April 17, 1934. F. L. AIME 1,954,976

AIR SWITCH

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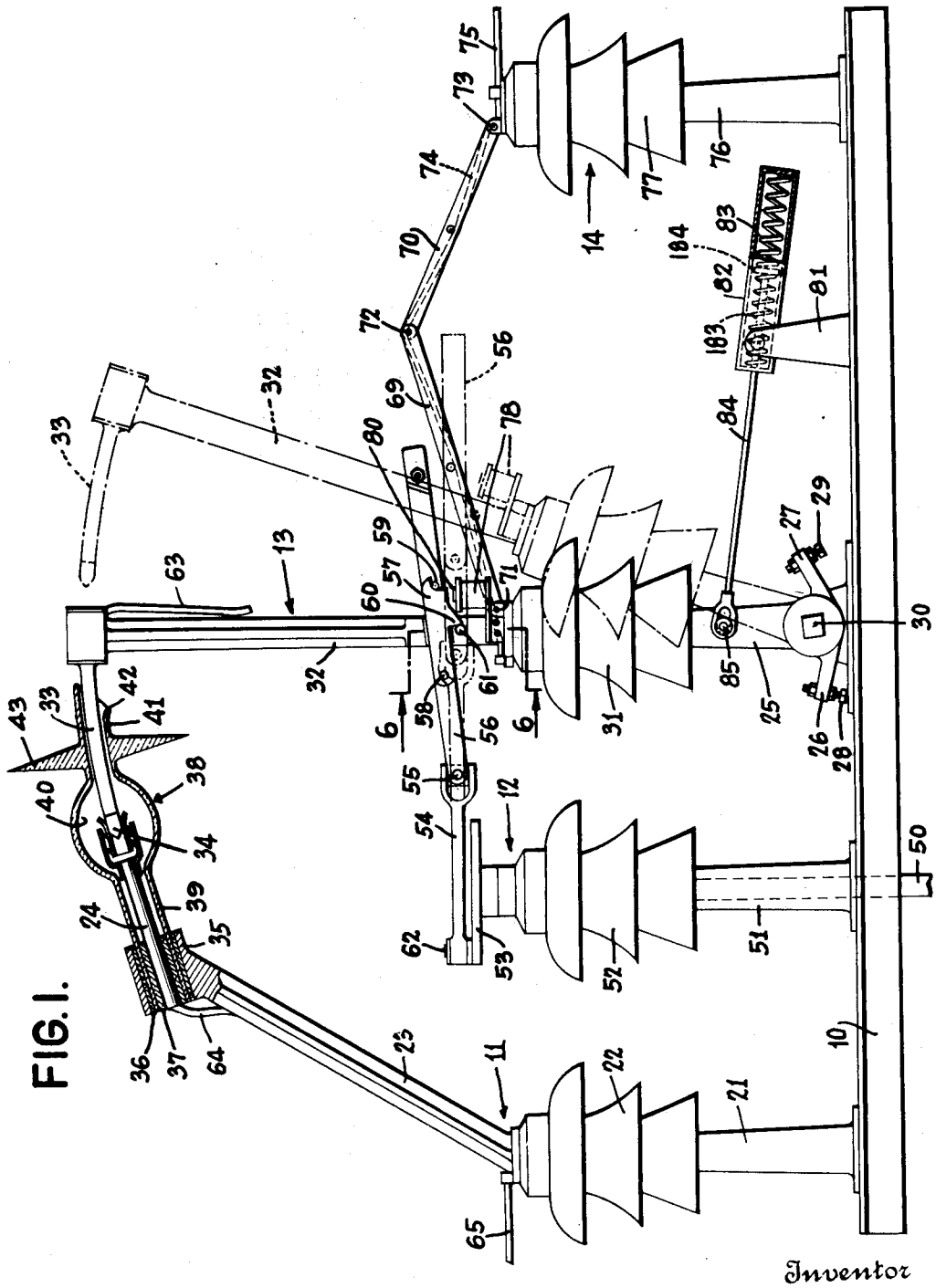


FIG. 1.

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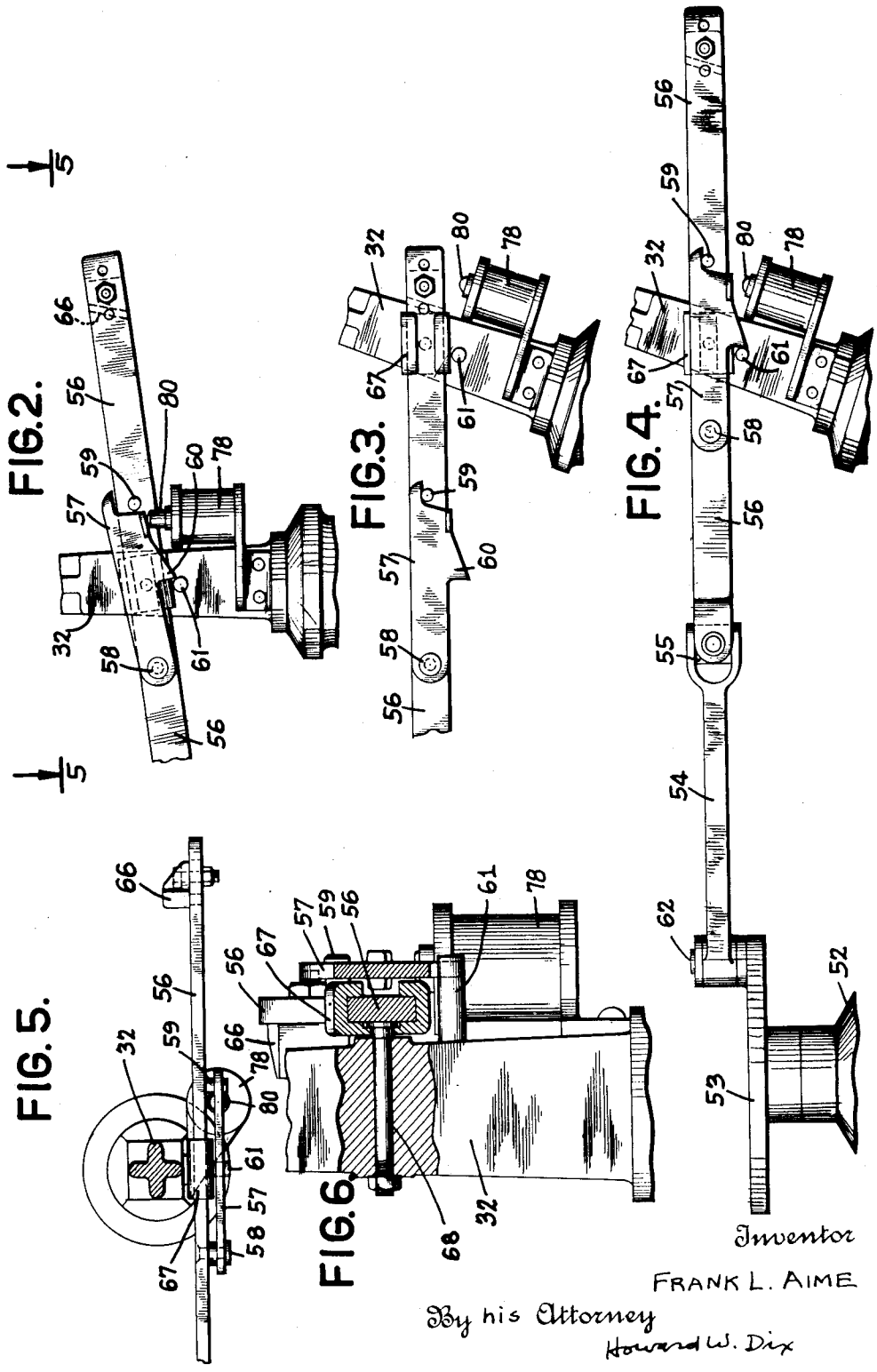
By his Attorney

Howard W. Dix

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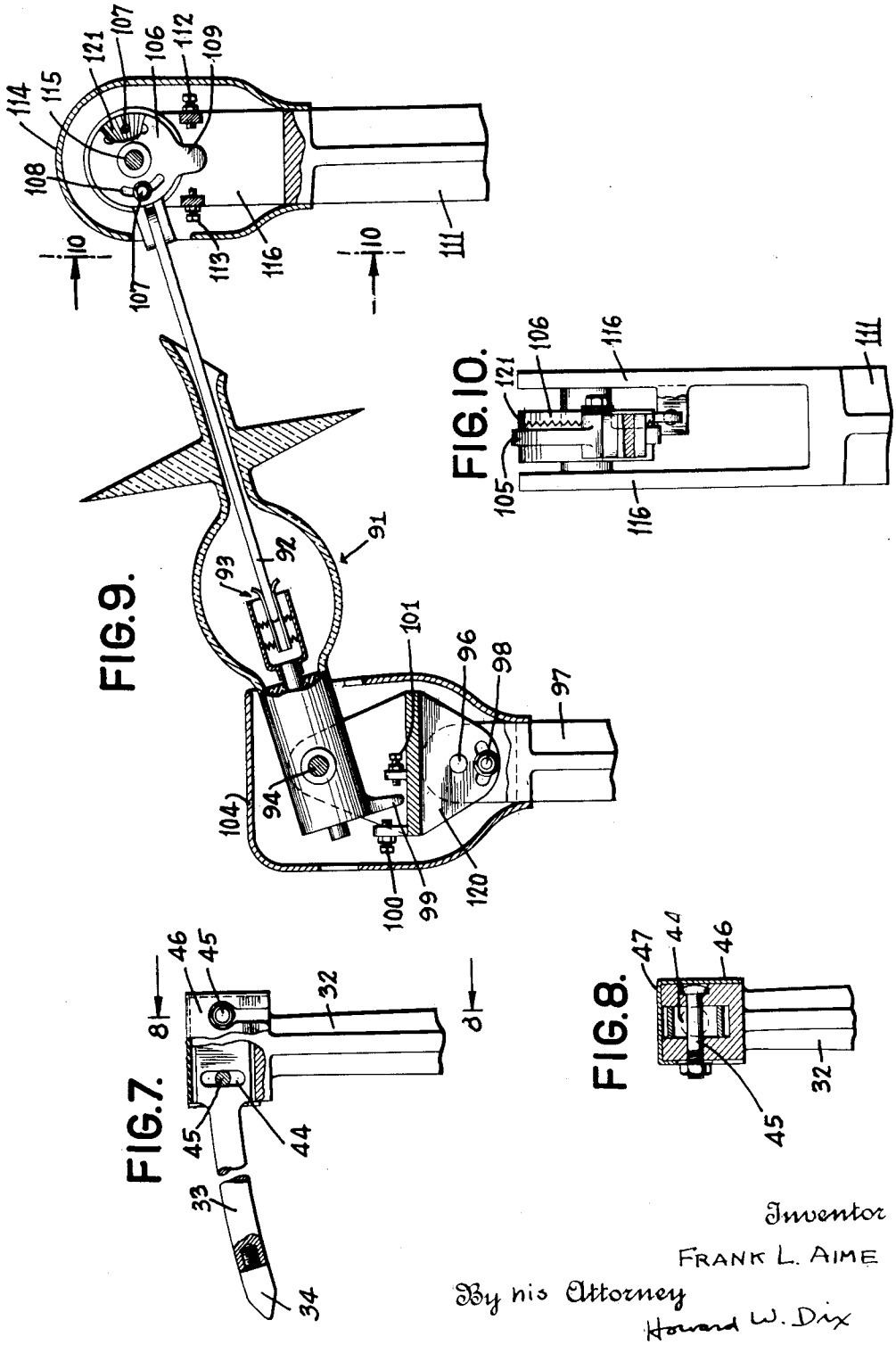
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AIR SWITCH

Filed April 22, 1930 3 Sheets-Sheet 3



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Patented Apr. 17, 1934

1,954,976

UNITED STATES PATENT OFFICE

1,954,976

AIR SWITCH

Frank L. Aime, Yonkers, N. Y.

Application April 22, 1930, Serial No. 446,219

7 Claims. (Cl. 200—89)

The invention relates in general to electric switches, and more particularly to air break switches.

An object of the invention is to provide an air switch having means for automatically operating to extinguish the arc.

Another object of the invention is to provide an air break switch having means for causing the pressure generated by the arc to assist in extinguishing it.

Another object of the invention is to provide an air break switch having devices for causing a current of gases to flow longitudinally of the arc to assist in extinguishing the arc.

Another object of the invention is to provide an air break switch having either manual or automatic trip-free disconnecting means, or both.

Another object of the invention is to provide an air break switch with an arc extinguishing device, which assists in moving the switch mechanism.

Another object of the invention is to provide an air break switch, which is simple, strong, and durable in construction, and effective in operation.

Other objects will be apparent from the following description and claims when considered with the accompanying drawings, in which

Figure 1 is a side elevation, partly in section, of a preferred form;

Figures 2 and 3 are details illustrating the operation of an automatic over-load release;

Figure 4 illustrates the operating parts in open position;

Figure 5 is a section on the line 5—5 of Figure 2;

Figure 6 is a section on the line 6—6 of Figure 1;

Figure 7 is a detail illustrating the plug contact of the switch;

Figure 8 is a section on the line 8—8 of Figure 7;

Figure 9 illustrates a modified form of the invention; and

Figure 10 is a section on the line 10—10 of Figure 9.

In the following description and in the claims parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Like reference characters denote like parts in the several figures of the drawings.

Referring now to the drawings, and more particularly to Figure 1, the switch comprises a base 10 which is mounted upon a suitable support as is well known in the art. The switch further comprises a stationary arm 11, an operating member 12, a movable arm 13, and an insulator support 14.

The stationary arm 11 comprises an insulator pin 21 upon which is mounted a suitable insulator such as a petticoat insulator 22, which, in turn, supports an arm 23 which supports the socket contact terminal 24.

The movable arm 13 comprises an insulator pin 25 supporting a suitable insulator 31, which in turn, supports an arm 32 which carries the plug terminal 33 of the switch. The insulator pin 25 is mounted upon a horizontal shaft having a squared end 30 upon which is also mounted stop arms 26 and 27 having set screws 28 and 29 for limiting the positions of the movable arm 13. It will be understood that, as explained hereinafter, the squared end 30 may be engaged by a suitable operating mechanism to throw the movable arm 13 from a closed to open position, or vice versa.

Referring now to the switch terminals and the devices for extinguishing the arc, the terminal 24 is shown in the form of a conventional socket, which is well-known in the art, and is mounted in a collar 35 at the upper end of arm 23. The contact 33 is in form of a plug, which seats within the socket 24 and has a removable tip 34 (Figure 7). The terminal 33 has a pair of slots 44 in its end, which seats between ears 46 on the end of arm 32. A plurality of bolts 45 pass through the ears 46 and slots 44 to adjustably clamp the terminal 33 in semifixed position. Surrounding the connection between terminal 33 and arm 32 is a shroud 47.

Surrounding the contacts is body or chamber 38 made of suitable insulating material, such as porcelain, or of a plastic insulating material, such as bakelite. The housing 38 comprises a suitable enlarged portion 40, a tubular portion 39, and a tubular portion 41. The tubular portion 39 surrounds and supports the terminal 24, and in turn is supported by the collar 35. Suitable means 37 such as cement may be interposed between terminal 24 and tubular portion 39 and suitable means 36 such as felt may be interposed between tubular portion 39 and collar 35. A petticoat 43 is mounted upon the tubular portion 41 for increasing the creepage distance. The mouth of the tubular portion 41 is shown at a suitable angle to the vertical to substantially prevent the entrance of rain, snow, sleet, dirt, etc., into the tubular portion 41 and into the enlarged portion 40. Preferably the mouth is provided

with a depending lip 42. It will be understood that the movable contact 33 and the parts of the housing 38 and of the stationary terminal 24, which cooperate with the movable terminal 33, are laid out on the arc of the circle whose center is the shaft 30.

The operating insulator 12 comprises an insulator pin 51 having a projection 50 passing through the base 10. It will be understood that the projecting shaft 50 passes through to suitable operating mechanism (not shown) for rotating it together with the insulator pin 51. Mounted upon the pin 51 is a suitable insulator 52 having a plate 53 mounted thereon, which carries a crank pin 62. Secured to crank pin 62 is a link 54, which is connected to another link 56 by a suitable restricted universal joint 55. The link 56 is provided with a catch 57 pivoted by pivot 58, and resting upon a pin 59 (see also Figures 2, 3, and 4). The catch 57 has an abutment 60, which normally engages a pin 61 mounted upon arm 32.

Connected to the arm 32 by means of a bolt 68 (Fig. 6) is a guide member 67 supporting the arm or link 56. The link 56 has a stop member 66 mounted thereon, which cooperates with the guide 67 to assist in limiting the open position of the switch. However, arms 26 and 27 are the principal limiting means.

Pivoted to the cap on the insulator 31, by pivot 71, is a link 69 which is pivoted to link 70 by pivot 72, the link 70 being pivoted to the cap of insulator 77 by pivot 73, forming in effect a grasshopper mechanism, which supports a pigtail or flexible conductor 74, which connects with the line conductor 75 and with the solenoid 78. The insulator 77 is mounted upon an insulator pin 76, which is supported by the base 10. If desired, in place of the line supporting insulator 14, a strain insulator may be used in which case the grasshopper mechanism will extend to the line side of the strain insulator, as is well-known in the art.

The solenoid 78 is mounted in suitable position above the cap of insulator 31 and has a plunger 80, which is adapted to engage the catch 57 to knock it up when overload flows through the line and the solenoid is actuated. This disengages the abutment 60 with the pin 61, and allows the switch to be pulled to open position automatically by means of a spring mechanism hereinafter described.

Referring now to the spring opening mechanism the base 10 supports a pedestal 81 to which is pivoted a sleeve 82 enclosing a pair of coil springs 83 and 183. A stiff rod 84, which is pivoted to the insulator pin 25 by a pivot 85, has an abutment 184 disposed between the springs 83 and 183.

It will be understood that a suitable pigtail conductor 63 extends from the solenoid 78 to the terminal 33, and that a suitable pigtail conductor 64 extends from the contact 24 to the line 65, which is connected to the cap on insulator 22.

In the position shown in full lines in Figure 1, the switch is closed. To open the switch manually the shaft 50 may be rotated forcing the contact 33 out of closed position and allowing the spring 183 to assist in quickly pulling the movable contact 33 out of engagement with the stationary contact 24 to the position shown in dotted lines. If desired, the operating insulator and cooperating mechanism 12 may be omitted, and the movable arm 13 may be operated by engaging the squared end of shaft 30 directly by a suitable tool or mechanism.

In addition to manual opening of the switch, the switch may be opened automatically by the trip-free mechanism due to over-load. In this case the over-load current flowing through the line actuates the solenoid 78 causing the plunger 80 to hit catch 57, which in turn causes disconnection between abutment 60 and pin 61 allowing the spring 183 to quickly pull the switch to open position.

It will be noted that the end of the terminal 24 is located approximately in the center of the sphere 40, and that the tubular portion 41 of the housing 38 fits rather snugly about the terminal 33. As the switch is opened either automatically or manually, it will be understood that the initial arc caused by the separation of the tips of contacts 24 and 33 causes the reservoir of air and/or gases held in enlarged portion 40 to suddenly heat up, tend to expand, and produces gas or gases under pressure. Due to the more or less snug fit between the contact 33 and tubular portion 41, the compressed gas or gases cannot escape readily, so it assists in forcing the movable contact 33 to open position, and at the same time creates a flow of gas or gases longitudinally of the arc and through the neck or cylindrical portion 41 of housing 38, which assists in extinguishing the arc.

This assistance is accomplished in two or more ways acting either alone or in cooperation with one another: one by the action of the gas under pressure carrying with it as it blows out of the tubular portion 41, the ingredients therein such as metals of the electrodes in gaseous form which help to sustain the arc, thus ridding the chamber of materials which would normally assist in sustaining the arc; another by the process of the expansion of the gases as they leave the chamber or housing 38 cooling themselves and thereby serving to make it difficult or impossible for the arc to be maintained or reformed; and coincidentally thereto by these gases escaping from the chamber 38 causing a partial vacuum in the chamber which action also makes it difficult or impossible for the arc to be maintained or reformed and further by the partial vacuum thus formed requiring new and cooler air to flow into the chamber 38 to bring the pressure in it into a state of balance with that of the outside air, thus further hindering or preventing the maintenance or reforming of the arc.

Referring now to the modified form shown in Figures 9 and 10, the arc extinguishing housing is denoted by 91, and is of a similar construction to the housing 38 in Figure 1, except that it is laid out along a straight line instead of the arc of a circle. The socket contact is denoted by 93, and the plug contact by 92. The housing 91 carries the socket 93 in a manner similar to that described in connection with Figure 1, and the housing 91 is pivoted frictionally by the pivot 94 to a fitting 120 carried by the stationary arm 97. The arm 97 has the fitting 120 connected thereto by a pivot 96. The fitting 120 has a slot through which a bolt 98 passes into the arm 97 for adjustably positioning the fitting 120. The fitting 120 has a pair of adjustable stops 100 and 101 between which a finger 99 connected to the housing 91 is positioned. Surrounding the connection between the housing 91 and the arm 97 is a shroud 104.

The movable arm 111 has a pair of ears 116 between which is frictionally pivoted by pivot 115 a fitting 106. The fitting 106 carries a lug 109

located between a pair of adjustable stops 112 and 113 which cooperate with lug 109 to limit the movement thereof. Also mounted upon the pivot 115 is a second fitting 105 having a corrugated surface 121, which interfits with a similar surface upon the fitting 106. The fitting 105 carries the contact 92 and is provided with a pair of bolts 107 disposed in a pair of slots 108 in the fitting 106. A shroud 114 surrounds the entire connection between the arm 111 and contact 92. It will be understood that the movable arm 111 moves about a center in a manner similar to the arm 13 in Figure 1.

The frictional pivots 94 and 115 have sufficient friction to hold the housing 91 and the contact 92 in any set position, but the friction is not sufficient to prevent the necessary pivotal movement for the contact 92 and housing 91 to engage and separate. It will be understood that the contact 92 and housing 91 must remain in line while they engage and separate. In other words, as the tip of the movable contact 92 leaves or enters the tip of the housing 91, the axes of these members must be in line. After the housing 91 and contact 92 separate completely, the axes of these members go out of line, the friction of pivots 94 and 115 holding the housing 91 and contact 92 in the same relative position to the arms 97 and 111 that they had when the tips of the housing 91 and contact 92 were separating.

So far as the operation of the arc extinguishing device is concerned it is the same in this modification as that described above in connection with Figure 1. The movable arm 11 may be moved manually or automatically by an overload mechanism, in both cases the construction being similar to that described in connection with Figure 1.

While certain novel features of the invention have been shown and described and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In an air break switch, a base, a stationary insulator on said base carrying a stationary contact, a movable arm comprising a support pivoted to said base, an insulator on said support, a member carried by said insulator and carrying a movable contact, a second stationary insulator, a grasshopper mechanism connecting the line side of said second stationary insulator and said member, elastic means between said support and base normally assisting in carrying said movable arm to open position, means for operating said movable arm, said means comprising operating mechanism and a link extending to said member from said operating mechanism, a latch pivoted to said link and engaging an abutment on said member, a solenoid having a plunger and carried by said movable arm insulator, said solenoid being in series cooperation with the line conductor connecting said line and movable contact, said plunger being adapted to engage said latch.

2. In an air break switch, a base, a stationary insulator on said base carrying a stationary contact, a movable arm comprising a support pivoted to said base, an insulator on said support, a member carried by said insulator and carrying a movable contact, a second stationary insulator, a grasshopper mechanism connecting the line side of said second stationary insulator and said member, elastic means between said support and base normally carrying said movable arm to open position, means for operating said movable arm, said means comprising operating mechanism and a link extending to said member from said operating mechanism, a latch pivoted to said link and engaging an abutment on said member, a stop on said link to engage and limit the open position of said movable arm, a solenoid having a plunger and carried by said movable arm insulator, said solenoid being in series cooperation with the line conductor connecting said line and movable contact, said plunger being adapted to engage said latch.

3. In an air break switch, a base, a stationary insulator on said base carrying a stationary contact, a movable arm comprising a pin pivoted to said base, an insulator on said pin, a member carried by said insulator and carrying a movable contact, a second stationary insulator, a grasshopper mechanism connecting the line side of said second stationary insulator and said member, elastic means between said pin and base normally urging said movable arm to open position, an operating arm comprising a pin rotatably mounted on said base and an insulator carrying a crank pin, a link extending between said crank pin and said member, a latch pivoted to said link and engaging an abutment on said member, a stop on said link to engage and limit the open position of said movable arm, a solenoid having a plunger and carried by said movable arm insulator, said solenoid being in series cooperation with the line conductor connecting said line and movable contact, said plunger being adapted to engage said latch.

4. In an air break switch, a base, stationary insulator on said base carrying a stationary contact, a movable arm comprising a support pivoted to said base, an insulator on said support, a member carried by said insulator and carrying a movable contact, elastic means between said support and base normally carrying said movable arm to open position, and automatic trip and trip-free mechanism for operating said movable arm.

5. In an air break switch, a base, a stationary insulator on said base carrying a stationary contact, a movable arm comprising a pin pivoted to said base, an insulator on said pin, a member carried by said insulator and carrying a movable contact, elastic means between said pin and base normally carrying said movable arm to open position, means for operating said movable arm, said means comprising operating mechanism and a link extending to said member from said operating mechanism, a latch pivoted to said link and engaging an abutment on said member, a stop on said link to engage and limit the open position of said movable arm, a solenoid having a plunger and carried by said movable arm insulator, said solenoid being in series cooperation with the line conductor connecting the line and movable contact, said plunger being adapted to engage said latch.

6. In an air break switch, a base, a stationary insulator on said base carrying a stationary contact, a movable arm comprising a pin pivoted to said base, an insulator on said pin, a member carried by said insulator and carrying a movable contact, elastic means between said pin and base normally urging said movable arm to open position, an operating arm comprising a pin rotatably mounted on said base and an insulator carrying a crank pin, a link extending between said crank pin and said member, a latch pivoted to said link and engaging an abutment on said member, a stop on said link to engage and limit the open position of said movable arm, a sole-

noid havin a plunger and carried by said movable arm insulator, said solenoid being in series cooperation with the line conductor connecting the line and movable contact, said plunger being adapted to engage said latch.

7. In an out door high tension air break switch, a pair of contacts, yieldable means for urging said contacts into open position, an arc extinguishing housing surrounding a first of said contacts, automatic means responsive to abnormal conditions for tripping the switch and allowing said yieldable means, assisted by the force due to the pressure generated by the arc in said housing, to open the switch, the said second contact separating a substantial distance from said housing and said first contact to provide sufficient air gap for the high tension and trip free means for closing the switch without interfering with the action of said automatic tripping means.

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