

AUSTRALIA

Patents Act 1990

NOTICE OF ENTITLEMENT

INSTRUCTIONS

(a) Name of person making statement.

(b) Position of that person.

(c) Name of applicant

(d) Address of applicant

(e) Delete as necessary

(f) Insert details if not covered by (i) or (ii)

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(h) Delete for non-convention applications

Insert DATE of signing

(j) Signature(s) of person making statement

Note: No legalization or other witness required

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(b) Patent Engineer

of (c) LK A/S

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State the following:-

1. The nominated person (applicant) is entitled to the grant of a patent

(e) (i) as assignee of the actual inventor(s)

(ii) ~~by contract of employment of the actual inventor(s)~~

or (iii) (f)

2. The nominated person (applicant) is entitled to claim priority from the basic convention application(s).

(g) (i) as applicants of the said application(s)

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~~(iii) with the consent of the applicants of the said application(s)~~

3. The basic convention application(s) was/were the first made in a Convention country in respect of the invention the subject of the application. (h)

Dated (i) 1. sep. 1995

(j) Ib Stanley-Madsen

LK A/S

To: The Commissioner of Patents



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- (54) Title
BASIC SWITCH MODULE FOR A MULTIPOLE ELECTRICAL MOTOR CIRCUIT BREAKER, AND A MOTOR CIRCUIT BREAKER COMPRISING SAID BASIC SWITCH MODULES
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- (56) Prior Art Documents
US 4713498
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- (57) Claim

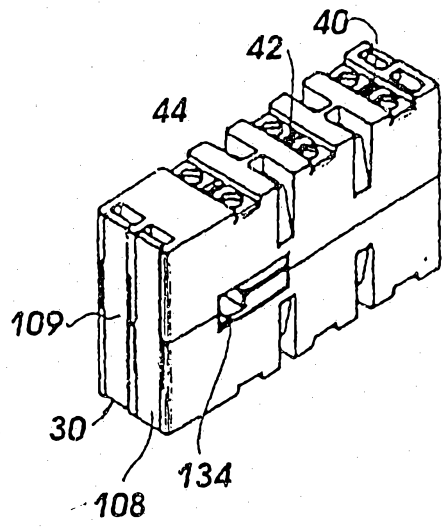
1. A basic switch module for a multipole electrical motor circuit breaker of the type comprising movable contacts, the displacement of which is controlled by a bar member, said movable contacts being adapted to be displaced towards fixed contacts between which said movable contacts are arranged to form a bridge and connect a current and to be displaced away from the fixed contacts to break the current, a displacement of the bar member being controlled by an operating mechanism, characterised in that the basic switch module is multipole, and comprises an essentially closed housing containing the bar member with several movable contacts being fixed to the bar member, said bar member being provided with means for receiving a control device connected to the operating mechanism, the basic switch module further comprising an opening through which the control device may be inserted into the basic module, as well as a plurality of openings designed for external insertion of the fixed contacts, between which the movable contacts may form a bridge.



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(54) Title: BASIC SWITCH MODULE FOR A MULTIPOLE ELECTRICAL MOTOR CIRCUIT BREAKER, AND A MOTOR CIRCUIT BREAKER COMPRISING SAID BASIC SWITCH MODULES



(57) Abstract

The basic switch module according to the invention makes it possible to construct a multipole electrical motor circuit breaker comprising a circuit breaker base (12), arranged to accommodate several basic switch modules (30), an operating mechanism (25), a top section (46), and a handle on a square shaft. The same basic switch modules may be used for several different types of circuit breaker, whereby the estimated number of switch modules to be produced by the manufacture is so large that the modules may be made highly automated production.

Title: Basic switch module for a multipole electrical motor circuit breaker, and a motor circuit breaker comprising said basic switch modules.

Technical Field

The invention relates to a basic switch module for a multipole electrical heavy-current motor power switch of the type described in the preamble to claim 1, and a power switch composed of said basic switch modules.

Background Art

A plurality of modular-based power switches, also called circuit breakers, are already known, for instance from Danish published specifications No. 147.588, 10 No. 150.427 and No. 165.470, and from EP 327 708, DE-OS 37 29 616, EP 232 250, GB 2 185 632, GB 2 227 612, EP 112 232, EP 325 371, EP 228 723, and Swedish published specification No. 347 605. However, none of the circuit breakers presently known use three-pole modules of the type described below.

Disclosure of the Invention

15 The object of the invention is to provide a circuit breaker which can be used as a switchboard circuit breaker, for instance in switchgears, and which may be mounted either on a DIN rail or directly on an apparatus. The circuit breaker preferably has a high short-circuit capacity and is able to function as a safety circuit breaker with insulation capacity. Furthermore, the circuit breakers should
20 be suitable for delivery in boxes, i.e. a compact box-like configuration is preferred. The dimensions of the circuit breaker is preferably small. For an economical production of the breakers, it is preferably to use a highly automated production, and it is preferable to construct circuit breakers for several different current strengths from common components (such as basic modules), i.e. from about 10
25 til 100 Amp.

According to the invention, a basic switch module as stated in the preamble to claim 1 is characterised in that the basic switch module is multipole, and comprises an essentially closed housing containing the bar member and several movable contacts being fixed to the bar member, said bar member being provided with
5 means for receiving a control device (bar) connected to the operating mechanism, the basic module further comprising an opening through which the control device (bar) may be inserted into the basic module, as well as a plurality of openings designed for external insertion of the fixed contacts, between which the movable contacts may form a bridge.

10 A circuit breaker according to the invention breaks three-phased currents, and comprises modules, each module being able to handle and break a three-phased current. By inserting additional modules adjacently, as explained in details in the following with reference to the drawings, almost any current may be handled by the assembly of modules. Switch gears installations having this type of modular
15 circuit breakers may easily be extended to handle heavier currents than originally planned. The most important advantage is that the same type of multipole, multi-phase module may be used in circuit breakers of different current capacity and for different purposes.

Moreover, according to the invention, the basic switch module may comprise
20 three movable contacts and is provided with two sets of three openings for the insertion of two sets of three fixed contacts, between which the three movable contacts may form a bridge in pairs, thus enabling the basic module to be used as a three-pole circuit breaker, whereby the basic switch module is adapted to accommodate three conductors, each representing one phase in a three-phase
25 power supply installation.

All previous (three-phased) modular switches have consisted of modules, each module only handling one phase (of the three phases commonly used in electrical installations).

Furthermore, according to the invention, the basic switch module may have an essentially right-angled parallelepiped shape, whereby the modules are easy to arrange adjacently in a socket or base and further easy to pack and may be shipped in a very compact manner.

- 5 According to the invention, the basic switch modules may preferably be provided with movable contacts arranged to establish contact with knife contacts and fixed contacts designed as knife contacts. This arrangement is preferred, as the knife contacts are easy to insert and fix from the outside, when the module is assembled with the other members of the modular circuit breaker.
- 10 Furthermore, the invention relates to a multipole electrical circuit breaker, characterised in that it comprises a number of basic switch modules according to one or more of the claims 1 to 4. As a result, a flexible modular switch is obtained, as the current ratings may be increased by adding a basic switch module to the already inserted modules. Furthermore, the manufacturing thereof is much
- 15 cheaper than otherwise due to the identical basic switch modules of all the switches regardless of which current they are rated for.

According to the invention, the multipole electrical circuit breaker preferably comprises a switch base arranged to accommodate several basic switch modules, the operating mechanism, a top section and a handle, whereby the switch base

20 forms an advantageous socket member, wherein each basic switch module can be received and positioned accurately in order to cooperate with the operating mechanism. When the top section portion is mounted on top of the inserted fixed contact rails, and the fixing means has been fastened, the complete circuit breaker is thoroughly and reliably assembled. This assembling is so simple and secure that

25 it can be performed on the site by the local operators. When using the known switches, a switch having the requested rating need be provided pre-assembled by the manufacturer.

Moreover, according to the invention, the operating mechanism comprises a control device arranged to engage a bar member in each basic switch module. It is thus ensured that a single operating mechanism can control the position of each basic switch module.

- 5 Furthermore, according to the invention said control device is mounted in a slide which may be moved forwards and backwards on a set of rails, whereby a reliable guiding of the control bar is provided.

Finally, according to the invention the displacement of the slide along the rails may be controlled by a carrier on partially cylindrical, rotating devices which may
10 engage a handle shaft directly or indirectly. As a result, the rotational movement of the handle is reliably transferred to a displacement of the slide.

Brief Description of the Drawings

The invention is described in detail below, with reference to the attached drawings, in which

- 15 Fig. 1 is an exploded view of a preferred embodiment of a three-pole circuit breaker according to the invention with two basic switch modules,

Fig. 2 shows the same with four basic switch modules,

Fig. 3 is a diagrammatic view of various types of circuit breakers,

Fig. 4A shows a basic switch module,

- 20 Fig. 4B is an exploded view of the same basic switch module,

Fig. 5 shows a set of movable contacts, and

Fig. 6 is an exploded view of a bar member.

Description of the Preferred Embodiments of the Invention

Fig. 1 shows an exploded view of a three-pole circuit breaker with two basic switch modules 30. Each basic switch module is capable of breaking and closing three currents, each rating several amperes, for instance 20 Amp, in a three-phase installation. At the bottom of Fig. 1, a bottom section or base 12 is shown with a lower surface 13 designed for snapping onto a DIN rail. On both sides of the base three fixed contacts 14 are provided, each connected to its own terminal 16 for attaching external phase conductors, which are to be connected to the three-pole circuit breaker.

An operating mechanism 25 is inserted in the centre of the base 12 and a basic switch module 30 is attached on each side of the operating mechanism 25. A bar 32 is designed to be inserted through the openings 33 in both basic switch modules and through the housing 26 enclosing the operating mechanism 25.

The operating mechanism 25 comprises a slide 18, a set of rails 20 to support and guide the slide and two partially cylindrical parts and a flat spring 27. A part 24 is provided with a square hole arranged at one end to receive a square handle shaft (not shown), and a hole at the other end to receive and engage a part 22, thus ensuring that a rotation of the handle results in a rotation of the part 24, and e.g. by means of the carrier 23 on the part 22 as well as displacement of the slide 18.

In the embodiment shown, the bar 32 is mounted in notches 132 in the slide 18. This ensures that displacement of the slide 18 along the rails 20 will result in displacement of the bar 32 and the bar members 103 in Fig. 4B in the mounted modules 30, and thus in displacement of the movable contacts 123, 124, 125 inside the basic switch module 30. These contacts are shown in Figs. 4A, 4B and 5,

which show the preferred design of a basic switch module 30.

Fig. 1 shows three fixed contact rails 34-38 above the basic switch modules 30, The rails are designed to connect the two basic switch modules. The contact rail in the middle 36 is shown with a circular arch-shaped middle section, designed
5 to accommodate the cylinder-shaped parts 22, 24 of the operating mechanism for engagement with a handle.

The three rails are pressed down into the slits provided 40-44 in the basic switch modules. Finally, the whole assembly is covered by a top section 46 secured by means of screws 48 shown at the bottom of the drawing. The circuit breaker may
10 then be snapped onto a DIN rail.

Fig. 2 shows a similar circuit breaker capable of closing and breaking heavy currents, e.g. 40 Amp., and provided with four basic switch modules. All of the parts used are identical, with the exception of the base 212, which can accommo-
15 234-238 forming the fixed contacts.

Fig. 3 shows various types of circuit breakers which may be constructed from the same basic switch modules 30.

A "QA 16" (i.e. a circuit breaker for 16 Amp, with or without a neutral pole) may be constructed from a handle 320, a front module or top section 346 (includ-
20 ing terminals), a basic switch module 330, and a base section 312 (including a second set of fixed contacts and terminals) provided with an operating mechanism 325.

A "QA 25/32" (i.e. a circuit breaker for 32 Amp) may be constructed from a handle 320, a front module or top section 346 with inserted current rails 334
25 which are shown by means of dotted lines on the lower face of a plate 345, two

basic switch modules 330, and a base section 312 (including fixed contacts and terminal) provided with an operating mechanism.

A "QA 63" (i.e. a circuit breaker for 63 Amp) may be constructed from a handle 320, a front module or top section 346 with inserted current rails 334, four basic switch modules 330, and a base section 312 (including fixed contacts and terminals) provided with an operating mechanism.

A "QSA 25/32" (i.e. a circuit breaker for 32 Amp with fuses mounted on top of an alternative top section or front module 355 or 356) may be constructed from a handle 320, the alternative fuse-bearing front module 355, 356, four basic switch modules 330, and a base section 312 (including fixed contacts and terminals) provided with an operating mechanism.

A QP 80/100 with parallelly connected switch modules may be constructed when it is needed to connect and break a current of up to 80/100 Amp. In this version the front module (like base 312) is provided with terminals to the wires which need to be connected to the circuit breaker.

Fig. 3 also shows that the lower surface of the base section 12, 212 preferably is provided with two orthogonal tracks or recesses adapted to fit on a DIN rail, whereby the base section 12, 212 can be mounted on a DIN rail in two directions as indicated by A and B in Fig. 3. Further, the circuit breaker may be extended by means of a fourth or even fifth pole with or without the break function.

The description above shows that a basic switch module according to the invention makes it possible to use a few basic components to construct several different types of circuit breaker to suit various current strengths and various functions.

Fig. 4A and Fig. 4B show the preferred embodiment of the basic switch module

30 comprising a top section 101, a bottom section 102, and a bar member 103. The top section 101 and bottom section 102 are preferably identical. The notches 134 form openings 33, allowing the bar 32 to pass through the basic switch module, and in particular through the opening 84 in the bar member 103, which
5 may be longitudinally displaced inside the basic switch module by the bar 32. When the basic switch module has been assembled, the three sections form an essentially closed, right-angled parallelepiped. Preferably, the top section and bottom section are provided with snap-on devices 108,109 to keep the two sections close together.

- 10 Fig. 5 shows an embodiment of a set of movable contacts 123-125 to be mounted on a bar member 103, as shown in Fig. 4. The contacts 401 and 402 are arranged in a manner known per se to form a bridge between two knives, i.e. fixed contacts (e.g. 14,34). The contacts 401 and 402 are pressed against each other by means of springs 406,407, which are kept in position by a spring retainer 405.
15 Numerals 411 and 412 refer to convex contact surfaces, which have to be brought into engagement with the fixed knife contacts 14,34.

Fig. 6 shows how the bar member 103 is constructed by means of two essentially identical halves 121,122 designed to accommodate three sets of movable contacts 123,124,125. Four pins 90 (two in each half) are designed to be retained in four
20 corresponding holes 91. Numerals 127 and 128 are partition walls separating the three sets of contacts, thereby creating an essentially closed break chamber around each set of contacts 123-125, when the parts are mounted in the top section 101 and bottom section 102 of the basic switch module. However, the partition walls 117, 118 in the two halves of the basic switch module 101,102 also provide the
25 separation of the breaking chambers.

The circuit breaker function in the following manner. If the circuit breaker handle (320 in Fig. 3) is set into engaged position, said rotation results in a corresponding rotation of the cylindrical parts 24,22. The carrier 23 displaces the slide 18

and the bar 32. The openings 33 are sufficiently long to enable the bar to be displaced without engaging the surfaces 101,102 of the basic switch module. However, the openings 84 in the bar members 103 of the basic switch modules are so narrow that the displacement of the bar 32 is transmitted to the bar members 103, and thereby to the movable contacts 123-125. In the circuit breakers shown in Figs. 1 and 2, turning the handle shaft clockwise means that all of the movable contacts 123-125 are displaced in such manner that the contacts 401,402 are on opposite sides of a set of knife contacts 14,34, thus forming a bridge between the two knife contacts.

10 Similarly, turning the handle shaft anti-clockwise means that all of the movable contacts are displaced away from knife contacts 14,34, thereby cutting off the current.

By use of a correct combination of basic switch modules 30 and selected embodiment of the switch base 12,112,212,312, the front module 46,246,345,355,356, 15 and suitable current rails 34,36,38,234,236,238 or optionally terminals for alternative components, e.g. the fuse sections 355,356, it is possible to obtain a wide range of switches for several current strengths and several applications with or without fuses.

The basic switch module may also be provided with a zero voltage trip mechanism, 20 making automatic re-connection possible. Similarly, it will be possible to make multipole versions with a longitudinal connection.

The claims defining the invention are as follows:

1. A basic switch module for a multipole electrical motor circuit breaker of the type comprising movable contacts, the displacement of which is controlled by a bar member, said movable contacts being adapted to be displaced towards fixed contacts
5 between which said movable contacts are arranged to form a bridge and connect a current and to be displaced away from the fixed contacts to break the current, a displacement of the bar member being controlled by an operating mechanism, characterised in that the basic switch module is multipole, and comprises an essentially closed housing containing the bar member with several movable contacts
10 being fixed to the bar member, said bar member being provided with means for receiving a control device connected to the operating mechanism, the basic switch module further comprising an opening through which the control device may be inserted into the basic module, as well as a plurality of openings designed for external insertion of the fixed contacts, between which the movable contacts may
15 form a bridge.
2. A basic switch module according to claim 1, characterised in that it comprises three movable contacts and provided with two sets of three openings for the insertion of two sets of three fixed contacts, between which the three movable contacts may form a bridge in pairs, thus enabling the basic module to be used as a three-pole
20 circuit breaker.
3. A basic switch module according to claim 1 or 2, characterised in that it has an essentially right-angled parallelepiped shape.
4. A basic switch module according to claim 1, 2 or 3, characterised in that said movable contacts are arranged to establish contact with knife contacts, and the fixed
25 contacts are designed as knife contacts.
5. A multipole electrical motor circuit breaker of the type comprising movable contacts, the displacement of which is controlled by a bar member, and whose movable contacts controlled by the bar member being able to be displaced towards fixed contacts and form a bridge between the fixed contacts to connect a current; and
30 to be displaced away from the fixed contacts to break a current, the displacement of



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29 July 1997

the bar member being controlled by an operating mechanism, characterised in that the circuit breaker comprises a number of basic switch modules according to any one of claims 1 to 4.

6. A multipole motor circuit breaker according to claim 5, characterised in that
5 the circuit breaker comprises a switch arranged to accommodate several basic switch modules, the operating mechanism, a top section, and a handle.

7. A multipole motor circuit breaker according to claim 5, characterised in that the operating mechanism comprises a control device arranged to engage a bar member in each basic switch module.

10 8. A multipole motor circuit breaker according to claim 5, characterised in that that the control device is mounted in a slide which may be moved forwards and backwards on a set of rails.

9. A multipole motor circuit breaker according to claim 8, characterised in that that the displacement of the slide on the rails is controlled by a carrier on partially
15 cylindrical, rotating devices which may engage a handle shaft directly or indirectly.

10. A switch module for a multiple electrical motor circuit breaker substantially as hereinbefore described with reference to the accompanying drawings.

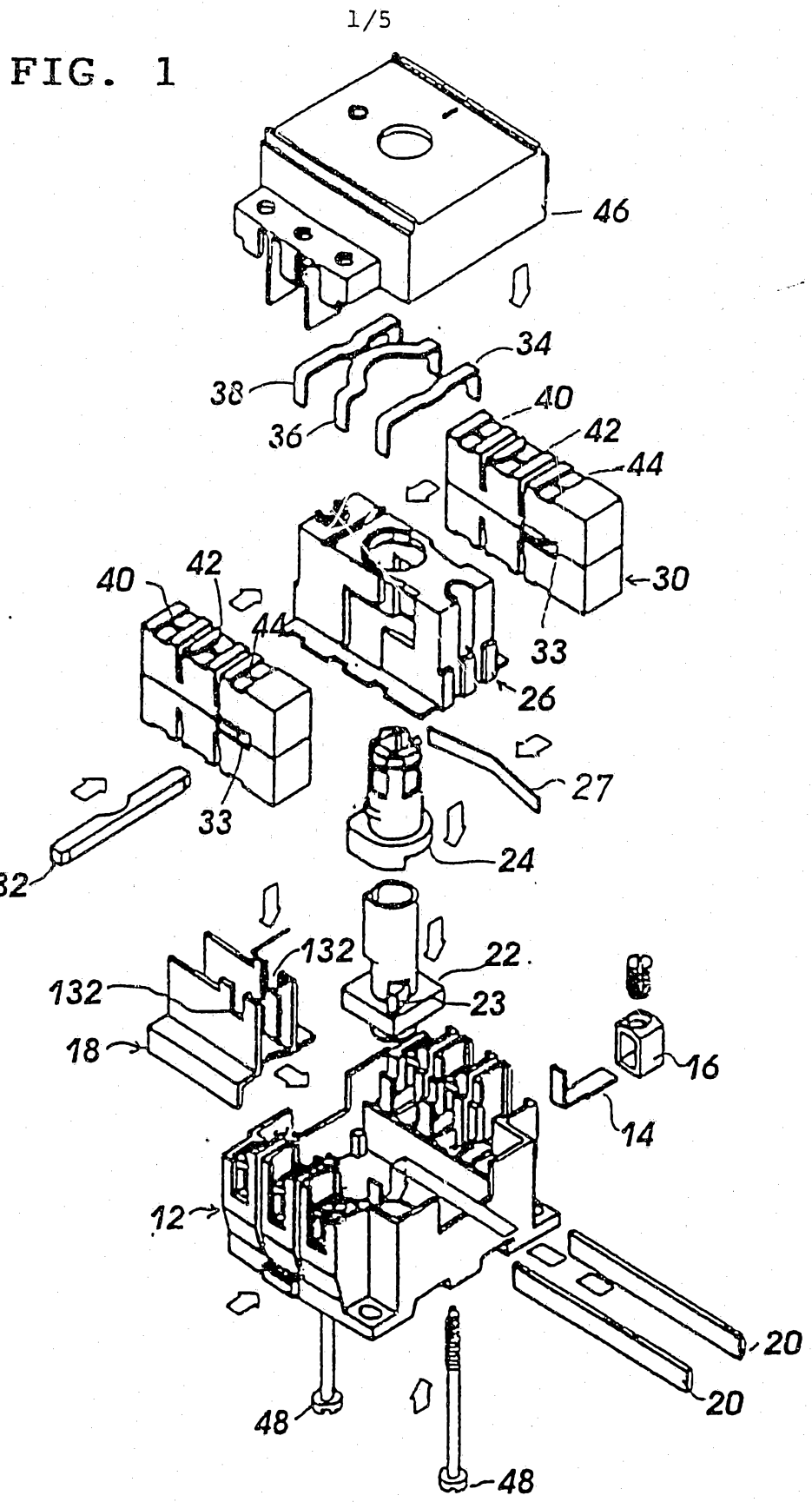
DATED: 29 July 1997

CARTER SMITH & BEADLE

Patent Attorneys for the Applicant:

LK AS





2/5

FIG. 2

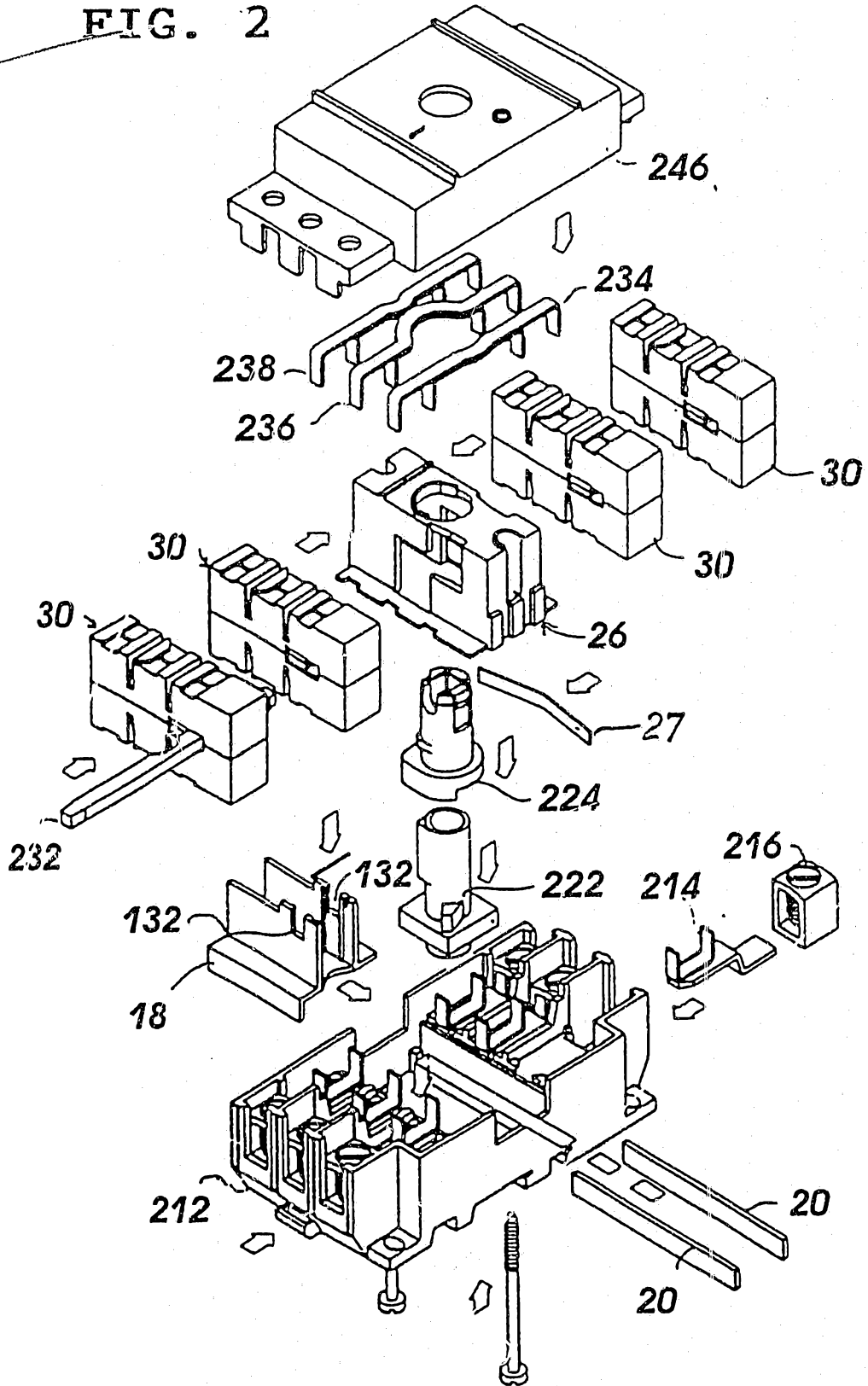
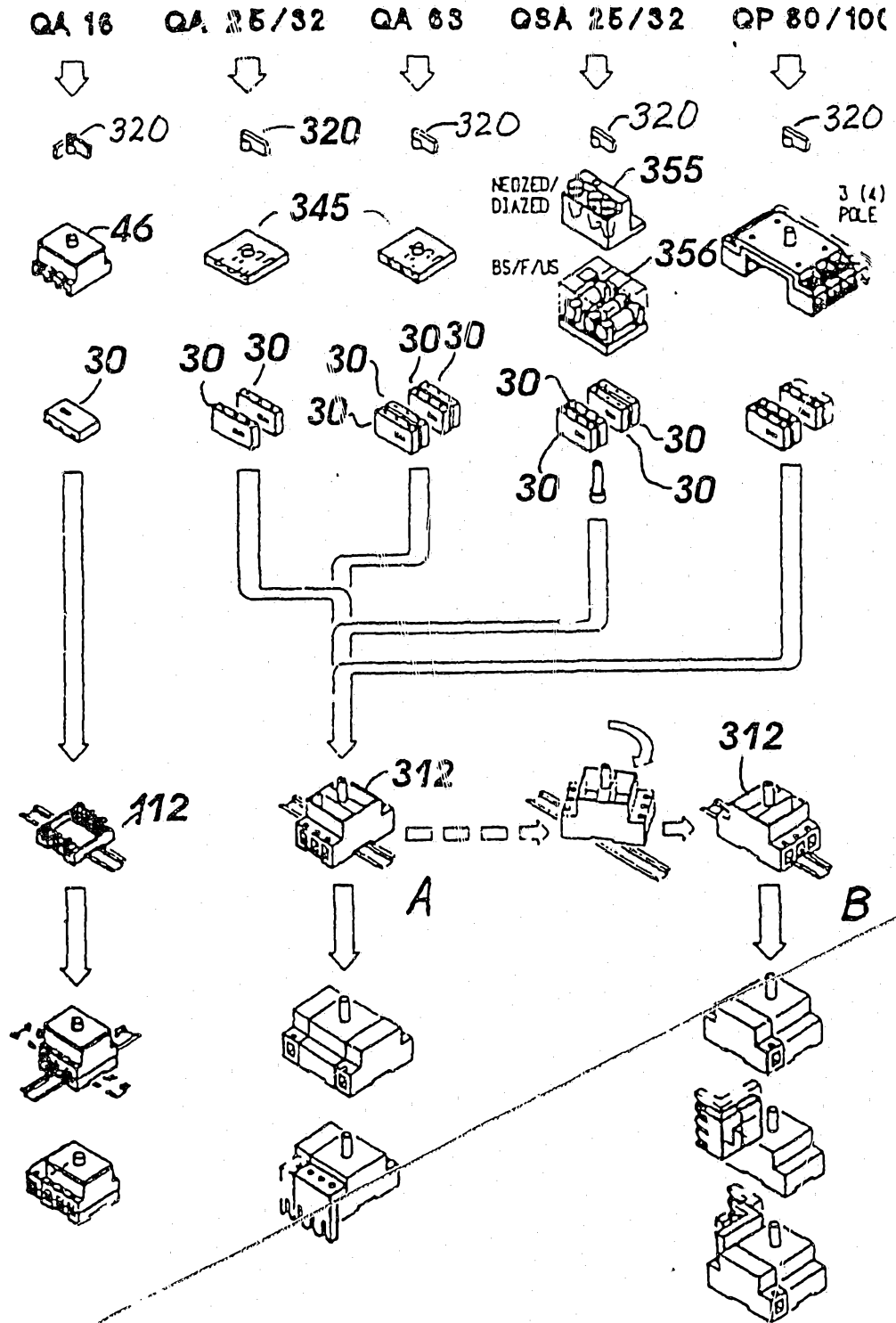


FIG. 3



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FIG. 4A

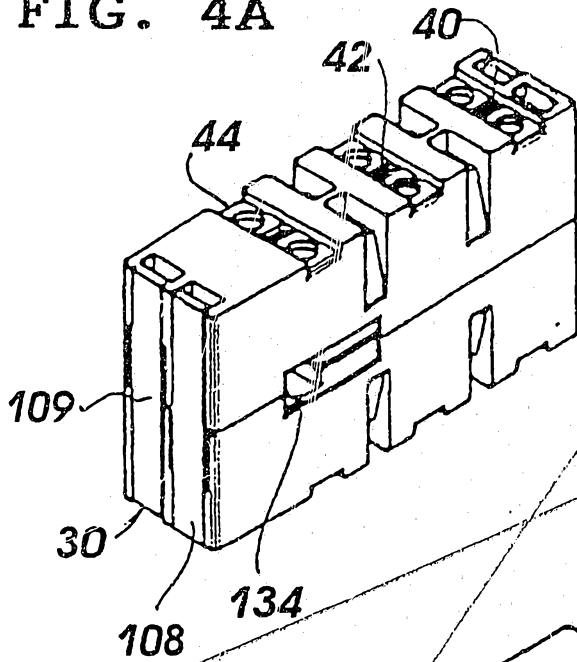
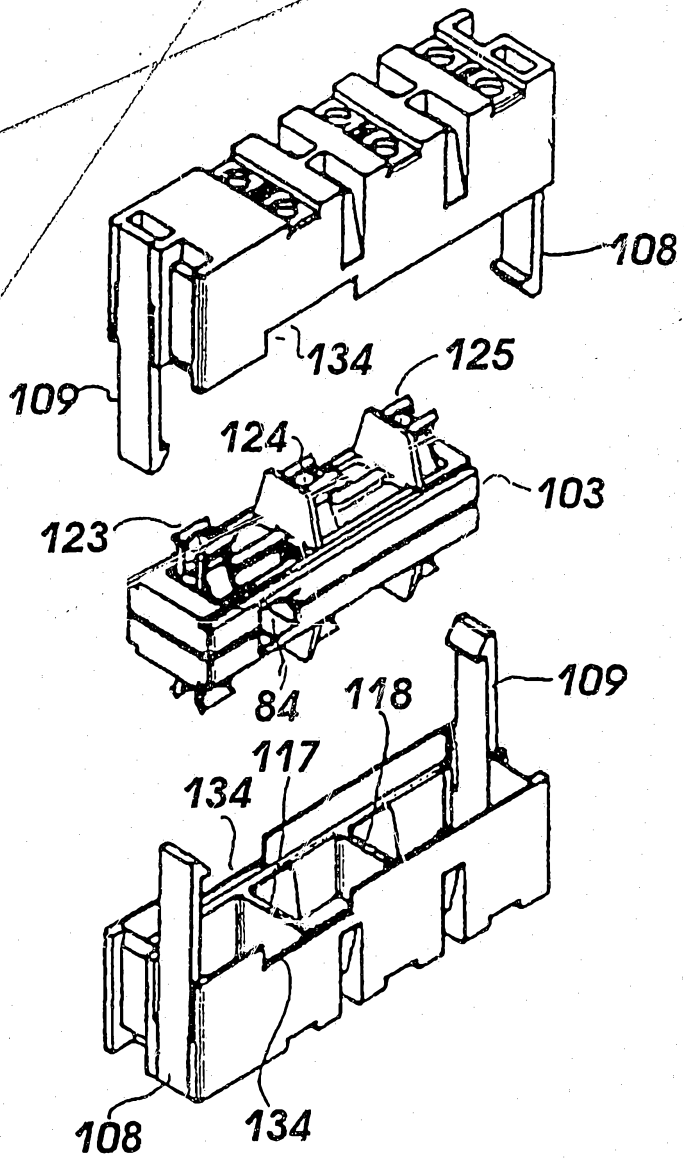


FIG. 4B



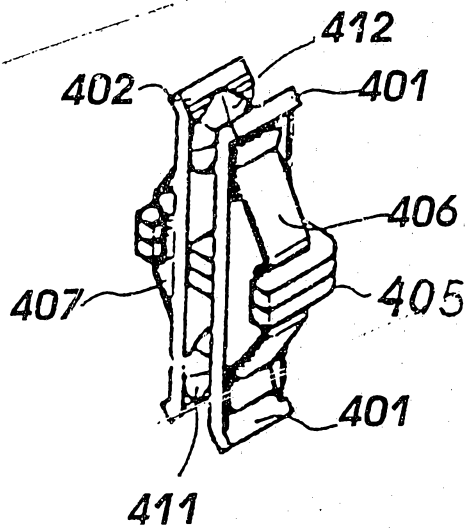
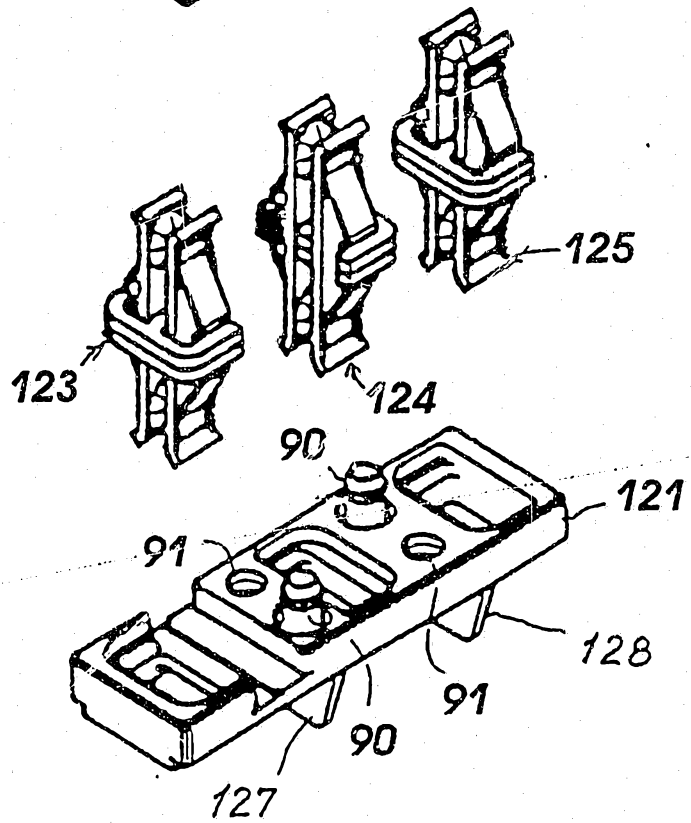
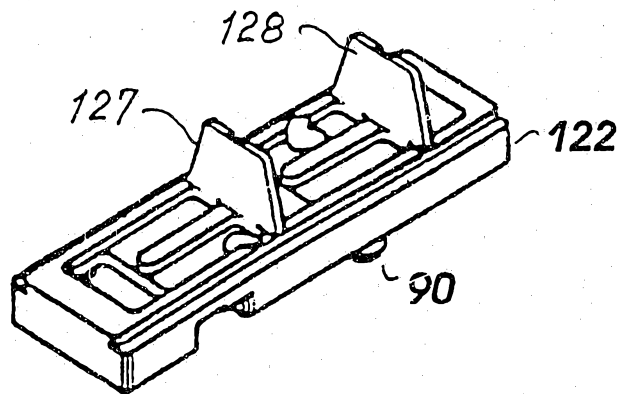


FIG. 5

FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 94/00128

A. CLASSIFICATION OF SUBJECT MATTER

IPC : H01H 1/12, H01H 9/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC : H01H, H02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP, A1, 0219570 (SQUARE D STARKSTROM GMBH), 29 April 1987 (29.04.87), abstract --	1, 3, 5, 6
A	WO, A1, 9000805 (SQUARE D COMPANY), 25 January 1990 (25.01.90), abstract -- -----	1, 3, 5-7

 Further documents are listed in the continuation of Box C.

 See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search

27 June 1994

Date of mailing of the international search report

13 -07- 1994

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INTERNATIONAL SEARCH REPORT
Information on patent family members

28/05/94

International application No.
PCT/DK 94/00128

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A1- 0219570	29/04/87	SE-T3- 0219570 AU-B- 593188 AU-A- 6363086 CA-A- 1268849 US-A- 4713498	01/02/90 30/04/87 08/05/90 15/12/87
WO-A1- 9000805	25/01/90	AU-B- 623168 AU-A- 4041689 CA-A- 1329404 DE-D- 68914973 EP-A, B- 0378679	07/05/92 05/02/90 10/05/94 00/00/00 25/07/90