Dec. 15, 1953

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2,662,947

COMBINATION FUSE CUTOUT AND SWITCH

Filed April 25, 1951

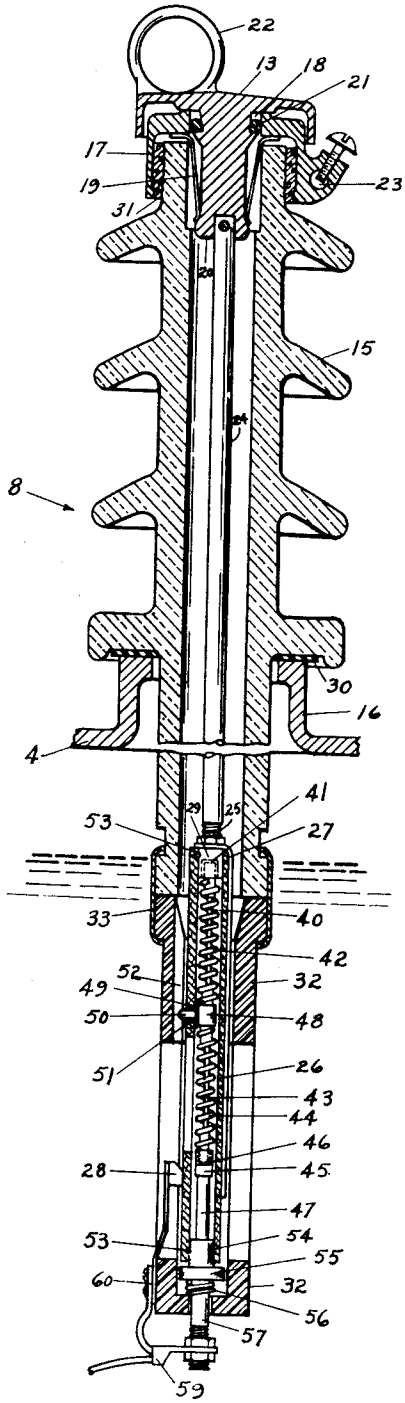


Fig. 1

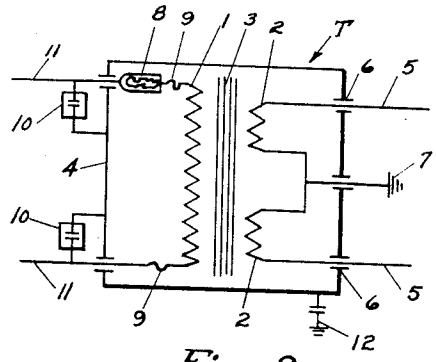


Fig. 2

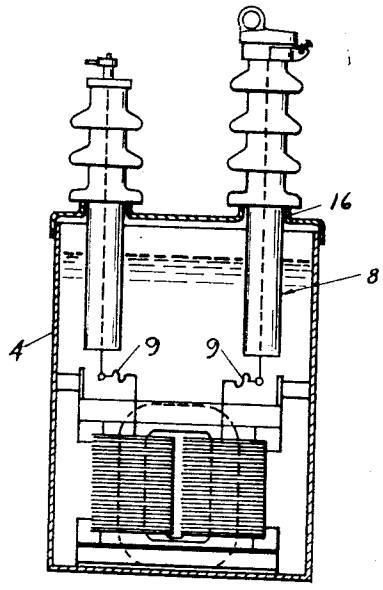


Fig. 3

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Patented Dec. 15, 1953

2,662,947

UNITED STATES PATENT OFFICE

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COMBINATION FUSE CUTOUT AND SWITCH

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Application April 25, 1951, Serial No. 222,849

3 Claims. (Cl. 200—114)

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My invention relates to protective devices designed to protect electrical apparatus, such as distribution transformers, against damage by high voltage surges and other abnormal conditions in an electric circuit.

Various forms of fuse cutouts are used in power distribution systems. It frequently is to the advantage of the power companies to have circuit reclosing means for closing the circuit as quickly as possible after a fuse has ruptured in order to temporarily restore service along the line until the fuse has been replaced.

I make use of a dual characteristic fuse which is constructed in such a manner that it will react to a predetermined rise in the temperature of the transformer oil produced by low over-loads of long continuing duration and will also react to sudden surges of current of abnormally high voltage of relatively short duration to raise the temperature of the transformer oil appreciably. In this way damage to the transformer insulation is prevented when over-loads of long duration or short circuits occur in a service line.

One object of my invention is to provide a combination dual characteristic fuse and circuit recloser mounted in a primary transformer bushing, the circuit being reclosable only after excess current has ruptured the fuse.

Another object is to provide a dual characteristic fuse and circuit recloser mounted in a primary transformer bushing whereby the fuse will alternatively interrupt a circuit on a low steady overload after predetermined conditions in an electrical apparatus have occurred or on a sudden surge or short circuit condition immediately upon occurrence thereof.

It is also an object to provide a combined dual characteristic fuse and recloser wherein upon interruption of the circuit, the circuit can be easily closed manually through the recloser only after interruption.

A further object is to provide a combined fuse and switch whereby the circuit is closed through the fuse by linear motion and through the switch by rotary motion only after rupture of the fuse.

A still further object is to provide a two element transformer fuse link that is a circuit maker and breaker and includes a switch operable only after rupture of the link.

An object also is to provide a circuit maker and breaker mounted in a primary transformer bushing which is fusible in its first part when the temperature of the oil or other cooling agent in which it is immersed reaches a value indicating sustained overload and is fusible in the second part by a load which is of insufficient duration to raise the temperature of the cooling agent in which it is immersed to a value that would fuse the first part but will damage the transformer insulation.

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Specifically, it is an object to provide a bayonet type combination fuse and recloser for transformer bushings, the fuse having dual characteristics operable under either of two abnormal circuit conditions and the recloser being manually operable to reclose the circuit upon rupture of the fuse under either of the abnormal circuit conditions.

Other purposes will appear from time to time in the course of the specification and claims.

In the drawings which accompany this specification I have illustrated an embodiment of my invention, but I wish it to be understood that I do not in the appended claims limit the terms to such embodiment, but do embrace all embodiments which come generically within the purview of my inventive concept.

Figs. 1 and 2 of the disclosure of the present application are respectively substantially identical to Figs. 4 and 2 of the co-pending application of Roald H. Amundson, Serial No. 226,077, filed May 12, 1951, and assigned to the same assignee of the present application and in which latter application the structures are presented in various forms and in greater detail and the disclosures are claimed specifically.

Referring to the drawings:

Fig. 1 is a fragmentary sectional view in side elevation taken longitudinally of the axis of an embodiment of this invention.

Fig. 2 is a diagrammatic illustration of an electrical transformer embodying my invention.

Fig. 3 is a view in elevation, partly in section, showing an embodiment of my invention incorporated in a transformer which is illustrated more or less symbolically.

Like parts are designated by the same reference characters throughout the several views.

The distribution transformer T, illustrated diagrammatically in Fig. 2, includes a primary winding 1, a secondary winding 2 and a core 3.

The secondary windings 2 are connected to service lines 5 which terminate at secondary bushings 6 and are grounded at 7.

A combined fuse and switch embodying my invention is shown diagrammatically in a primary bushing at 8 with an over-load protective fuse 9 in series with and located between it and the winding 1. An excess voltage device or expulsion gap 10 is placed between the primary leads 11

and the casing 4. A tank discharge gap is shown at 12.

Referring to Fig. 1, the primary bushing 8 and the embodiment of my novel combination, I show a flat topped cover or closure 13 because I believe it to be a safer form than the bayonet type top. However, it is to be understood that a bayonet type top could be substituted without deviating from my invention.

The bushing 8 is provided with skirts 15 in its upper part and a tubular "Bakelite" sleeve 32 at its lower end. A sleeve 33 fits over adjacent enlarged ends of the bushing 8 and sleeve 32 and is spun over at its ends to hold the bushing and extension together.

The transformer bushing or housing 8 is mounted in an opening 16 of the casing or container 4. A sealing means 30 is used to make this connection airtight. At the upper end of the porcelain bushing 8 is a terminal or ferrule 17. A cement 31 is injected between the ferrule 17 and the bushing 8 to securely fasten them together. The ferrule 17 has an opening 18 in its center portion substantially co-axial with the bore in the bushing 8. On the under-side of the ferrule 17 adjacent its opening 18 is attached a plurality of contact fingers 19 extending downwardly and inwardly so as to contact a metal projection 20 which extends downwardly from the closure 13. A gasket 21 provides a seal between the ferrule 17 and closure 13. Integral with the closure 13 is a handle or operating eye 22 which is used to rotate the closure 13 by means of a stick (not shown).

A socketed line terminal clamp 23 is located at some convenient place on the ferrule 17 from where the electric current is conducted through the contact fingers 19 to the metal projection 20 to which is attached the conducor rod 24.

At the lower end of the conductor rod 24 is a threaded portion 25 which is connected with the dual characteristic fuse and switch hereafter described. This combination fuse and switch is surrounded along its length by a fibre fuse tube 26.

A metal socket 29 is encased within the upper section of the fibre fuse tube 26 and fastened to the tube 26 by means of a key 53 and in direct contact with the conductor rod 24. Extending into a bore of the metal socket 29 is a flexible link 40 of the dual characteristic fuse, joined to it at 41 by means of a low melting solder joint which is responsive to the temperature of the cooling medium in the transformer casing. A spring 42 surrounds the flexible link 40 and maintains tension thereby in the link as long as the link 40 remains joined at 41. The lower ends of the link 40 and the spring 42 are anchored to a spacer 48. This spacer 48 is of sufficient diameter to loosely fill the bore within the fibre fuse tube 26. Vertical extensions in both directions of this spacer 48 serve as a means for securing the flexible fuse links 40 and 43 and their respective springs.

The second flexible link 43 of the dual characteristic fuse is held in tension by a surrounding spring 44. In reverse similar manner the link 43 is attached within a bore in a metal piece 45, joined by a solder joint 46. Below metal piece 45 is a resistor element 47 which becomes warm if a sudden surge of electricity travels through the circuit which may be of insufficient duration to warm the transformer oil but of suffiient voltage to damage the transformer windings. The warmth in this resistor 47 is conveyed to the solder joint 46, and dissolves the joint when it reaches some predetermined temperature thus allowing the spring 44 to recoil carrying the second flexible link 43 with it which causes the current to be broken.

Attached to the lower end of the resistor 47 is a metal conductor piece 54. The lower end of the fibre fuse tube 26 is pinned to it by a key means 53. Below the metal piece 54 is a guide flange conductor member 55 and below the guide flange is a terminal rod 57. Between the guide flange 55 and the lower enclosure of the "Bakelite" sleeve 32 is a spring means 56 surrounding the terminal rod 57. A lead 59 connects with the terminal rod 57 thus forming the second end of the conductor.

In contact with the lead 59 is the auxiliary connection 60 which connects with the contact member 28. After the fuse has blown at either 41 or 46, the circuit can be closed by rotating the handle 22 which switches the position of the conductor strap 27 so as to contact the contact piece 28.

Adjacent the spacer 48 is an opening 49 in the fibre fuse tube 26, of sufficient diameter to hold a detent 50 with its surrounding spring 51. The head of the detent 50 is held tightly against the spacer 48 by the spring 51. The detent will remain in this position until either of the fuse links breaks the circuit. The detent is then free to move into the core of the fibre fuse tube 26. A slot 52 in the "Bakelite" sleeve 32 controls the position of the circuit maker and breaker. The handle 22 cannot be rotated while the detent 50 is in the slot 52.

The use and operation of my invention are as follows:

In order to protect electrical transformers against destruction by excess current and to afford renewal of electrical service after circuit interruption, I evolved the idea of this invention. I mount a circuit maker and breaker in the primary bushing of an electrical transformer. This circuit maker and breaker includes a dual characteristic fuse link that will blow in one part as a result of low steady over-load and will blow in its second part as a result of sudden surges on the line.

A steady over-load on the service lines will gradually warm the transformer oil or other cooling medium and this heat, when a given temperature is reached, will in turn cause the solder joint 41 to melt and release the springs 42 and 44 which will then produce a gap of sufficient length to extinguish the arc and open the circuit. If a sudden surge of current occurs and its duration is not great enough to raise the temperature of the transformer oil but may be of sufficient intensity to damage the transformer insulator, it will heat the resistor 47 and the heat in the resistor 47 will be transmitted to the solder joint 46 and dissolve the joint and thus release the springs 42 and 44 and produce a gap designed to extinguish the arc and open the circuit. When either of the joints 41 or 46 is destroyed the spacer 48 will be moved to one side or the other of the detent 50 and the spring 51 will move the detent radially into the space occupied by the spacer 48 and withdraw from the slot 52.

After the circuit has been opened in the manner indicated, the circuit may again be closed by rotating the bayonet through the medium of the eye 22 on the closure 13 until the conductor strap contacts the contact piece 28 and closes the circuit therethrough. It will be understood that a

circuit is reestablished in the manner indicated to continue the service until the bayonet can be substituted by one in which the fuse elements are intact.

I claim:

1. A circuit interrupter and recloser comprising in combination an insulating support including relatively spaced first and second terminals, a manually operable circuit closer movably supported by said support for movement successively between open circuit position to a normal circuit closing position, and from said normal circuit closing position after circuit interruption to a circuit reclosing position, said closer when in normal circuit closing and reclosing positions having a first contact engaging said first terminal and a second contact engaging said second terminal, a dual characteristic fuse carried by said closer and electrically connecting said contacts when said closer is in its normal circuit closing position, and a switch member carried by said closer and normally in open circuit position when said closer is in normal circuit closing position and movable with said circuit closer to circuit closing position between said terminals when said closer is moved to said circuit reclosing position, said dual characteristic fuse comprising two fusible sections in series relation when said closer is in its normal circuit closing position, one of said sections responsive to ambient temperatures of predetermined value produced by over-load currents in said one section and the other of said sections responsive to abnormal surge currents in said other of said sections in excess of a predetermined value.

2. A tubular bushing for a casing enclosing an electrical apparatus and a cooling medium, said bushing having an electric line terminal and an apparatus terminal, in combination with a circuit closer insertable in said bushing adjacent said line terminal and movable in said bushing

from a first position to a second position, said closer including a contact engaging said line terminal and a contact engaging said apparatus terminal, a dual characteristic fuse carried by said closer and closing an electric circuit in said apparatus when said closer is in said first position, said fuse comprising two fuse sections normally in series with each other and with said contacts when said closer is in said first position, one of said sections responsive to ambient temperature of the cooling medium in excess of a predetermined value and the other of said sections responsive to surge currents in said circuit exceeding a predetermined value, and a switch member carried by said closer and normally in open circuit relation to said terminals when said closer is in said first position and movable with said closer into closed circuit relation to said terminals when said closer is moved to said second position upon rupture of said fuse responsive to either of said predetermined values.

3. In a circuit maker and breaker including a support having a pair of spaced terminals, a unit combination comprising a manually operable circuit closer mounted on said support and movable thereon from a first position relative to said terminals to a second position relative to said terminals, said closer including a fuse carried thereby and electrically connecting said terminals when said closer is in said first position and including also a conductor carried thereby and normally out of circuit closing relation to said terminals when said closer is in said first position and electrically connecting said terminals when said closer is in said second position.

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