

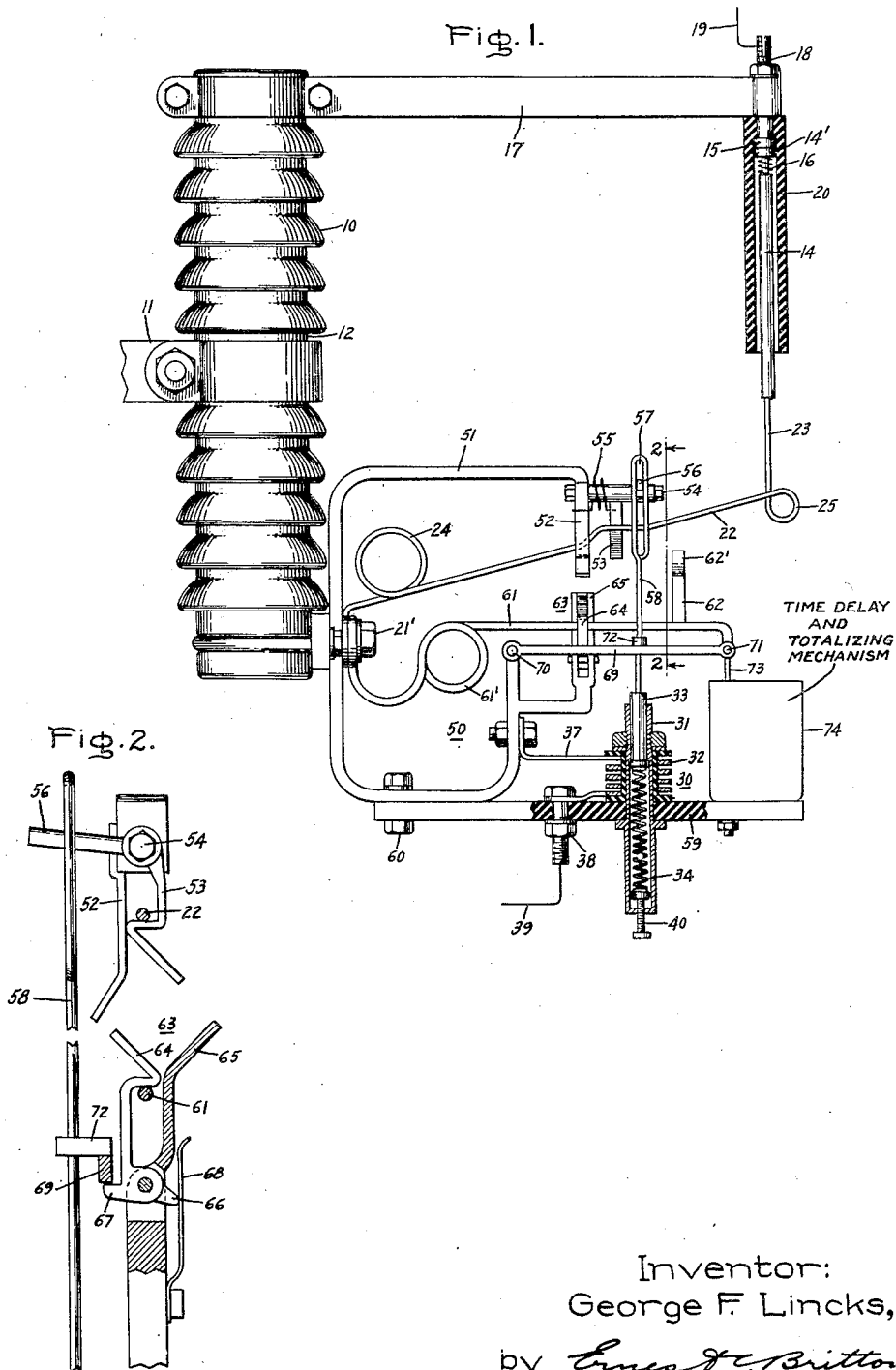
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G. F. LINCKS

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ELECTRIC CIRCUIT INTERRUPTER

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Inventor:
George F. Lincks,
by *Ernest H. Britton*
ATTORNEY

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ELECTRIC CIRCUIT INTERRUPTER

George F. Lincks, Pittsfield, Mass., assignor to
General Electric Company, a corporation of
New York

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2 Claims. (Cl. 200—89)

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My invention relates to electric circuit interrupters, and more particularly to such circuit interrupters which are adapted to be used in place of the conventional fuse cutout devices. Specifically my invention relates to a so-called fuseless cutout of the open reclosing type. This application is a division of my copending application for "Electric Circuit Interrupter," Serial No. 52,584, filed February 16, 1944, and assigned to the same assignee as the instant application.

Fuse cutout devices have been used to a large extent in the protection of high tension electric distribution circuits. Devices of this kind in general heretofore have comprised replaceable fusible means usually located in close proximity to the high tension conductors. An abnormal electrical condition occurring on a circuit protected by a fuse cutout will destroy the fuse link and hence require replacement thereof. In modern practice on distribution systems several of these overcurrent protective cutout devices are connected in series thus demanding accuracy in order for proper correlation of such devices and so that each device performs its predetermined function. The need for renewal of the fuse link introduces the human element which, especially in a time of stress which is the time when fuse links blow, it apt to err by installing a fuse link of incorrect rating because the correct rating is not available. Moreover, in case the conventional reclosing fuse cutout is employed, the clearing of temporary faults without service interruption is limited to the number of fuse links available for successive operation or to the ability of the operator to discover and to renew blown fuse links before an outage occurs. It would therefore be desirable to provide a reclosing fuseless cutout concerning which it is unnecessary to manually replace any fuse links so that an unlimited number of temporary faults can be cleared without any attention by the operator.

It is an object of my invention, therefore, to provide a new and improved electric circuit interrupter adapted to replace the fuse cutouts of the prior art.

It is another object of my invention to provide a new and improved fuseless cutout which is simple and compact, economical in construction and which may be substituted for conventional prior art fuse cutouts.

It is another object of my invention to provide a new and improved fuseless cutout of the reclosing type.

Further objects and advantages of my inven-

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tion will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention, reference may be had to the accompanying drawings in which Fig. 1 is a side view, partly in section, of a fuseless cutout of the reclosing type embodying my invention, and Fig. 2 is an enlarged view partly in section taken along the line 2—2 of Fig. 1.

Referring now to the drawings, I have illustrated my invention in connection with an insulating support 10 of porcelain or other similar insulating material of a size and shape used in connection with the fuse cutouts of the prior art, such as is disclosed for example, in United States Letters Patent No. 2,354,907, Bennett et al., granted August 1, 1944, and assigned to the same assignee as the present application. Insulating support, or insulator 10 may be suitably supported from a pole carrying the transmission line (not shown) as by a supporting strap, mounting bracket, or hanger construction generally indicated at 11, which is adapted to surround a central portion of reduced diameter 12 of the insulator 10. Supported from the lower end of insulator 10 is the lower terminal contact assembly 50, to be described in greater detail hereinafter, which includes a movable contact 14. Cooperating with movable contact 14 is the stationary contact 15. In order to provide a satisfactory contact wipe the contact 14 is provided with a portion 14' biased toward contact 15 by spring 16. Contacts 14 and 15 comprise the relatively movable contacts of the circuit interrupter of my invention and contact 15 is illustrated as being mechanically supported from the upper end of insulator 10 by means of supporting arm 17. Contact 15 is furthermore electrically connected to line terminal 18 to which an external electric circuit such as conductor 19 may be connected.

It should be understood that insofar as my invention is concerned the relatively movable contacts 14 and 15 may be embodied in any suitable type of circuit breaker. As illustrated in Fig. 1, these contacts are embodied in an expulsion type circuit interrupter and contact 15 is mounted at the upper end of a tube of insulating material 20 which is suitably supported from arm 17 either by a permanent or readily removable means. Tube 20 is preferably at least lined with a material from which an arc extinguishing gas is

evolved when subjected to the heat of an electric arc. Movable contact 14 is furthermore constructed in the form of a rod and reciprocally movable within insulating tube 20. Upon relative separation of contacts 14 and 15 by downward movement of rod contact 14 an arc is drawn in insulating tube 20. The heat of this arc causes gas to be evolved from the gas evolving surface within tube 20 to cause rapid extinction of the arc drawn and expulsion of the arc gases from the lower end of tube 20, which is open.

The lower terminal contact assembly 50 comprises a U-shaped support of conducting material 51, which is suitably fastened to insulator 10, as indicated at 21'. Electrically and mechanically connected to U-shaped conducting support 51 is a resilient contact supporting arm 22. This resilient contact supporting arm extends outwardly from insulator 10 in the same direction as support 11 and terminates in an upwardly extending portion 23 upon which rod contact 14 is supported. Resilient arm 22 might secure its resilience from a separate biasing means or may be formed of heavy wire, preferably with a coiled portion 24 adjacent the supported end thereof to increase the resiliency and furthermore to constantly bias the contact 14 in a downward direction. Preferably resilient arm 22 is provided with a loop or eye 25 adjacent the contact supporting end thereof so as to be engageable by a switch stick for manually closing the circuit breaker, as will be described in greater detail hereinafter.

The contacts 14 and 15 are held in the closed circuit position against the inherent action of resilient arm 22 which tends to move downwardly, by a latching means mounted on conducting support 51. This latching means comprises a backing member 52 and the latching member 53 which is pivotally mounted as indicated at 54 and biased in a clockwise direction, as viewed in Fig. 2, toward backing member 52 by spring means 55. Rigidly mounted to latching member 53 is an extension member 56 which is adapted to be engaged in the slot 57 of rod 58 connected to armature 33 of electromagnetic means 30 which otherwise comprises the magnetic structure 31, the winding 32 and the spring 34 biasing armature 33 to the upward position. The current responsive setting of electromagnetic means 30 may be adjusted by varying the adjustment of a screw 40 which in turn varies the compression of spring 34 thereby requiring a higher current to move plunger, or armature 33, downwardly if the compression of spring 34 is increased. Electromagnetic means 30 is mounted on an insulating member 59, which in turn is fastened to U-shaped conducting support 51 as indicated at 60. One end of winding 32 is electrically connected as by means of conductor 37 with U-shaped conducting support 51, while the other end of winding 32 is connected to line terminal 38 which is connected to a suitable external circuit as illustrated by conductor 39. When the current flowing through contacts 14 and 15, resilient arm 22, U-shaped conducting support 51, conductor 37 and winding 32, which are all in series, reaches a sufficiently high value as determined by the electromagnetic means 30 and the adjustment of screw 40, armature 33 and consequently rod 58 are pulled downwardly sufficiently to trip latching member 53 whereupon resilient arm 22 is no longer restrained and high speed separation of relatively movable contacts 14 and 15 results with the consequent interruption of the circuit.

Although I have illustrated the resilient arm 22 as forming a part of the lower terminal contact assembly 50, it will be obvious that it might just as well form a part of the upper terminal contact assembly. Also, although I have illustrated the tripping mechanism as being exposed to the weather, it is obvious that a suitable housing may be provided which could readily be supported on U-shaped conducting support 51.

Manual opening of the circuit interrupter may be accomplished by pulling downwardly on extension 56. An appropriate insulated maintenance tool would be used for this purpose. It would not be desirable, however, to open the circuit by pulling downwardly on a maintenance tool which engaged eye 25, since such action might interfere with the high speed opening of the circuit breaker after member 53 has been released. The eye 25 is provided primarily for manually relatching the circuit interrupter in the closed position after it has operated. Such relatching is accomplished by merely moving resilient arm 22 upwardly until it is again latched in the position indicated in Figs. 1 and 2 with the contacts 14 and 15 in current carrying engagement.

In order automatically to reclose the circuit through contacts 14 and 15 upon opening thereof, it is necessary to provide means for applying an upward force to resilient arm 22 to cause it to relatch in the closed position. To this end I have provided resilient arm 61 provided with a coiled portion 61' so as to tend to move arm 61 in an upward direction. Arm 61 might comprise a rigid arm with separate biasing means but is preferably made of heavy wire, heavier than that from which arm 22 is made, so that when arm 61 is free to move it is capable of forcing arm 22 to its closed circuit position. Arm 61 may be supported directly below arm 22 and as shown may be held in position by the same means which holds resilient arm 22 in position. Supported on the outer end of resilient arm 61 is a member 62 having forked end 62' for engaging resilient arm 22 during the circuit reclosing operation. In order to prevent resilient arm 61 from moving upwardly and continually holding resilient arm 22 in the closed circuit position, I provide a latch 63 comprising the pivotally mounted latching member 64 and the backing member 65. The latching member 64 is provided with a pair of extensions 66 and 67. The extension 66 is adapted to be engaged by spring 58 clearly shown in Fig. 2, which will hold the latching member 64 in either the open or closed position when moved to either of these positions. The latch 64 is adapted to be operated by engagement of the extension 67 with a rod 69 pivotally mounted at one end, as indicated at 70, to conducting support 51 and pivotally mounted at the other end, as indicated at 71, to the free end of resilient arm 61.

A member 72 rigidly fastened to rod 58 attached to the armature 33 of electromagnetic means 30 is adapted to engage arm 69. Upon the occurrence of an abnormal current condition electromagnetic means 30 will not only trip latching member 53 as previously described, but in addition by virtue of member 72 and arm 69 resilient arm 61 would be pulled downwardly and stressed to an even greater extent than in the position shown in Fig. 1. Such downward movement of arm 69 will cause it to move latching member 64 to the open position by virtue of extension 67 and thereafter latching member 64 will be maintained in the open position until

again engaged by arm 69 in its upward movement to the position indicated in Fig. 1.

It will be understood that means should be provided for delaying the reclosure of contacts 14 and 15 following the extinguishing of the arc therebetween. Accordingly, in Fig. 1 I have generally indicated a time delay and totalizing mechanism which is operated by a lever 73 pivotally connected to arms 61 and 69 as indicated at 71. This time delay and totalizing mechanism, generally indicated at 74, may comprise an escapement mechanism or any other suitable timing mechanism. I prefer to use a time delay and totalizing mechanism constructed in accordance with that disclosed in U. S. Letters Patent 2,069,082, granted January 26, 1937, and assigned to the assignee of the present application. Such a time delay and totalizing mechanism, after a predetermined number of consecutive operations would be arranged to lock the arm 69 in a downward position and consequently lock the circuit breaker in the open position, as in the above mentioned U. S. Letters Patent 2,069,082. In certain cases, however, it might be desirable to lock the circuit breaker in the closed position as disclosed and claimed in United States Letters Patent No. 2,414,786, assigned to the same assignee as the present application. In accordance with the teachings of this patent, the arm 69 after a predetermined number of consecutive operations would cause the contacts 14 and 15 to be locked in the closed position. It should be understood that the time delay and totalizing mechanism 74 may be any suitable mechanism and forms no part of the present invention insofar as the specific construction thereof is concerned.

In view of the detailed description included above, the operation of the reclosing circuit interrupter illustrated in Figs. 1 and 2 will be obvious. An abnormal current will cause armature 33 of electromagnetic means 30 to move downwardly. This movement will not only trip latching member 53 with the consequent interruption of the circuit at contacts 14 and 15 by the high speed downward movement of resilient arm 22 but will also pull resilient arm 61 and arm 69 downwardly. Downward movement of arm 69 will open latching member 64. As soon as the circuit is interrupted at contacts 14 and 15 armature 33 is free to move upwardly and is moved in that direction under the bias of spring 34. However, the time delay mechanism 74 prevents resilient arm 61 and arm 69 from moving upwardly at high speed, since a predetermined time delay is introduced. When this predetermined time has elapsed, arm 61 moves upwardly at high speed and since latch 64 is open it does not impede or stop the upward movement of resilient arm 61 whereupon resilient arm 22 is moved to its latched position and the circuit is closed at contacts 14 and 15. When arm 69 moves upwardly past the extension 67 of latching member 64, the latching member is moved to its latching position so as to latch resilient arm 61 when it again is moved to the position indicated in Fig. 1. However, if excessive current again flows through the circuit interrupter, armature 33 will be pulled downwardly so as to again trip open latch 64 and the reclosing and opening operations will function as hereinbefore described until the totalizing mechanism included in 74 locks open or locks closed the contacts 14 and 15 as described above. In performing such subsequent opening operations immediately following the initial reclosing operation which would occur in the

event of a permanent fault, armature 33 must pull arm 69 as well as rod 58 for a greater distance than on the initial opening operation thereby introducing time delay in such subsequent opening operations. In any event rod 58 and arm 69 move downward sufficiently to permit resilient arm 22 quickly to separate contacts 14 and 15 the necessary amount before latch 53 is tripped as hereinbefore described. Electromagnetic means 30, member 72 and arms 61 and 69 are so constructed that normal load current flowing through electromagnetic means 30 will be sufficient to latch arm 61 so that the fuseless cut-out will reset to the initial operating position, shown in Fig. 1, after clearing a temporary fault from the line. Whenever resilient arm 22 moves downwardly, it engages the forked end 62' of the member 62 and rests therein until the reclosing operation is performed. Preferably the time delay and totalizing mechanism 74 is such that after one, two or three successive reclosures and openings of the circuit breaker the arm 61 will be locked in either its open or closed position in accordance with the prior art referred to above.

While I have shown and described a particular embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a fuseless cutout, the combination of an insulating support, a pair of normally closed relatively movable contacts, an arm extending from said support and having one of said contacts mounted thereon, said arm being constantly biased in a direction to cause relative separation of said contacts, releasable holding means normally preventing movement of said arm in said direction so as to hold said contacts in engagement, a second arm extending from said support and engageable with said first mentioned arm, said second arm being constantly and sufficiently biased to move said first arm in a direction to effect reengagement of the contacts when said holding means is released and said arms are in engagement, a latch normally preventing movement of said second arm to effect reengagement of the contacts and means responsive to a predetermined current through said contacts for releasing said holding means to effect separation of said contacts and for releasing said latch to effect engagement of said second arm with said first mentioned arm and reengagement of said contacts.

2. In an electric switching device, the combination of an insulating support, an arm extending outwardly from said support with one end thereof immovably fixed to said support, said arm being a spring member inherently resilient to cause relatively wide resilient movement of the other and free end thereof, a pair of relatively movable contacts, one of said contacts being stationary the other of said contacts being mounted on said free end of said resilient arm so that the resiliency thereof constantly biases said contact to a circuit opening position with respect to said other contact, releasable holding means for holding said contacts and said resilient arm in a closed circuit position so that said one contact is in current carrying engagement with the other of said pair of relatively

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movable contacts, another inherently resilient arm with one end thereof immovably fixed to said support and a portion adjacent the opposite and free end thereof engageable with said first mentioned arm, said other resilient arm being a stronger spring member than said first mentioned arm and the biasing action thereof being in a direction opposite to the biasing action of said first arm so as to cause reclosing of said contacts when said contact holding means is released and when said other arm is in engagement with said first arm, a latch normally restraining the biasing action of said second arm tending to cause engagement thereof with said first mentioned arm and means responsive to a predetermined current through said contacts for releasing said contact holding means to effect separation of said contacts and for releasing

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said latch to effect engagement of said second arm with said first mentioned arm and reengagement of said contacts after a predetermined delay following release of said contact holding means.

GEORGE F. LINCKS.

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The following references are of record in the file of this patent:

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2,261,721	Duffing	Nov. 4, 1941
2,321,122	Birkenmaier et al.	June 8, 1943
2,442,477	Wallace et al.	June 1, 1948

Certificate of Correction

Patent No. 2,532,259

November 28, 1950

GEORGE F. LINCKS

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 1, line 9, for the serial number "52,584" read *522,584*; column 7, line 3, for "suport" read *support*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 10th day of April, A. D. 1951.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

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[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.