and also an outer spring-finger 45, adapted to make contact with the outer concentric row of stationary contact-plates. The lower plate 43 is provided at one end with two spring-fingers 46, adapted to coöperate with the two outer rows of stationary contact-plates, and at the other end with spring-fingers 47, which are adapted to coöperate with the two inner rows of contacts. The spring-fingers (numbered 44 to 47) are preferably made of much thinner sheet material than the plates 42 and 43, to which they are attached, and are curved to correspond with the casing, so that we are enabled to employ relatively long elastic fingers without weakening the connection with the arbor. Instead of allowing the ends of the spring-fingers to engage directly with the stationary contact-plates we provide them with self-adjusting contacts 48, (shown particularly in Fig. 8,) having the hemispherical upper surfaces engaging hollowed recesses formed in the ends of the springs and provided with the studs passing through apertures in the springs and having the heads 50 at the upper ends.

The ball-and-socket connection with the springs permits the contacts to adjust themselves on the plates and prevents excessive wear, besides insuring a good connection at all times.

For the purpose of properly lubricating the contacts and the contact-plates and insuring their smooth operation relatively we provide

some of the plates in each concentric line with small apertures 51, as shown in Fig. 6, each adapted to receive a small quantity of a suitable lubricant, such as oil, which will be drawn up by capillary attraction in sufficient quantity to prevent the contacts from becoming too dry and sticking or wearing unduly.

We do not deem it necessary to describe in detail the particular electrical connections between the generator and motor through our controller, as they are not essentially different from those in our prior patent, although the structure of the switch-contacts and the means for operating them are radical improvements and while particularly adapted for this controller could be used in other connections or for different purposes. The link connections between the spring-operated abutments or arms 11 and the lever enable the operator to gradually move the latter against the tension of the spring without the exercise of any considerable force, as the resistance to its movement does not increase in the same proportion as in our patented structure, and he can therefore regulate the amount of current with great exactness and when the adjustable stud 9^a is used can keep the current on by a slight movement of his foot.

It will be understood that many of the improvements contained herein can be applied to other forms of switch than that shown, and particularly those parts which cause the movements for locking the lever, and the contacts on the ends of the spring-fingers can be used in any form of switch desired.

In the modification shown in Figs. 9 and 10, wherein the stud 9^a is adjustable, the centering-pin 16, with which the links engage, is also employed; but in this instance the inner edges of the links are provided with two small notches $16^\times$ and the notches nearest the arbor are normally in engagement with the pin 16, which is smaller than in the preferred construction, so that when the rod 18 is pushed in the links will be carried backward and the forward small notches $16^\times$ will engage the pin 16. This arrangement is for the purpose of centering the links and at the same time permitting the adjustment of the stud 9^a for locking the lever.

We claim as our invention—

1. In a controller the combination with stationary contacts, an oscillatory lever and contacts actuated thereby, of the arms pivoted on stationary centers, the links having the pivotal connections with the lever and with the free ends of the arms, stop devices for limiting the approach of the arms and a single tension-spring connected to the arms between their pivots and the point of connection with the links.

2. In an electrical switching device, the combination with the pivoted oscillatory lever having the stud thereon adjustable toward and from the pivot, of the spring-operated abutment, the link coöperating with the abutment and with a stud on the lever and a stop for limiting the movement of the lever, whereby the link and the lever form an adjustable toggle serving to hold the lever in one position when the stud is adjusted.

3. In an electrical controller, the combination with the pivoted oscillatory lever having the downwardly-extending pedal at the end, the adjustable rod arranged above the pedal and the stud thereon, of the spring-operated abutment and the link pivotally connected with the stud and abutment.

4. The combination with the stationary contacts, the oscillatory lever and the contacts operated thereby, and the stud on the lever, of the plate or support 13 having the stop 16, the arms 11 pivoted on the plate, the links 10 pivoted to the ends of the arms and engaging the stops on the plate and lever, and the spring 15 connected to the levers between their pivots and free ends.

5. In an electrical contact device, the combination with a contact-surface, of a finger or support movable relatively laterally of the contact-surface and a contact coöperating with the surface and carried by said support and having a ball-and-socket connection with the latter arranged between the support and surface whereby the contact may have a universal movement relative to its support.

6. In an electrical controller the combination with the contact-surface, of a relatively movable yielding finger or support, a contact carried thereby having a ball-and-socket connection therewith arranged between the support and surface and axially of the contact whereby the latter may yield and accommodate itself to inequalities in the contact-surface.

7. In an electrical controller, the combination with a spring-finger having the recessed apertured end, of the contact having the rounded surface and the pin passing through the aperture in the finger.

8. In an electrical controller, the combination with the casing and a series of stationary contacts, of an oscillatory arbor having a plate, as 41, thereon, two conducting-plates clamped to the plate 41 and insulated from it and from each other and contact-springs secured to opposite ends of the conducting-plates adapted to coöperate with the stationary contacts.

9. In an electrical controller, the combination with the casing and a plurality of series of stationary contact-plates arranged concentrically, of an oscillatory arbor, the two conducting-plates secured rigidly on the arbor and insulated from it and from each other, separate curved contact-fingers secured to the plates on the arbor and coöperating with the stationary contact-plates.

10. In an electrical controller, the combination with a support and the contacts 20 to 38

inclusive, of the oscillatory arbor, the plates 42 secured thereto having the spring-fingers 44 and 45 thereon and the plate 43 on the arbor having the fingers 45, 46 and 47.

11. In an electrical controller, the combination with stationary contact-plates having recesses therein adapted to receive a lubricant, of a movable contact coöperating with said plates, substantially as described.

OSCAR H. PIEPER.
ALPHONSE F. PIEPER.

Witnesses:
F. F. CHURCH,
G. WILLARD RICH.