Oct. 17, 1933. T. E. MURRAY 1,930,485

CIRCUIT BREAKING MECHANISM

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Fig. 1

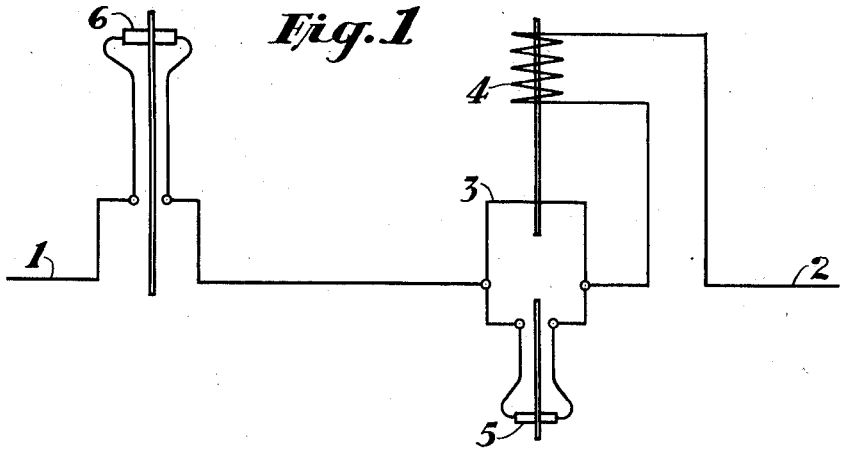


Fig. 2

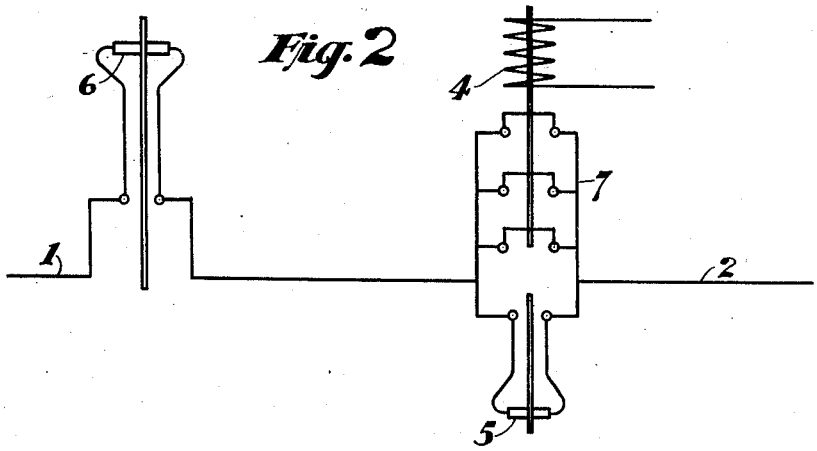
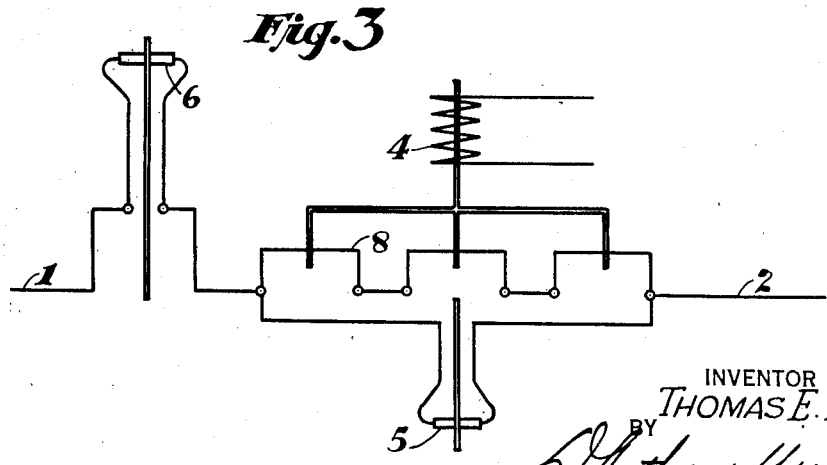


Fig. 3



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Oct. 17, 1933. T. E. MURRAY 1,930,485

CIRCUIT BREAKING MECHANISM

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Fig. 4

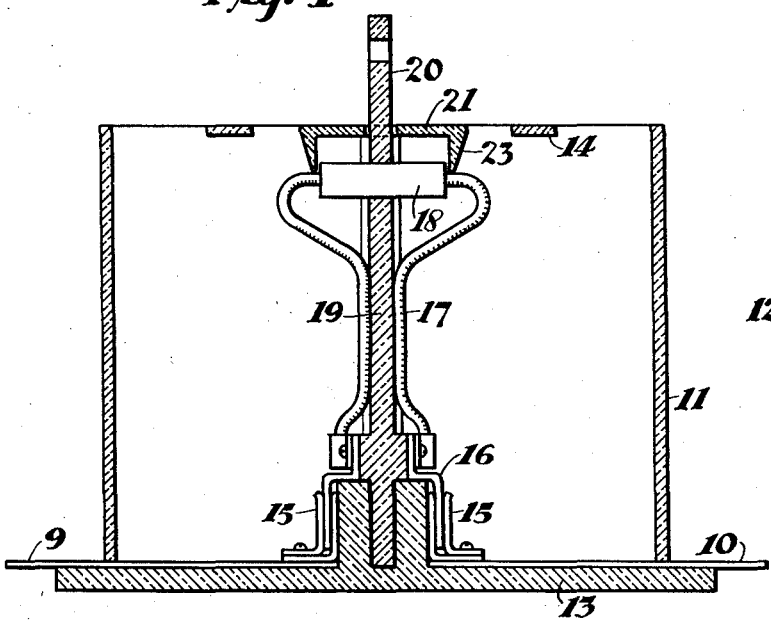


Fig. 5

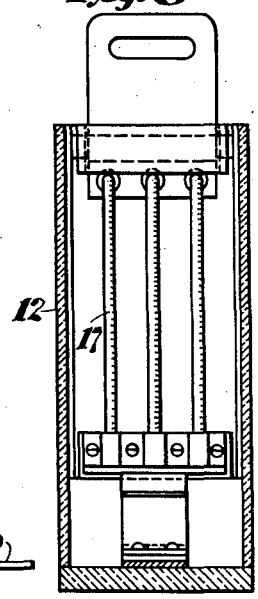


Fig. 6

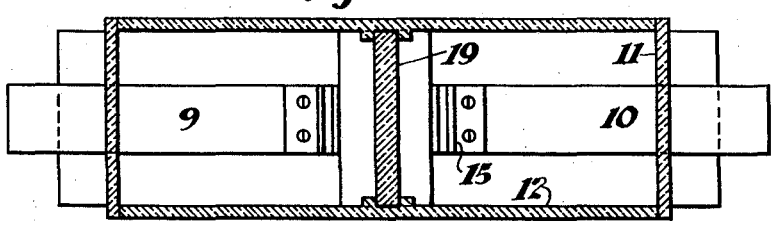
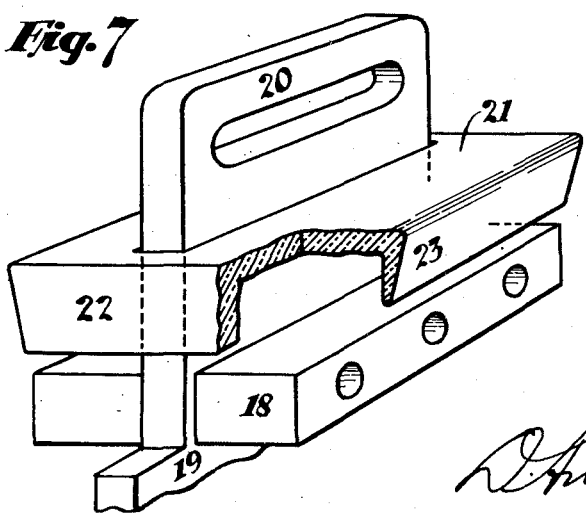


Fig. 7



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CIRCUIT BREAKING MECHANISM

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Fig. 8

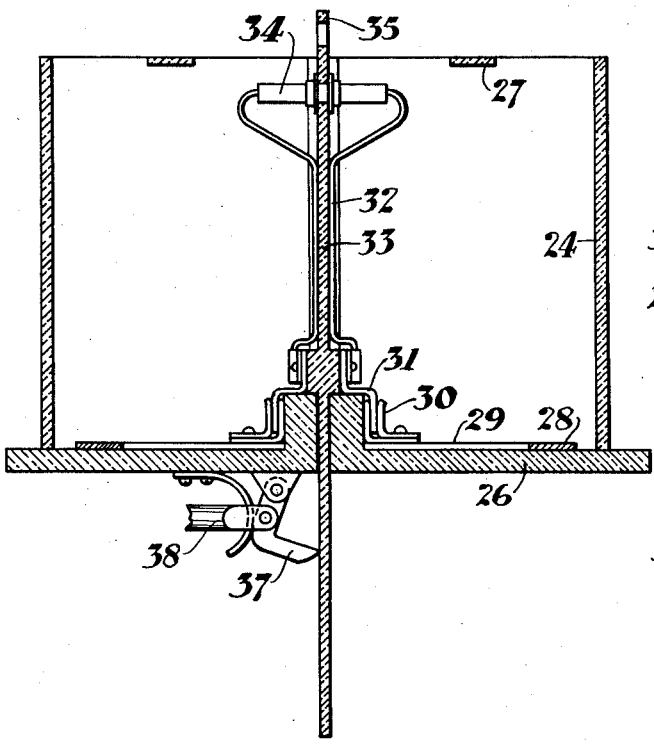


Fig. 9

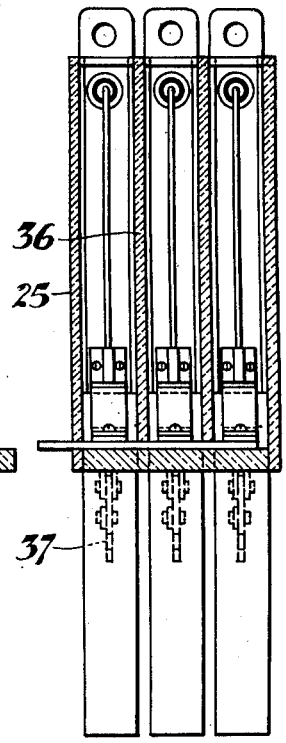
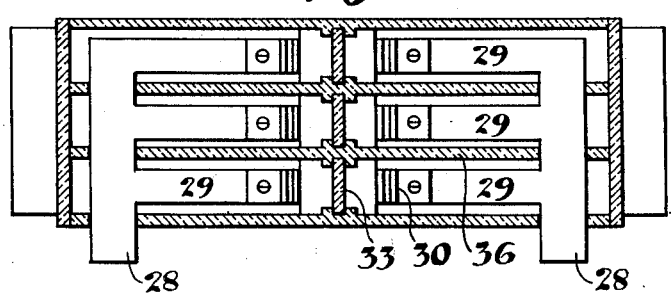


Fig. 10



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CIRCUIT BREAKING MECHANISM

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Fig. 11

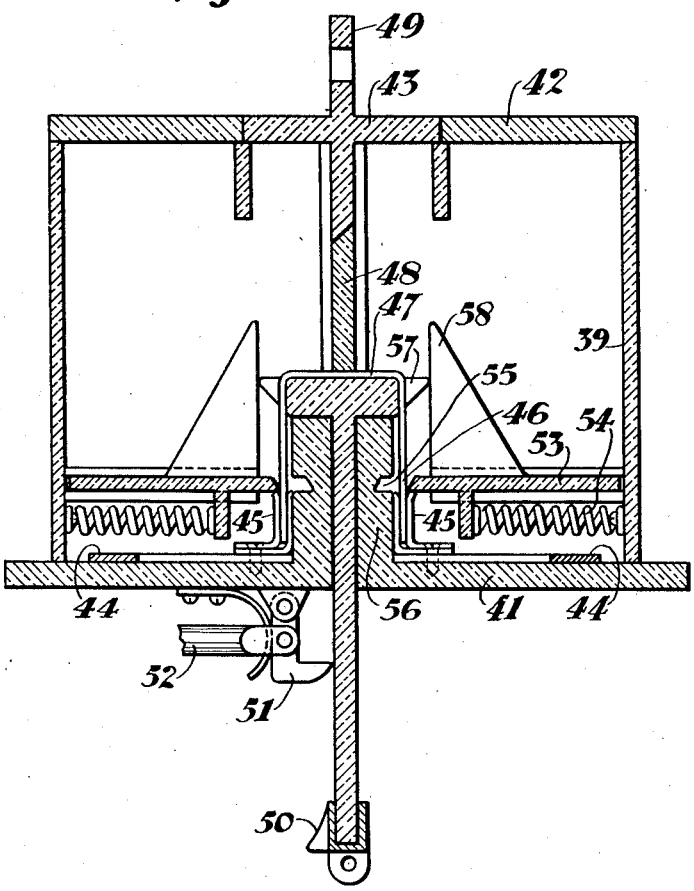


Fig. 12

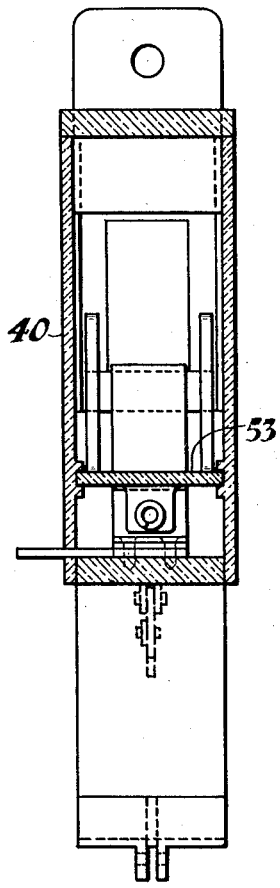
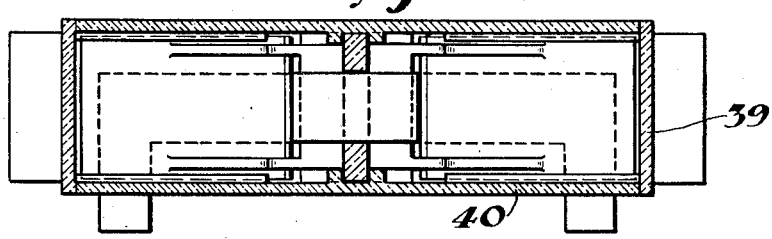


Fig. 13



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Patented Oct. 17, 1933 1,930,485

UNITED STATES PATENT OFFICE

1,930,485

CIRCUIT BREAKING MECHANISM

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Application August 2, 1928. Serial No. 296,881

4 Claims. (Cl. 175—294)

The invention aims to provide an improved combination of devices useful particularly for the breaking of high tension circuits as substitutes for the complicated and expensive oil switches. The mechanism or combination of devices may be controlled in normal operation manually or by means of an overload, reverse current, reverse energy or other form of relay in the same manner as the usual oil circuit breakers. In addition there is provided a fuse breaker which opens the circuit on a dead short circuit. This operation takes much less time than is required by the mechanisms at present in use in which it is necessary to overcome the inertia of mechanical devices such as relays, trip coils, springs and the like which have to be set in motion.

The accompanying drawings illustrate embodiments of the invention.

Figs. 1, 2 and 3 are diagrams illustrating alternative circuit arrangements;

Figs. 4, 5, 6 and 7 illustrate the heavy duty fuse breakers; Fig. 4 being a vertical longitudinal section; Fig. 5 a vertical transverse section; Fig. 6 a horizontal section of the fixed contacts, and Fig. 7 a perspective view of a detail;

Figs. 8, 9 and 10 illustrate the light duty fuse breaker; Fig. 8 being a longitudinal vertical section, Fig. 9 a transverse vertical section and Fig. 10 a horizontal section showing the fixed contacts;

Figs. 11, 12 and 13 are similar views respectively illustrating the relay controlled or other distant controlled switch;

Referring first to Fig. 1, the lines 1 and 2 are parts of one circuit or of one phase of a multiple phase circuit. In this line are introduced a switch 3 controlled from a distant point by a relay 4, a light duty fuse breaker 5 in parallel with the switch 3 and a heavy duty fuse breaker 6 in series with the switch 3.

Fig. 2 illustrates a modification in which the distant controlled switch is a triple switch 7 with three branches in multiple.

Fig. 3 illustrates a similar arrangement using a triple switch 8 with the three branches in series.

When the switch 3 is opened by the action of the relay lifting the bridge between the terminals, the entire current will be thrown on to the fuse 5 which will blow promptly and complete the break in the circuit.

This type of circuit breaker is more fully described and claimed in an application of Thomas E. Murray, Jr. No. 257,861 filed Febrary 29, 1928.

This combination switch and fuse breaker operates upon a gradual and slight increase of the current beyond the normal, and thus effects a comparatively slow break in the circuit. Or the switch 3 may be opened by hand during the passage of the normal current. For very high tension circuits or for circuits carrying a very large volume of current the mechanically operated switch, that is, the relay or hand operated switch, may be of the multiple type such as the parallel arrangement 7 of Fig. 2 or of the series arrangement such as the switch 8 in Fig. 3.

In case of accident, such as a dead short circuit, the heavy duty fuse 6 will blow and break the circuit in a very much shorter period of time than can be effected through the mechanical switch. The invention contemplates the omission of this heavy duty fuse in some installations. Where it is introduced into the line, the blowing of it will not affect the light duty fuse 5. The ordinary fuses in electric circuits have a capacity very slightly above the normal load on the circuit so that they will blow on a slight overload.

I propose to have the fuse (or fuses where several are combined) of the heavy duty fuse breaker of a capacity which is substantially above the normal load on the circuit and which is predetermined so as to avoid a blow in the case of slight trouble on the line and so that the fuses will not be subjected to a serious heating effect under normal conditions.

To avoid these disadvantages I propose to make the fuse capacity at least ten per cent greater than the normal load and preferably many times greater. To take care of an extreme short circuit on a line normally carrying two hundred amperes I might even use a fuse having a capacity of two thousand or three thousand amperes. Such a fuse is heated only to a trifling extent under normal conditions and is, therefore, more reliable over a long period of time than the ordinary fuses which carry under normal conditions current approaching that capacity and are thereby subjected to considerable heating effect.

The structural arrangement of the heavy duty fuses is illustrated in Figs. 4, 5 and 6. The leads 9 and 10 enter the opposite ends of a box having end walls 11, side walls 12 and a base 13, the top being open except for braces 14, or being closed as illustrated in the box or casing for the switch, Fig. 11. The leads carry fixed contacts 15 normally engaged by movable contacts 16 which are clamped to the lower ends of three cables 17 which are carried upward and into a block 18 within which the ends are connected to a fuse. The block 18 and the cables 17 and switch blades 16 are carried on a barrier 19 arranged to slide

in grooves in the side walls, the carrier having a handle 20 which projects up above the top of the box. The main purpose of this carrier is to lift the fuses and connections out of the box in order to replace them after they have blown.

On the upper portion of the carrier there is a shield 21 which slides freely up and down and which has side flanges 22 (Fig. 7) and end flanges 23 adapted to fit over the fuse block 18.

The shield 21 has its ends resting on the cables 17. When a fuse blows the explosive effect of the gases generated and the repulsion effect due to the interposed insulating barrier formed by the carrier 19 cause the ends of the cables to fly apart as far as their length and the space within the box will permit. This wide separation of the ends is important to prevent the persistence of the current through an arc between the ends which were attached to the fuse. The shield 21 furnishes a further security against such an arc. It is made of insulating material so that when it drops over the block 18 it closes the passageways therethrough and prevents the arc from passing or continuing to pass from one side to the other of the barrier 19.

Figs. 8, 9 and 10 illustrate the light duty fuse. It is mounted in a box similar to that of the heavy duty fuse comprising ends 24, sides 25 and a base 26 and having an open top with braces 27, or being closed if preferred. Whereas the heavy duty fuse consisted of three separate fuse elements in multiple, for the light duty I propose to use a single fuse element at each operation. The drawings show three light duty fuses, but these are used only one at a time. The leads 28 which enter the box near opposite ends have branches 29 each with a fixed switch terminal 30 adapted to engage a movable terminal 31 which is connected to a single upright cable 32 mounted on a carrier 33 forming a partition or barrier between the two ends of the box. The opposite cables 32 are connected at their upper ends to a fuse within the case 34. The carrier has a handle 35 at the top by which it may be raised to a position giving access to the fuse for replacement. There are longitudinal partitions 36 (Figs. 9 and 10) dividing the box into three isolated chambers longitudinally and in each of these chambers there is a carrier 33 with its connected parts and a pair of branches 29 with their fixed terminals. Under the bottom of the box there are spring latches 37 each of which engages the lower end of one of the carriers 33 when these are lifted to carry the fuse and its connected cables out of the circuit. Starting with all of the fuses thus lifted and out of circuit, a solenoid or other distant control is operated through its rod 38 to withdraw one of the latches 37 and to permit one of the fuses to drop into position with its terminals 31 entering the fixed switch terminals 30. When this fuse blows the distant control will be exerted to drop the next fuse into operative position, and so on.

Although only one of these light duty fuses is intended to be in line at a given time because they are comparatively small fuses, there may be several of them arranged in multiple as described for the heavy duty fuse breaker.

The mechanically operated breaker or switch of Figs. 11, 12 and 13 is like the fuse breakers mounted in a box having end walls 39, side walls 40, a base 41 and a top 42 which with branches 43 on the carrier entirely encloses the box (or it may be left open as shown in connection with the fuse breakers). The leads 44 enter the opposite ends of the box and carry fixed terminals 45 adapted for engagement by the movable terminals 46 of a conducting bridge 47 which is carried by the carrier 48 movable in guides in the side walls and adapted to be raised by a handle 49 until a projection 50 on its lower end engages a spring latch 51 which holds it until released by a solenoid pulling on a rod 52 whereupon the carrier will drop again into the closed circuit position.

For this switch mechanism I propose also to use certain insulating barriers 53 arranged to slide horizontally in guides in the side walls of the box and under pressure of springs 54 to move across the gap created between the terminals 45 and 46 when the latter are raised, the ends of these sliding barriers entering recesses 55 in an upward extension 56 from the bottom of the box.

The carrier is provided at opposite sides with cams 57 which bear on the vertical faces of cams 58 carried by the slides. When the barrier drops, the cams 57 force the slides back to permit the movable plates to enter the fixed plates.

When the carrier is sufficiently raised to bring the cams 57 above the tops of the cams 58, the slides are automatically pushed into their operative position. The barriers 53 extend across the full width of the box and thus effectively prevent the establishment or maintenance of an arc between the separated terminals.

When the carrier is unlatched it will drop by gravity to the circuit closing position.

The mechanically operated switch of Figs. 11, 12 and 13 is shown as a single break switch. Where a multiple break switch is preferred, the units of Fig. 11 need only to be multipled accordingly, being connected in shunt or in series as desired.

The fuse used may be of various known types. Preferably, however, it is of the type illustrated in the above mentioned application of Thomas E. Murray, Jr., and in my application No. 755,135 filed December 11, 1924, in which the gas generated by the blowing of the fuse is caused to separate the ends promptly and sufficiently to the full distance permitted by the connections so as to prevent reestablishment of the current.

Various modifications may be made by those skilled in the art without departing from the invention as defined in the following claims.

1. A high tension electric circuit which comprises a circuit breaker switch, means for automatically opening said switch on the passage of current above a determined limit, a fuse in parallel with said switch and adapted to blow upon the opening of said switch, and a fuse in series with said switch and adapted to blow upon the appearance of a dead short circuit.

2. A high tension electric circuit which comprises a number of circuit breaker switches in parallel, means for automatically opening said switches on the passage of current above a determined limit, a fuse in parallel with and adapted to blow upon the opening of said switches, and a fuse in series with said switches and adapted to blow upon the passage of a current of upwards of ten per cent in excess of the normal current of said circuit.

3. A high tension electric circuit which comprises a fuse adapted to blow upon the passage of a current above the normal current of said circuit, a circuit breaker switch in parallel with said fuse, means for automatically opening said

switch upon the passage of a current sufficient to blow said fuse, and a fuse in series with said switch and adapted to blow upon the passage of a current exceeding by at least ten per cent the normal current of said circuit.

4. A high tension electric switch which comprises a circuit breaker switch, a fuse in parallel with said switch and adapted to blow upon the opening of said switch, and a fuse in series with said switch and adapted to blow upon a dead short circuit.

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