Dec. 4, 1934. W. L. GARLINGTON 1,982,986

SECTIONALIZING RELAY APPARATUS

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Fig. 1.

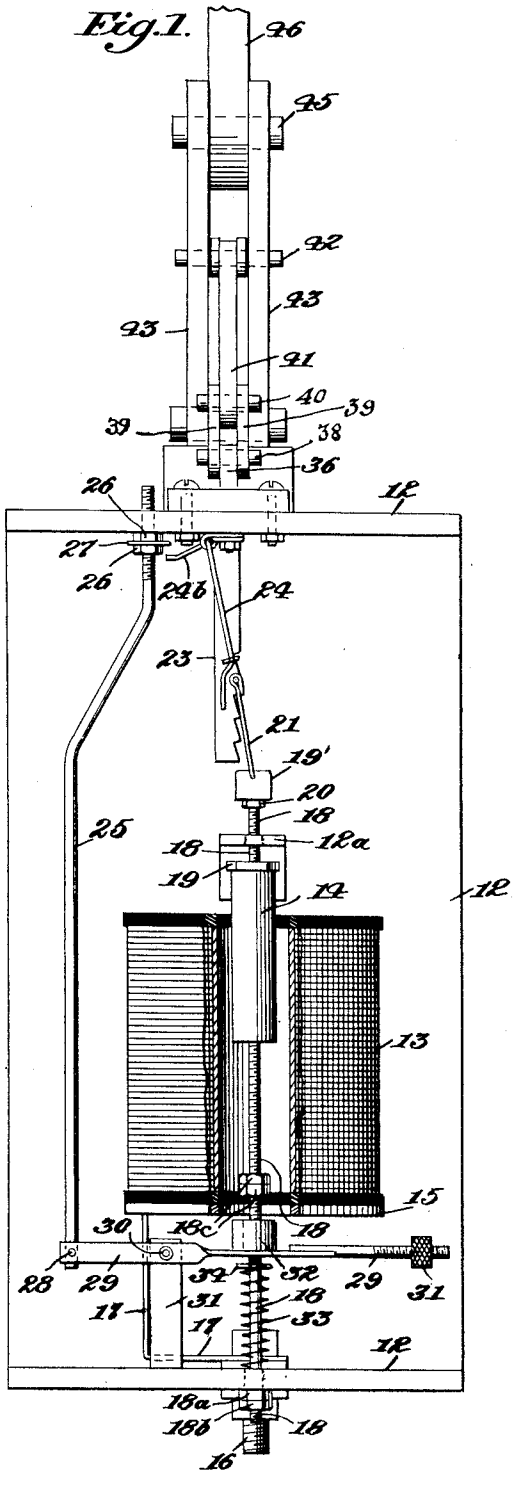

Fig. 2.

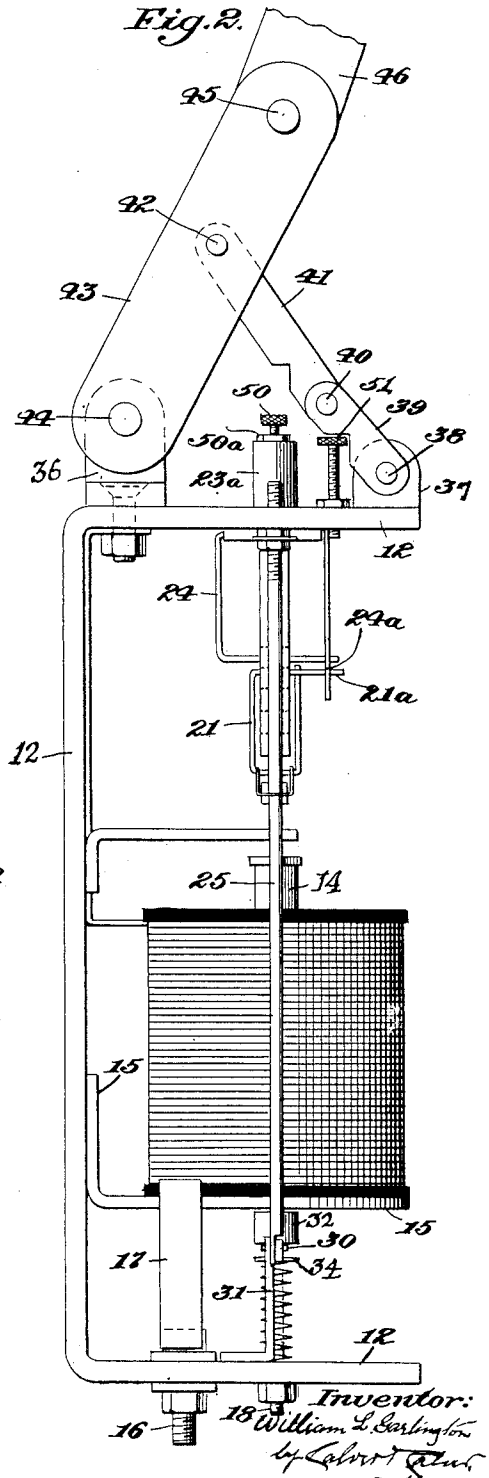

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Fig. 3.

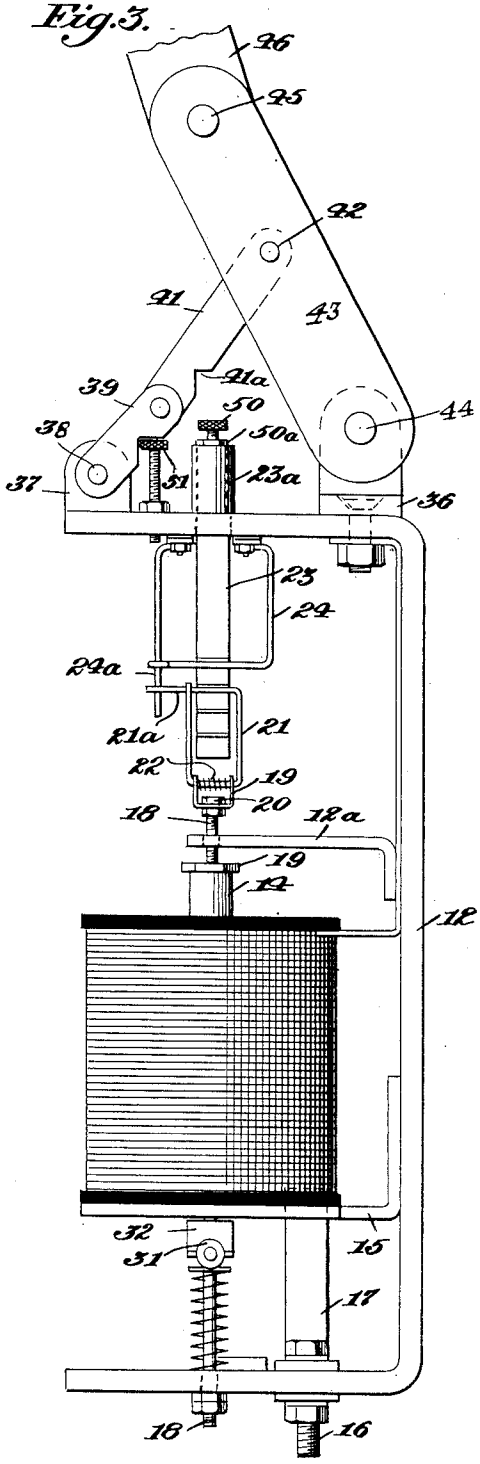


Fig. 4.

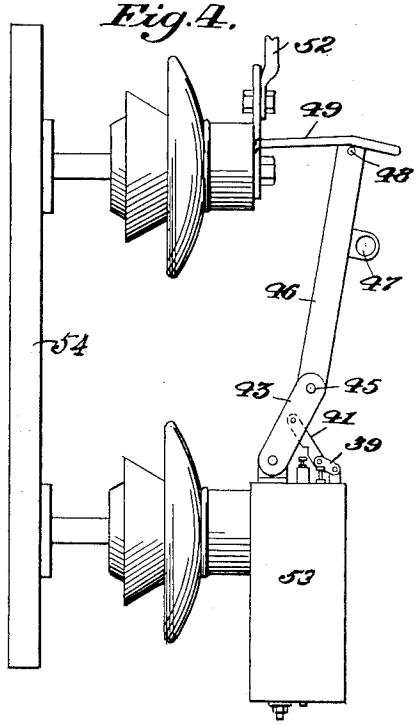
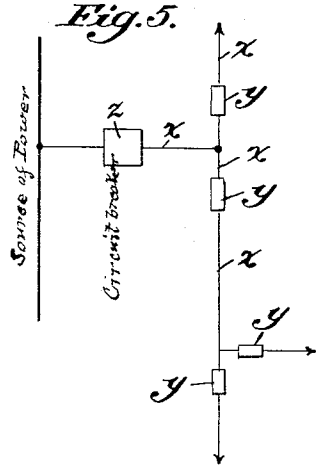


Fig. 5.



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SECTIONALIZING RELAY APPARATUS

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Application June 20, 1933, Serial No. 676,715

7 Claims. (Cl. 200—89)

This invention has for its object to provide an automatic sectionalizing relay apparatus by which, when a predetermined number of overcurrent impulses occur in a circuit, a section of the line feeder may be disconnected or cut out and the remainder of the circuit energized.

Another object of the invention is to provide means whereby the flow of current through the relay below the overcurrent value, before the relay trips the sectionalizer, will cause the relay to be reset to its normal position, the same as if no overcurrent impulse or impulses had occurred through the relay.

It is the usual practice with power companies, whenever trouble on a feeder by overcurrent necessitates deenergizing it, to restore power to the feeder several times if necessary before allowing the feeder to remain without power until the trouble can be found and corrected. The automatic sectionalizing relay apparatus of the present invention serves an important purpose in that it allows the faulty section to drop out after the feeder has been energized by overcurrent a given number of times, allowing service to be restored to the rest of the feeder.

The main application or use of my invention, for the sectionalizing relay, will be on electric transmission and distribution feeders, but may be on electric circuits of any kind.

In the accompanying drawings Fig. 1 is an elevation illustrating a preferred form of the present invention. Fig. 2 is a side view looking from the left of Fig. 1, and Fig. 3 is a side view looking from the right of Fig. 1. Fig. 4 shows the relation of the sectionalizing relay to a suitable base. Fig. 5 is a diagram showing how the sectionalizers may be arranged with relation to the power line.

Referring to the drawings, 12 denotes a suitable frame on which is mounted a solenoid relay comprising a series operating coil 13 and an armature 14. The said coil 13 rests on a support 15 fixed to the frame 12. A line terminal 16, insulated from the frame 12, is electrically connected to one terminal of coil 13 by a conductor 17. The other terminal of the coil 13 is connected to the frame of the relay. The armature 14 is adjustably mounted on a screw-threaded part of a rod 18 and may be fixed in any desired position of adjustment by a nut 19. The rod 18 passes loosely through a guiding support 12^a fixed to the frame 12 and is steadied in its vertical movements by said support.

The upper end of rod 18 is connected with a U-shaped frame or support 19' which may be adjustably secured to the said rod by nuts 20. Pivotally mounted in the frame 19' is a notching latch 21 the upper part of which is held in engagement, by a torsional spring 22, with notches or teeth on a bar 23 passing loosely through a guide 23^a fixed to the upper part of the frame 12. Pivotally supported beneath the said upper part of the frame 12 is a retaining and releasing latch 24 having a downwardly extending part 24^a arranged to engage a lateral arm 21^a of the notching latch 21. Said arms 21^a and 24^a interlock, being integral with the retaining and releasing latch 24 and the notching latch 21 so that when the latch 24 is released from the notching bar 23 by the reset mechanism, to be referred to presently, said latch 24 also releases latch 21 from the notching bar. The retaining and releasing latch 24 acts as a pawl to engage the teeth of the notching bar 23 so as to hold said bar up as it is successively lifted and until said latch and the latch 21 are released, as will presently be described.

A reset rod 25, the upper end of which extends loosely through an opening in the upper part of the frame 12, is provided with nuts 26 between which is clamped a washer 27 arranged to engage a laterally extending arm 24^b of the retaining and releasing latch 24 when the said rod 25 is moved downward. The lower end of the rod 25 is connected by a pin 28 with the rear arm of a lever 29 fulcrumed on a pivot pin 30 mounted on a standard 31 fixed to the base of the frame 12, the forward arm of said lever carrying an adjustably mounted weight 31. Fixedly mounted on the lever 29 is an armature 32 through which the rod 18 loosely extends.

Surrounding the lower end of the rod 18 is a coil spring 33, the upper end of which engages a washer 34 held in place by a pin 35 extending through said rod 18, the lower end of said spring resting on the base or lower part of the frame 12. The said spring acts to force the rod 18 upward after it has been lowered by the action of the armature 14, the upward movements of said rod being limited by the adjustable check nut 18^a, which is fixed in place by a set nut 18^b.

Fixed to the top of the frame 12 are standards 36 and 37. Pivoted to the standard 37, by a pin 38, is a link 39, connected by a pivot pin 40 with a second link 41 which is in turn connected by a pivot pin 42 with a link 43 pivotally connected with the standard 36 by a pin 44. The links 39 and 41 constitute a toggle as will be understood. The link 43 is jointed by a pin 45 to an operating disconnecting lever 46 provided at its upper end

with a pin 48 engaged by retaining spring latch 49. The links 39 and 43 are each formed by two plates between which the single member link 41 is received, and the single member lever 46 also extends between the two members of the link 43, as will be understood from the drawings.

Mounted at the upper end of the notch-bar 23 is an adjustable trip 50 for the toggle 39, 41, the toggle link 41 being adapted to be engaged by said trip at the notch 41^a for the purpose of raising or breaking said toggle when the said trip is raised to the proper height. The trip 50 may be secured in any desired position of adjustment on the bar 23 by the set nut 50^a. Mounted on the upper part of the frame 12 is an adjustable stop 51 arranged to be engaged by a notched part of the link 39, as shown in Figs. 2 and 3, when the parts are set for operation. Thus when the said toggle is broken by the trip 50 the link 43, to which said toggle is connected, will operate the disconnecting lever 46 to disengage the pin 48 on said lever from the spring latch 49 allowing the lever 46 to swing down, thus opening the circuit afforded by the entire chain of parts from the terminal 16 through the series coil to the case of the apparatus and thence to the line terminal at 52.

The sectionalizing apparatus may be enclosed in a suitable casing 53 (see Fig. 4) and the apparatus may be connected to a supporting base 54 equipped with insulators, as shown in Fig. 4.

In the operation of the apparatus just described when the feeder is energized by an overcurrent impulse the armature 14 is drawn down to the extent of a tooth or notch of the bar 23, and when the overcurrent relaxes the spring 33 lifts the rod casing 18 causing the latch 21 to lift the bar 23 and the trip 50 at the top of said bar. A succession of these overcurrent impulses will cause the bar 23 to be successively lifted a predetermined number of times before the trip 50 engages the toggle to lift or break the said toggle and thus operate the disconnecting lever 46 to open the circuit.

Whenever a normal current, or a current less than that required to operate armature 14, flows through coil 13 (which will necessarily be before the device has been tripped, as no current can flow with the circuit open) the armature 32 around rod 18 will be attracted upward, thus causing the lever 29, to which the armature 32 is fixed, to operate the reset rod 25 to cause the washer 27, fixed to said reset rod, to engage the arm 24^b of the latch 24, said latch in turn operating the latch 21 to disengage said latch 21 from the notch bar 23, thereby resetting the said notch bar for a new sequence of operations. The normal current referred to is assumed to be a current of any value between the minimum required to operate the reset armature 32 and the minimum required for notching the apparatus.

The closing of the circuit breaker *z* between the source of power and the sectionalizers may be either automatic or done by hand. In the case of automatic reclosing circuit breakers it is necessary for the breaker to be set to reclose at least as many times as the highest number of overcurrent impulses for which any sectionalizer is set to trip.

From the foregoing it will be understood that, after a notching operation has occurred and before the disconnecting device has been tripped, if a current less than that required to operate armature 14 flows in coil 13, armature 32 will be attracted upward, thus operating the resetting rod 25 and thereby setting the device for a new sequence of operations.

The nuts 18^c on rod 18 limit the upward movement of the armature 32, and interlock the two armatures 14 and 32 for co-operation, so that armature 32 is prevented from operating while armature 14 is pulled down by an overcurrent. The weight 31 permits of a proper balancing of the resetting mechanism and provides part of the necessary inertia to allow armature 14 to operate quicker than armature 32.

The arrangement of the tripping mechanism as described above, whereby a notching occurs after the circuit is deenergized, makes it unnecessary for the sectionalizer to interrupt any current upon tripping, since the sectionalizer drops open between the time the circuit breaker *z* trips and recloses. As is well known in the art to which this invention relates this is a great advantage, since it is exceedingly difficult to interrupt heavy currents in the open air.

An adjustment for the current required to operate armature 14 is effected by screwing said armature up and down on rod 18.

The number of overcurrent impulses required before tripping is effected may be regulated by adjustment of trip 50.

The sectionalizing relay mechanism herein described may be used in connection with a current transformer in which the framework of the device could be grounded and the tripping mechanism be modified as might be necessary.

A typical application or use of the invention is illustrated by the diagrammatic view, Fig. 5, of the drawings. This shows a feeder *x* made up of several branches in each of which an automatic sectionalizing device *y* has been installed. Between the feeders and the source of power a circuit breaker *z* will preferably be installed which will open either automatically or by hand upon occurrence of overcurrent in the feeder. Each time overcurrent flows in any section of the line all sectionalizers in the branches through which the overcurrent flows will lift the bar 23 to the extent of one tooth or notch of said bar upon the opening of circuit breaker *z* deenergizing the line. After a predetermined number of successive overcurrent impulses through any sectionalizer for which it is set occur, the sectionalizing relay allows the disconnect to open, thus disconnecting the faulty section and permitting the restoration of service on the rest of the feeder. When more than one sectionalizer is connected in series in different parts of the feeder the most remote one from the source of power must be set to drop out on the least number of overcurrent impulses, and each one nearer the breaker will be set to drop out on one more impulse than the next one farther away.

No notching operation occurs in the sectionalizers connected in branches of the feeder not drawing overcurrent.

If, at any time after a notching operation has occurred and before the sectionalizer drops out, the circuit is energized without the flow of overcurrent the flow of normal current will lift the reset armature 32 to reset the apparatus for a new sequence of operations. It will therefore be understood that the flow of normal current, after any overcurrent impulse and before a tripping operation to open the circuit has occurred, will cause the apparatus to be reset for a new sequence of operations, as above stated.

From the foregoing description it will be apparent that I have devised a sectionalizing relay

with the following advantages over other apparatus now in use:

The relay with suitable disconnecting device, comprising a sectionalizer, is self-container, requiring a minimum amount of space, and is readily adaptable for replacing line fuses without additional equipment or changes to existing structures.

All parts may be conveniently operated at line voltage, making it unnecessary to provide costly insulation between the line and part of the sectionalizing apparatus.

Only one operating coil is required in the electrical circuit to perform all the functions of notching, resetting, or tripping. This reduces construction costs and space required, and eliminates all control circuit wiring and reduces the burden or electric load required to a value that makes it possible to operate the sectionalizer without any external source of power other than the current through the series coil.

The notching relay armature is so arranged that no notching of the relay occurs as long as current above a predetermined value flows through the operating coil. This prevents the sectionalizer from notching and opening on overcurrent and allows it to open while the coil is deenergized or after the current through it has fallen below a predetermined value. This feature makes it unnecessary to provide other means, such as a separate relay, to lock the sectionalizer in until the operating coil is deenergized or current through it has fallen below a predetermined value.

The simplified resetting mechanism is controlled by a normal current flow through the operating coil and does not require a timing device of any kind for controlling the resetting feature. This makes the usual complicated timing relay, dashpot requiring periodical inspection, or other timing device, unnecessary.

Having thus described my invention, I claim and desire to secure by Letters Patent:

1. A trip for a circuit breaker and comprising a notch bar, a spring-pressed rod, an armature mounted on said rod, a lifting latch connected with said rod and arranged to engage the teeth or notches of said bar, a trip carried by said notch-bar and means, co-operating with said trip, whereby said circuit may be broken after a predetermined number of overcurrent impulses have occurred and disappeared.

2. A trip for a circuit breaker and comprising a notch-bar, a spring-pressed rod, an armature mounted on said rod, a lifting latch connected with said rod and arranged to engage the teeth or notches of said bar, a trip carried by said notch bar, means, co-operating with said trip, whereby said circuit may be broken after a predetermined number of overcurrent impulses, and automatic means for releasing said latch to reset the mechanism upon the establishment of normal current flow through the relay.

3. A trip for a circuit breaker and comprising a latch-bar, a spring-pressed rod, an armature mounted on said rod, a lifting latch connected with said rod and arranged to engage the teeth or notches of said bar, means, co-operating with said trip, whereby said circuit may be broken after a predetermined number of overcurrent impulses, said circuit-breaking means comprising a toggle arranged to be engaged and lifted or broken by said trip, and a disconnecting arm operated by said toggle.

4. A trip for a circuit breaker and comprising a notch-bar, a spring-pressed rod, an armature mounted on said rod, a lifting latch connected with said rod and arranged to engage the teeth or notches of said bar, a trip carried by said notch-bar, means, co-operating with said trip, whereby said circuit may be broken after a predetermined number of overcurrent impulses, a retaining and releasing latch arranged to engage said lifting latch, and tripping means for operating said retaining and releasing latch to disengage said lifting latch from said notch-bar upon the establishment of normal flow through the sectionalizer.

5. The combination with a circuit connected to a source of electricity, of make and break mechanism connected to said circuit and operable step by step by circuit impulses in said circuit in excess of normal from an initially set circuit-make position to a circuit-break position only after a predetermined number of steps from the initially set position, and means operable by any normal current impulse in said circuit occurring after movement of said mechanism from its initially set position and before completion of said predetermined number of steps to restore said mechanism to its initially set position.

6. The combination with a circuit connected to a source of electricity, of make and break mechanism connected to said circuit and comprising a support; a yielding terminal fixed to said support; a toggle linkage mounted on said support; a second terminal pivoted to said linkage to swing freely about its pivot axis into and out of contact with the first named terminal; a stop adjustable on said support to hold the linkage in adjusted position to maintain said terminals in yielding contact with each other; and trip mechanism operable step-by-step by current impulses in said circuit in excess of normal from an initial setting to move the linkage from said adjusted position only after completion of a predetermined number of such impulses occurring in succession after said setting.

7. The combination with a circuit connected to a source of electricity, of make and break mechanism connected to said circuit and comprising a support; a yielding terminal fixed to said support; a toggle linkage mounted on said support; a second terminal pivoted to said linkage to swing into and out of contact with the first named terminal; a stop adjustable on said support to hold the linkage in adjusted position to maintain said terminals in yielding contact with each other; and trip mechanism operable step-by-step by current impulses in said circuit in excess of normal from an initial setting to move the linkage from said adjusted position only after completion of a predetermined number of such impulses occurring in succession after said setting, and means operable by any normal current impulse in said circuit, occurring after the initial setting of said mechanism and before completion of said predetermined number of impulses, to restore said mechanism to its initially set position.

WILLIAM L. GARLINGTON.