A. J. HORTON.

ELECTRIC SWITCH.

APPLICATION FILED APR. 21, 1913.

1,227,789.

Patented May 29, 1917.

2 SHEETS—SHEET 1.

Fig. 1.

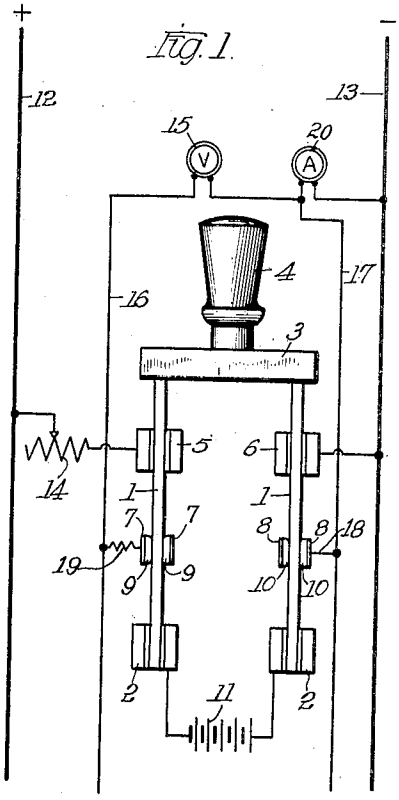


Fig. 2.

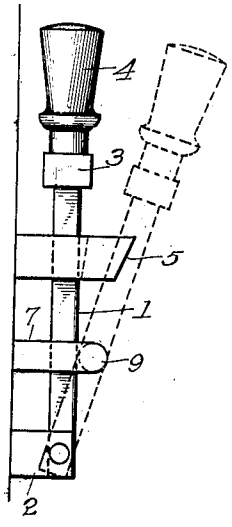


Fig. 3.

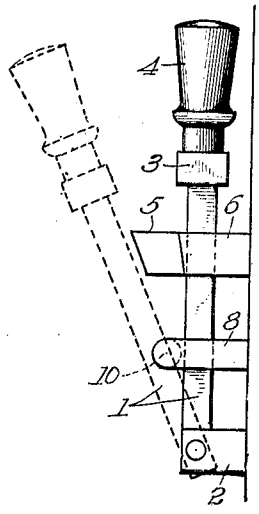
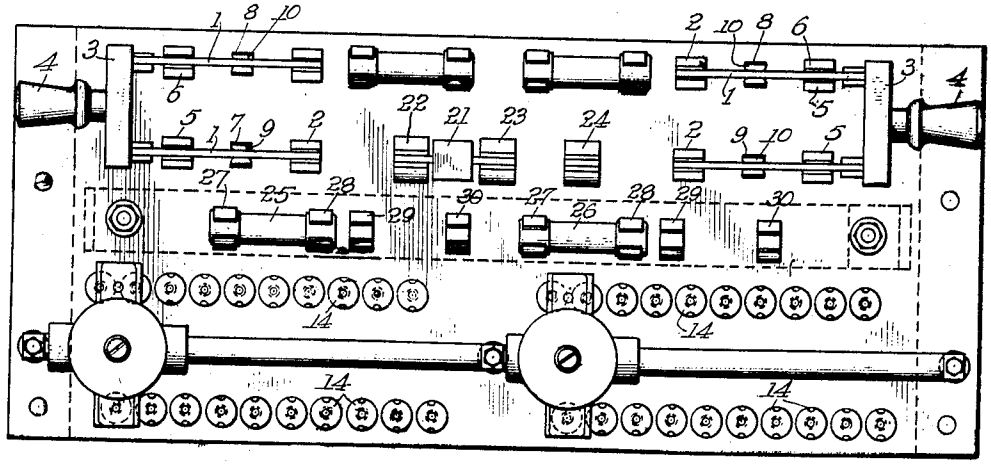


Fig. 4.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 5.

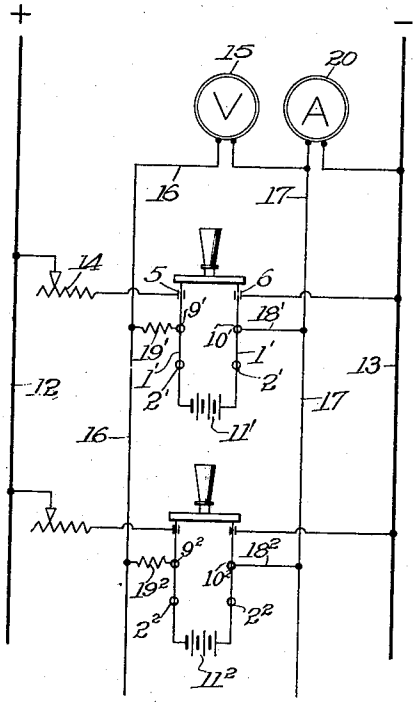


Fig. 6.

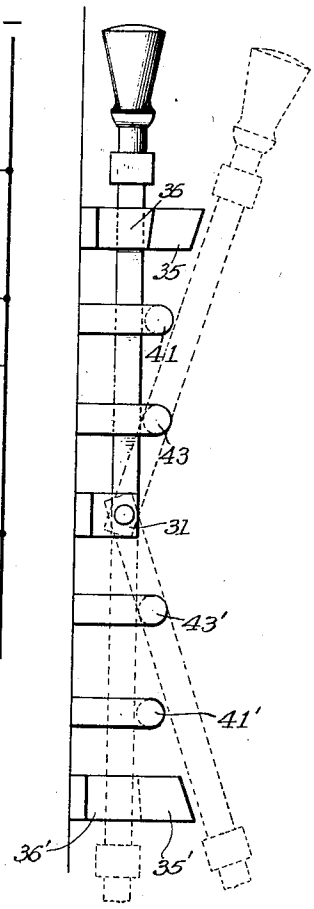


Fig. 7.

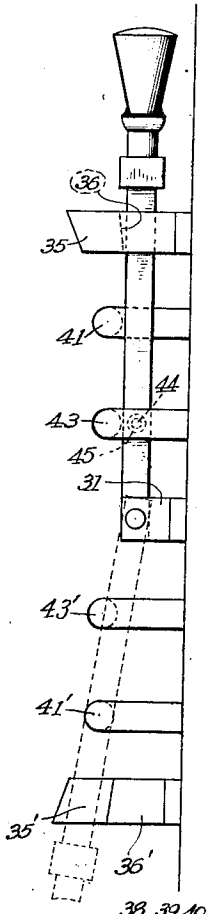
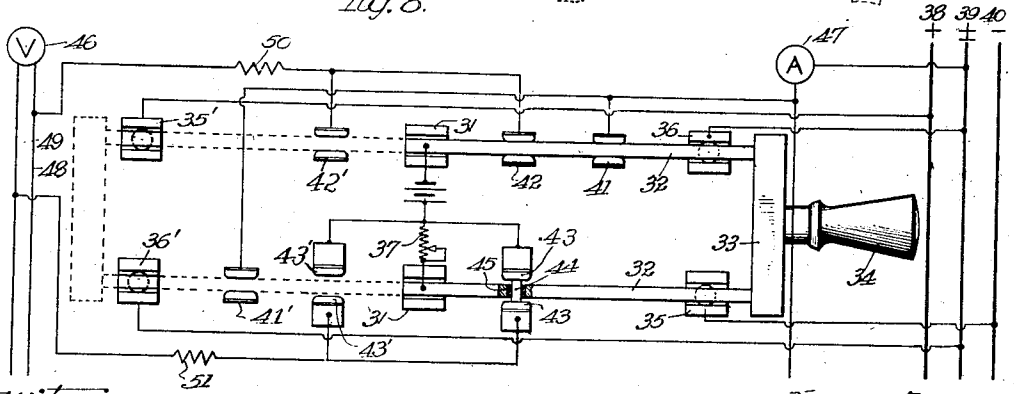


Fig. 8.



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UNITED STATES PATENT OFFICE.

ALBERT J. HORTON, OF WHITE PLAINS, NEW YORK, ASSIGNOR TO THE CUTLER-HAMMER MFG. CO., OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

ELECTRIC SWITCH.

1,227,789. Specification of Letters Patent. Patented May 29, 1917.

Application filed April 21, 1913. Serial No. 762,581.

To all whom it may concern:

Be it known that I, ALBERT J. HORTON, a citizen of the United States, residing at White Plains, in the county of Westchester and State of New York, have invented new and useful Improvements in Electric Switches, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in electric switches. One object of my invention is to provide an improved switch which may be actuated to connect an ammeter in series with, and a volt meter in shunt with, the circuit which is controlled by said switch. Another object of my invention is to provide a switch adapted particularly for use in connection with the charging of storage batteries. Further objects of the invention may be readily inferred from the subsequent description of the several embodiments thereof which I have illustrated in the accompanying drawings. These embodiments will serve to disclose the essential features of the invention, but it is to be understood that said invention may be embodied in other forms, and, hence, I do not limit myself to those illustrated.

Figure 1 of said drawing is an elevation of one form of switch, the circuit connection being shown diagrammatically;

Fig. 2 is a side elevation thereof;

Fig. 3 is an elevation of the opposite side of said switch;

Fig. 4 is a panel showing the preferred manner of mounting such switches thereon in pairs, together with rheostats, fuses and other adjuncts which coöperate therewith;

Fig. 5 is a circuit diagram showing the ciruit connections for two or more switches;

Fig. 6 is a side elevation of another form of switch;

Fig. 7 is an elevation of the opposite side thereof;

Fig. 8 is a top plan view of said switch showing the circuit connections diagrammatically.

The switch in the first form illustrated is a knife switch, comprising a pair of blades 1, 1 pivotally supported in the hinge clips 2, 2 and connected at their opposite ends by a yoke of insulating material 3 provided with a suitable handle 4. The switch when in closed position is adapted to make contact with a pair of spring clips or jaw clips 5, 6, the former being much longer than the latter, as will be readily apparent from a comparison of Figs. 2 and 3. Auxiliary clips or meter clips 7, 8 are also provided, the latter having projecting contacts 9 and 10, respectively, which make contact with the knife blades 1 when the switch is in either of the two dotted line positions shown in Figs. 2 and 3, but not at other times.

In order to explain the operation of the switch, I will describe its use in connection with the charging of a storage battery; for example, a vehicle battery. The main function of the switch is to connect the battery 11 to the charging mains 12, 13. For this purpose said battery is connected preferably to the hinge clips 2, 2, and the spring clips 5, 6 are connected to the mains 12, 13, respectively, although, of course, the switch connections may be reversed; that is, the battery may be connected across the spring clips and the hinge clips connected to the mains. A charging rheostat 14 is arranged between the mains and said switch so as to be connected in series with said battery, whereby the battery charging current may be regulated to substantially a constant value in a manner which is well understood.

A voltmeter 15 is connected across the auxiliary contacts 9 and 10 through conductors 16, 17, 18, a resistance 19 being connected between the clip 7 and the conductor 16, to limit the current, for a purpose hereinafter described. As the switch is being closed, the knife blades contact first with the auxiliary contacts 9 and 10, as indicated in dotted lines, in Fig. 3, thereby establishing the voltmeter circuit only and enabling the operator to determine from the deflection of the voltmeter needle not only the condition of the battery, but also whether or not said battery has been properly connected in circuit. As the operator continues the switch closing movement, he moves said switch from the dotted line position shown in Fig. 3 to the dotted line position shown in Fig. 2, thereby establishing also the ammeter circuit. The ammeter 20 is connected to one of the mains 13, and also to the auxiliary contacts 10. When the meter is connected in circuit, one of the knife blades contacts with the spring clip 5, which is longer than the spring clip 6, the latter being out of contact with its knife blade. With this arrangement the storage battery is connected to the mains through the ammeter, the voltmeter circuit

being still established. The circuit to the battery may be traced as follows: from the positive main 12, through the charging rheostat 14, to the long clip 5, and through the knife blade 1, in contact therewith, to the battery 11, thence through the other knife blade 1, to the auxiliary contacts 10, and through conductors 18 and 17 to the ammeter 20, and thence to the negative line 13. The voltmeter circuit may be traced from the positive battery terminal through knife blade 1, to the auxiliary contacts 9, through resistance 19, conductor 16, voltmeter 15, conductors 17, 18, auxiliary contact 10, knife blade 1, and thence to the storage battery.

The operator by a further movement of the switch handle closes the switch, the latter being shown in closed position in full lines in Figs. 2 and 3. In this position the battery is connected directly to the mains 12 and 13 through the charging rheostat 14. Neither the voltmeter nor the ammeter circuits are established at this time, being open circuited by the contacts 9 and 10, the spring clips 7, 7 and 8, 8 being arranged on each side of the adjacent knife blades, with the clips of each pair spaced apart, so as to be out of contact therewith. It will be seen that, with the battery charging circuit established, the operator may at any time draw the handle 4 outwardly so as to move the knife blades through a small angle, and thereby establish the voltmeter and ammeter circuits so as to take a reading, the left hand knife blade 1, as seen in Fig. 1, remaining in contact with the clips 5 during this movement, whereas the right hand knife blade 1 is moved out of contact with the clips 6, just after making contact with the auxiliary contacts 10.

During the charging of the battery the rheostat 14 is adjusted to maintain the battery charging current at substantially a constant value in the usual manner. When it is desired to discontinue the battery charging current, the switch may be thrown open quickly, the momentary contact made with the auxiliary contacts being entirely incidental, and having no effect on the opening of the circuit. In the construction illustrated, it will be seen that the meter circuits are established prior to the closing of the main circuit, the auxiliary contacts being arranged in advance of the main contacts. It is apparent, however, that said contacts may be arranged to the rear of the main contacts if desired, whereby the meter circuits may be established by further movement of the switch handle away from the operator.

While the switch as thus far described is adapted for use in any relation where it is desired to establish auxiliary circuits as an incident to the opening or closing of the main circuit controlled by said switch, it is particularly useful in the charging of storage batteries as outlined above, and it is especially adapted for use in the charging of more than one battery. When used in this latter relation, I preferably mount the switches in pairs on a common duplex panel, such a duplex panel being illustrated in Fig. 4, and enough of the circuit connections being shown in Fig. 5 to illustrate the relation of the two switches to each other. The same reference characters have been employed in Fig. 4 as heretofore employed, to indicate corresponding parts. Each panel section as more fully set forth in my application Serial No. 769,863, filed May 26, 1913, carries two charging rheostats, indicated by the reference number 14 previously employed, and suitable fuses hereinafter mentioned, the right-hand and left-hand halves of the panel being independent of each other ordinarily, and being employed in charging two batteries independently of each other. The circuit connections are such, however, that by removing the blade contact 21 from between the two spring clips 22, 23 and placing it between the clips 23, 24, it is possible to connect the two rheostats in series, so that a small number of cells may be properly charged, the circuit thereto being controlled by the left hand switch. The circuit connections are also such that by leaving the blade contact 21 in the position in which it is illustrated and changing the position of the fuses 25, 26 from the clips 27, 28, in which they are held to the clips 29, 30, immediately to the right thereof, it is possible to connect the two rheostats in parallel so that a battery of high capacity can be charged.

The diagram, Fig. 5, illustrates how two or more batteries may be connected across the mains so that they may be charged simultaneously when connected to a duplex panel; for example, as shown in Fig. 4. In said diagram I have illustrated only two such batteries, although the number may be increased indefinitely by providing preferably a panel for each group of two batteries. The two switches shown in said diagram may be assumed to be the two which are shown in Fig. 4 mounted on a common panel, and the same reference characters have been employed to indicate the various elements as have been used in the description of the preceding figures, the exponents 1 and 2 being added to distinguish one switch from the other. By reference to this diagram, the necessity for the resistance 19 will be clear. If a single battery is being charged and only a single switch is being used, said resistance is not necessary, nor would it be necessary where a plurality of batteries are being charged simultaneously, provided the operator established the meter

circuits from the individual switches one at a time, and never simultaneously. Said resistances are employed, however, to prevent damage which might occur should the operator simultaneously move two or more of the switches to establish the meter circuits therefrom. In order to appreciate the difficulties which would arise under such conditions, assume the battery 11^1 to be an 80 volt cell and the battery 11^2 to be a 30 volt cell.

Under these circumstances, if the circuits from each switch to the voltmeter were established simultaneously, the two batteries would be connected in series and opposed to each other in such a manner that the 80 volt battery would discharge through the 30 volt battery, thereby establishing a short circuit having impressed thereon an effective voltage equal to the difference between 80 volts and 30 volts; viz., 50 volts. The local discharge circuit thus established may be traced as follows: from the positive terminal of battery 11^1, to the left-hand knife blade 1^1, contact 9^1, conductor 16, contact 9^2, through battery 11^2, from positive to negative terminal, conductors 18^2, 17, 18^1, and back to the negative terminal of battery 11^1. By providing the resistances 19^1, 19^2, however, such short circuits are prevented, the voltmeter being modified so that its resistance is less than it would otherwise be, whereby it gives proper readings under the modified conditions.

In Figs. 6, 7 and 8 I have illustrated a modified form of switch, which is adapted particularly for use in the charging of storage batteries from a three wire system. With such a system, if a number of vehicle batteries, for example, are being charged, some of the batteries may be connected across one side of the line and some across the other side, said batteries being balanced up to a certain extent so as to balance more or less the load on opposite sides of the line. For this purpose the switch is constructed with a duplicate set of contacts, so that it may be thrown to either of two positions, thereby enabling a battery to be charged from whichever side of the line happens to be loaded the lightest at the time said battery is connected thereto.

The switch is quite similar in its general construction to the first form of switch described, and it comprises a pair of hinge clips 31, 31, to which are pivoted a pair of knife blades 32, 32, the latter being connected by a suitable insulating yoke 33 provided with a handle 34. A pair of spring clips 35, 36 are provided, the former being longer than the latter, as shown in Figs. 6 and 7. The battery to be charged may be connected to the hinge clips 31, 31 through a suitable charging rheostat 37, whereby said battery may be connected across one side or the other of the three wire mains 38, 39, 40. An auxiliary pair of contacts 41 is provided, and additional auxiliary contacts 42, 43 are also provided, said auxiliary contacts being similar in general to the auxiliary contacts of the first form of switch described in that they do not contact with the knife blades when the switch is in open or closed position, but only when said switch is in some intermediate position. Said contacts 43 do not contact directly with the knife blade at all, but contact instead with a conducting pin 44, which is carried thereby and projects through an opening therein, being supported in said opening by an insulating bushing 45, said conducting pin serving to bridge the two contacts 43.

A duplicate set of switch contacts are provided, as seen at the left-hand half of Fig. 8, the corresponding contacts being lettered 35^1, 36^1, etc. These additional contacts correspond to the first set of contacts, but some have their relative positions reversed, as will be apparent from the drawings. This reversal permits the charging current to flow through the battery in the same direction, whether said battery is connected to the mains 38, 39 or 39, 40. With the switch in the position shown, said battery is connected across the mains 39, 40. If the switch is moved outwardly through a small angle, circuits are established to the voltmeter 46 and ammeter 47. The voltmeter circuit is established through conductors 48, 49, which are connected to the contacts 42, 43 through suitable resistances 50, 51, the function of said resistances being to prevent a short circuit where two or more batteries are being charged simultaneously and where the meter circuits are established simultaneously, the conditions being analogous to those described in connection with the first form of switch. If the switch handle is moved outwardly still farther, the voltmeter circuit alone will be established. This feature will be clear from inspection of Figs. 6 and 7, the operation being analogous to that previously described.

Although in Fig. 8 I have illustrated a single battery only and a single switch adapted to connect said battery to either side of the charging line, it will be apparent that additional batteries may be connected to said line by simply duplicating the connections shown in said figure and making the necessary connections to the voltmeter and ammeter, whereby a single set of instruments will suffice for any number of batteries. Said switches may be mounted in pairs on suitable supporting panels, as in the case of the first form of switch described. In both forms of switch described, the knife blades are moved by a common handle. It is apparent that the two blades may be moved independently by separate handles

if desired. It is to be understood in general that the invention is not limited to the two forms of switch described and illustrated nor to their use in the relations disclosed, as said forms have been selected for the purpose of disclosing the main features of the invention and the general adaptability thereof to meet varying conditions. Accordingly, I do not desire to limit myself to said disclosures, but desire to cover within the appended claims whatever modifications may be made which fall within the scope of the invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:—

1. The combination with a switch having a pair of stationary contact members, a pair of movable contact members adapted to cooperate therewith to open and close a circuit, and a pair of auxiliary contacts, of a voltmeter connected across said auxiliary contacts, and an ammeter connected to one of said auxiliary contacts and to one of said switch contacts, said auxiliary contacts being normally out of contact with said movable contact members when the latter are in circuit closing position, but being mounted so as to be engaged thereby when moved to another position.

2. In an electric switch, a pair of blades pivoted at one end, a handle at the other end common to both blades, and a pair of stationary contacts each adapted to be engaged by one of said blades to close a circuit, a pair of auxiliary contacts so disposed as to be engaged by said blades during movement thereof either to open or close said circuit, one of said stationary contacts remaining in contact with its cooperating blade during movement between the circuit closing position and the position of engagement with said auxiliary contacts.

3. The combination with a storage battery, of a charging circuit, battery testing apparatus, and a switch having pivoted knife blades, contacts to be engaged by said blades to connect said battery to one or both sides of said charging circuit selectively and auxiliary contacts to be engaged by said blades for connecting said battery to said testing apparatus but only in a position of said blades to interrupt circuit between said battery and one side of said charging circuit.

4. In an electric switch, main contacts, movable circuit closing elements adapted to be moved into and out of engagement therewith and auxiliary ammeter and voltmeter contacts, said contacts being so disposed that the voltmeter circuit may be established independently of the remaining circuits by movement of said elements to one position, the voltmeter and ammeter circuits may be established simultaneously by movement to a different position and the main circuit alone may be established by movement to a third position.

5. The combination with a storage battery, of a charging circuit, battery testing apparatus, and a switch having a pair of pivoted knife blades, clips to be engaged by said blades to connect said battery to said charging circuit, one of said clips being shorter than another for interruption of the connection between said battery and one side of said charging circuit while maintaining the connection between said battery and the opposite side of said circuit and auxiliary clips to be engaged by said blades to connect said battery to said testing apparatus, said auxiliary clips being engaged by said blades in the position of the latter to establish connection between said battery and one side only of said charging circuit and to be disengaged thereby when moved to connect said battery to both sides of said charging circuit.

6. The combination with a storage battery, of alternative charging circuits therefor, a testing meter and a switch to connect said battery to said circuits selectively and to establish a temporary connection to said meter prior to connection of said battery to either circuit.

7. The combination with a storage battery, of alternative charging circuits therefor, a testing meter and a double throw switch movable to opposite extreme positions for connecting said battery to said circuits selectively, said switch having auxiliary contacts to establish a temporary connection to said meter prior to connection of said battery to either circuit.

8. The combination with a storage battery, of alternative charging circuits therefor, an ammeter and a double throw switch movable to its opposite extreme positions to connect said battery to said circuits selectively, said switch having auxiliary contacts to establish a temporary connection to said ammeter prior to connection of said battery to either circuit, said auxiliary contacts providing for establishment of such ammeter connections as to insure a uni-directional flow of current through said battery upon reverse movements of said switch.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

ALBERT J. HORTON.

Witnesses:
GEO. B. JONES,
R. R. KNAPP.