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TITLE OF THE INVENTION

Electric Power Distribution Installation Circuit

BACKGROUND OF THE INVENTION

5 1. FIELD OF THE INVENTION

The present invention relates to an electric power receiving and distributing device which transmits an electric power from a high voltage bus line to a distribution substation, and, in particular, 10 relates to a grounding fault protection in an electric power distribution installation circuit which employs a loop electric power distribution system as a method of main circuit electric power distribution from a high voltage bus line to a plurality of distribution 15 substations.

As a method of high voltage electric power distribution in an electric power receiving and distributing device, transmission of an electric power from one feeder line to one distribution substation is 20 commonly employed. Further, as a grounding system a non-grounding system is commonly used.

In a grounding fault protection in the non-grounding system a grounding type potential transformer or a capacitor type grounding voltage 25 detector is provided at the high voltage bus line through which a grounding fault voltage is detected, and further a grounding fault current is detected

through grounding fault current detectors provided at respective feeder lines, and through a combination of these with grounding fault detection relays an alarm or removal of a grounding fault line is performed.

5 Further, with provision of grounding fault voltage detection relays at a tertiary winding terminal of the grounding type potential transformer or a secondary winding terminal of a capacitor type grounding voltage detector and with a series combination of an operation

10 of the grounding fault voltage detection relays and the grounding fault detection relays a grounding fault line is removed while separating from sound lines and enhancing reliability.

Different from the above explained system, when

15 the electric power transmission method from a high voltage bus line to a plurality of distribution substations is a loop system, current transformers are respectively provided at the side of electric power transmission and at the side of electric power

20 reception, and through combination thereof with pilot wire relays a section of grounding fault point is judged and detection and removal of a grounding fault point is performed.

Further, like the above, when the electric power

25 transmission method from a high voltage bus line to a plurality of distribution substations is a loop system, grounding fault current detectors are provided

respectively at the side of reception and of transmission of respective distribution substations and through combination thereof with grounding fault detection relays an operating condition of the
5 respective relays is sent to an installation such as a central monitoring installation which can inclusively monitor and control the electric power receiving and distributing device, judges a fault point based on positional relation of operated relays and sends out
10 an opening signal to a concerned circuit breaking unit so as to protect the circuit.

When a grounding fault accident is caused in any of distribution substations or at cables in an electric power receiving and distributing device which
15 performs electric power loop distribution from a feeder line connected to a high voltage bus line to a plurality of distribution substations, the combination of the grounding fault current detector and the grounding fault detector relay causes such problem
20 that the grounding fault detection relay at the distribution substations where the grounding fault accident is caused of course detects the grounding fault accident, however, at the same time the grounding fault detection relay at a sound
25 distribution substation may operate depending on the fault point, and the concerned circuit breaker unit is opened and the sound distribution substation may

interrupt electric power supply service.

Further, when a fault point is judged in a manner by sending out the operating condition of the relays to the installation such as a central monitoring
5 installation which can monitor and control inclusively the electric power receiving and distributing device including the distribution substations, there arises a problem that it takes time for the processing as well as it delays to send out an opening signal to a
10 concerned circuit breaker unit even under an accident.

Still further, the combination of current transformers and pilot wire relays or the over all monitoring and controlling of the electric power receiving and distributing device including the
15 distribution substations requires complex devices and further necessitates laying great many control use cables for the sides of electric power transmission and reception or for between electric rooms and the central monitoring device which arises a problem of
20 increasing the cost thereof and thus prevents introduction thereof. Further, JP-A-10-112928(1998), for example, discloses the art as has been explained above.

25 SUMMARY OF THE INVENTION

An object of the present invention is to provide an electric power distribution installation which

prevents unnecessary electric power supply service interruption of all electric power distribution system due to a grounding fault accident.

An electric power distribution installation circuit according to the present invention which achieves the above object, is characterized, in that the electric power distribution installation circuit comprises feeder use circuit breakers which distribute electric power from a main bus line into a plurality of distribution lines, an electric power distribution loop circuit to which a plurality of distribution substations are connected between the respective feeder use circuit breakers, a first and a second circuit breaker each provided at the respective distribution substations, grounding fault current detectors each detects grounding fault current flowing through the respective feeder use circuit breakers, a directional grounding fault detection relay and another directional grounding fault detection relay which detects grounding fault current in an opposite direction for the respective first and second circuit breakers, timers each connected to both directional grounding fault detection relays, wherein the operation timing of the timers for the first circuit breakers are determined in such a manner that the operation timings of the timers are successively set earlier along the feeder use circuit breaker at one

side toward the feeder use circuit breaker at the other side and on the other hand the operation timings of the timers for the second circuit breakers are determined in such a manner that the operation timings
5 of the timers are successively set earlier along the feeder use circuit breaker at the other side toward the feeder use circuit breaker at the one side and when a grounding fault current from a grounding fault point flows to the feeder use circuit breaker at the
10 one side and the feeder use circuit breaker at the other side via the electric power distribution loop circuit, one of the first and second circuit breakers, in which the both directions of the grounding fault current and the directional grounding fault detection
15 relay are the same as well as the operation timing of the timer is the earliest, is interrupted.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a system circuit diagram showing an
20 entire structure of an electric power distribution installation circuit representing one embodiment according to the present invention; and

Fig. 2 is a circuit diagram of a control unit for grounding fault protection in Fig. 1 embodiment.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Hereinbelow, a structure for grounding fault

protection in an electric power distribution installation circuit representing an embodiment according to the present invention will be explained with reference to Figs. 1 and 2.

5 Fig. 1 is an entire system diagram of an extra high voltage electric power reception and high voltage power distribution system representing one embodiment according to the present invention in which an electric power distribution from a feeder line to
10 distribution substations is performed through a loop electric power distribution and non-grounding system is used as its grounding system.

 In Fig. 1, to a three phase extra high voltage line 1 connected to a power source substation an
15 electric power receiving use line 2 is connected, and to the electric power receiving use line 2 such as a grounding switch 3, a disconnecting switch unit 4, a circuit breaker 5 and a transformer 6 are connected through which the extra high voltage is stepped down
20 to a high voltage, thereafter, an electric power distribution loop circuit 7 serving as a high voltage bus line is further connected thereto.

 To the electric power distribution loop circuit 7 a grounding type potential transformer or a capacitor
25 type grounding voltage detector 8 is connected and feeder lines 10 and 11 are further connected. In the feeder lines 10 and 11, are respectively provided

feeder use circuit breakers 12 and 13, grounding fault current detectors 14 and 15 and directional grounding fault detection relays 16 and 17 which use in combination the grounding type potential transformer or the capacitor type grounding voltage detector 8 and the grounding fault current detectors 14 and 15. The directional grounding fault detection relays 16 and 17 are designed to operate when a grounding fault current i flows from the side of a load L toward the extra high voltage line 1. From the respective feeder lines 10 and 11 a loop electric power distribution is performed to respective distribution substations 20, 21 and 22.

In the respective distribution substations 20, 21 and 22 connected to the electric power distribution loop circuit 7, circuit breakers 30, 32 and 34 and circuit breakers 31, 33 and 35 are connected in series with the electric power distribution loop circuit 7, and further in the respective distribution substations 20, 21 and 22 other grounding type potential transformers or capacitor type grounding voltage detectors 8 and grounding fault current detectors 40, 41, 42, 43, 44 and 45 for detecting grounding fault current are provided and still further directional grounding fault detection relays 50, 51, 52, 53, 54 and 55 which use in combination the grounding type potential transformers or the capacitor type grounding

voltage detectors 8 and the grounding fault current detectors 40 through 45. The directional grounding fault detection relays 51, 53 and 55 are designed so as to operate when a grounding fault current i flows in the same direction as in the directional grounding fault detection relay 16, and the directional grounding fault detection relays 50, 52 and 54 are designed so as to operate when a grounding fault current i flows in the same direction as in the directional grounding fault detection relay 17.

The directional grounding fault detection relays 16, 17 and 50 through 55 are respectively connected to the tertiary or secondary terminals of the grounding type potential transformers or the capacitor type grounding voltage detectors 8 and the secondary terminals of the grounding fault current detectors 14, 15 and 40 through 45. The respective directional grounding fault detection relays 16, 17 and 50 through 55 detect a grounding fault accident caused in the system concerned through detection of voltages outputted from the tertiary or secondary terminals of the grounding type potential transformers or capacitor type grounding voltage detectors 8 and through detection of currents outputted from the secondary terminals of the grounding fault current detectors 14, 15 and 40 through 45.

When a grounding fault accident is detected, A

contacts 16A, 17A, 50A, 51A, 52A, 53A, 54A and 55A in the respective directional grounding fault detection relays 16, 17 and 50 through 55 as shown in Fig. 2 are respectively closed.

5 Control units 10A, 11A, 20A, 20B, 21A, 21B, 22A and 22B are connected to the respective directional grounding fault detection relays 16, 17 and 50 through 55. Further, the control unit 10A is incorporated in the feeder 10, the control unit 11A is incorporated in
10 the feeder 11, the control units 20A and 20B are incorporated in the distribution substation 20, the control units 21A and 21B are incorporated in the distribution substation 21 and the control units 22A and 22B are incorporated in the distribution
15 substation 22.

The operation of the control units 10A, 11A, 20A, 20B, 21A, 21B, 22A and 22B will be explained with reference to Fig. 2.

When the A contacts 16A, 17A, 50A, 51A, 52A, 53A, 54A and 55A in the respective directional grounding
20 fault detection relays 16, 17 and 50 through 55 are closed, the control units 10A, 11A, 20A, 20B, 21A, 21B, 22A and 22B activate respective internal A contacts T1A, T2A, T3A, T4A, T5A, T6A, T7A and T8A
25 with respective predetermined time delays and output respective opening commands 12A, 13A, 30A, 31A, 32A, 33A, 34A and 35A, and thus, the circuit breaker 12 is

opened with the opening command 12A, the circuit
breaker 13 with the opening command 13A, the circuit
breaker 30 with the opening command 30A, the circuit
breaker 31 with the opening command 31A, the circuit
5 breaker 32 with the opening command 32A, the circuit
breaker 33 with the opening command 33A, the circuit
breaker 34 with the opening command 34A and the
circuit breaker 35 with the opening command 35A.

Herein, the control units 10A, 11A, 20A, 20B,
10 21A, 21B, 22A and 22B are provided with timers T1, T2,
T3, T4, T5, T6, T7 and T8 for determining the
operation timings of the A contacts T1A, T2A, T3A,
T4A, T5A, T6A, T7A and T8A in such a manner that the A
contact T1A operates in a delayed timing with respect
15 to the A contact T4A, the A contact T4A operates in a
delayed timing with respect to the A contact T6A and
the A contact T6A operates in a delayed timing with
respect to the A contact T8A, further, the A contact
T2A operates in a delayed timing with respect to the A
20 contact T7A, the A contact T7A operates in a delayed
timing with respect to the A contact T5A, and the A
contact T5A operated in a delayed timing with respect
to the A contact T3A.

Now, the internal structure of the control units
25 10A, 11A, 20A, 20B, 21A, 21B, 22A and 22B will be
explained.

The control unit 10A is provided with the A

contact T1A which is designed to be operated after being delayed by a predetermined time by the delay timer T1 connected to the A contact 16A in the directional grounding fault detection relay 16. The
5 delay timer T1 can be a delay time adjustable timer. The set time of the delay timer T1 is determined in relation to the delay timers T4, T6 and T8 provided in the control units 20B, 21B and 22B, in that the set time for the delay timer T1 is set longer than that
10 for the delay timer T4, the set time of the delay timer T4 is set longer than that for the delay timer T6, and the set time of the delay timer T6 is set longer than that for the delay timer T8. The set time for the delay timer T1 is, for example, 2 sec., the
15 set time for the delay timer T4 is, for example, 1.5 sec., the set time for the delay timer T6 is, for example, 1 sec., and the set time for the delay timer T8 is, for example, 0.5 sec.

The control unit 20B is provided with the A
20 contact T4A which is designed to be operated after being delayed by a predetermined time by the delay timer T4 connected to the A contact 51A in the directional grounding fault detection relay 51. The delay timer T4 can be a delay time adjustable timer.
25 The set time of the delay timer T4 is determined in relation to the delay timers T1, T6 and T8 provided in the control units 10A, 21B and 22B, in that the set

time for the delay timer T1 is set longer than that for the delay timer T4, the set time of the delay timer T4 is set longer than that for the delay timer T6, and the set time of the delay timer T6 is set longer than that for the delay timer T8. The set time for the delay timer T1 is, for example, 2 sec., the set time for the delay timer T4 is, for example, 1.5 sec., the set time for the delay timer T6 is, for example, 1 sec., and the set time for the delay timer T8 is, for example, 0.5 sec.

The control unit 21B is provided with the A contact T6A which is designed to be operated after being delayed by a predetermined time by the delay timer T6 connected to the A contact 53A in the directional grounding fault detection relay 53. The delay timer T6 can be a delay time adjustable timer. The set time of the delay timer T6 is determined in relation to the delay timers T1, T4 and T8 provided in the control units 10A, 20B and 22B, in that the set time for the delay timer T1 is set longer than that for the delay timer T4, the set time of the delay timer T4 is set longer than that for the delay timer T6, and the set time of the delay timer T6 is set longer than that for the delay timer T8. The set time for the delay timer T1 is, for example, 2 sec., the set time for the delay timer T4 is, for example, 1.5 sec., the set time for the delay timer T6 is, for

example, 1 sec., and the set time for the delay timer T8 is, for example, 0.5 sec.

The control unit 22B is provided with the A contact T8A which is designed to be operated after being delayed by a predetermined time by the delay timer T8 connected to the A contact 55A in the directional grounding fault detection relay 55. The delay timer T8 can be a delay time adjustable timer. The set time of the delay timer T8 is determined in relation to the delay timers T1, T4 and T6 provided in the control units 10A, 20B and 21B, in that the set time for the delay timer T1 is set longer than that for the delay timer T4, the set time of the delay timer T4 is set longer than that for the delay timer T6, and the set time of the delay timer T6 is set longer than that for the delay timer T8. The set time for the delay timer T1 is, for example, 2 sec., the set time for the delay timer T4 is, for example, 1.5 sec., the set time for the delay timer T6 is, for example, 1 sec., and the set time for the delay timer T8 is, for example, 0.5 sec.

The control unit 11A is provided with the A contact T2A which is designed to be operated after being delayed by a predetermined time by the delay timer T2 connected to the A contact 17A in the directional grounding fault detection relay 17. The delay timer T2 can be a delay time adjustable timer.

The set time of the delay timer T2 is determined in relation to the delay timers T3, T5 and T7 provided in the control units 20A, 21A and 22A, in that the set time for the delay timer T2 is set longer than that
5 for the delay timer T7, the set time of the delay timer T7 is set longer than that for the delay timer T5, and the set time of the delay timer T5 is set longer than that for the delay timer T3. The set time for the delay timer T2 is, for example, 2 sec., the
10 set time for the delay timer T7 is, for example, 1.5 sec., the set time for the delay timer T5 is, for example, 1 sec., and the set time for the delay timer T3 is, for example, 0.5 sec.

The control unit 20A is provided with the A
15 contact T3A which is designed to be operated after being delayed by a predetermined time by the delay timer T3 connected to the A contact 50A in the directional grounding fault detection relay 50. The delay timer T3 can be a delay time adjustable timer.
20 The set time of the delay timer T3 is determined in relation to the delay timers T2, T5 and T7 provided in the control units 11A, 21A and 22A, in that the set time for the delay timer T2 is set longer than that for the delay timer T7, the set time of the delay
25 timer T7 is set longer than that for the delay timer T5, and the set time of the delay timer T5 is set longer than that for the delay timer T8. The set time

for the delay timer T2 is, for example, 2 sec., the set time for the delay timer T7 is, for example, 1.5 sec., the set time for the delay timer T5 is, for example, 1 sec., and the set time for the delay timer
5 T3 is, for example, 0.5 sec.

The control unit 21A is provided with the A contact T5A which is designed to be operated after being delayed by a predetermined time by the delay timer T5 connected to the A contact 52A in the
10 directional grounding fault detection relay 52. The delay timer T5 can be a delay time adjustable timer. The set time of the delay timer T5 is determined in relation to the delay timers T2, T3 and T7 provided in the control units 11A, 20A and 22A, in that the set
15 time for the delay timer T2 is set longer than that for the delay timer T7, the set time of the delay timer T7 is set longer than that for the delay timer T5, and the set time of the delay timer T5 is set longer than that for the delay timer T3. The set time
20 for the delay timer T2 is, for example, 2 sec., the set time for the delay timer T7 is, for example, 1.5 sec., the set time for the delay timer T5 is, for example, 1 sec., and the set time for the delay timer T3 is, for example, 0.5 sec.

25 The control unit 22A is provided with the A contact T7A which is designed to be operated after being delayed by a predetermined time by the delay

timer T7 connected to the A contact 54A in the directional grounding fault detection relay 54. The delay timer T7 can be a delay time adjustable timer. The set time of the delay timer T7 is determined in
5 relation to the delay timers T2, T3 and T5 provided in the control units 11A, 20A and 21A, in that the set time for the delay timer T2 is set longer than that for the delay timer T7, the set time of the delay timer T7 is set longer than that for the delay timer
10 T5, and the set time of the delay timer T5 is set longer than that for the delay timer T3. The set time for the delay timer T2 is, for example, 2 sec., the set time for the delay timer T7 is, for example, 1.5 sec., the set time for the delay timer T5 is, for
15 example, 1 sec., and the set time for the delay timer T3 is, for example, 0.5 sec.

Now, when it is assumed, for example, that all of the circuit breakers 12, 13 and 30 through 35 connected in series along the loop electric power
20 distribution circuit are closed to form an electric power distribution loop circuit and electric power is transmitted from the feeders 10 and 11 to the respective distribution substations 20, 21 and 22, a grounding fault accident in a case of an open loop
25 electric power transmission from the feeders 10 and 11 is detected with the grounding type potential transformers or the capacitor type grounding voltage

detectors 8, the grounding fault current detectors 14, 15 and 40 through 45 and the directional grounding fault detection relays 16, 17 and 50 through 55 connected to the secondary or tertiary terminals of the above.

When the directional grounding fault detection relays 16, 17 and 50 through 55 are operated at the same time, the A contacts 16A, 17A and 50A through 55 are closed and the timers provided inside the control units 10A, 11A, 20A, 20B, 22A and 22B are excited. Therefore, the setting times of the timers are determined in such a relationship that the timer T1 operates in later timing than the timer T4, the timer T4 operates in later timing than the timer T6, the timer T6 operates in later timing than the timer T8, the timer T2 operates in later timing than the timer T7, the timer T7 operates in later timing than the timer T5, and the timer T5 operates in later timing than the timer T3. For example, the set time for the timer T1 is 2 sec., for the timer T4 1.5 sec., for the timer T6 1 sec., for the timer T8 0.5 sec., for the timer T2 2 sec., for the timer T7 1.5 sec., for the timer T5 1 sec., and for the timer T3 0.5 sec.

As has been explained above, the operation timings of the respective timers from the timer T1 at one side toward the timer T2 at the other side are determined faster successively in the following order

T1>T4>T6>T8. Further, the operation timings of the respective timers from the timer T2 at the other side toward the timer T1 at the one side are determined faster successively in the following order T2>T7>T5>
 5 T3.

When it is assumed that a grounding fault accident 60 is induced at the distribution substation 22 in the electric power distribution loop circuit 7, a grounding fault current i_1 and a grounding fault
 10 current i_2 flow from the grounding fault accident 60 to the feeder use circuit breaker 12 at one side and to the feeder use circuit breaker 13 at the other side. All of the grounding type potential transformers or the capacitor type grounding voltage
 15 detectors 8 detect grounding fault voltages, and the grounding fault current i_1 is detected by the grounding fault current detectors 14, 15, 41 and 43.

When the directional grounding fault detection relays 16, 51 and 53 in the same direction as the
 20 grounding fault current i_1 operate at the same time, the A contacts 16A, 51A and 53A are closed. Among these the timer having the fastest operation timing is the timer T6, therefore, the timer T6 is for the first time excited to close the A contact T6A, and an
 25 interruption command 33A is outputted to the circuit breaker 33 to trip the same.

On the other hand, since the directional

grounding fault detection relay which shows the same direction as the grounding fault current i_2 is only the directional grounding fault detection relay 17, when the directional grounding fault detection relay 5 17 operates, the A contact 17A closes and the timer T2 is excited to close its A contact T2A, thereby, an interruption command 13A is inputted to the circuit breaker 13 to trip the same.

As a result, electric power supply can be 10 continued to loads L1 and L2 without interrupting electric power supply service for all of the Loads L1, L2 and L3. Namely, since the grounding fault accident point 60 can be removed thereby, no other interruption commands 31A and 12A are outputted, the electric power 15 transmission from the feeder 10 is continued and unnecessary electric power supply service interruption to the distribution substations 20 and 21 can be prevented.

Subsequently, it is now assumed that a grounding 20 fault accident 61 is induced in the electric power distribution loop circuit 7 at a main circuit cable connecting between the distribution substations 21 and 22.

When the grounding fault accident 61 is induced, 25 a grounding fault current i_1 and a grounding fault current i_2 flow from the grounding fault accident 61 to the feeder use circuit breakers 12 and 13. All of

the grounding type potential transformers or the capacitor type grounding voltage detectors 8 detect grounding fault voltages, and the grounding fault current i_1 is detected by the grounding fault current detectors 14, 41 and 43.

When the directional grounding fault detection relays 16, 51 and 53 in the same direction as the grounding fault current i_1 operate at the same time, the A contacts 16A, 51A and 53A are closed. Among these the timer having the fastest operation timing is the timer T6, therefore, the timer T6 is for the first time excited to close the A contact T6A, and an interruption command 33A is outputted to the circuit breaker 33 to trip the same.

On the other hand, when the directional grounding fault detection relays 17 and 54 in the same direction as of the grounding fault current i_2 operate, the A contacts 17A and 54A close and the timers T2 and T7 are excited, and in this instance since the timer operating timing of the timer T7 is faster than that of the timer T2, the A contact T7A thereof is closed and an interruption command 34A is inputted to the circuit breaker 34 to trip the same.

As a result, electric power supply can be continued to loads without interrupting electric power supply service for all of the loads L1, L2 and L3. Namely, since the grounding fault accident point 61

can be removed thereby, no other interruption commands 31A, 12A and 13A are outputted, the electric power transmission from the feeders 10 and 11 are continued and unnecessary electric power supply service interruption to the distribution substations 20, 21 and 22 can be prevented.

Further, in case of a grounding fault accident 62, since the circuit breakers 31 and 32 are tripped by the grounding fault currents i_1 and i_2 , an electric power supply can be continued to all of the loads without interrupting electric power supply service for all of the loads L1, L2 and L3.

Still further, in case of a grounding fault accident 63, since the circuit breakers 12 and 32 are tripped by the grounding fault currents i_1 and i_2 , an electric current supply service can be continued to the loads L2 and L3.

Still further, as an alternative application method, it is, for example, assumed that an open loop electric power distribution circuit is formed by opening the circuit breaker 13 and closing all of the other circuit breakers 12 and 30 through 35 connected in series along the loop electric power distribution circuit and an electric power is transmitted from the feeder 10 to the respective distribution substations 20, 21 and 22.

In this instance, when a grounding fault accident

62 is induced, since the circuit breaker 13 is opened, no grounding fault current i_2 flows and the circuit breaker 31 is tripped by the grounding fault current i_1 , thereby, the electric power supply service for the
5 distribution substations 20, 21 and 22 is interrupted regardless to their soundness, although, the electric power supply service to the load L1 is never interrupted.

In this instance, if the circuit breaker 13 is
10 closed manually or by an automatic control unit under a condition that the directional grounding fault detection relay 51 is operated and the circuit breaker 31 is tripped, an electric power re-supply service to the distribution substations 20, 21 and 22 can be
15 permitted, although, the grounding fault current i_2 flows to trip the circuit breaker 32. Accordingly, the present invention can be also applied to such an open loop circuit.

According to the present invention as has been
20 explained above, since the operation timing of the timers for the first circuit breakers are determined in such a manner that the operation timings of the timers are successively set earlier along the feeder use circuit breaker at one side toward the feeder use
25 circuit breaker at the other side and on the other hand the operation timings of the timers for the second circuit breakers are determined in such a

manner that the operation timings of the timers are successively set earlier along the feeder use circuit breaker at the other side toward the feeder use circuit breaker at the one side and thus when a
5 grounding fault current from a grounding fault point flows to the feeder use circuit breaker at the one side and the feeder use circuit breaker at the other side via the electric power distribution loop circuit, one of the first and second circuit breakers, in which
10 the both directions of the grounding fault current and the directional grounding fault detection relay are the same as well as the operation timing of the timer is the earliest, is interrupted, thereby, the electric power can be continuously supplied to the loads
15 without interrupting electric power supply service to all of the loads L1, L2 and L3, thus, reliability of electric power supply service is enhanced.



CLAIMS :

1. An electric power distribution installation circuit, characterized, in that the electric power
5 distribution installation circuit comprises feeder use circuit breakers which distribute electric power from a main bus line into a plurality of distribution lines, an electric power distribution loop circuit to which a plurality of distribution substations are
10 connected between the respective feeder use circuit breakers, a first and a second circuit breaker each provided at the respective distribution substations, grounding fault current detectors each detects grounding fault current flowing through the respective
15 feeder use circuit breakers, a directional grounding fault detection relay and another directional grounding fault detection relay which detects grounding fault current in an opposite direction for the respective first and second circuit breakers,
20 timers each connected to both directional grounding fault detection relays, wherein the operation timing of the timers for the first circuit breakers are determined in such a manner that the operation timings of the timers are successively set earlier along the
25 feeder use circuit breaker at one side toward the feeder use circuit breaker at the other side and on the other hand the operation timings of the timers for



the second circuit breakers are determined in such a manner that the operation timings of the timers are successively set earlier along the feeder use circuit breaker at the other side toward the feeder use circuit breaker at the one side and when a grounding fault current from a grounding fault point flows to the feeder use circuit breaker at the one side and the feeder use circuit breaker at the other side via the electric power distribution loop circuit, one of the first and second circuit breakers, in which the both directions of the grounding fault current and the directional grounding fault detection relay are the same as well as the operation timing of the timer is the earliest, is interrupted.