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KAZUMICHI MIYAZAWA
OVERCURRENT INTERRUPTING APPARATUS

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Fig. 1.

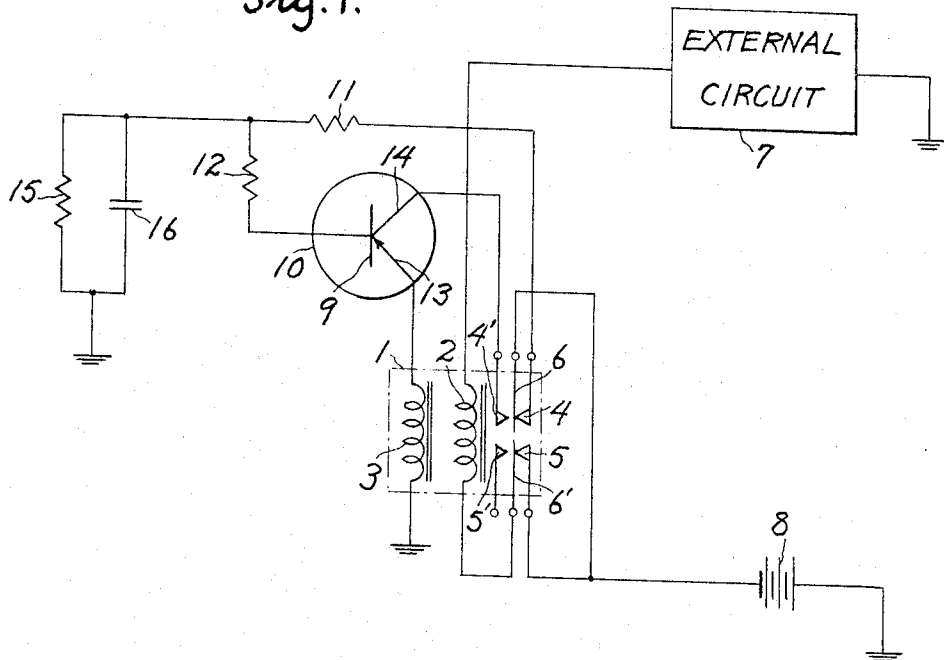
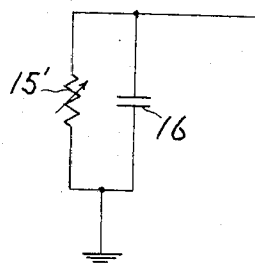


Fig. 2.



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OVERCURRENT INTERRUPTING APPARATUS
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2 Claims. (Cl. 317—155)

The present invention relates to overcurrent interrupting apparatus, which are automatically restored after a definite time.

An overcurrent interrupting apparatus according to the invention comprises a relay which consists of a main coil, a holding coil, two pairs of contacts and a pair of armatures, a direct current source which is connected to said main coil through one of said armatures and one of said contacts, a transistor, to the base of which a bias voltage is given by said source through another armature and one of said contacts as well as two resistors, the emitter of said transistor being earthed through said holding coil and the collector of said transistor being connected to one of opened contacts, and a parallel circuit consisting of a resistor and a condenser for providing a suitable time constant, one end of which is connected to the connection point of said two resistors, the other end of said parallel circuit being earthed.

According to said overcurrent interrupting apparatus, when overcurrent flows through said main coil, to which an external circuit is connected, said overcurrent is interrupted to protect said external circuit from damage, and said apparatus is automatically restored after a definite time defined by the time constant of said parallel circuit.

The more specific objects and advantages will become apparent from a consideration of the following description.

In the accompanying drawing:

FIG. 1 shows a block and connection diagram of an overcurrent interrupting apparatus according to the invention; and

FIG. 2 shows a connection diagram of a part of another embodiment of the invention.

Like characters of reference show corresponding parts throughout the views.

Referring to FIG. 1, 1 denotes a relay which consists of a main coil 2, a holding coil 3, two pairs of contacts 4, 4' and 5, 5', and a pair of armatures 6 and 6' which are arranged between the contacts 4, 4' and 5, 5', respectively and contact with the contacts 4 and 5, respectively.

One end of the main coil 2 is connected to an external circuit 7 which is to be protected from overcurrent, and then earthed, and the other end of said main coil is connected to the negative pole of a direct current source, for example a battery 8 through the armature 6' and the contact 5, the positive pole of said battery being earthed.

The negative pole of the battery 8 is also connected to the base 9 of a transistor 10 through the armature 6, the contact 4 and two resistors 11 and 12. The emitter 13 of said transistor is earthed through the holding coil 3, and the collector 14 of said transistor is connected to the contact 4'.

The connection point of the resistors 11 and 12 is earthed through a resistor 15 and a condenser 16 which are connected in parallel to provide a suitable time constant.

The overcurrent interrupting apparatus according to the invention is thus constructed, and in its present inactive state, in which a normal current flows through the external circuit 7, a bias voltage is given to the base 9 of the transistor 10 through the two resistors 11 and 12 by the battery 8, but no current flows through the collector 14 since its circuit is opened, and the condenser 16 is charged by said battery.

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When, for example, the external circuit 7 is short-circuited, overcurrent flows through the main coil 2 of the relay 1, then said relay actuates and the armatures 6 and 6' are respectively yielded to contact with the contacts 4' and 5', departing from the contacts 4 and 5, and accordingly, the main circuit, into which the external circuit 7 is inserted, is opened, whereby said external circuit is protected from damage.

On the other hand, owing to the contact of the armature 6 with the contact 4', the collector 14 of the transistor 10 is connected to the negative pole of the battery 8, and although the base bias from said battery disappears due to the disconnection of the armature 6 and the contact 4, the base 9 is at the same time given a bias voltage by the charged condenser 16 through the resistor 12, whereby a comparatively large current flows through the holding coil 3, the emitter 13 and the collector 14 from the battery 8, then said holding coil actuates to retain the armatures' yielding positions in spite of demagnetization of the main coil 2.

The charged condenser 16 discharges gradually in conformity with the time constant of the parallel circuit consisting of said condenser and the resistor 15, and accordingly, the base bias increases, whereby the collector current flowing through the holding coil 3 decreases. When said collector current decreases to the extent that said holding coil can not retain the armatures' yielding positions, the armatures 6 and 6' are restored to the original positions, contacting with the contacts 4 and 5, respectively.

Thus, according to said overcurrent interrupting apparatus, when overcurrent flows through the main circuit having the main coil 2 of the relay 1, into which circuit the external circuit 7 is inserted, due to accident, for example short-circuiting, said relay actuates to open said main circuit, and after a definite time defined by the time constant of the parallel circuit consisting of the resistor 15 and the condenser 16, said apparatus is automatically restored. If the accident is still not removed after said definite time, said apparatus will repeatedly operate until said accident is removed.

The resistor 15 in said parallel circuit may be replaced by a variable resistor 15' as shown in FIG. 2, then the time constant of the parallel circuit may be adjusted in order to obtain a desirable self-restoring time.

What I claim is:

1. An overcurrent interrupting apparatus comprising a relay which consists of a main coil, a holding coil, two pairs of contacts and a pair of armatures, a direct current source which is connected to said main coil through one of said armatures and one of said contacts, a transistor, to the base of which a bias voltage is given by said source through another armature and one of said contacts as well as two resistors, the emitter of said transistor being earthed through said holding coil and the collector of said transistor being connected to one of opened contacts, and a parallel circuit consisting of a resistor and a condenser for providing a suitable time constant, one end of which is connected to the connection point of said two resistors, the other end of said parallel circuit being earthed.

2. An overcurrent interrupting apparatus according to claim 1, in which said parallel circuit consists of a variable resistor and a condenser.

References Cited by the Examiner

UNITED STATES PATENTS

3,170,088 2/1965 Coutsourakis ----- 317—33 X

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