(12) UK Patent Application (19) GB (11) 2 386 255 (13) A

(43) Date of A Publication 10.09.2003

(21) Application No 0205001.1

(22) Date of Filing 04.03.2002

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(51) INT CL[7]
H01H 71/24 73/44 83/04

(52) UK CL (Edition V)
H1N NCB N185 N202 N227 N576 N630 N637 N748

(56) Documents Cited
EP 1126492 A2 **US 6211757 A**
US 5258732 A **US 5089796 A**
US 4301435 A

(58) Field of Search
INT CL[7] **H01H**
Other: **Online: WPI, EPODOC**

(54) Abstract Title
Leakage current breaker

(57) A protective leakage current breaking device includes a coil 2 adapted to generate electromagnetic force in the presence of leakage current, and a trip unit 3 adapted to cut off the power supply when actuated by the electromagnetic force generated by the coil. The trip unit includes a linking plate 33 electrically connected to a power supply, a hooking plate 34 normally hooked to a front end of the linking plate, and a spring 36 normally pushing the front end of the linking plate 33 upward. When an electrical appliance externally connected to the device has leakage of current, the coil 2 immediately generates electromagnetic force to attract the hooking plate 34 and disengage same from the linking plate 33, allowing the spring to pivot the linking plate and disengage this from the power supply, so that an open circuit is formed in the device.

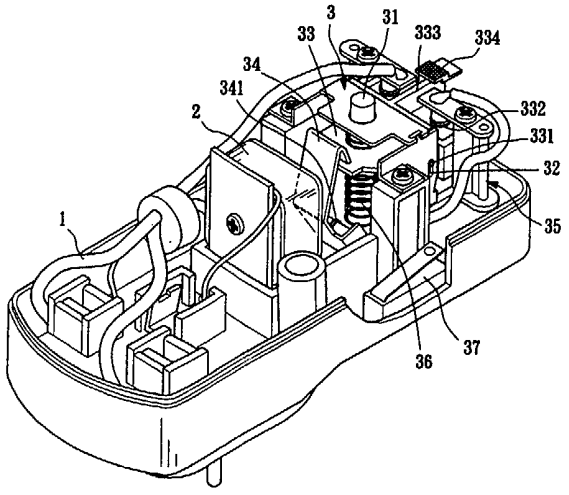

Fig. 1

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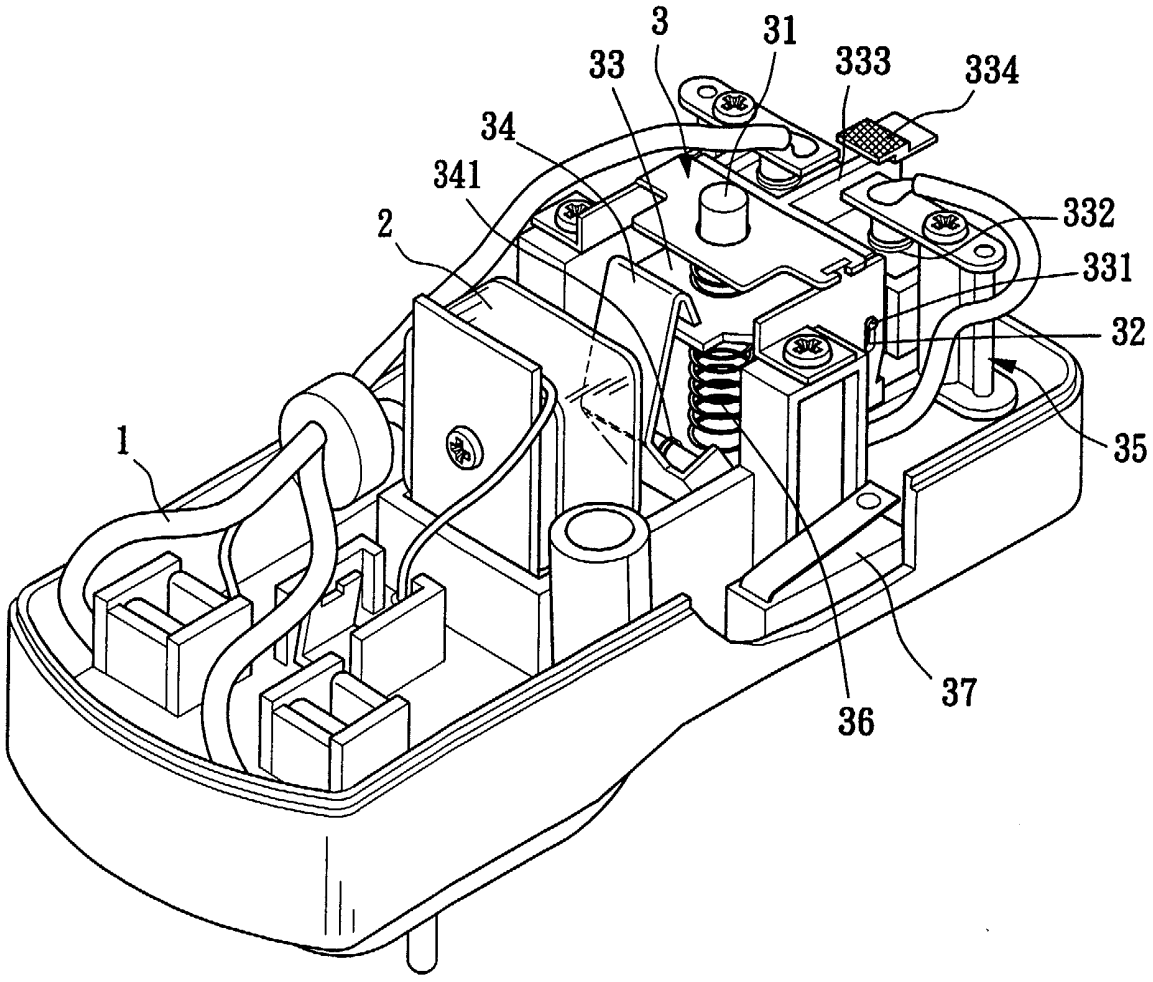

Fig. 1

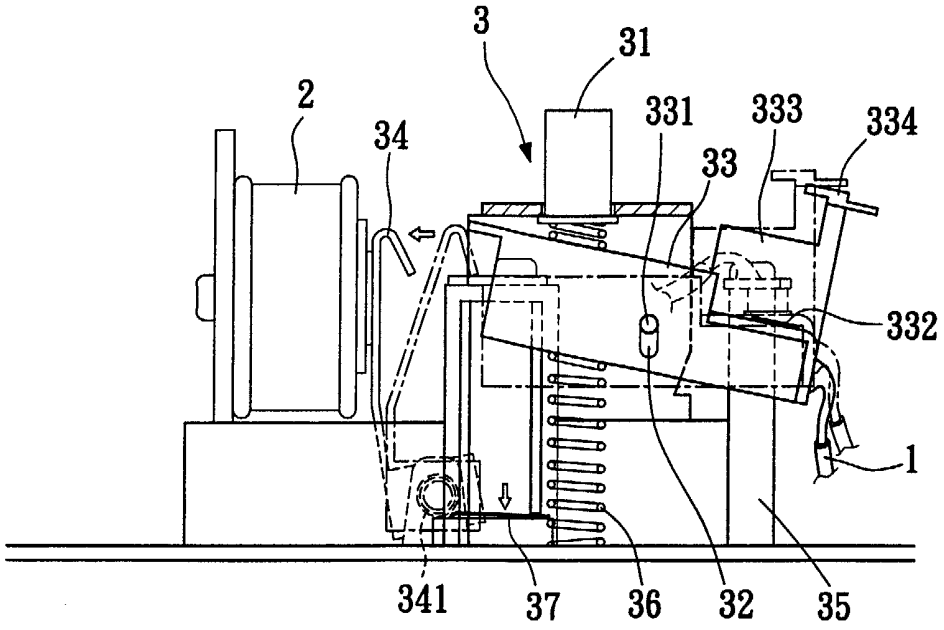
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Fig. 2

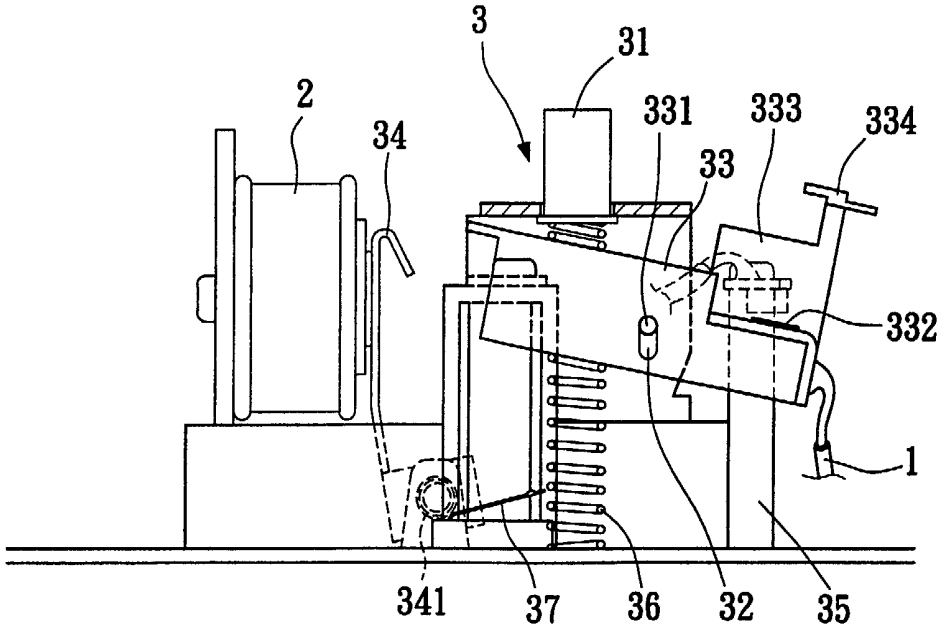
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Fig. 3

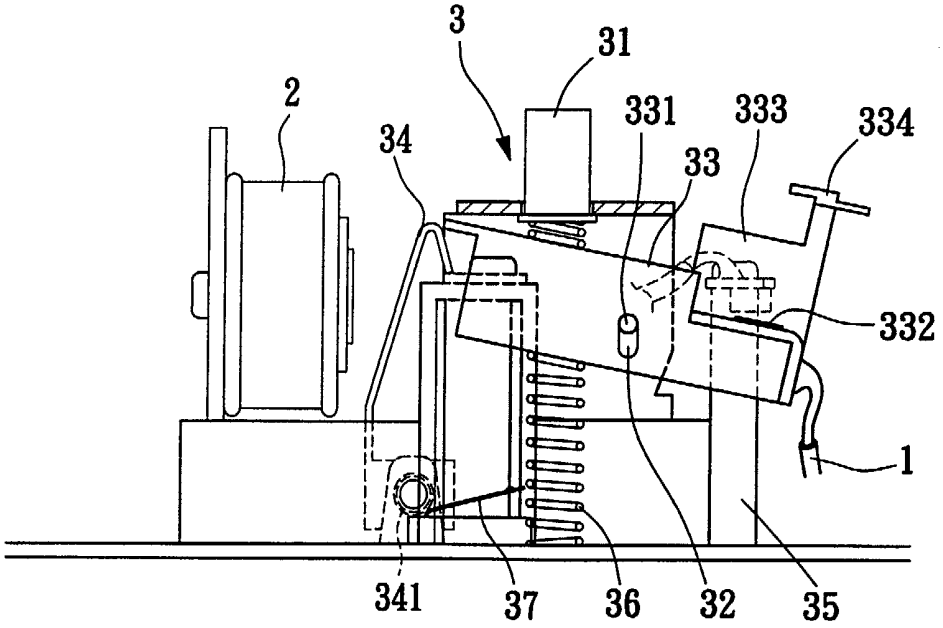
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Fig. 4

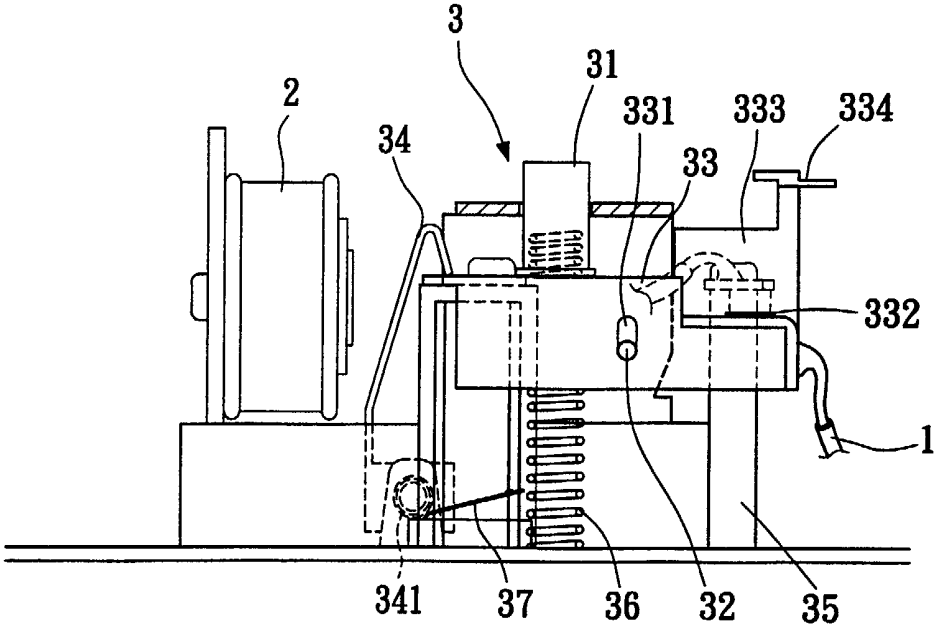
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Fig. 5

PROTECTIVE LEAK CURRENT BRAKING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to a protective leak current braking device, and more particularly to a simplified and reliable leak current braking device that includes an exciting coil adapted to generate electromagnetic force when an externally connected electrical appliance has leakage of current, and a breaking unit that can be actuated by the electromagnetic force generated by the exciting coil to disconnect from power cords to form an open circuit in the device and thereby breaks the leak current.

With the rapid developments in industrial fields, a lot of electrical appliances have become prerequisite to our daily life. It is inevitable some parts of these electrical appliances become failed due to physical catalyzed reactions and result in leakage of current. Leak current tends to cause confusions to users, such as electrically shocks users or flows backward to break a main power supply.

Taiwan Patent Publication No. 72876 and US Patent Publication No. 5089796 disclose a socket-type leak current breaker, which mainly includes a main body and

an upper cover. The upper cover is provided with holes for a plug to plug thereto, a push button to serve as a power switch and leak reset button, and a key to serve as a leakage test switch. The main body is internally provided with a leak current breaking unit and a socket body. Wherein, the leak current breaking unit includes at least the following components:

a circuit board mounted to an underside of the main body and including a leak driving circuit thereon;

a zero phase current transformer adapted to connect to wires and to bear against the leak driving circuit;

two adapter conductors separately provided at two upper corners of the main body to connect to an external power source;

two actuating springs corresponding to the two adapter conductors and connected to a socket plate via wires extended through the zero phase current transformer;

an electromagnet provided between the two actuating springs with an actuating post located at a middle point thereof, the electromagnet is controlled through the circuit board and has two projected plates extended therefrom to pivotally connect to a pivot;

a bearing plate being provided at two ends with a pin hole for a pin to fit therein and a right-angled bearing portion, respectively, and at a middle point with a through hole for the actuating post to extend therethrough; and

an actuating plate being provided at one end with two laterally extended projections, and at a top surface with an opening corresponding to the pin fitted on the bearing plate, such that the actuating plate may be put around the actuating post to fit on the bearing plate with the two projections bearing against the two actuating springs.

When the push button is pushed, the bearing plate and the actuating plate cause the actuating springs to contact with the adapter conductors and thereby electrically connects the socket body to the external power source. When an externally connected electrical appliance has leakage of current, the electromagnet is actuated to cause tripping-off of the actuating springs and the push button and thereby breaks the leak current.

The above-described conventional leak current breaker is able to form an open circuit when an externally

connected electrical appliance leaks. However, it includes too many parts and components to have low manufacturing cost. Moreover, it takes a lot of time to check and repair the above-described leak current breaker whenever there is any failed part. The complicate structure of the conventional leak current breaker also reduces the reliability of the breaker.

It is therefore tried by the inventor to develop an improved protective leak current braking device that has simplified structure and upgraded reliability to eliminate drawbacks existing in the conventional leak current breaker.

SUMMARY OF THE INVENTION

A primary object of the present invention is to provide a protective leak current braking device that includes an internal exciting coil capable of generating electromagnetic force when an externally connected electrical appliance has leakage of current, such that a breaking unit of the leak current braking device is actuated by the electromagnetic force to disconnect from power cords of the device and forms an open circuit to break the leak current.

To achieve the above and other objects, the protective

leak current braking device of the present invention mainly includes input and output power cords, an exciting coil located between the input and the output power cords to generate electromagnetic force in the presence of any leak current, and a breaking unit located behind the exciting coil to cut off power supply when being actuated by the electromagnetic force generated by the exciting coil.

The breaking unit includes an elastically returnable button provided at a top thereof to upward project from a case of the device, two lateral walls on which two long slots being symmetrically formed, a linking plate being provided at two sides with two tenons adapted to engage with the two long slots, a shaft-driven hooking plate located between the exciting coil and a front end of the linking plate to normally engage a hooked head portion thereof with the front end of the linking plate and to move away from the linking plate toward the exciting coil when the exciting coil excites to generate the electromagnetic force, two contact points provided at two upper rear corners of the linking plate for electrically connecting to the input and the output power cords by normally upward contacting with two conductive posts that are separately connected to the power cords having the same polarity, an upward extended dam located between the

two contact points, and an elastic element provided below the linking plate close to the front end thereof for inclining the linking plate backward.

When an electrical appliance externally connected to the protective leak current braking device has abnormal leakage of current, the exciting coil generates an electromagnetic force to attract the hooking plate, causing the hooked head portion of the hooking plate to disengage from the front end of the linking plate and the spring below the linking plate to push the front end of the linking plate upward, so that the linking plate inclines backward to disengage the contact points from the conductive posts and accordingly the power cords to form an open circuit in the protective leak current braking device to break the leak current.

BRIEF DESCRIPTION OF THE DRAWINGS

The structure and the technical means adopted by the present invention to achieve the above and other objects can be best understood by referring to the following detailed description of the preferred embodiments and the accompanying drawings, wherein

Fig. 1 shows an internal structure of a protective leak

current braking device according to the present invention;

Fig. 2 is a partially sectioned side view of the protective leak current braking device of Fig. 1 showing the operation thereof;

Fig. 3 is another partially sectioned side view of the protective leak current braking device of Fig. 1 showing the operation thereof;

Fig. 4 is still another partially sectioned side view of the protective leak current braking device of Fig. 1 showing the operation thereof; and

Fig. 5 is still another partially sectioned side view of the protective leak current braking device of Fig. 1 showing the operation thereof.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Please refer to Fig. 1 in which a protective leak current braking device according to the present invention is shown. The protective leak current braking device is designed for fixedly mounting on a body of a socket, and mainly includes an input and an output power cord 1, an exciting coil 2 located between

the input and the output power cords 1, and a breaking unit 3 located behind the exciting coil 2. The exciting coil 2 generates electromagnetic force in the presence of leak current, and the breaking unit 3 cuts off power supply when it is actuated by the electromagnetic force generated by the exciting coil 2.

The breaking unit 3 includes an elastically returnable button 31 upward projected from a case of the device. Two long slots 32 are symmetrically formed at two lateral walls of the breaking unit 3. A linking plate 33 is supported in the breaking unit 3 by connecting at two lateral tenons 331 to the two long slots 32, such that the linking plate 33 is pivotally turnable forward and backward about the tenons 331 in the long slots 32. A shaft-driven hooking plate 34 is provided between the exciting coil 2 and a front end of the linking plate 33 with a hooked head portion of the shaft-driven hooking plate 34 normally hooked to the front end of the linking plate. When the exciting coil 2 generates electromagnetic force, the hooked head portion of the hooking plate 34 is electromagnetically attracted to move toward the exciting coil 2 and away from the linking plate 33. A return spring 341 is mounted around a lower driving shaft of the hooking plate 34. When the hooking plate 34 is released from

the electromagnetic force generated by the exciting coil 2, the return spring 341 automatically returns the hooking plate 34 to an original position close to the breaking unit 3. The linking plate 33 is provided near two upper rear corners with two contact points 332 for electrically connecting to the power cords 1. When the hooking plate 34 hooks up the front end of the linking plate 33, the linking plate 33 is pivotally turned to lower the front end thereof, and the two contact points 332 at the upper rear corners of the linking plate 33 are lifted to contact with two conducting posts 35 that are connected to the power cords 1 having the same polarity. A dam 333 is upward extended from a rear end of the linking plate 33 to locate between the two contact points 332. A stepped plate 334 is provided at a rearmost end of the dam 333 to indicate the present state of the device of the present invention. And, a spring 36 is provided below the button 31 close to the front end of the linking plate 33, such that the linking plate 33 is normally inclined backward by an upward spring force of the spring 36.

A test leaf spring 37 is provided to one lateral side of the breaking unit 3 for simulating a leak current and testing the exciting coil 2 to ensure that the exciting coil 2 is able to excite normally and thereby

effectively actuates the breaking unit 3, as shown in Figs. 2 and 3. When the test leaf spring 37 is depressed, the exciting coil 2 immediately excites to attract the hooking plate 34, which is then pivotally turned about its driving shaft to move its hooked head portion away from the linking plate 33. At this point, the front end of the linking plate 33 is released from the hooking plate 34 and is pushed upward by the spring 36, causing the rear end of the linking plate 33 to lower. In other words, the linking plate 33 is pivotally turned about the tenons 331 in the long slots 32 to a rearward inclined position, and thereby causes the contact points 332 at two upper rear corners of the linking plate 33 to separate from the two conducting posts 35 and the power cords, accordingly, to form an open circuit in the device to break the leak current.

The exciting coil 2 stops exciting as soon as the circuit is open, and the hooking plate 34 previously electromagnetically attracted to the exciting coil 2 is returned to its original position by the return spring 341 mounted around the driving shaft of the hooking plate 34, as shown in Fig. 4. However, the hooked head portion of the returned hooking plate 34 is now located below the linking plate 33 instead of hooking to the front end of the linking plate 33 to

hold the same in a horizontal position. By depressing the elastically returnable button 31, the front end of the linking plate 33 is lowered to a height low enough for the hooked head portion of the hooking plate 34 to engage therewith, and the breaking unit 3 of the leak current braking device is now returned to the state of electrically connecting at the contact points 332 to the conductive posts 35, as shown in Fig. 5.

The present invention may also be directly provided in an electrical appliance without using other power transfer means. In this manner, material cost for making the case of the leak current braking device may be saved, and any problem possibly encountered by a user due to omission of the leak current braking device may be avoided.

The present invention has been described with a preferred embodiment thereof and it is understood that many changes and modifications in the described embodiment can be carried out without departing from the scope and the spirit of the invention as defined by the appended claims.

What is claimed is:

1. A protective leak current braking device comprising input and output power cords, an exciting coil located between said input and said output power cords to generate electromagnetic force in the presence of any leak current, and a breaking unit located behind said exciting coil to cut off power supply when being actuated by said electromagnetic force generated by said exciting coil;

said breaking unit including an elastically returnable button provided at a top thereof to upward project from a case of said device, two lateral walls on which two long slots being symmetrically formed, a linking plate being provided at two sides with two tenons adapted to engage with said two long slots, a shaft-driven hooking plate located between said exciting coil and a front end of said linking plate to normally engage a hooked head portion thereof with the front end of said linking plate and to move away from said linking plate toward said exciting coil when said exciting coil excites to generate said electromagnetic force, two contact points provided at two upper rear corners of said linking plate for electrically connecting to said input and said output power cords

by normally upward contacting with two conductive posts that are separately connected to said power cords having the same polarity, an upward extended dam located between said two contact points, and an elastic element provided below said linking plate close to the front end thereof for inclining said linking plate backward;

whereby when an electrical appliance externally connected to said protective leak current braking device has abnormal leakage of current, said exciting coil generates an electromagnetic force to attract said hooking plate, causing said hooked head portion of said hooking plate to disengage from the front end of said linking plate and said spring below said linking plate to push said front end of said linking plate upward, so that said linking plate inclines backward to disengage said contact points from said conductive posts to form an open circuit in said protective leak current braking device to break said leak current.

2. The protective leak current braking device as claimed in claim 1, wherein said breaking unit is provided at one lateral side with a test leaf spring for simulating a leakage of current, in order to ensure that said exciting coil could be normally

excited to effectively actuate said breaking unit.

3. The protective leak current braking device, constructed and arranged substantially as herein shown in the accompanying drawings.

Application No: GB 0205001.1
Claims searched: 1-3

Examiner: Vaughan Phillips
Date of search: 27 March 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T):

Int Cl (Ed.7): H01H

Other: Online: WPI, EPODOC

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	EP 1126492 A2	(EATON) see col.6 line 35 - 46	1 at least
X	US 6211757 B1	(GEC) see col.4 line 53 - col.5 line 5	"
X	US 5258732	(FURNAS) see col.8 line 61 - col.9 line 8	"
X	US 5089796	(SQUARE D) see col.4 lines 34-57	"
X	US 4301435	(GEC) see whole document	"

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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