P. V. HUNTER.

ELECTRIC SWITCH.

APPLICATION FILED MAY 6, 1913.

1,127,996. Patented Feb. 9, 1915.

FIG. I.

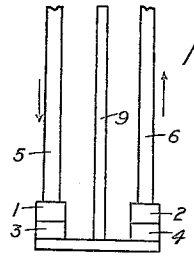


FIG. II.

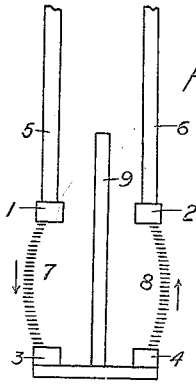


FIG. IV.

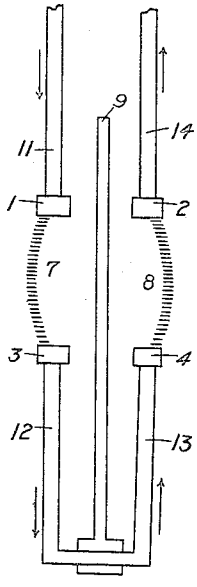


FIG. III.

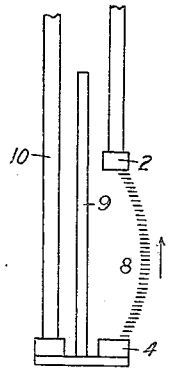


FIG. V.

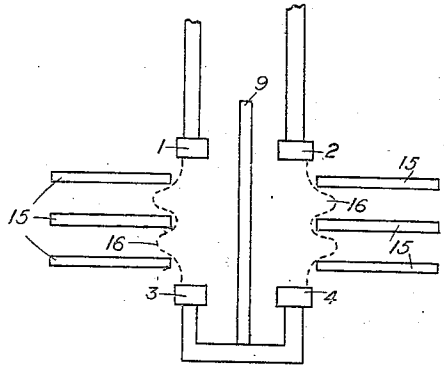


FIG. VI.

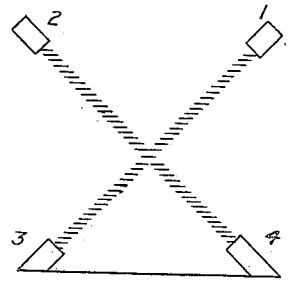


FIG. VII.

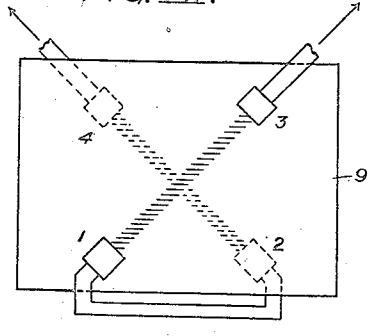
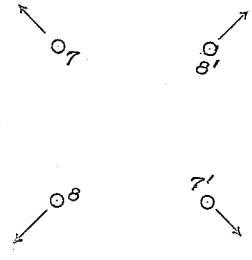


FIG. VIII.



WITNESSES

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UNITED STATES PATENT OFFICE.

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ELECTRIC SWITCH.

1,127,996. Specification of Letters Patent. Patented Feb. 9, 1915.

Application filed May 6, 1913. Serial No. 765,747.

To all whom it may concern:

Be it known that I, PHILIP VASSAR HUNTER, residing at 41 Coquet Terrace, Heaton, Newcastle-upon-Tyne, in the county of Northumberland, England, have invented new and useful Improvements in Electric Switches, of which the following is a specification.

It is known practice to make electric switches with a number of breaks (that is to say, places where there are pairs of contact points or surfaces between which the circuit is broken and arcing takes place) arranged in series; and in order to attenuate or lengthen the arcs formed so as rapidly to quench these arcs, it is known practice to employ what is termed a "magnetic blow-out", the usual form being a coil placed in series with the circuit.

In my invention I employ contact points or surfaces at which the circuit is to be broken in series but instead of employing a magnetic blow-out as is usual I arrange these contact points or surfaces in such manner that the arcs formed upon separation of the points or surfaces will be parallel or nearly so with one another and close together or in arc-extinguishing proximity, the current flowing in opposite directions in each arc of a pair of arcs. By this means each arc of a pair will repel the other and an attenuating effect and quenching of the arcs will be obtained.

My invention is illustrated by the accompanying drawings, in which,

Figures I and II illustrate a simple case of my invention where the repulsion is between two arcs. Fig. III illustrates a case in which the repulsion is between an arc and a conductor. Fig. IV shows a case in which the conductors in circuit with the arcs are arranged so as to reinforce the repellant action. Fig. V illustrates the employment of baffles to increase the attenuation of the arcs. Figs. VI and VII illustrate cases in which the arcs are crossed, and Fig. VIII illustrates how four arcs or two arcs and two conductors may be arranged so as to secure the desired repellant action.

In Figs. I and II, I illustrate a simple case of my invention in which 1, 2 are contact points or surfaces attached to rods 5, 6 and in fixed position. 3, 4 are movable contacts designed to make contact with the fixed contacts 1 and 2 respectively. These movable contacts 3, 4 are in electrical connection with one another and adapted to be pulled away from the fixed contacts when circuit is to be broken. In Fig. I, I show the pairs of contacts (1 and 3, and 2 and 4 respectively) in their closed position while in Fig. II, I show them in their separated position, it being assumed that they have just been pulled apart for the purpose of breaking circuit. The direction of the current is shown by the arrows and is seen to be in opposite directions. 7, 8 (Fig. II) represent the two arcs formed on the opening of the circuit and it will be seen that these repel one another as shown, the direction of the repelling forces being to separate them and blow them out and the proximity of the arc being sufficient to effect this result.

My invention is particularly applicable to switching apparatus in large power distributing systems at high potentials and it will be seen that in spite of this fact I place the two arcs in close proximity to one another whereas in electrical practice hitherto one would naturally consider that they should be put widely apart. My reason for placing them in close proximity to one another is to obtain as strong a repelling effect between the two arcs as possible so that they may be quickly extinguished. In other words, I place them in arc-extinguishing proximity and I further make the distance between a pair of arc striking terminals less than the length of each arc, that is, less than the maximum separation of the co-acting switch terminals, which means less than the throw of the switch. The reasons which in current practice would naturally lead to their being placed as far apart as possible are well known to and appreciated by electrical engineers especially in the case of high tension and extra high tension systems.

In the figures just described 9 is a fireproof separator of suitable non-magnetic material which I sometimes find it convenient to employ. It is not an essential feature of my invention and when I employ it I prefer to make it of what is known as "fused silica."

In the figures just described I show only one pair of arcs but when desired I may employ two or more pairs of arcs.

I do not confine my invention to the main contacts of switching apparatus but may apply it to auxiliary contacts placed either

in series or in parallel with the main contacts and the number of pairs of contacts connected after the manner of my invention may be considerable.

I have hereinbefore referred to pairs of arcs each one of a pair repelling the other arc of a pair. It will be seen however that the current in a conductor is equivalent to the current of the arc and that therefore a conductor could be substituted for one of the arcs and without departing from the spirit of my invention. This is illustrated in Fig. III where it will be seen that instead of having two breaks I have only one break and that the arc at that break will be parallel or nearly parallel with the conductor 10 which is the equivalent of and substitute for the arc 7 shown in Fig. II.

In some cases I so arrange the conductors in circuit with the arcs as to reinforce or increase the repellent action. Thus I may make the leads on one or both sides of the arc long and parallel and so as in themselves to exert a repellent action. This is illustrated in Fig. IV. Here it will be seen that the conductors 11, 12 on either side of arc 7 are placed parallel with the conductors 12, 13 on either side of the arc 8 and with the currents flowing in the directions shown by the arrows. The effect of this is to intensify the blow-out action as this will depend, in each arc, not only upon the magnetic field produced by the opposite arc but also upon that set up by the conductors shown. When desired I may increase the attenuation of the arcs by placing baffles of insulating fireproof material in the course of the arcs themselves. This is diagrammatically illustrated in Fig. V where 15, 15 show the baffles and 16, 16 the hypothetical course of the baffled arcs.

I have hereinbefore spoken of the two arcs as being parallel or nearly so, but in some cases I may depart from this practice. Thus in one form I contemplate so arranging the arcs that they cross one another. This is shown in its simplest diagrammatic expression in Fig. VI where it will be seen that contact 3 is assumed to have been separated from contact 1 and contact 4 from contact 2 so that the arcs pass between 1 and 3, and 2 and 4 respectively. Fig. VII illustrates this crossed arc arrangement in connection with the separator 9, this separator being in the present instance in the form of a flat sheet. The contacts 3 and 4 are in this case the movable ones and they are assumed to have been drawn apart from their corresponding fixed contacts in the directions of the arrows. The use of full and dotted lines in this case illustrates that separation takes place in two planes one on each side of the separator. In the case of a single arc and a repellent conductor I may also obtain the crossing effect and this I can do either by parting the arc contacts in a rectilineal manner as shown at one arc in Fig. VII or by separating the contacts in a helical direction. In one way of doing this the center of angular movement of the movable contact or contacts would be around an axis coincident with that of the repellent conductor assuming the latter to be straight. It will of course be understood that the shape of the separator will depend upon circumstances. Thus when the separation takes place in a helical direction the separator may take a cylindrical or prismatic form. Or, and this applies to most forms, the separator may take the form of a tube surrounding or partly surrounding the space occupied by one of the arcs or surrounding or partly surrounding a repellent conductor.

The actual mechanism by means of which the contact surfaces are separated forms no part of my present invention. It will be seen that by applying the forces which draw out or attenuate the arcs to the arcs themselves (which have practically no mass and therefore but little inertia) very rapid acceleration in breaking the circuits may be obtained.

I think it probable that in electric switches, contacts at which circuits have to be broken may have been placed so that parallel arcs or an arc parallel with a conductor may have been employed but if so I believe that it must have been with a totally different object in view as in the present condition of electrical knowledge electrical engineers instead of placing arcs or conductors in close proximity would place them as far apart as conveniently possible. I however place my repellent arcs or arcs and repellent conductors in abnormally close or arc-extinguishing proximity and in accordance with what at the present time would be considered as bad practice. Thus in the ordinary construction of a switch there must be some means of supporting the contacts and this often includes metal work at earth potential between which and the live conductors a large clearance is necessary. So important is it to prevent short circuits and the like that such metallic conductors are always placed as far apart as conveniently may be. Thus in a construction resembling say that in Figs. I and II the distances between the contacts 1 and 2 or between 3 and 4 would naturally be made greater than the distance to which the movable contacts 3, 4 could be separated from the fixed contacts 1, 2 whereas in my invention this need not be the case. Further, it is common practice in the construction of switches to place the contacts in separate steel chambers widely spaced apart and such steel chambers would present

screens against the repellent action which I desire and upon which I rely.

I have hereinbefore spoken of the repulsion between two arcs or between an arc and a repellant conductor. I may however if desired employ more than two arcs or arcs and repellent conductors. Thus for example, referring to Fig. VIII, 7, 8, 7′, 8′, indicate in end view four arcs arranged at the four corners of a square. Current in the arcs 7, 7′ flows in one direction and current in the arcs 8, 8′ flows in the other direction. Thus it will be seen that each arc has adjacent to it two arcs in which current flows in the opposite direction. The result is that each arc is repelled outwardly in the direction of a diagonal of the square as indicated by the arrows. In this case also instead of having four arcs I might have two arcs and two repellent conductors as will be readily understood from the foregoing.

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

1. An electric switch comprising a pair of terminals between which an arc is struck on separation and a parallel portion of the same circuit arranged in arc-extinguishing proximity to these terminals substantially as described.

2. An electric switch comprising pairs of terminals between each of which an arc is struck on separation having their current direction opposite, the pairs of terminals being arranged in arc-extinguishing proximity whereby the tendency to short circuit across the terminals is overcome, substantially as described.

3. An electric switch comprising pairs of terminals between each of which an arc is struck on separation, the pairs of terminals being arranged in arc-extinguishing proximity and the distance between the pairs being less than the throw of the switch substantially as described.

In witness whereof I have signed my name to this specification in the presence of two subscribing witnesses.

PHILIP VASSAR HUNTER.

Witnesses:

H. NIXON,

A. MITCHINSON.