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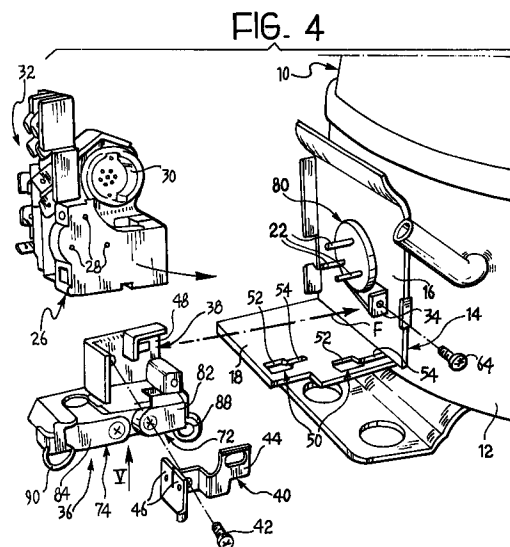
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(54) **A supply and protection device for a hermetic compressor of a refrigeration machine, a connector device for the connection of electrical components, and a hermetic compressor of a refrigeration machine provided with such a device**

(57) The metal casing (10) of a hermetic compressor is provided with a metal plate (14) which includes a projecting apertured lug (34). An electrical unit is attached to the plate (14) which includes an insulating support body (26) and an insulating earth-connector body (36) separate from the preceding body. The insulating support body (26) includes a protection switch (30) and a resistor having a positive temperature coefficient (PTC). The insulating earth-connector body (36) includes a seat (38) for receiving the lug (34), at least one portion acting as a cable clamp (72,74) and an apertured attachment wall (48) which delimits the seat (38) and flanks the lug (34). A shaped metal element (40) is held in the insulating body (36) which includes an apertured blade-like portion (44) and terminal earthing portions (46) for various electrical components of the refrigeration machine. A metal member such as a screw (64) passes through the holes of the lug (34), the attachment wall (48), the blade-like portion (44) and an end terminal of an earth conductor of a supply cable, for fixing them together.



EP 0 793 068 A1

Description

The present invention concerns a supply and protection device for a hermetic compressor of a refrigeration machine, including:

- a metal plate welded to a side wall of the casing of the compressor, through which project the pins of an electrical connector which passes hermetically through the casing; and
- an electrical supply and protection unit including a female connector part coupled with the pins, and in which the electrical unit includes:
 - an insulating support body;
 - a thermally-activated protection switch housed in the body and in thermal contact with the metal plate;
 - a resistor having a positive temperature coefficient (PTC) housed in the body; and
 - electrical connection means carried by the insulating body for electrically connecting an external supply cable to the windings of the electric motor of the compressor, having a thermostat for controlling the compressor and possible accessories.

An example of this type of device is known from the document US-A-4 467 385.

On the other hand, in a refrigeration machine such as a domestic or commercial refrigerator it is known for the electrical supply cable or the cables intended to supply any accessories of the machine such as an internal light for a refrigerator, a fan, a condenser, etc to converge at a terminal board mounted on the casing of the compressor.

By law, all of these cables must be clamped below a cable press, or so-called "tension reliever".

The terminal board must therefore be provided with a large number of contacts (of screw type and/or of the type known by the commercial name "fast-on"), so that all of the necessary connections may be achieved safely.

One of the terminals is intended to connect together the earth wires of the various components of the refrigerator or other machine (a cabinet, light socket, thermostat, compressor, possible fans, etc) and is, in its turn connected to the earth wire of the user's electrical system.

The earth terminal is usually mounted on the terminal board or on the casing of the compressor at a point adjacent the terminal board itself. The need to satisfy ever-increasing consumer demands and reduce production costs has lead to the development of increasingly compact terminal boards integrated with the electrical components of the compressor.

These known terminal boards may be fixed to the compressor either using "snap engagement" systems or screws, or they may be supported on the electrical

components connected directly to the pins of an electrical connector of the type known by the commercial name "Fusite" which hermetically traverses the casing of the compressor.

The tension reliever for the connection cables may be an integral part of the terminal board.

In all cases, the metal casing of the compressor must be electrically connected to the earth wire of the supply line.

Various solutions are known for achieving this earth connection which, for various reasons, have certain disadvantages relating to production costs or the difficulties encountered by whoever has to make the final electrical connections, that is, the manufacturer of the refrigeration machines for which the compressors are intended.

Examples of compact terminal boards integrated with electrical components of a compressor are given in the documents EP-A-0 313 024, IT-B-1 147 234, IT-B-1 159 282 and IT-B-1 141 680.

Further examples of compact terminal boards are given in the documents IT-U-166 464 and IT-PV92U000011.

The principal aim of the invention is that of providing a supply and protection device of the aforesaid type which has at least the following advantages:

- speed and ease of installation;
- a secure earth connection for both the compressor casing and various accessories;
- providing a tension reliever for the supply cable.

According to the present invention, this aim is achieved by means of a supply and protection device of the aforesaid type, characterised in that the aforesaid metal plate includes a projecting apertured lug situated in a position off-set from the aforesaid support body, and in that the electrical unit includes:

- an insulating earth-connector body separate from the aforesaid support body, which includes a seat for receiving the lug, at least one portion acting as a cable clamp for the aforesaid supply cable and its earth conductor, and an apertured attachment wall defining the seat and flanking the lug;
- a shaped metal element held in the insulating body, including an apertured blade-like portion facing the aforesaid apertured wall and earthing terminal portions for electrical components of the refrigeration machine; and
- a metal member which extends through the holes in the lug, the attachment wall, the blade-like portion and a possible further terminal of the supply cable earth conductor, to fix them together.

Thanks to this solution, the advantages obtained from this arrangement may be summarised below:

- the earth terminal is fixed to the tension reliever so

that it is part of this latter and does not therefore constitute an additional part to be handled separately;

- it is not necessary for the manufacturer of the refrigeration machine to fix the earth terminal directly to the metal casing of the compressor, that is, a supplementary operation which would increase production costs is not required;
- the electrical continuity of the earth connection to the metal casing of the compressor is assured by means of a simple connection using a screw or other member such as a rivet to a lug formed in the same metal plate welded to the side wall of the compressor casing, and the tension reliever is fixed to this same lug;
- since the insulating earth-connector body, with its portion or portions acting as a tension-relieving cable clamp, is fixed to the compressor casing independently of the aforesaid insulating support body which contains the protection switch and PTC resistor, there are no positioning constraints related to the tolerances of the two bodies: the insulating body containing the protection switch and PTC resistor may be engaged on the pins of the "Fusite" connector while the separate insulating earth-connector body may be engaged on the apertured lug irrespective of the positioning tolerances of the pins and the lug;
- the direct connection of the terminal of the supply cable earth conductor to the metal compressor casing means that a further cable is not needed, with a consequent reduction in material costs, handling and labour;
- the attachment of the insulating earth-connector body to the lug by a screw, rivet or the like, also provides for excellent anchorage of the tension reliever to the compressor with the advantage of not requiring an excessive limitation of the moulding tolerances of an insulating body formed from plastics material and of the metal plate with its lug to obtain a tension reliever attachment having the mechanical characteristics necessary to withstand the tension tests required by the safety regulations;
- the positioning of the supply cable earth conductor terminal close to the tension reliever instead of on a terminal board together with the other terminals means that safety regulations can be satisfied (the earth wire must be the last to come away when the supply cable is pulled).

The invention also concerns a device for connecting various electrical components and a metal casing to earth, as well as a hermetic compressor for refrigeration machines provided with a device according to the invention.

The invention will become clearer from reading the following detailed description, given by way of non-limitative example and with reference to the accompanying drawings, in which:

- Figure 1 is a perspective view of a hermetic compressor provided with a supply and protection device according to the invention, in which the box enclosing the device is represented in broken outline;
- Figure 2 is a view in the direction of the arrow II of Figure 1, in which the box is represented in section;
- Figure 3 is a partial section on an enlarged scale taken on the line III-III of Figure 2;
- Figure 4 is an exploded perspective view of the same supply and protection device in which the casing of the compressor is partially shown;
- Figure 5 is a view from below of an insulating earth-connector body forming part of the device seen in the direction of the arrow V of Figure 4 and on an enlarged scale;
- Figure 6 is a perspective view of the same insulating body shown in a condition in which two cable clamps forming part of the body itself are represented in an open condition; and
- Figure 7 is a perspective view in which the supply and protection device is represented by chain lines and in which its electrical cables are represented in solid outline.

With reference to Figures 1 to 4, a hermetic compressor for a refrigeration machine includes a metal casing generally indicated 10.

The casing 10 includes a lower part 12.

A metal plate 14 is welded to a side wall of the lower part 12 of the casing 10.

Preferably, as is shown, the metal plate 14 is of L-shape. One limb 16 thereof is welded to the side wall of the lower part 12 of the casing 10. Another limb 18 projects from the casing 10 in the form of a bracket.

Outside the casing 10, part of an electrical connector 20 of the type known by the commercial name "Fusite", which hermetically traverses the casing, extends through the welded limb 16.

The connector 20 has projecting pins 22 outside the casing 10.

An electrical supply and protection unit generally indicated 24 is associated with the connector 20.

The unit 24 is protected by a box 25 in a known way.

The unit 24 includes an insulating support body 26 of complex shape and formed from a moulded synthetic material.

In Figure 4 can be seen holes 28 in a front wall of the body 26, which enable the pins 22 to engage through holes 28 with corresponding female connector parts (not shown).

The attachment and support of the body 26 on the casing 10 are obtained by the simple insertion of the pins 22 into the holes 28 and into the female connector parts lying behind them.

The insulating support body 26 contains a thermally-activated protection switch 30 of known type which is in thermal contact with the limb 16 of the metal plate 14 (Figure 4).

The same body 26 houses (Figure 4) a resistor having a positive temperature coefficient (PTC), not shown, which is also well known.

The electrical unit 24, as well as containing the aforesaid protection switch and PTC resistor, functions as a compact terminal board in that it includes electrical connection means, generally indicated 32, in the form of blade-like elements with flat pins of the type known by the commercial name "fast-on" and which will be described below. The connection means 32 enable an external supply cable to be connected electrically to the windings of the electric motor of the compressor by means of the aforesaid protective switch and PTC resistor and by means of a compressor control thermostat, as well as the connection with any other accessories of a refrigerator or other refrigeration machine.

These connection means will be discussed below with reference to Figure 7.

According to the invention the welded limb 16 of the metal plate 14 includes a projecting apertured lug 34 formed by cutting and bending, the hole through which, in the case shown, is threaded.

Preferably, the lug 34 is bent so as to lie in a general plane perpendicular to the general planes of both of the limbs 16 and 18 of the welded plate 14.

Referring to Figures 5 and 6 as well as Figures 1 to 4, an insulating body formed from moulded synthetic material and generally indicated 36 is associated with the apertured lug 34.

The insulating body 36 which, as will be seen, is intended for connecting the supply and protection device to earth, is completely separate from the support body 26.

The body 36 has a complex shape which can be seen in the drawings and which will not be described in detail.

Among other things, a seat 38 for receiving the apertured lug 34 is formed in the body 36.

A shaped blade-like metal element 40 (Figures 3 and 4) is housed and retained in the insulating body 36.

The blade-like element 40 is provided with a screw 42 for a possible alternative earth connection, as provided by the regulations.

The element 40 includes an apertured blade-like portion 44 and male connector parts 46 of the type known by the commercial name "fast-on".

The blade-like portion 44 faces an apertured wall 48 of the body 36. In particular, in the embodiment shown, the blade-like portion 44 and the wall 48 comprise the opposite sides of the seat 38.

As will be better understood below, the connectors 46 of the metal element 40 constitute earthing terminal portions for various electrical components of a refrigeration machine.

As will also be better understood below, the seat 38 is intended to receive the lug 34 when the insulating body 36 has been installed.

For the installation of the body 36, the limb 18 projects from the casing 10 in the form of a bracket and

has a pair of attachment apertures 50 (Figure 4).

The two attachment apertures 50 are elongate in a direction perpendicular to the plane of the aforesaid welded limb 16. Each includes a wide part 52 in the form of a window which is further from the welded limb 16, and a narrow part 54 in the form of a slot closer to the welded limb 16.

The insulating earth-connector body 36 includes, in its turn (Figures 5 and 6), a base wall 56 having a pair of attachment projections 58 corresponding to the attachment apertures 50.

Each attachment projection 58 includes a wide foot 60. The size and shape of each foot 60 is such that it is able to pass through the wide part 52 of the associated attachment aperture 50.

Each attachment projection 58 also includes a narrow leg 62 the size and shape of which is such that it is able to slide along the narrow part 54 of the associated attachment aperture 52.

The distance between the base wall 56 and each foot 60 corresponds to the thickness of the projecting limb 18.

The arrangement is such that the aforesaid reception seat and the projecting lug 34 of the plate 14 are aligned when each attachment projection 58 is inserted in the associated attachment aperture 50. When each attachment projection 58 has been inserted right through the wide part 52 of the associated attachment aperture 50, and when the base wall 56 of the insulating body 36 is attached to the projecting limb 18, the sliding of the body 36 towards the welded limb 16 in the direction of the arrow F of Figure 4, guided by each leg 62 sliding along the narrow part of the associated attachment aperture 50, brings the seat 38 to couple with the apertured lug 34 which, in the embodiment represented, remains framed (Figure 3) between the blade-like portion 44 and the wall 48.

Once this condition has been achieved, the holes in the blade-like portion 44, the lug 34 and the wall 48 are aligned.

In order to take into account possible defects in alignment, the holes in the blade-like portion 44 and the wall 48 are elongated as slots, as can be seen in Figure 4.

Once this final position has been reached, the insulating body 36 is attached to the lug 34 together with the blade-like portion 44 by means of a simple screw 64 (or other metal member, such as a rivet) screwed into the threaded hole of the lug 34.

The screw 64, or a metal member, also provides for the fixing of a terminal end 66, better seen in Figure 7, of an earth conductor 68 of a three-core supply cable 70 in electrical contact with the blade-like portion 44.

Alternatively, a terminal end like the terminal end 66 of the earth conductor 68 of the three-core supply cable 70 may be fixed in electrical contact with the blade-like element 40 by means of a further screw connection 42.

In an embodiment not shown, an insulating body like the insulating body 36 may also comprise only one

attachment projection like the projection 58, intended to couple with a single attachment aperture like the aperture 50.

According to the invention, the insulating body 36 includes at least one cable clamp and, preferably, as shown, a pair of cable clamps. 5

The two cable clamps are generally indicated 72 and 74 in Figures 1 and 4 to 7.

Each cable clamp 72, 74 is preferably situated, as shown, on a side of the insulating body 36 opposite the side adjacent the aforesaid support body 26. 10

Each cable clamp 72, 74 defines a passage which preferably, as shown, is oriented vertically when the compressor has been installed to allow the insertion (Figure 7) of the supply cable 70 (in the cable clamp 72) and a bundle of conductors 76 (in the cable clamp 74) upwards from below, in conformity with safety regulations. 15

Preferably, each cable clamp 72, 74 includes an associated hollow 78, 80 (Figures 3, 5 and 6) on one side in the base wall 56 of the insulating body 36, and an associated clamp 82, 84 on the other side. 20

Preferably, the insulating body 36 is formed from a synthetic material which is relatively flexible in small thicknesses and each clamp 82, 84 is formed as a single piece with the body 36 and is connected integrally with the body itself by an associated flexible thread-like connector 88, 90. 25

The tightening of the clamp 82, 84 is obtained by means of associated screws 92, 94 screwed into the body 36. 30

Figure 7 shows an example of the wiring of the supply and protection device including the two separate bodies 26 and 36.

As can be seen, the cable clamp 72 holds the ends of the three-core supply cable 70, the end terminal of which is fixed to the screw 64 which, at the same time, fixes the body 76 to the lug 34 (Figures 2, 3 and 4). 35

The phase conductors 96 lead to respective blades of the terminal board 32. 40

The terminal board 32 includes further blades to which lead the conductors of the bundle 76 locked in the cable clamp 74.

Earth conductors 98 form part of the bundle 76, which lead to the blades 46 of the blade-like element 40, and serve to connect other parts of the refrigeration machine to earth. 45

The further electrical connections illustrated in Figure 7 will not be described in detail as they are easily understandable by those skilled in the art. 50

Claims

1. A supply and protection device for a hermetic compressor of a refrigeration machine, including: 55

- a metal plate (14) welded to a side wall of the casing (10) of the compressor through which project pins (22) of an electrical connector (20)

- which hermetically traverses the casing; and
- an electrical supply and protection unit including a female connector part (28) coupled to the pins (22),

and in which the electrical unit includes:

- an insulating support body (26);
- a thermally-activated protection switch (30) housed in the body (26) and in thermal contact with the metal plate (14);
- a resistor having a positive temperature coefficient (PTC) housed in the body (26); and
- electrical connection means (32) extending from the insulating body (26) for electrically connecting an external supply cable (70) to the windings of the electric motor of the compressor, with a thermostat for controlling the compressor and possible accessories,

characterised in that the aforesaid metal plate (14) includes a projecting apertured lug (34) situated in a position off-set from the aforesaid support body (26),

and in that the electrical unit includes:

- an insulating earth-connector body (36) separate from the aforesaid support body (26), which includes a seat (38) for receiving the lug (34), at least one portion (72) acting as a cable clamp for the aforesaid supply cable (70) and its earth conductor (68), and an apertured attachment wall (48) defining the seat (38) and flanking the lug (34);
- a shaped metal element (40) held in the insulating body (36) and including an apertured blade-like portion (44) facing the aforesaid apertured wall (48), and terminal portions (46) for earthing the various electrical components of the refrigeration machine; and
- a metal member (64) passing through the holes in the lug (34), the attachment wall (48), the blade-like portion (44) and a possible end terminal (66) of the earth conductor (68) of the supply cable (70), for fixing them together.

2. A device according to Claim 1, characterised in that the blade-like element (40) is provided with a further screw connection (42) for an alternative fixing of an end terminal of the earth conductor of a supply cable.

3. A device according to Claim 1 or Claim 2, characterised in that the welded metal plate (14) is of L-shape with a limb (16) welded to the side wall of the

casing (10) of the compressor, from which projects the apertured lug (34), and a limb (18) projecting from the casing (10) in the form of a bracket, in that the projecting limb (18) has at least one attachment aperture (50) elongate in the direction perpendicular to the plane of the welded limb (16) and including a wide part (52) in the form of a window further from the welded limb (16) and a narrow part (54) in the form of a slot closer to the welded limb (16), in that the aforesaid insulating earth-connector body (36) includes a base wall (56) having at least one attachment projection (58) which includes a wide foot (60) the size and shape of which is such as to be able to pass through the wide part (52) of the attachment aperture (50) and a narrow leg (62) the size and shape of which is such as to be able to slide along the narrow part (54) of the attachment aperture (50), the distance between the base wall (56) and the foot (58) corresponding to the thickness of the projecting limb (18), and in that the aforesaid reception seat (38) and the projecting lug (34) of the plate (14) are so disposed as to be aligned when the attachment projection (58) is inserted in the attachment aperture (50), the arrangement being such that when the attachment projection (58) has been inserted right through the wide part (52) of the aperture (50), and the base wall (56) of the insulating earth-connector body (36) is applied to the projecting limb (18), sliding this body (36) towards the welded limb (16), guided by the sliding of the aforesaid leg (62) along the narrow part (54) of the attachment aperture (50), causes the coupling of the seat (38) with the apertured lug (34).

4. A device according to Claim 3, characterised in that the apertured lug (34) lies in a general plane perpendicular to the general plane of both limbs (16,18) of the welded plate (14).

5. A device according to any preceding Claim, characterised in that the aforesaid metal fixing member is a screw (64).

6. A device according to any preceding Claim, characterised in that the aforesaid insulating earth-connector body (36) includes two portions acting as separate cable clamps (72,74), one for the supply cable (70) and the other for a bundle of cables (76) for connecting the accessories.

7. A device according to any preceding Claim, characterised in that the or each cable clamp (72,74) has on one side a hollow (78,80) in the insulating earth-connector body (36) and, on the other side, a locking clamp (82,84) formed from an insulating material.

8. A device according to Claim 7, characterised in that

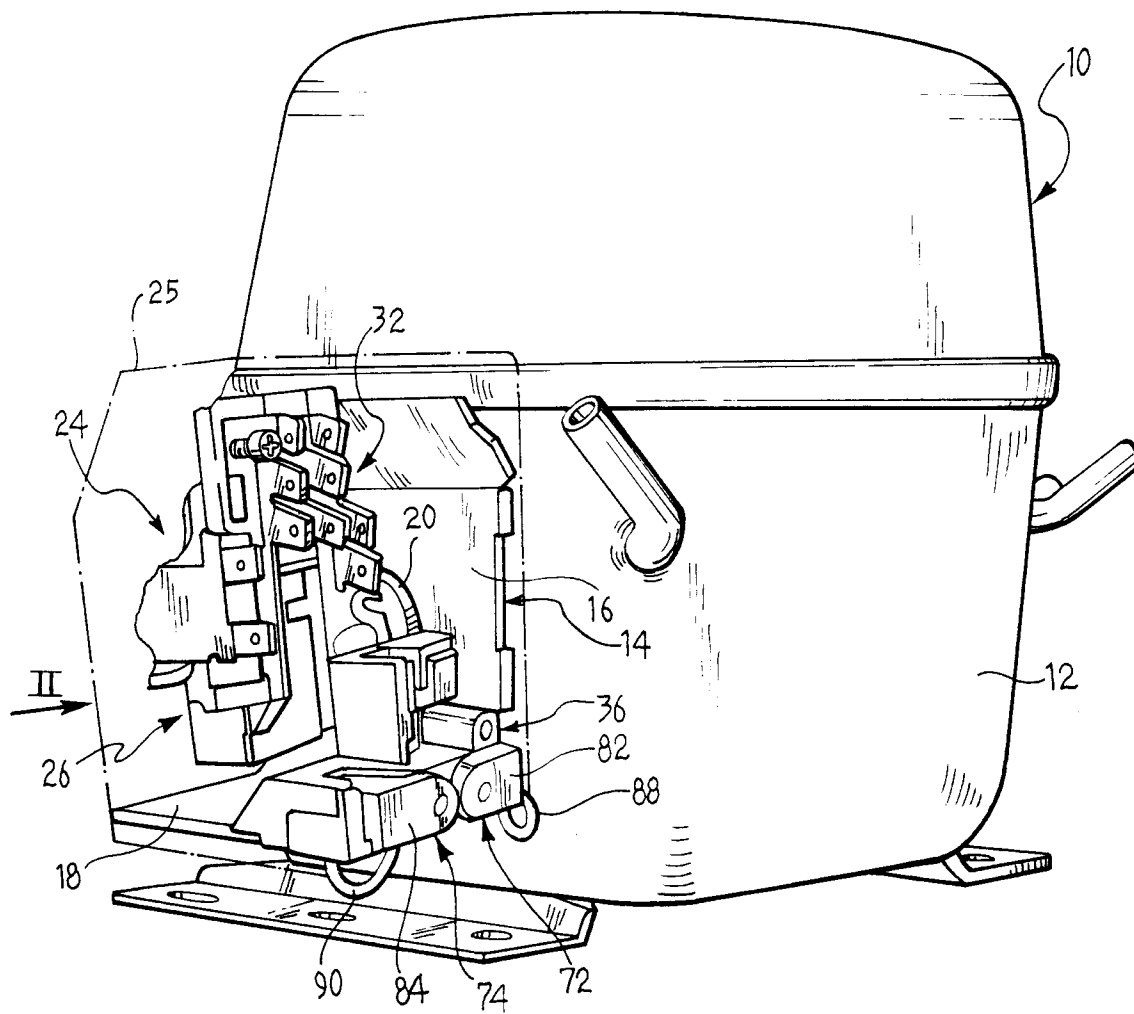
the or each cable clamp (72,74) is located on a side of the insulating body (36) opposite the side adjacent the aforesaid support body (26) and defines a passage which, when the compressor has been installed, is oriented vertically to allow the insertion of the cable (70) and/or the bundle of conductors (76) upwards from below.

9. A device according to any preceding Claim, characterised in that the insulating earth-connector body (36) is formed from a synthetic material which is relatively flexible in small thicknesses, and the or each clamp (82,84) is formed as a single piece with the body (36) and is connected integrally thereto by means of a flexible connection (88,90) formed integrally with the body and the clamp.

10. A connector device for connecting to earth various electrical components and a metal casing, such as a casing (10) of a compressor of a refrigeration machine, having a projecting apertured metal lug, characterised in that it includes an insulating earth-connector body (36) and a shaped metal element (40) having the characteristics described above.

11. A hermetic compressor for a refrigeration machine provided with a device according to any preceding claim.

FIG. 1



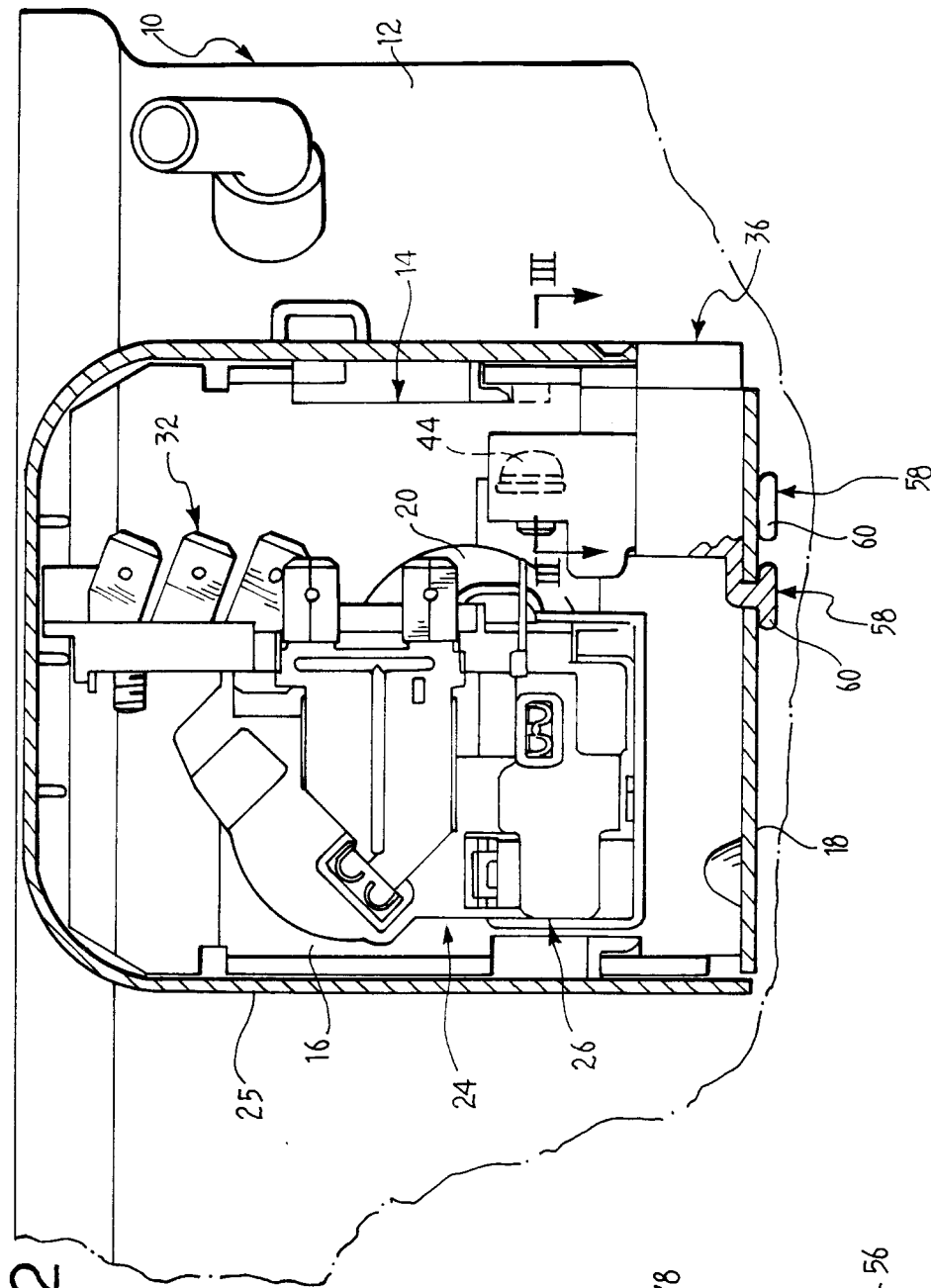
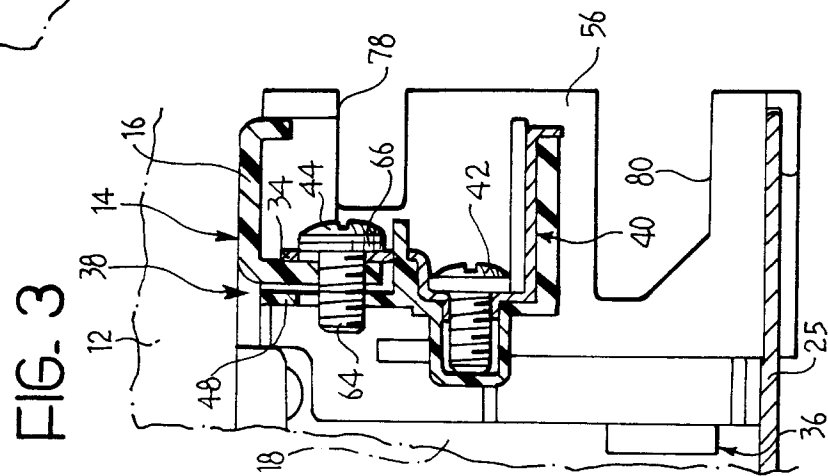


FIG. 2



3
F/G

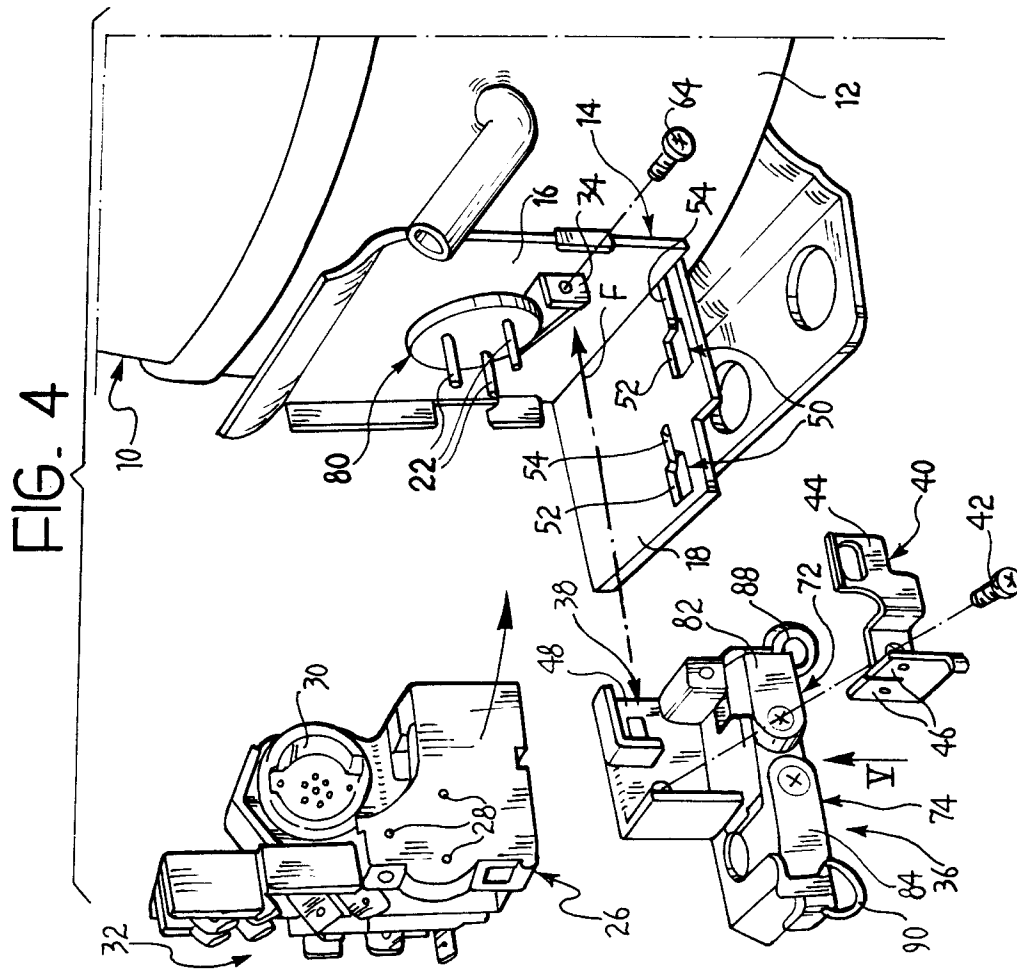
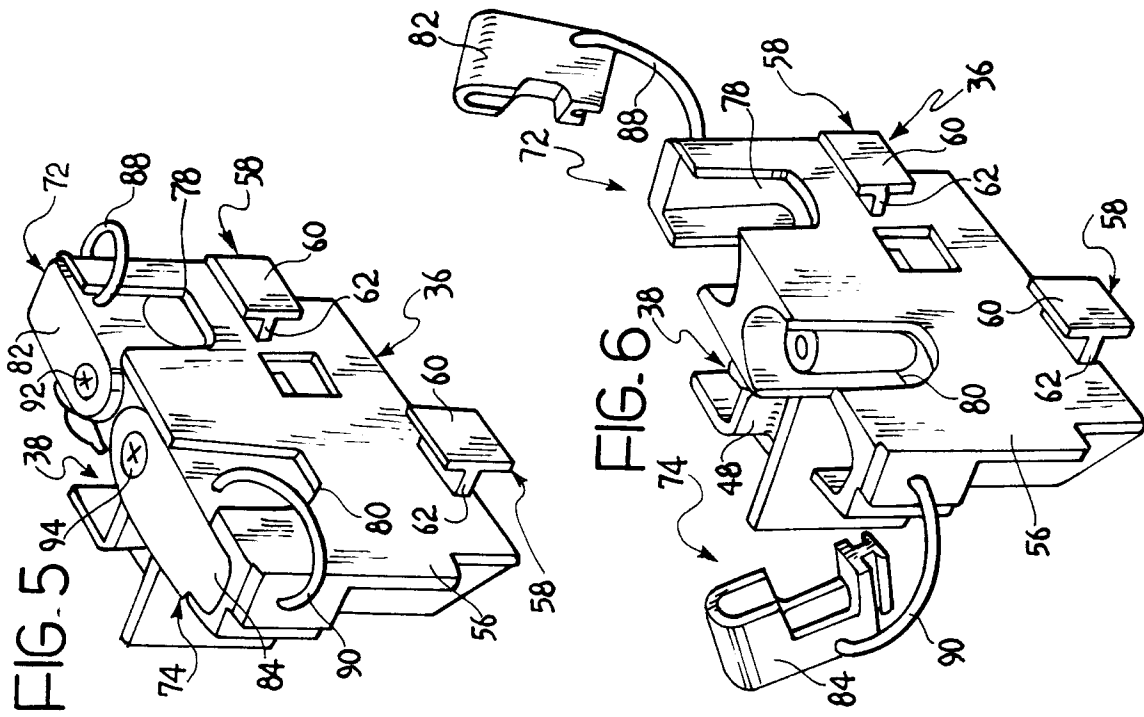
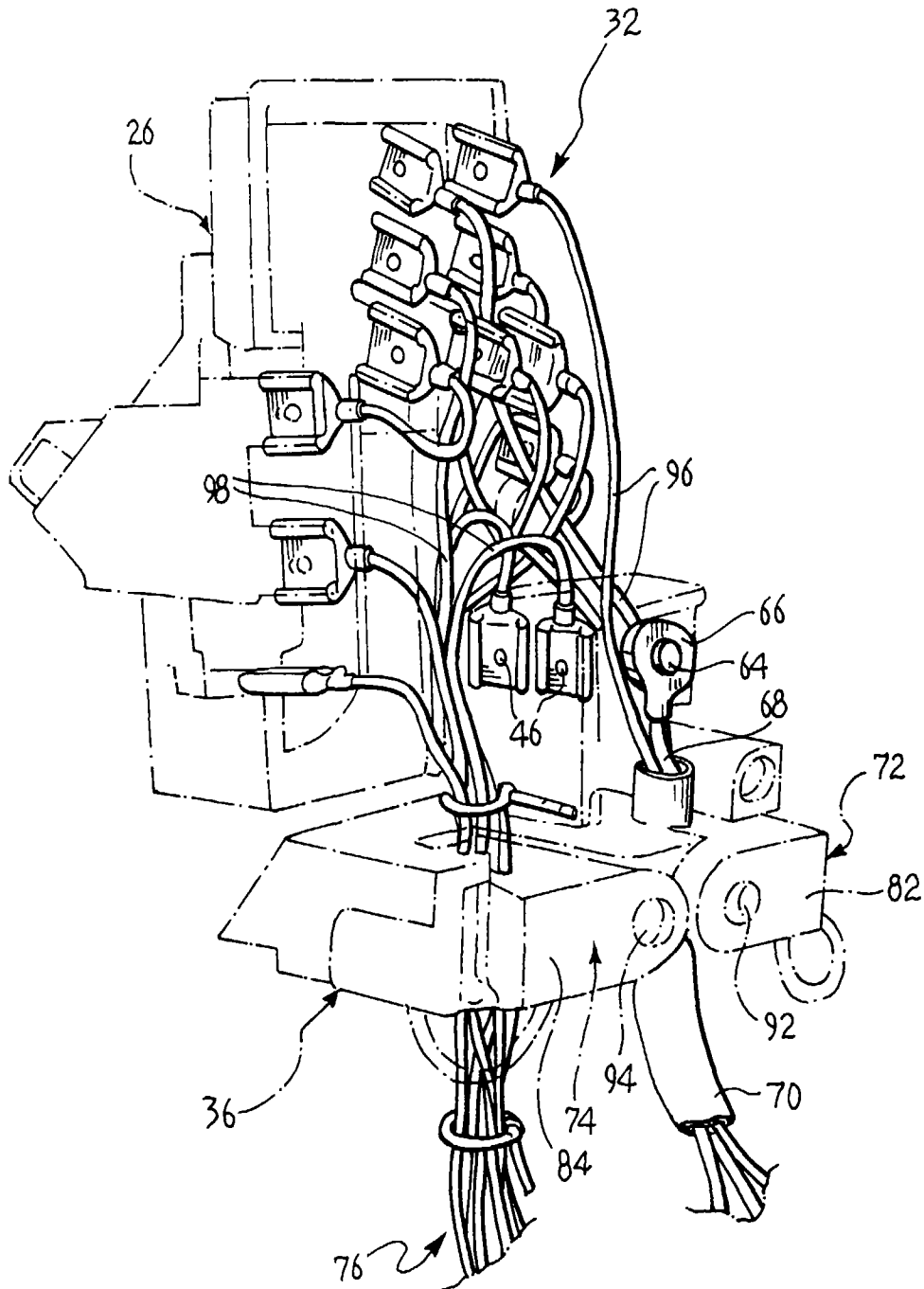


FIG. 7





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EUROPEAN SEARCH REPORT

Application Number
EP 97 10 2972

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	FR 2 541 831 A (THOMSON BRANDT) 31 August 1984 * page 5, line 6 - line 24 * * page 6, line 33 - page 7, line 3; figures *	1	F25D29/00
A	FR 2 028 340 A (BOSCH) 9 October 1970 * figures *	1	
A,D	EP 0 313 024 A (ZANUSSI ELETTROMECC) 26 April 1989 * figures *		
A,D	US 4 467 385 A (BANDOLI FULVIO ET AL) 21 August 1984 * figures *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6) F25D H02K H01R
Place of search THE HAGUE		Date of completion of the search 27 May 1997	Examiner Zanichelli, F
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