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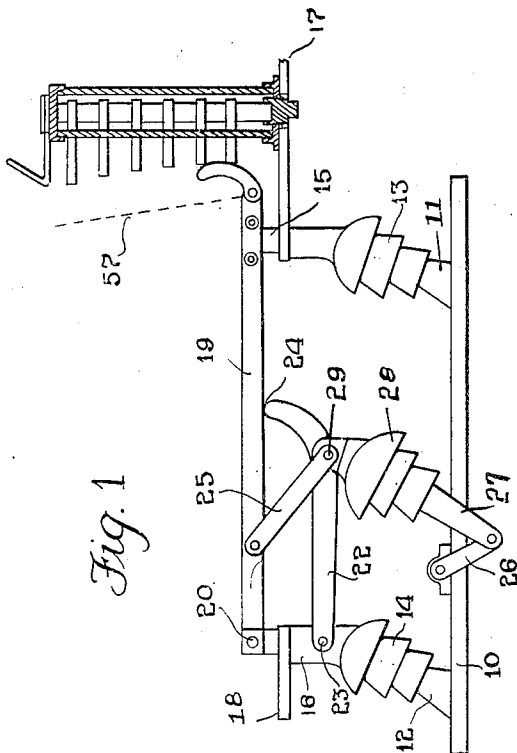
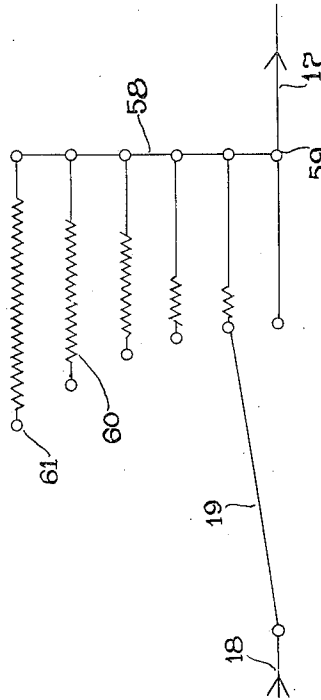
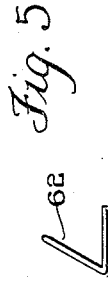
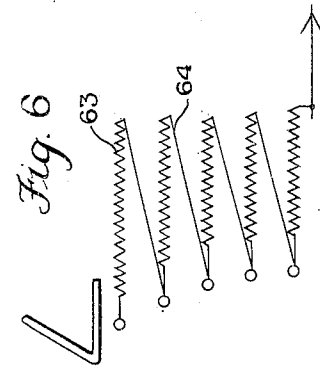
C. CHRISTENSEN

1,563,833

HIGH TENSION AIR BREAK SWITCH

Filed Dec. 5, 1919

2 Sheets-Sheet 1



Inventor
Christen Christensen
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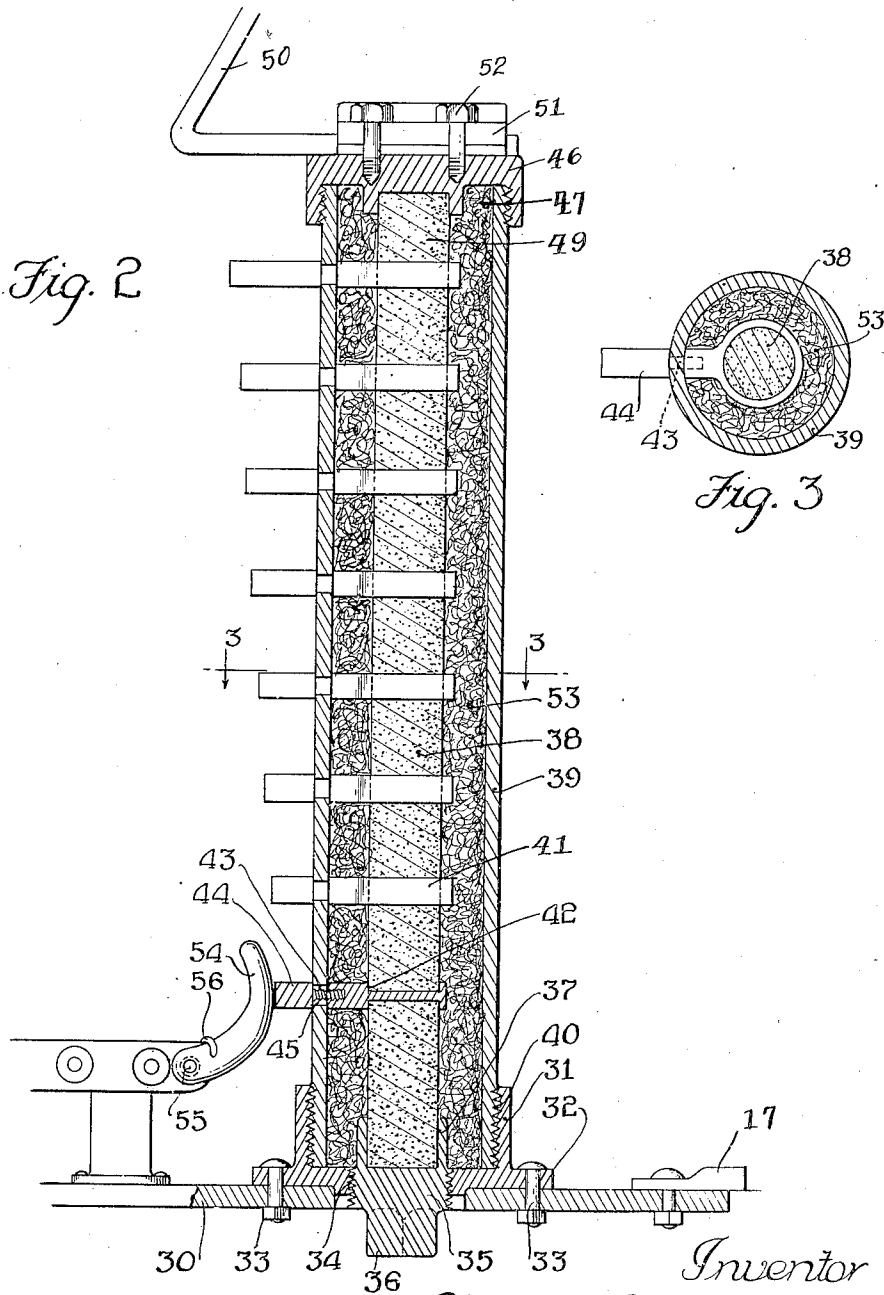
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C. CHRISTENSEN

HIGH TENSION AIR BREAK SWITCH

Filed Dec. 5, 1919

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

CHRISTEN CHRISTENSEN, OF CHICAGO, ILLINOIS, ASSIGNOR TO ELECTRICAL ENGINEER'S EQUIPMENT CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

HIGH-TENSION AIR-BREAK SWITCH.

Application filed December 5, 1919. Serial No. 342,640.

To all whom it may concern:

Be it known that I, CHRISTEN CHRISTENSEN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in High-Tension Air-Break Switches, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

The present invention relates to switches and is particularly applicable to high tension switches of the air break type, although it is to be understood that the invention is not limited to such use only.

In the matter of interrupting current flow, particularly when the same operates under considerable pressure or voltage, when a switch is opened there is a tendency for the current to continue flowing across the break. This tendency is present at all voltages, but it becomes acute only at higher voltages, or under particularly heavy current flow. In other words, the question of interrupting a flow of electrical energy may be put in terms of wattage, and the switch may be rated in terms of its interrupting capacity for a flow of energy indicated in watts.

Heretofore, in the art, it has been found that an air break switch of the usual type is capable of interrupting a flow of energy represented by between four and five thousand k. w., but higher than this an air break switch is unreliable as heretofore constructed.

I have conceived that if means were provided for reducing the flow of current by the insertion of resistance or other means, so that the wattage of the flow of energy did not exceed the safe amount, it would be possible to interrupt any commercial flow of energy whatever.

My proposal amounts to a change in the point where the heat is developed upon the interruption of current flow, by causing part of this heat to develop in the resistance and part in the arc, the part in the arc being

small enough to permit the flow of current to be interrupted.

I am aware that it has been customary to employ a rheostat in controlling electric motors and other electrical apparatus, but I believe that I am the first to point out how it is possible to interrupt a large flow of electrical energy by first introducing resistance to cause part of the heat which would otherwise be generated in the arc upon breaking the circuit to be developed in a resistance or at some other point, so that the flow of energy is decreased to a safe value for rupturing at the switch. I believe furthermore that I am the first to have this resistance automatically controlled by the switch itself so that the simple act of opening the switch first inserts the resistance to cut down the flow of energy to a safe value, and then rupturing the same on further movement of the switch.

This improvement in the rupturing ability of the switch also entails other advantages. Heretofore, it has been found that the interruption of a relatively large flow of energy is often accompanied by surges. This seems to be due to the fact that the breaking of the arc in the air is very sudden. The inertia of the flow of energy thereupon becomes very noticeable, resulting in excessive potential rises which are dangerous to the insulation of the line or the apparatus and which tend to disturb the phase relation in multiphase circuit, or to interfere with synchronous apparatus.

By the same means which tends to permit the interruption of a large flow of energy, it is possible to reduce the flow of energy slowly enough so that no surge effect is caused.

It is not intended to limit the invention solely to an air break switch, as the principles of the invention may be equally well applied to oil switches or switches of any other type. While the invention is described in connection with an air break switch as a specific embodiment, it is to be understood that different ways of arranging the structure may be provided. The switch arm may

be made to contact directly with the resistance, as well as with a plurality of taps as I have shown.

A further object of my invention is to embody the foregoing principle in a simple, efficient and durable structure, described in detail in the following specification and disclosed in the accompanying drawings, in which:

Figure 1 is an elevational view, partly in section, of an air break switch embodying the improvements in my invention;

Figure 2 is an enlarged longitudinal sectional view of a preferred form of resistance element;

Figure 3 is a cross section on the line 3—3 of Figure 2;

Figures 4, 5 and 6 are diagrammatic illustrations of the preferred form of the invention and two modifications of the resistance shown.

Referring more particularly to the drawing, the device of my invention is shown applied to an air break switch, the latter embodying a structure similar to that disclosed in my copending application, Serial No. 301,714, filed June 4, 1919, and comprising a base board or panel 10 of insulating material on which the elements of the switch are mounted. The switch comprises a pair of pedestals 11 and 12 carrying insulators 13 and 14 respectively, the latter supporting the terminals 15 and 16 of the line wires 17 and 18, respectively.

A switch blade 19 is pivoted at 20 to the terminal 16 and in closed position engages the terminal 15. The switch blade 19 is actuated by a lever 22 pivoted at 23 to the terminal 16, said lever being bent to engage the switch arm as at 24 and connected to the arm by a link 25, said link having pivotal connection with the switch arm and lever. A crank 26 is mounted on the panel 10 and is pivotally connected to a stud 27, carrying an insulator 28, which is in turn connected at 29 with the lever 22. The structure described in the foregoing may be varied to suit different conditions without bearing upon my invention.

My invention provides a resistance element either continuous or divided into sections and provided with contact elements disposed in the path of the switch arm and one preferred form is shown in Figures 2 and 3.

Referring now to Figure 2 I provide a support 30 extending horizontally from the terminal 15. The support 30 has mounted thereon an interiorly threaded cup 31 provided with an annular flange 32 secured to the support 30 by means of bolts 33. The base of the cup 31 is provided with a central opening 34 threaded to receive a plug 35 provided with a squared head 36 to receive a wrench. The plug 35 is provided

on its inner end with a recess 37 to receive one section 38 of the resistance element. The resistance element is housed by a casing 39 threaded into the cup 31 at 40, said casing being constructed of bakelite or some other insulating material such as porcelain.

As pointed out hereinbefore, the resistance element is made up of a plurality of sections 38, these sections having their adjacent ends receivable within abutments 41, said abutments being provided with recesses 42 in the opposite faces thereof to receive the adjacent ends of said resistance sections. Each of the abutments 41 is provided with a threaded opening adapted to receive the threaded extension 43 carried by the contact members 44, said casing 39 being provided with a plurality of slightly elongated openings 45 to accommodate said threaded extensions 43 when assembling the device. The contact members 44 are graduated in length from the base toward the top of the casing in order that the same may be maintained within the path of movement of the switch blade at all points.

The upper end of the casing 39 is threaded to receive a cap 46, said cap being provided with a concentric enlargement 47 recessed as at 48, to receive the end of the endmost resistance section 49. A standard arcing horn 50 is secured to the cap 46 by means of a clamp 51 and bolts 52. The space between the abutment and between the resistance sections and the wall of the casing may be filled in by an insulating compound 53.

In order that the switch blade may have good contact with the contact members 44, a follower arm or finger 54 is pivotally mounted at 55 on the free end of said switch blade, a coiled spring 56 being associated with the pivot and engaged with the finger 54 to maintain the same in contact with the members 41.

In actual use, when the switch is installed the crank 26 is usually connected to a switch handle (not shown) the panel 10 being mounted on a framework in an elevated position and the operating handle of the switch being located either within the power house or at some point convenient to the operator. When the switch blade is moved to the open position the free end of the same describes an arc defined by the dotted line 57 in Figure 1. As the finger 54 passes over the contacts 44, it engages each one successively and thereby increasing by steps the degree of resistance interposed in the circuit, and when the finger 54 finally leaves the arcing horn the resistance interposed in the circuit reduces any arcing to a minimum and consequently upon breaking the circuit there is little or no surging in the line.

Figure 4 illustrates diagrammatically the circuit as applied in the preferred form of the invention embodying the structure

shown in Figures 1 to 3, inclusive. In this figure the line wires 17 and 18 are shown and the switch blade 19. The resistance sections 38 are shown diagrammatically and also the tap 44.

In Figure 5 the resistance is in multiple, a conductor 58 being connected at 59 to the load line wire 17 and having extending therefrom a plurality of resistances being in increasing proportion in relative size from the load line outwardly toward the end of the conductor 58. The following finger or contact arm 54, carried by the switch blade, must necessarily be of sufficient length to span two or more of the contact points 61, for an obvious purpose. An arcing horn 62 is arranged at the outer end of the bank of resistances.

Figure 6 illustrates a plurality of resistances 63 of equal size connected in series by means of the conductors 64. The resistances shown in Figures 5 and 6 may be either resistances or reactances, or both.

It will be understood, of course, that I do not limit myself to the specific application of the device to the type of switch shown, the disclosure merely illustrating one application of my invention. Neither do I desire to be limited to the specific construction of the resistance element, as the same may as easily comprise coiled resistance as that shown. The resistance shown is preferably carborundum or any other composition suitable for the purpose.

I claim:

1. The combination with a high tension air break switch having a swinging arm, of a plurality of resistances substantially free of inductance having taps arranged in the path of movement of the swinging arm to be cut into the circuit controlled by the arm as the same is swung, and an arcing horn in the path of movement of said arm.

2. In combination with a high tension air break switch having a swinging arm, an extension on one terminal of said switch, a casing of insulating material mounted on said extension, a plurality of sections of resistance in said casing, a plurality of taps defining the sections and extending beyond the casing into the path of movement of the arm, and means for securing said sections of resistance.

3. The combination with a high tension air break switch having a swinging arm, of an extension on one terminal of said switch, a casing mounted on said extension having a plurality of sections of resistance therein, a plurality of abutments forming taps defining said sections, and projecting beyond the casing, a retaining cap on the casing, and means at the other end of the casing for clamping said sections against said cap.

4. In the art of interrupting high poten-

tial circuits in air the novel process of breaking the flow of current in such a manner as to avoid setting up of surges or other dangerous potential disturbances which comprises, interposing a resistance substantially free of inductance gradually into the circuit at the point where the current is to be interrupted, drawing an arc in air in series with said resistance, and then breaking the arc in air.

5. In the art of interrupting high potential circuits the novel process of breaking the flow of current in such a manner as to avoid setting up potential disturbances which comprises, interposing resistance substantially free of inductance gradually into the circuit at the point where the current is to be interrupted, drawing an arc in series with said resistance, and then quenching the arc.

6. In combination a line, a switch normally connected in closed position in said line in series, said switch having a movable blade, a horn gap electrode mounted adjacent the path of the blade, a resistance substantially free of inductance permanently connected between the horn gap electrode and one side of the line, said movable blade for first switching said resistance gradually into the circuit and thereafter interrupting the circuit at said horn gap.

7. In a switch a stationary pivot terminal, a stationary contact terminal, a switch arm pivoted on said pivot terminal and adapted to engage said contact terminal, said arm having an extending contact member, a resistance member having a row of stationary contacts adapted to be successively engaged by said contact members when the free end of the switch blade is swung about the pivot terminal for opening the circuit by gradual reduction of current flow.

8. In a switch a stationary pivot terminal, a stationary contact terminal, a switch arm pivoted on said pivot terminal and adapted to engage said contact terminal, said arm having an extending contact member, a resistance member having a row of stationary contacts adapted to be successively engaged by said contact member to cause gradual reduction of current flow, when the free end of switch blade is swung about the pivot terminal for opening the circuit, and an arcing horn surmounting said resistance member and adapted in connection with said contact member to rupture the final arc upon opening of the switch.

9. In a switch a stationary pivot terminal, a stationary contact terminal, a switch blade pivoted on the pivot terminal and adapted to engage the contact terminal when in closed position, a series of contacts arranged in a row vertically adjacent the stationary contact terminal, resistance means of a suitable value to reduce the flow of current

through the switch when the resistance is connected in series therewith, said resistance means being connected between said contacts, a finger at the end of the moving switch blade adapted to engage said contacts and an arcing electrode mounted above said row of contacts, said arcing electrode cooperating with said fingers to rupture the final arc when the circuit is opened. In witness whereof I hereunto subscribe my name this 25th day of November A. D. 1919.

CHRISTEN CHRISTENSEN.