

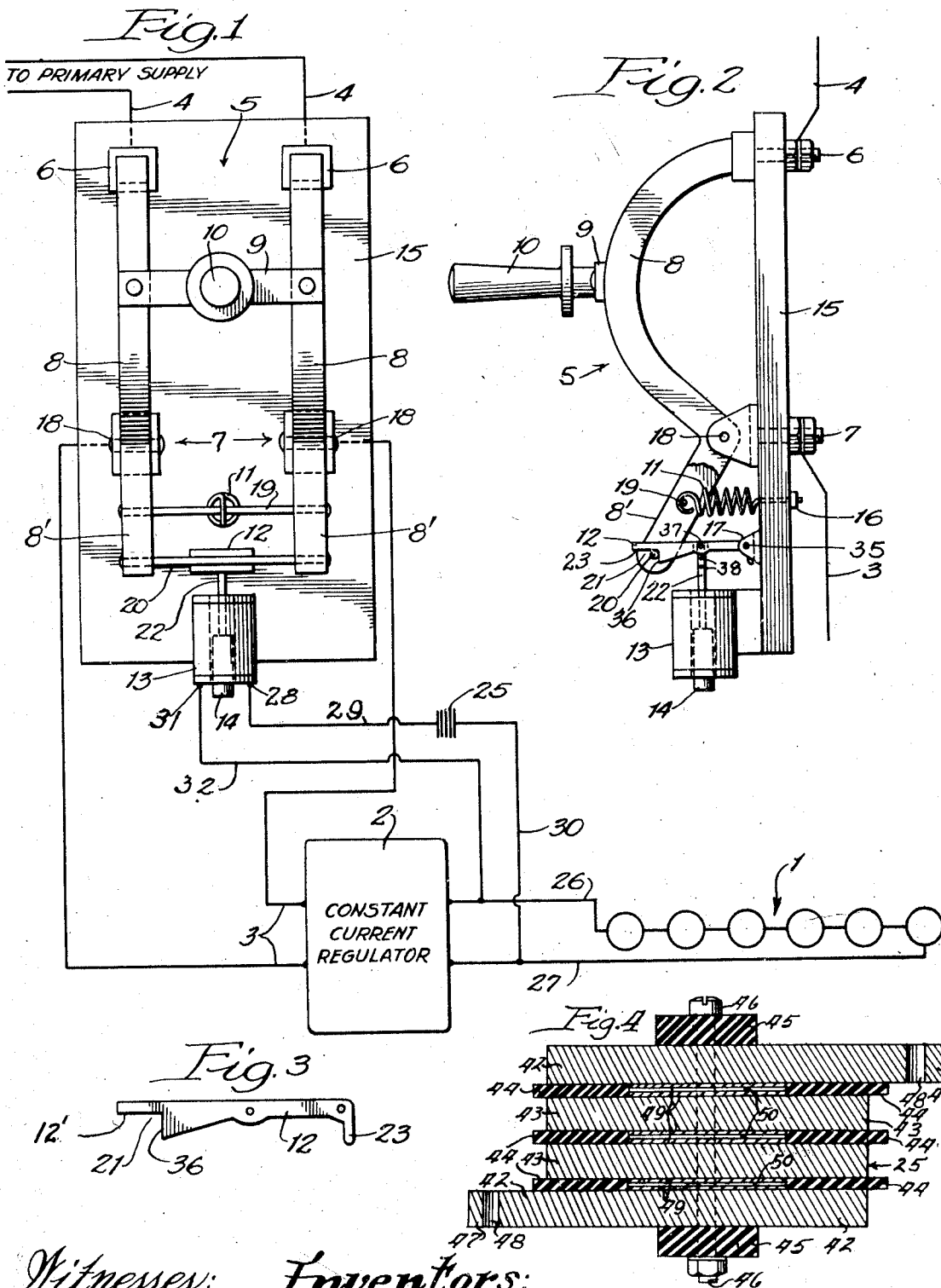
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AUTOMATIC SWITCH

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Witnesses:

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AUTOMATIC SWITCH

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Our invention relates to constant current load, alternating current power distributing systems, and more especially to protection against destructive high voltages resulting from open circuit conditions. It relates still further to an automatic electrically operated primary breaker switch and control means therefor.

It is one of the objects of our invention to provide an improved switching device such as may be utilized in the present circuit and in the circuit arrangement shown in Patent No. 2,226,041 issued December 24, 1940, so as to obtain complete open circuit protection for constant current systems, such as illustrated thereby and so that when an open circuit occurs in the constant current load line, high voltage switching apparatus will in sequential order short circuit the transformer secondary of the constant current regulator and then immediately disconnect the primary supply circuit from such regulator.

It is another object of our invention to provide an improved electrical switching apparatus utilizing automatic cut-ins of such nature as pyroelectric cut-outs or the like in combination with a method for providing a means for constant current control whereby the primary switch will open due to a fault in the constant current load circuit. The switch of our invention is so designed that it is impossible to reset the said switching apparatus without first having repaired or corrected the load line fault causing the open circuit.

It is a further object of our invention to provide an improved switching apparatus so constructed that the switch must be reset manually after an open circuit trip-out. Thus, not only must the fault causing the open circuit condition be first corrected but switching apparatus must then be reset or closed manually after the correction of the fault.

This feature of our invention is very desirable from the standpoint of "safety first." It is well known that in street lighting systems, especially in aerial or pole line circuits open circuits are unavoidable in actual practice. Our present invention contains two safety features that preclude the attending hazards and danger of live wires under these conditions. The construction of the switching mechanism requires, first, that the constant current circuit be in perfect operation and condition before the switch may be reclosed or reset, and second that the switch must then be reset manually before the load line of the constant current system can be re-energized. There is no possibility of reclosing or resetting

the switch until all faults causing the open circuit condition have been cured.

This invention is illustrated by the accompanying drawing in which:

Figure 1 is mainly a circuit diagram of a constant potential source to constant current load system.

Fig. 2 shows a side view of the automatic switch contained in the circuit of Figure 1.

Fig. 3 is an enlarged side view of the switch latch.

Fig. 4 shows the construction of the breakdown cut-in device contained in the circuit of Fig. 1.

Referring first to Figure 1, the constant current load circuit 1 is supplied with power through a constant current regulator 2 which receives constant potential current through leads 3 connected to the constant potential power source leads 4 through an automatic control switch 5.

Said switch 5 comprises a pair of appropriately mounted terminals 6 to which the leads 4 are connected respectively, a pair of hinge terminals 7 to which leads 3 are connected, a pair of blades or bars 8 pivoted to terminals 7 for make and break contact with terminals 6, an insulation cross bar 9 connecting said blades and having a handle 10 for closing the switch, a tension spring 11 connected to pull the switch open, a latch 12 to lock the switch closed, a solenoid 13 and plunger 14 to release said latch. The insulation block 15 on which said terminals 6 and 7 and solenoid 13 are mounted also carries an anchorage 16 for the inner end of spring 11 and a pivot mounting 17 for the outstanding latch 12.

The switch blade members 8 have leverage arms 8' extending back of their hinge pivots 18 whereon are mounted two insulation crossbars 19 and 20, the former medially and the latter at the outer ends of arms 8'.

The movable end of spring 11 is attached to the middle of bar 19 for pulling the switch open when released, and the free end of latch 12 engages the middle of bar 20 so as to prevent opening when the switch is closed, the latch being notched at 21 to enable engagement when the latch swings downward as by gravity on closing the switch, as viewed in the drawing, and to enable release when pushed upward by plunger 14 through its extension finger 22 so as to release the switch for opening by spring 11. Latch 12 has a stop toe 23 to limit downward swing when the switch is open.

Solenoid 13 is energized by overpotential on

the load circuit 1, it being connected in series with an automatic cut-in device 25 across the load leads 26 and 27. This connection is from solenoid terminal 28 through conductor 29 to cut-in 25 and thence by conductor 30 to load lead 27; and from solenoid terminal 31 by conductor 32 directly to load lead 28.

The said cut-in 25 is normally open, but closes in response to high voltages on the line 1. It is substantially like or similar to the device of our Patent No. 2,198,101 of April 23, 1940.

In case it should be desired to delay the opening of the switch 3 in response to solenoid 13, the effective length of the plunger finger 22 is increased by changing its pivotal connection at 37 on the latch to a different point on said finger through appropriate selection of a perforation 38 on said finger, the solenoid thus being set lower and requiring more energization in solenoid 13. The effective length of said finger may be oppositely adjusted for raising plunger 14 and so hastening the circuit opening response of plunger 14 and switch 3 to said cut-in 25.

Referring more in detail to the construction and operation of the device 25, this circuit closing means as a composite unit comprises a pair of terminal disks 42 and two intermediate disks 43 all of amalgamated or mercurized copper in combination with a pair of intermediate insulating rings 44 of mica and a clamping support comprising rigid insulating bars 45 between which the elements 42, 43 and 44 are securely clamped by bolts 46. Each end plate 42 has a side terminal 47 apertured at 48 to receive a conductor or fastening therefor, not shown, as will be apparent on inspection of the circuit diagram, Fig. 1. The thin layer of mercury on the copper plates is illustrated at 49. Holes 50 in the discoidal layers or annuli 44 serve each as an ionization chamber where, in use, dangerously high abnormal pressures cause ionization of the mercury and hence a short-circuiting arc of low resistance.

It is obvious that upon throwing the load circuit into use as by closing switch 3, voltage builds up quickly during a brief period. As soon as the voltage reaches about 1515 volts across the load circuit it remains constant so long as the load remains the same, then in case of an accident to the load circuit whereby it is opened as by destruction of a lamp or the breaking of a load conductor, the voltage jumps upward immediately toward infinity, but is arrested at about 3000 volts by operation of the circuit closing means 25. The voltage then drops immediately to about twenty-five volts where it remains, due to the characteristic of the transformer (not shown) in the constant current regulator 2. Then after a necessary repair interval the circuit is closed at switch 3, whereupon the load voltage climbs gradually to a normal value for the given load, after which it continues so long as conditions remain unchanged.

The system here described is thrown into use by grasping the handle 18 and closing switch 3. In so doing the latch 12 turns upwardly somewhat on its pivot 35 of block 17 and when lock-bar 20 of switch 3 reaches the notch 21 of said latch, it bears inwardly against shoulder 38 and upwardly against toe 12' of said latch as the latter drops downward by gravity to its effective position as shown in Fig. 2.

The system remains thus until an open circuit occurs on the load line, as for instance by the destruction of a pole, whereupon the cut-in 25 closes the solenoid circuit and by upward thrust of plunger 14 the extension finger 22 lifts and releases latch 12 and permits spring 11 to open the switch.

It is to be understood that some of the details set forth may be altered or omitted without departing from the spirit of our invention as defined by the following claims.

We claim:

1. An electric power system comprising a source of constant potential alternating current, a constant current A. C. load line, a regulator interposed between and connecting said source and load line, a solenoid switch connected in series with said source to open the source circuit, and an automatic cut-in to which said switch is responsive, said cut-in being connected in series with the switch solenoid and across the load line, and said cut-in being arranged to close instantly on excessive load line voltage.

2. An electric power system comprising a source of constant potential alternating current and a constant current load line, a regulator interposed between and connecting said lines, an automatic-opening solenoid switch connected in series with said source line to open the circuit, and a normally open cut-in to which said switch is responsive, said cut-in being connected in series with the switch solenoid across the load line, and said cut-in being responsive to close on a predetermined excessive load line voltage.

3. The combination of a constant voltage source line of electric current, a constant current load line, regulating means connecting the same, an automatic switch in said source line and provided with an operating solenoid, and an automatic excess-voltage-operated cut-in, said solenoid being energized upon and by operation of said cut-in, which with the solenoid are bridged in series across the load line, operation of which cut-in short-circuits the constant current load circuit and then by actuating said switch disconnects the source line from the constant current regulator in sequential order.

4. A constant voltage source to constant current load safety control system comprising a solenoid and plunger actuated automatic breaker switch in the primary circuit, and an over-voltage circuit closer connected in series with the switch solenoid and across the load circuit, said switch having a spring to pull it open when released and a switch closure locking latch releasable by the solenoid plunger which is adjustably related to said latch for presetting, according to desired sensitivity and critical load voltage.

5. In an A. C. power distributing system, a constant voltage supply line, a constant current load line, and a monocrystalline-square regulator therefor, in combination with an electromechanical cut-out switch for the supply line, and a normally open ionization cut-in across the load line and in series with electrical actuating means for said switch to short the load line and cause actuating energization of said switch in response to load line opening and the resultant excess voltage surge therein.

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