Sept. 1, 1942. M. C. COOLEY 2,294,833

ELECTRICAL APPARATUS

Filed Oct. 10, 1940 2 Sheets-Sheet 1

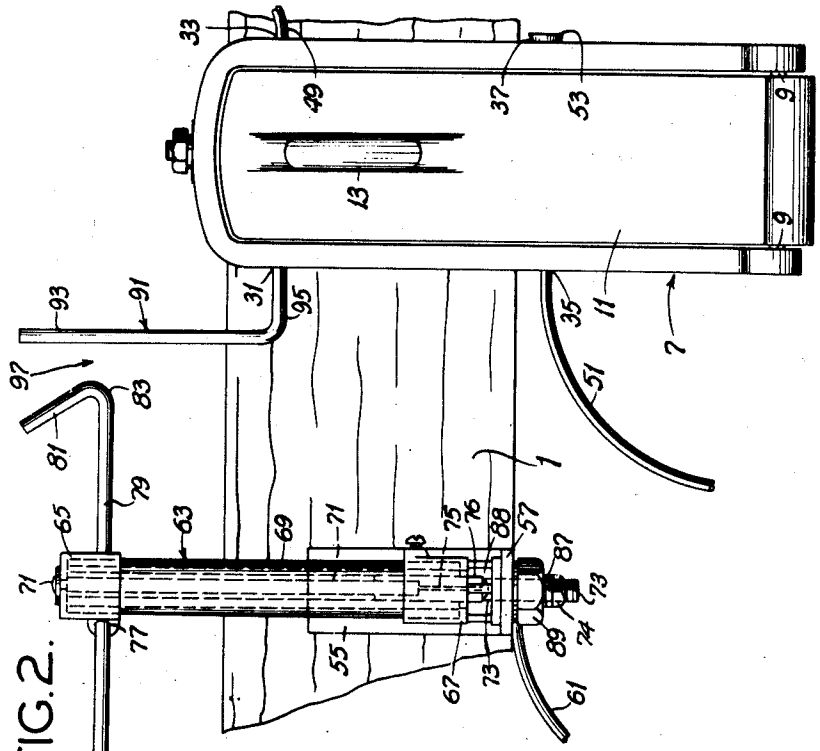


FIG. 2.

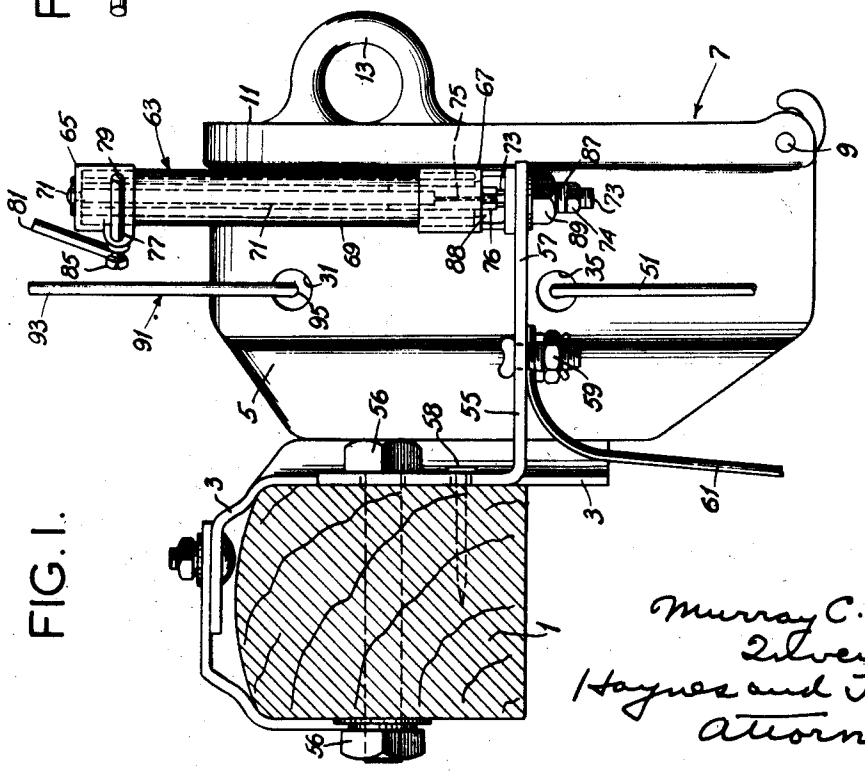


FIG. 1.

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Filed Oct. 10, 1940 2 Sheets-Sheet 2

FIG. 3.

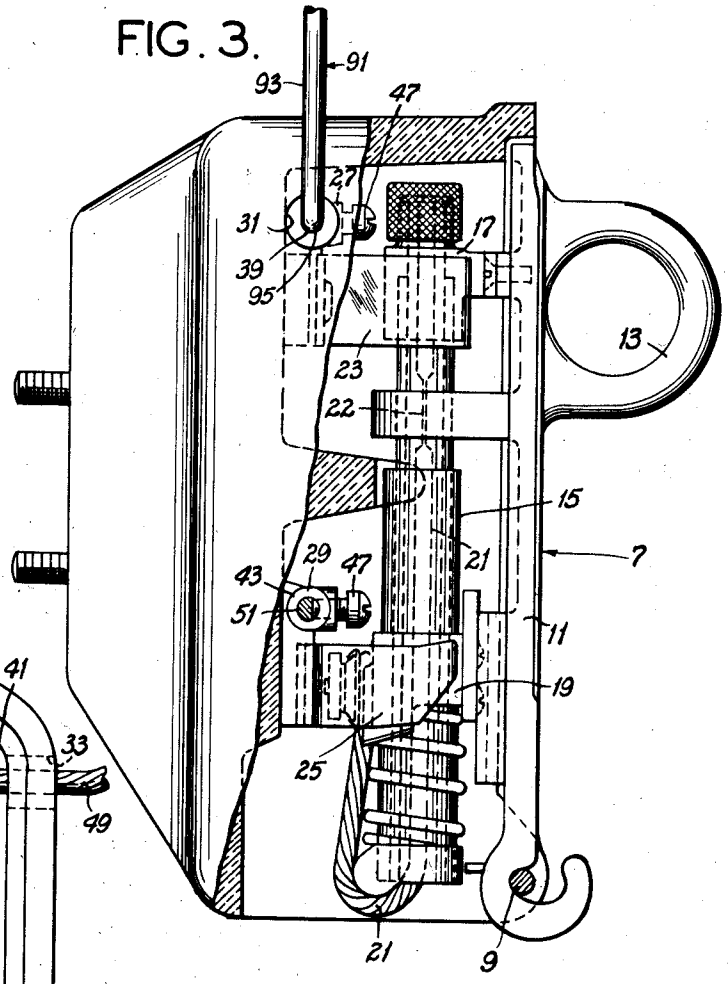
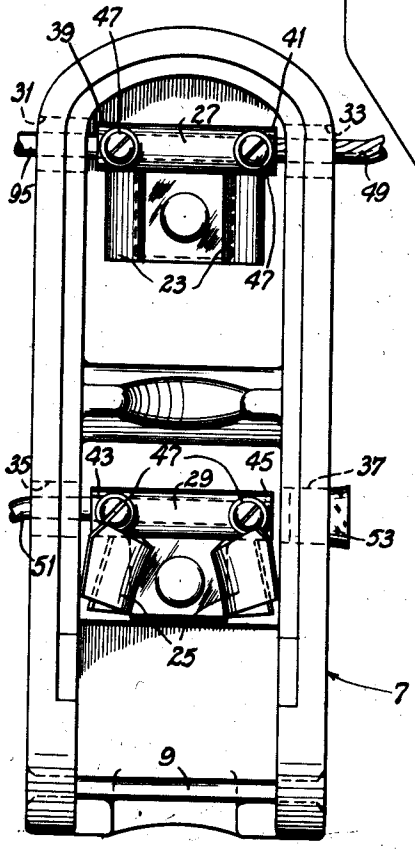


FIG. 4.



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UNITED STATES PATENT OFFICE

2,294,833

ELECTRICAL APPARATUS

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Application October 10, 1940, Serial No. 360,564

9 Claims. (Cl. 200—115)

This invention relates to electrical apparatus, and with regard to certain more specific features, to a combined switch and lightning arrester.

Among the several objects of the invention may be noted the provision of a lightning-arrester gap, in association with switch means or the like which is preferably of the closed variety; and the provision of apparatus of the class described which uses to best advantage certain gap and switch constructions requiring only a simple addition to bring about an economical but effective combination for relieving the switch apparatus of lightning and like surges. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is illustrated one of various possible embodiments of the invention,

Fig. 1 is a side elevation;

Fig. 2 is a front elevation taken from the right of Fig. 1;

Fig. 3 is an enlarged detail side elevation of a fuse switch, parts being broken away for clarity; and,

Fig. 4 is an elevation taken from the right of Fig. 3, but showing a door and fuse holder removed.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now more particularly to Fig. 1, there is shown at numeral 1 a cross arm of a pole or the like (not shown) which carries a bracket 3 for the enclosing housing 5 of a fuse switch box shown generally at numeral 7. The fuse switch is exemplary of various enclosed switches to which this invention appertains. The housing 5 has a pivot 9 upon which is hinged a door 11, adapted to be controlled from a handle 13 for opening and closing. Full details of a fuse switch box are shown for example in the Birkenmaier United States Patent 2,176,045, dated October 17, 1939.

As indicated in Figs. 3 and 4, the door 11 carries a fuse holder 15, having terminal-engaging elements 17 and 19 connected by a fuse link 21. The terminal-engaging elements 17 and 19 contact with spring clips 23 and 25, respectively. The clips 23 and 25 are riveted respectively to tubular conducting line terminals 27 and 29.

Generally speaking, enclosing boxes of this type are provided in their housings with four openings, such as indicated at 31, 33, 35 and 37. Opposite these openings within the box are axially located the tubular line terminals 27 and 29. Cylindric wire-receiving portions 39, 41, 43 and 45 are opposite the openings 31, 33, 35 and 37, respectively. Suitable set screws, such as shown at 47, serve to hold whatever line wires are brought into the proper openings, thus making electrical contact between the respective line wire and the proper line terminal.

Since only one wire connection needs to be made with each tubular line terminal 27 or 29 (see for example wires 49 and 51), the remaining unused openings in the box are ordinarily shut by means of a cork or the like, as indicated for example at 53. Heretofore these unused openings have served no useful purpose after the line wires have been connected to the line terminals. Likewise, one pair of the wire-receiving sockets 39, 41, 43 and 45 was unused, together with respective set screws. The present invention makes use of one of these in connection with a lightning arrester gap.

At numeral 55 is shown a conducting bracket held in part by means of a bolt 56, and in part by means of a nail 58. This bracket has a horizontal portion 57, with which is associated a wire connector 59 for connecting a ground wire 61. The ground wire 61 is suitably grounded for accommodating lightning surges and the like.

At the end of the horizontal bracket 55 is carried a tubular gap member shown generally at 63 and being of the general type shown in the United States patent application of Carl E. Mosley, Serial No. 345,944, filed July 17, 1940, for Electrical apparatus. Full details of this device are disclosed in said application; but briefly, it consists of an upper conducting head 65 and a lower conducting head 67 joined by an insulating tube 69. The lower head 67 is in electrical connection with the bracket 55. Within the insulating tube 69 is a conducting rod 71 reaching from the upper conducting and enclosing head 65 downward into the tube 69. It is spaced from a lower conducting member 73 by means of a gap 75 in an insulating plug 76. The member 73 is in conducting relationship with respect to the bottom member 67 being threaded through an extension 87 therefrom. A lock nut 74 holds any predetermined threaded adjustment of the member 73 up against the plug 76. The member 67 rests upon the con-

ducting bracket 55 and is held in an opening in the bracket by the stud 87 and holding nut 89 which is threaded thereon. Openings 88 in member 67 permit exit of gases engendered upon breakdown through the gap 75. All of this is shown in said application.

The conducting head 65 is provided with a cylindric passage or bore 77 for receiving a gap arm 79 at a horizontal cylindric portion. The arm 79 may rotate and slide in the opening 77. A bent portion 81 forms an angle 83. A set screw 85 serves to hold the gap arm 79 in any adjusted axial or rotary position. The unit 63 being adjustably held to the bracket 55 by bolt 87 and nut 89, it may be rotated. Hence there are two degrees of rotary adjustment for the gap arm 79, one about a vertical axis, and the other about a horizontal axis. In addition, the gap arm is adjustable axially along the horizontal axis.

Considering the wire 49 as the main line wire of the switch box 7, there is inserted in the same line terminal element 27 which carries said wire a right angular gap arm 91 which has a vertical portion 93 and a horizontal portion 95. The horizontal portion is inserted through opening 31 into the respective socket 39 and held by the respective set screw 47, thus forming a gap-forming extension from the line 49. By rotating the member 63 and the gap arm 79, and if necessary adjusting the gap arm 79 axially, a gap 97 may be established between the gap arm 91 and the gap arm 79. Since the vertical portion 93 of the gap arm 91 is substantial in length, the point at which the bracket 55 is mounted is not critical.

Operation is as follows:

Assuming that the fuse switch box is fused as indicated in Fig. 3, the circuit under normal voltages is from the main line 49, socket 41, line terminal 27, terminal-engaging element 17, fuse link 21, terminal-engaging element 19, line terminal 29, socket 43, and to the distribution line 51. The circuit may be opened by swinging open the door 11, or by fusion at reduced section 22 of the fuse 21. Under the above circumstances, nothing occurs at the gap 97.

However, when a lightning or similar surge occurs, it passes directly through the line terminal 27 to the socket 39, gap arm 91, gap 97, gap arm 79, and through the device 63 to the bracket 55, whence the surge is grounded over the wire 61. This grounding thus occurs without putting the fuse box out of order.

It is to be understood that the invention is applicable to various enclosed types of switches, for example those in which there is substituted for the fuse-carrying member shown in Fig. 3 a switch blade on the door 11.

There are various advantages in the invention. The relatively long vertical portion 93 permits of application of the bracket 55 at any one of various vertical elevations, and the rotary characteristic of the tube 63, plus the rotary characteristic of the gap arm 79 and its axial adjustment, permits of adjusting the gap 97 as desired. Furthermore, axial and rotary adjustment of the horizontal arm 95 in the line terminal 27 makes adjustment more universal.

No change needs to be made in connection with the switch box, except to leave out the cork in one of the unused wire inlet openings and insert the gap arm 91. In addition to what is shown in said Mosley application and said Birkenmaier patent, there is only needed the part 91, and a suitable juxtaposition of the brackets 3 and 55 and the parts carried thereby.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. The combination in electrical apparatus, of switch means having line terminals, each line terminal having a pair of line receiving openings only one of which is used for line receiving purposes, a gap arm in one of the unused line receiving openings, a second gap arm spaced with respect to the first-named gap arm, a grounded bracket for the second gap arm adapted to be positioned at various points with respect to the switch means, the first-named gap arm having a horizontal portion providing a rotary adjustment in connection with the switch and a vertical portion, and the second-named gap arm having two degrees of rotary adjustment and an axial adjustment with respect to the gap arm on the switch.

2. In an electrical switch, a box, a pair of line terminals in the box, switch means for electrically connecting and disconnecting said line terminals, a pair of wire-receiving sockets associated with at least one of the line terminals, one of said sockets receiving a line wire, and a gap arm extending from the other socket, said box having openings for passage of the line wire and the gap arm respectively and a grounded gap arm adapted to be mounted adjacent to the switch in various positions and having a spaced relation with respect to the first gap arm, said grounded arm being adjustable.

3. In an electrical switch, a pair of line terminals, switch means for electrically connecting and disconnecting said line terminals, a pair of wire-receiving sockets associated with at least one of the line terminals, one of said sockets receiving a line wire, an adjustable gap arm extending from the other socket and having a vertical portion, and a second grounded gap arm adapted to be mounted adjacent to the switch in various positions and having a spaced relation with respect to the first gap arm, and being relatively adjustable with respect to said vertical portion.

4. In electrical apparatus, an enclosed switch comprising a housing box having four line-receiving openings, line terminals within the box adjacent to the openings, each of said terminals having two sockets, one of which is presented to a respective opening for receiving a conductor through the opening, line conductors attached in at least one opening in each pair, a gap arm extending from the other opening in at least one of the pairs and through the adjacent opening in the housing, and a second gap arm adapted to be adjustably mounted adjacent to the box in various positions and having a spaced relationship with respect to the gap arm which extends from the box.

5. In electrical apparatus, an enclosed switch comprising a housing box having four line-receiving openings, line terminals within the box adjacent to the openings, each of said terminals having two sockets, one of which is presented to a respective opening for receiving a conductor through the opening, line conductors attached in

at least one opening in each pair, an adjustable gap arm extending from the other opening in at least one of the pairs and through the adjacent opening in the housing and turned exteriorly to provide a vertical portion, and a second gap arm adapted to be mounted in various positions adjacent to the box and having a spaced relationship with respect to the gap arm which extends from the box, said second gap arm being adjustable to adjust the gap and to compensate for various positions of the second gap arm with respect to the switch.

6. In electrical apparatus, a switch comprising a line terminal and a load terminal, said line terminal having two line-receiving sockets, one of which is presented to receive a conductor, an adjustable gap arm extending from the other socket and angled exteriorly to provide a movable portion upon rotation of the gap arm in the socket, a separate grounded unit adapted to be mounted in various positions spaced from the switch, and a second gap arm adjustably mounted on said second unit to compensate for various positions of the second unit with respect to the switch and at the same time to obtain a predetermined gap between said two gap arms.

7. In electrical apparatus, a switch comprising a line terminal and a load terminal, said line terminal having two line-receiving sockets, one of which is presented to receive a conductor, an adjustable gap arm extending from the other socket and angled exteriorly to provide a movable portion upon rotation of the gap arm in the socket, a separate grounded unit adapted to be mounted in various positions spaced from the switch, and a second gap arm adjustably mounted on said second unit to compensate for various positions of the second unit with respect to the switch and to obtain a predetermined gap adjustment between said two gap arms, said second unit incorporating in its assembly a second predetermined gap in series with said adjustable gap which is unchanged by variations in positions of said units.

8. In electrical apparatus, a switch unit, a separate grounding unit, means for mounting each of said units independently in various related positions, an adjustable gap arm extending from the switch unit and an adjustable gap arm extending from the grounding unit, said arms being relatively adjustable to compensate for various relative positions of the units and to effect a predetermined gap between the gap arms at such various positions.

9. In electrical apparatus, a switch unit, a separate grounding unit, means for mounting each of said units independently in various related positions, an adjustable gap arm extending from the switch unit and an adjustable arm extending from the grounding unit to compensate for various relative positions of the units and to effect a predetermined gap between the gap arms under such conditions, the gap arm extending from the switch unit having a vertical component to provide for variations in elevational positions of the grounding unit, and the gap arm on the grounding unit being extensible laterally to compensate for various lateral spacings between the switch and grounding units.

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