COOPERATIVE PATENT CLASSIFICATION

ELECTRICITY

GENERATION; CONVERSION OR DISTRIBUTION OF ELECTRIC POWER

EMERGENCY PROTECTIVE CIRCUIT ARRANGEMENTS (indicating or signalling undesired working conditions G01R, e.g. G01R 31/00, G08B; locating faults along lines G01R 31/08; emergency protective devices H01H)

NOTE

This subclass covers only circuit arrangements for the automatic protection of electric lines or electric machines or apparatus in the event of an undesired change from normal working conditions

WARNING

In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

Details of emergency protective circuit arrangements

1/0043 . . . (to inrush currents (H02H 1/046 takes precedence; differential protection of transformers H02H 7/045))

1/046 . . . (upon detecting saturation of current transformers (for differential protection H02H 3/283))

Arrangements for supplying operative power

1/06 . Arrangements for supplying operative power (power supply arrangements in general G05F, H02M)

1/063 . . . (primary power being supplied by fault current)

1/066 . . . [and comprising a shunt regulator]

Emergency protective circuit arrangements for automatic disconnection directly responsive to an undesired change from normal electric working condition with or without subsequent reconnection (specially adapted for specific types of electric machines or apparatus or for sectionalised protection of cable or line systems H02H 7/00; systems for change-over to standby supply H02J 9/00; integrated protection (for motors H02H 7/0822))

3/003 . . . (reversal of power transmission direction (reversal of direct current H02H 3/18])

3/006 . . . [Calibration or setting of parameters]

3/02 . . . Details

3/021 . . . (concerning the disconnection itself, e.g. at a particular instant, particularly at zero value of current, disconnection in a predetermined order (disconnection at zero value in general H03K 17/18))

3/023 . . . . [by short-circuiting]

3/025 . . . . [Disconnection after limiting, e.g. when limiting is not sufficient or for facilitating disconnection]

3/027 . . . . with automatic disconnection after a predetermined time (H02H 3/033, H02H 3/06 take precedence; timing in overcurrent protection circuits H02H 3/093; in undervoltage protection circuits H02H 3/247; staggered disconnection (H02H 7/30))

3/033 . . . . with several disconnections in a preferential order, e.g. following priority of the users, load reparation (H02H 3/06 takes precedence)
responsive to reversal of direct current
responsive to excess voltage
{ [for dc systems] }
{ [using a spark-gap as detector] }
{ [also responsive to under-voltage (window comparators for indication G01R 19/165)] }
of short duration, e.g. lightning
responsive to undervoltage or no-voltage
{ (H02H 3/307 takes precedence) }
{ [for DC systems] }
having timing means
for multiphase applications, e.g. phase interruption
to difference between voltages or between currents; responsive to phase angle between voltages or between currents
{ [for three-phase systems] }
{ [and taking into account saturation of current transformers] }
{ [involving comparison of similar homopolar quantities] }
using pilot wires or other signalling channel
{ [involving phase comparison] }
{ [involving current comparison] }
{ [involving comparison of quantities derived from a plurality of phases, e.g. homopolar quantities; using mixing transformers] }
{ [for multiphase applications, e.g. phase interruption] }
{ [for motors H02H 7/0827] }
for multiphase applications, e.g. phase interruption
{ [for ac systems] }
{ [combined with other earth-fault protective arrangements] }
by means of an auxiliary voltage injected into the installation to be protected
{ [using summation current transformers H02H 3/33] }
{ [for three-phase system] }
using phase sequence analysers
{ [using summation current transformers] }
{ [involving comparison of phase voltages] }
{ [involving comparison of the voltage or current values at corresponding points in different conductors of a single system, e.g. of currents in go and return conductors] }
{ [involving voltage comparison (H02H 3/347 takes precedence)] }
{ [for transformers H02H 7/0045] }
{ [for three-phase systems] }
{ [involving comparison of the voltage or current values at two spaced portions of a single system, e.g. at opposite ends of one line, at input and output of apparatus] }
{ [for multiphase applications, e.g. phase interruption] }
{ [combined with means for increasing reliability, e.g. redundancy arrangements] }
{ [for logic circuits H03K 19/003] }
with automatic reconnection
{ [Details concerning the co-operation of many similar arrangements, e.g. in a network (sectionalised protection H02H 7/26)] }
{ [Reconnection being a consequence of eliminating the fault which caused disconnection] }
and with permanent disconnection after a predetermined number of reconnection cycles
responsive to excess current (responsive to abnormal temperature caused by excess current H02H 5/04)
{ [and depending on the direction] }
{ [for three-phase systems] }
{ [making use of a thermal sensor, e.g. thermistor, heated by the excess current (also responsive to the temperature of the protected device H02H 5/041, thermal images H02H 6/00)] }
for dc applications
{ [in general H02H 3/027; thermal delay H02H 3/085; timing means for undervoltage protection H02H 3/247] }
{ [the timing being determined by numerical means] }
additionally responsive to some other abnormal electrical conditions
responsive to excess current and fault current to earth
responsive to underload or no-load
{ [for motors H02H 7/0827] }
for multiphase applications, e.g. phase interruption
responsive to occurrence of voltage on parts normally at earth potential
{ [monitoring earth connection H02H 5/105] }
responsive to fault current to earth, frame or mass
{ [with balanced or differential arrangement H02H 3/26; ; monitoring earth connection H02H 5/105] }
{ [for ac systems] }
{ [for three-phase systems] }
{ [combined with other earth-fault protective arrangements] }
by means of an auxiliary voltage injected into the installation to be protected
{ [using summation current transformers H02H 3/33] }
Emergency protective circuit arrangements for automatic disconnection directly responsive to an undesired change from normal non-electric working conditions with or without subsequent reconnection (using simulators of the apparatus being protected H02H 6/69; specially adapted for specific types of electric machines or apparatus or for sectionalised protection of cable or line systems H02H 7/00)

- responsive to ionising radiation; Nuclear-radiation circumvention circuits (radiation detectors G01T; nuclear-explosion detection G21J 5/00)
- responsive to abnormal temperature (specialy adapted for electric machines H02H 7/0852)
- [additionally responsive to excess current (H02H 5/048 takes precedence)]

- [using temperature dependent resistors]
- [the temperature dependent resistor being disposed parallel to a heating wire, e.g. in a heating blanket]
- [using a semiconductor device to sense the temperature]
- [using a thermal radiation sensor]
- [using a thermocouple]
- [using a temperature responsive switch]
- [additionally responsive to excess current due to heating of the switch]
- in oil-filled electric apparatus
- responsive to abnormal fluid pressure, liquid level or liquid displacement, e.g. Buchholz relays
- [responsive to the entry or leakage of a liquid into an electrical appliance (moisture alarm G08B 21/20)]
- [of cooling or lubricating fluids]
- responsive to mechanical injury, e.g. rupture of line, breakage of earth connection
- [responsive to deterioration or interruption of earth connection (for preventing switching-on H02H 11/001)]

- responsive to undesired approach to, or touching of, live parts by living beings

Emergency protective circuit arrangements responsive to undesired changes from normal non-electric working conditions using simulators of the apparatus being protected, e.g. using thermal images

- [using digital thermal images]

Emergency protective circuit arrangements specially adapted for specific types of electric machines or apparatus or for sectionalised protection of cable or line systems, and effecting automatic switching in the event of an undesired change from normal working conditions (structural association of protective devices with specific machines or apparatus and their protection without automatic disconnection, see the relevant subclass for the machine or apparatus)

- for transformers
- for current transformers
- Differential protection of transformers
- [taking into account saturation of current transformers]
- [for capacitive voltage transformers, e.g. against resonant conditions]
- [for tapped transformers or tap-changing means]
- for dynamo-electric generators; for synchronous capacitors
- [for parallel connected generators]
- [against excitation faults]
- [on occurrence of a load dump (control on sudden change of load H02P 9/10); safety devices for generators driven at varying speed H02J 7/1461)]
- for dynamo-electric motors
- [for synchronous motors]
- [for dc motors (H02H 7/0833 takes precedence)]
- [concerning the starting sequence, e.g. limiting the number of starts per time unit, monitoring speed during starting]
- [Integrated protection, motor control centres]
- [responsive to underload or no-load, e.g. pump-off control circuits for pump motors]
- [for electric motors with control arrangements]
- [with H-bridge circuit]
- [Fail safe control, e.g. by comparing control signal and controlled current, isolating motor on commutation error]
- against excessive load ([H02H 6/00 takes precedence])
Emergency protective circuit arrangements for limiting excess current or voltage without disconnection (structural association of protective devices with specific machines or apparatus, see the relevant subclass for the machine or apparatus)

9/00

[Directly responsive to abnormal temperature by using a temperature sensor (in a control circuit H02H 7/0833)]

7/0833

for electronic equipment (for converters H02H 7/10)

7/10

for electric measuring instruments G01R 1/36; for dc voltage or current semiconductor regulators G05F 1/569; for amplifiers H03F 1/52; for electronic switching circuits H03K 17/08)

7/20

for controlled semi-conductors which are not included in a specific circuit arrangement

7/22

for distribution gear, e.g. bus-bar systems; for switching devices (detecting mechanical or electrical defects in gas-insulated switchgears H02B 13/06)

7/22

7/222 . . . . . (for switches)

7/224 . . . . . [Anti-pump circuits]

7/226 . . . . . [wires or cables, e.g. heating wires]

7/228 . . . . . [covered wires or cables]

7/24 . . . . . for spark-gap arresters

7/26 . . . . . Sectionalised protection of cable or line systems, e.g. for disconnecting a section on which a short-circuit, earth fault, or arc discharge has occurred (locating faults in cables G01R 31/08)

7/261 . . . . . (involving signal transmission between at least two stations (transmission of signals in general H02H 1/0061))

7/262 . . . . . (involving transmissions of switching or blocking orders)

7/263 . . . . . (involving transmissions of measured values (comparison of currents or voltages using pilot wires H02H 3/30))

7/265 . . . . . (making use of travelling wave theory)

7/266 . . . . . (involving switching on a spare supply (in general H02J 9/00))

7/267 . . . . . (for parallel lines and wires)

7/268 . . . . . (for dc systems)

7/28 . . . . . for meshed systems

7/30 . . . . . Staggered disconnection

9/02

[Involving transmission of switching or blocking orders]

9/001 . . . . . (limiting speed of change of electric quantities, e.g. soft switching on or off (progressive control of electronic switches for eliminating interferences H03K 17/16))

9/002 . . . . . (limiting inrush current on switching on of inductive loads subjected to remanence, e.g. transformers)

9/004 . . . . . (in connection with live-insertion of plug-in units (involving communication with a central processing unit G06F 13/40))

9/005 . . . . . (avoiding undesired transient conditions)

9/007 . . . . . (avoiding or damping oscillations, e.g. fenoresonance or travelling waves)

9/008 . . . . . [Intrinsically safe circuits]

9/02 . . . . . responsive to excess current (current limitation for voltage regulators G05F 1/573; disconnection after limiting H02H 3/025)

9/021 . . . . . (Current limitation using saturable reactors (H02H 9/023 takes precedence))

9/023 . . . . . (Current limitation using superconducting elements)

9/025 . . . . . (Current limitation using field effect transistors)

7/16 . . . . . for capacitors (for synchronous capacitors H02H 7/086)

7/18 . . . . . for batteries; for accumulators

7/0852 . . . . . [directly responsive to abnormal temperature by using a temperature sensor (in a control circuit H02H 7/0833)]

7/0853 . . . . . [specially adapted for motors rotating in both directions (H02H 7/0851 takes precedence)]

7/0854 . . . . . [responsive to rate of change of current, couple or speed, e.g. anti-kickback protection (H02H 7/0851 takes precedence)]

7/0855 . . . . . [avoiding response to transient overloads, e.g. during starting]

7/0856 . . . . . [characterised by the protection measure taken]

7/0857 . . . . . [by lowering the mechanical load of the motor]

7/0858 . . . . . [by reversing, cycling or reducing the power supply to the motor]

7/0859 . . . . . [avoiding restarting after fault condition has disappeared]

7/09 . . . . . against over-voltage; against reduction of voltage; against phase interruption

7/093 . . . . . against increase beyond, or decrease below, a predetermined level of rotational speed (centrifugal switches H01H 35/10)

7/097 . . . . . against wrong direction of rotation

7/10 . . . . . for converters; for rectifiers (forming part of the control circuit of the converter, see the relevant group in H02M)

7/103 . . . . . [for rotating converters]

7/106 . . . . . [for dynamic converters]

7/12 . . . . . [for static converters or rectifiers ((for discharge lamp power supplies using static converters H05B 41/2851, H05B 41/2921, H05B 41/2981)]

7/1203 . . . . . [circuits independent of the type of conversion]

7/1206 . . . . . [specially adapted to conversion cells composed of a plurality of parallel or serial connected elements]

7/1209 . . . . . [for converters using only discharge tubes]

7/1213 . . . . . [for DC-DC converters]

7/1216 . . . . . [for AC-AC converters]

7/122 . . . . . [for inverters, i.e. dc/ac converters]

7/1222 . . . . . [responsive to abnormalities in the input circuit, e.g. transients in the DC input]

7/1225 . . . . . [responsive to internal faults, e.g. shoot-through (avoiding shoot-through H02M 1/38)]

7/1227 . . . . . [responsive to abnormalities in the output circuit, e.g. short circuit]

7/125 . . . . . [for rectifiers]

7/1252 . . . . . [responsive to overvoltage in input or output, e.g. by load dump]

7/1255 . . . . . [responsive to internal faults, e.g. by monitoring ripple in output voltage]

7/1257 . . . . . [responsive to short circuit or wrong polarity in output circuit]

7/127 . . . . . [having auxiliary control electrode to which blocking control voltages or currents are applied in case of emergency]

7/16 . . . . . for capacitors (for synchronous capacitors H02H 7/086)

7/18 . . . . . for batteries; for accumulators

7/205 . . . . . (for controlled semi-conductors which are not included in a specific circuit arrangement)

7/22 . . . . . for distribution gear, e.g. bus-bar systems; for switching devices (detecting mechanical or electrical defects in gas-insulated switchgears H02B 13/06)

7/222 . . . . . (for switches)

7/224 . . . . . [Anti-pump circuits]

7/226 . . . . . [wires or cables, e.g. heating wires]

7/228 . . . . . [covered wires or cables]

7/24 . . . . . for spark-gap arresters

7/26 . . . . . Sectionalised protection of cable or line systems, e.g. for disconnecting a section on which a short-circuit, earth fault, or arc discharge has occurred (locating faults in cables G01R 31/08)

7/261 . . . . . (involving signal transmission between at least two stations (transmission of signals in general H02H 1/0061))

7/262 . . . . . (involving transmissions of switching or blocking orders)

7/263 . . . . . (involving transmissions of measured values (comparison of currents or voltages using pilot wires H02H 3/30))

7/265 . . . . . (making use of travelling wave theory)

7/266 . . . . . (involving switching on a spare supply (in general H02J 9/00))

7/267 . . . . . (for parallel lines and wires)

7/268 . . . . . (for dc systems)

7/28 . . . . . for meshed systems

7/30 . . . . . Staggered disconnection
9/026 . . (Current limitation using PTC resistors, i.e. resistors with a large positive temperature coefficient)

9/028 . . (Current limitation by detuning a series resonant circuit (H02H 9/021, H02H 9/023 take precedence))

9/04 . . responsive to excess voltage (lightning arrestors H01C 7/12, H01C 8/04, H01G 9/18, H01T)

9/041 . . [using a short-circuiting device]

9/042 . . [comprising means to limit the absorbed power or indicate damaged over-voltage protection device]

9/043 . . [Protection of over-voltage protection device by short-circuiting]

9/044 . . [Physical layout, materials not provided for elsewhere (varistors H01C 7/12; Ovshinsky devices H01L 45/00; spark-gaps H01T)]

9/045 . . [adapted to a particular application and not provided for elsewhere]

9/046 . . . [responsive to excess voltage appearing at terminals of integrated circuits (protection by specific structural integration design H01L 27/0248)]

9/047 . . . [Free-wheeling circuits]

9/048 . . . [Anti-latching or quenching devices, i.e. bringing the protection device back to its normal state after a protection action]

9/049 . . . [Circuit arrangements for limiting the number of protection devices]

9/06 . . using spark-gap arresters

9/08 . Limitation or suppression of earth fault currents, e.g. Petersen coil

11/00 Emergency protective circuit arrangements for preventing the switching-on in case an undesired electric working condition might result

11/001 . (in case of incorrect or interrupted earth connection (disconnection by breaking of earth connection H02H 5/105))

11/002 . (in case of inverted polarity or connection; with switching for obtaining correct connection)

11/003 . . [using a field effect transistor as protecting element in one of the supply lines]

11/004 . (in case of incorrect phase sequence; with switching for obtaining correct phase sequence (protection of motors against wrong direction of rotation H02H 7/097))

11/005 . (in case of too low isolation resistance, too high load, short-circuit; earth fault)

11/006 . (in case of too high or too low voltage)

11/007 . . [involving automatic switching for adapting the protected apparatus to the supply voltage]

11/008 . (preventing unsafe switching operations in substations (Schaltfehlerschutz))