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(54) CIRCUIT BREAKER COMPRISING A DOUBLE WALL SURROUNDING ITS THERMAL CHAMBER

(57) The invention relates to a circuit-breaker comprising a chassis (27) having an inner cylindrical surface (30) carrying a slidable mobile assembly (32) comprising :
a compression chamber (34) and a thermal chamber (36) with a cylindrical wall (40) delimiting the thermal chamber (36), the diameter of this cylindrical wall being smaller than the diameter of the cylindrical surface (30) of the chassis ;
- an additional cylindrical wall (41) surrounding the cylindrical wall (40) of the thermal chamber (36), this additional cylindrical wall (41) having an outer diameter corresponding to the inner diameter of the cylindrical surface of the chassis (27).

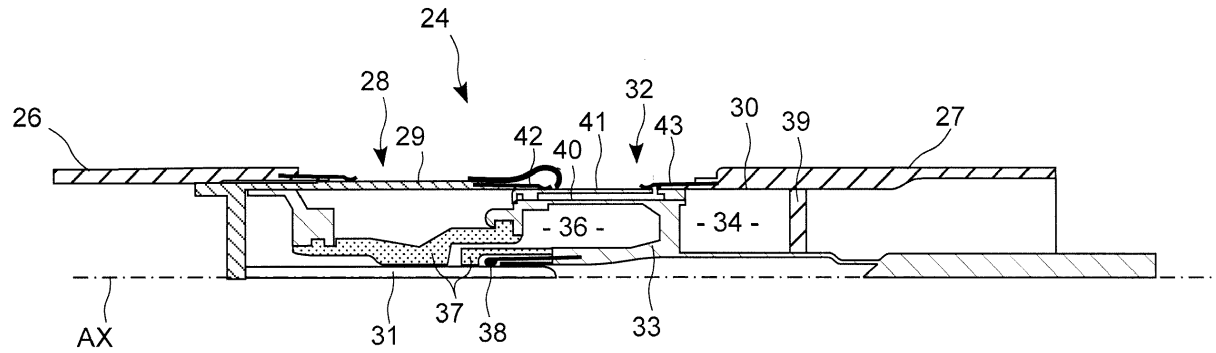

FIG. 2

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Description

TECHNICAL FILED

[0001] The invention relates to a medium or high voltage circuit-breaker comprising two arcing contacts, with a pneumatic compression chamber and a thermal compression chamber, to blow dielectric gas in the direction of an electric arc formed between the arcing contacts to extinguish it, upon opening operation of the circuit-breaker.

STATE OF PRIOR ART

[0002] A device comprising such a known circuit-breaker shown in figure 1 and marked 1 comprises a first and a second chassis 2 and 3 fixedly secured for example to the ground, at small distance from each other along a longitudinal axis AX. When the breaker 1 is closed as in figure 1, it allows electric current to flow between chassis 2 and 3, and when it is open the current cannot flow.

[0003] The first chassis 2 carries an assembly 4 which comprises a cylinder 6 carrying a fixed arcing contact 7. The second chassis 3 carries a mobile assembly 8 movable along axis AX.

[0004] This mobile assembly 8 comprises a main body 9 which delimits an annular compression chamber 12 and an annular thermal chamber 13 communicating with the compression chamber. It also carries a circular nozzle 14 made of insulating material communicating with the thermal chamber, and a hollow mobile arcing contact 16. The chassis 3 carries a fixed piston 11 which closes the compression chamber 12.

[0005] The mobile assembly 8 comprises a cylindrical outer wall 17 which corresponds to the outer wall of the compression chamber 12 and which slides in the second chassis 3. It further comprises another cylindrical wall 18, smaller than cylinder 17, and which corresponds to the outer wall of the thermal chamber 13. This other cylindrical wall 18 has a free end inserted in the cylinder 6 of assembly 4 when the breaker is closed as in figure 1.

[0006] A first permanent sliding contact 19 has a base fixedly secured to the free end of cylinder 6 and an extremity applied radially against the free end of cylindrical wall 18 when the breaker is closed, and a second permanent sliding contact 21 has a base fixedly secured to the second chassis 3 and an extremity applied radially against the outer wall 17 at any position of assembly 8.

[0007] When the breaker is closed as in figure 1, the fixed arcing contact 7 is inserted in the mobile arcing contact 9, and the permanent sliding contact 19 is applied against the free end of outer wall 18. In this situation, most part of the current passes through the permanent sliding contacts 19 and 21 and through outer wall 18, and a much lower amount of current flows through arcing contacts.

[0008] Upon opening of the breaker, the moving assembly 8 is moved opposite to the first chassis 2. During this movement, the first permanent sliding contact 19 loses electric connection with the free end of cylinder 6, resulting in all the current flowing through the arcing contacts 7,16. Then, an electric arc appears between the arcing contacts 7 and 9. The dielectric gas is compressed in the piston chamber 12 by virtue of the opening movement and it is compressed in the thermal chamber 13 due to thermal expansion resulting from the heat generated by the electric arc. The compressed dielectric gas is subsequently blown towards the electric arc through nozzle 14 to encourage extinguishing of this electric arc.

[0009] In the present case, the device of figure 1 is both a circuit-breaker and also a disconnecting switch : when assembly 8 has reach its extreme open position, the other assembly, i.e. assembly 4 can be moved slidably in the first chassis 2 to drive the arcing contact 7 further away from arcing contact 16 in order to increase the voltage that the breaker can withstand when it is open.

[0010] The goal of the invention is to find an arrangement allowing to reduce the length of a circuit breaker such as the one of figure 1.

PRESENTATION OF THE INVENTION

[0011] To this end, the invention relates to a circuit-breaker comprising a chassis having an inner cylindrical surface carrying a mobile assembly:

- the mobile assembly being slidably movable relatively to the chassis along a longitudinal axis of its cylindrical surface between an open position and a closed position ;
- the mobile assembly comprising a main body to delimit an annular compression chamber and an annular thermal chamber contiguous to the compression chamber along longitudinal axis ;
- the mobile assembly comprising a cylindrical wall delimiting the thermal chamber, the diameter of this cylindrical wall being smaller than the diameter of the cylindrical surface of the chassis ;
- a sliding contact fixedly secured to the chassis having an extremity slidably applied radially to the mobile assembly to ensure continuous electric contact beteween the chassis and the mobile assembly ;

characterized in that:

- the mobile assembly comprises an additional cylindrical wall surrounding the cylindrical wall of the thermal chamber, this additional cylindrical wall having an outer diameter corresponding to the inner diameter of the cylindrical surface of the chassis ;
- the extremity of the sliding contact is applied against the additional cylindrical wall for all the possible positions of the mobile assembly from its open position to its closed position.

[0012] With this solution, the extremity of the perma-

nent sliding contact is applied against the additional cylindrical wall instead of being applied against the outer wall of the compression chamber. This allows the whole compression chamber carried by the mobile assembly to be in the cylindrical surface of the chassis for any position of this mobile assembly, resulting in a reduction of the overall length of the breaker. This further allows to have two different diameters of the thermal chamber and the compression chamber.

[0013] The invention also relates to such a circuit-breaker wherein the main body of the mobile assembly comprises the cylindrical wall of the thermal chamber and the additional cylindrical wall surrounding the cylindrical wall of the thermal chamber which are separate elements fixedly secured together.

[0014] The invention also relates to such a circuit-breaker wherein the compression chamber is delimited by the cylindrical surface of the chassis.

[0015] The invention also relates to such a circuit-breaker, arranged to ensure that when the circuit breaker is electrically closed the electric current passes through the additional cylindrical wall.

[0016] The invention also relates to such a circuit-breaker, wherein the additional wall is made of a material which is different than the material of the main body.

[0017] The invention also relates to such a circuit-breaker, comprising a piston closing the compression chamber, and wherein this piston is fixed directly to cylindrical surface of the chassis.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

FIG. 1 shows in diagrammatic axial section a known breaker in the electrically closed state;

FIG. 2 shows in diagrammatic axial section a breaker according to the invention in the electrically closed state;

FIG. 3 shows in diagrammatic axial section the main elements of a breaker according to the invention in the electrically closed state;

FIG. 4 shows in diagrammatic axial section the main elements of a breaker according to the invention in the electrically open state;

FIG. 5 shows in diagrammatic axial section the main elements of a breaker according to the invention with its disconnecting switch electrically open.

DETAILED PRESENTATION OF PARTICULAR EMBODIMENTS

[0019] As seen in figure 2, the breaker according to the invention 24 has a general structure which is closed to the structure of the known breaker shown in figure 1.

[0020] The breaker according to the invention also comprises a first and a second chassis 26 and 27 aligned along a longitudinal axis AX, to allow or prevent current to flow from chassis 26 to chassis 27.

[0021] The first chassis 26 carries an assembly 28 comprising a cylinder 29 and a fixed rod arcing contact 31, both coaxial with axis AX. The second chassis 27 carries a mobile assembly 32 movable along axis AX and which has a shape of revolution around this axis AX. This mobile assembly slides into a corresponding inner cylindrical surface 30 of the second chassis 27, along longitudinal axis AX.

[0022] The mobile assembly 32 comprises a main body 33 which delimits an annular compression chamber 34 and an annular thermal chamber 36 communicating with the compression chamber, the thermal chamber 36 being contiguous to the compression chamber 34 along axis AX. It also comprises a circular nozzle 37 made of insulating material such as polytetrafluoroethylene communicating with the thermal chamber, and a hollow mobile arcing contact 38. The chassis 27 carries a fixed piston 39 which closes the compression chamber 34.

[0023] In the example of the figures, the outer wall of the annular compression chamber 34 is not carried by the mobile assembly 32, contrarily to the arrangement of the prior art disclosed in figure 1: the outer surface of the annular compression chamber is delimited by the cylindrical surface 30 of the second chassis 27.

[0024] This allows to fixedly secure the piston 39 directly to the inner cylindrical face 30 of the chassis 27, which renders the whole breaker more compact. As seen on the figures, the fixed piston 39 is mostly a flat wall having a circonferential contour.

[0025] The mobile assembly 32 comprises a cylindrical outer wall 40 which forms the outer wall of the thermal chamber 36, and an additional cylindrical wall 41 which surrounds outer wall 40 of the thermal chamber 36.

[0026] This additional cylindrical wall 41 is a metal part fixedly secured to the mobile assembly, which is a cast part. The additional wall 41 is fixed to the mobile assembly by clinching, or by fitting. It can also be threatened to the outer wall 40 or secured thereto in any other way which ensures that electrical current can flow from wall 40 to wall 41. The annular space between wall 40 and wall 41 is open by means of a hole or the like to allow gas to freely fill this annular space

[0027] This additional cylindrical wall 41 has a free end inserted in the cylinder 29 of assembly 28 when the breaker is closed as in figure 2. The external diameter of this additional cylindrical wall 41 corresponds to the diameter of inner cylindrical surface 30 of the chassis 27, which allows it to fit closely and to slide with the mobile assembly 32 in the inner cylindrical surface 30 of second chassis 27.

[0028] A first permanent sliding contact 42 has a base fixedly secured to the free end of cylinder 29 and an extremity applied radially against the free end of additional cylindrical wall 41 when the breaker is closed. A second permanent sliding contact 43 has a base fixedly secured to the second chassis 27 and an extremity applied radially against the additional cylinder wall 41 at any position of

assembly 8.

[0029] Since the outer face of additional wall 41 is continuously in electrical contact with the extremity of permanent sliding contact 43, this outer face is treated appropriately to ensure sufficient level of electrical conductivity with the extremity of the permanent sliding contact 43.

[0030] When the breaker is closed as in figure 2, the fixed arcing contact 31 is inserted in the mobile arcing contact 38, and the permanent sliding contact 42 is applied against the free end of additional cylinder wall 41. At this stage, most part of the current passes through the permanent sliding contacts 42 and 43 and through additional cylindrical wall 41, and a far much lower amount of current flows through arcing contacts.

[0031] Upon opening of the breaker, assembly 32 is moved opposite to the first chassis 26. In this movement, the first permanent sliding contact 42 looses electric connection with the free end of cylinder 41, resulting in all the current flowing from the second chassis 27 to the main body 33 through the piston 39, in order to pass through arcing contacts 31, 38. Then, an electric arc appears between the arcing contacts 31 and 38. The dielectric gas is compressed in the piston chamber 34 by this opening movement and in the thermal chamber 36 due to thermal expansion resulting from the heat generated by the electric arc. The compressed dielectric gas is subsequently blown towards the electric arc through nozzle 37 to encourage extinguishing of this electric arc.

[0032] The device of figure 2 is both a circuit-breaker and also a disconnecting switch: when assembly 32 has reach its extreme open position, the other assembly, i.e. assembly 28 can be moved slidably in the first chassis 26 to drive the arcing contact 31 further away from arcing contact 38 in order to increase the voltage that the open breaker can withstand.

[0033] The invention allows the extremity of the permanent sliding contact to be applied against the additional cylindrical wall instead of being applied against the outer wall of the compression chamber. This allows the whole compression chamber carried by the mobile assembly to be located in the region of the cylindrical surface of the chassis for any position of this mobile assembly, resulting in a reduction of the overall length of the breaker.

[0034] It is then possible to choose any outer diameter for the thermal chamber, beneath the diameter of the inner cylindrical surface of the chassis, in order to improve the shape and dimensions of the thermal chamber with respect to the efficiency of the blast to be produced by this thermal chamber. In other words the diameters of the compression chamber and of the thermal chamber can be chosen independently.

[0035] In the prior art arrangements, it was necessary to choose between a thermal chamber having a smaller diameter than the compression chamber which required to increase the length of the breaker, and a thermal chamber having the same diameter as the compression chamber resulting in lower efficiency of the gas blast.

[0036] Generally speaking in this kind of breakers, it is of significant importance to have the ability to choose freely the dimensions of the compression chamber and of the thermal chamber since these dimensions significantly impair the efficiency of the gas blast produced during opening operation to extinguish the electric arc. Most of the time it is expected that the thermal chamber be smaller than the compression chamber and the outer diameter of the cylindrical surface of the main body is given by the size of compression chamber which is chosen.

[0037] In the invention, the outer wall of the thermal chamber and the additional cylindrical wall form a double wall surrounding the thermal chamber, and the extremity of the permanent sliding contact is applied against the outer face of the additional cylindrical wall.

Claims

1. A circuit-breaker comprising a chassis (27) having an inner cylindrical surface (30) carrying a mobile assembly (32) :

- the mobile assembly (32) being slidably movable relatively to the chassis along a longitudinal axis (AX) of its cylindrical surface (30) between an open position and a closed position ;
- the mobile assembly (32) comprising a main body (33) to delimit an annular compression chamber (34) and an annular thermal chamber (36) contiguous to the compression chamber along longitudinal axis (AX) ;
- the mobile assembly (32) comprising a cylindrical wall (40) delimiting the thermal chamber (36), the diameter of this cylindrical wall being smaller than the diameter of the cylindrical surface (30) of the chassis ;
- a sliding contact (43) fixedly secured to the chassis (27) having an extremity slidably applied radially to the mobile assembly (32) to ensure continuous electric contact between the chassis (27) and the mobile assembly (32);

characterized in that:

- the mobile assembly comprises an additional cylindrical wall (41) surrounding the cylindrical wall (40) of the thermal chamber (36), this additional cylindrical wall (41) having an outer diameter corresponding to the inner diameter of the cylindrical surface (30) of the chassis (27) ;
- the extremity of the sliding contact (43) is applied against the additional cylindrical wall (41) for all the possible positions of the mobile assembly (32) from its open position to its closed position.

2. Circuit-breaker according to claim 1 wherein the main body (33) of the mobile assembly comprises the cylindrical wall (40) of the thermal chamber (36) and the additional cylindrical wall surrounding the cylindrical wall of the thermal chamber (36) which are separate elements fixedly secured together.

3. Circuit-breaker according to claim 1 or 2, wherein the compression chamber (34) is delimited by the cylindrical surface (30) of the chassis (27).

4. Circuit breaker according to claim 1 to 3 arranged to ensure that when the circuit breaker is electrically closed the electric current passes through the additional cylindrical wall (41).

5. Circuit-breaker according to claim 1 to 4, wherein the additional wall (41) is made of a material which is different than the material of the main body (33).

6. Circuit breaker according to claim 3, comprising a piston (39) closing the compression chamber (34), and wherein this piston (39) is fixed directly to cylindrical surface (30) of the chassis (27).

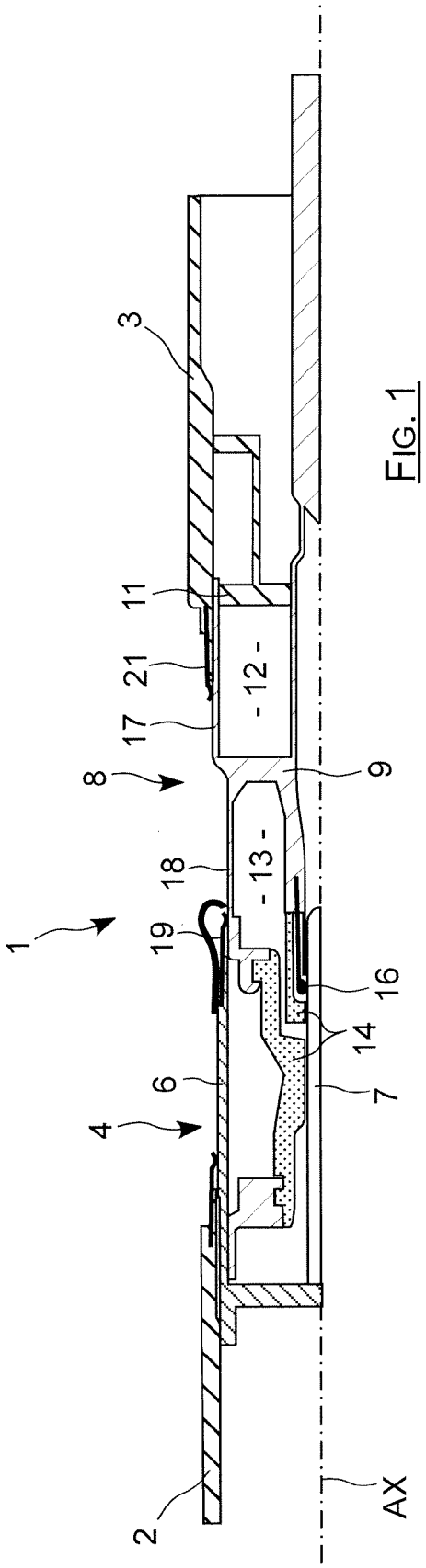
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FIG. 1

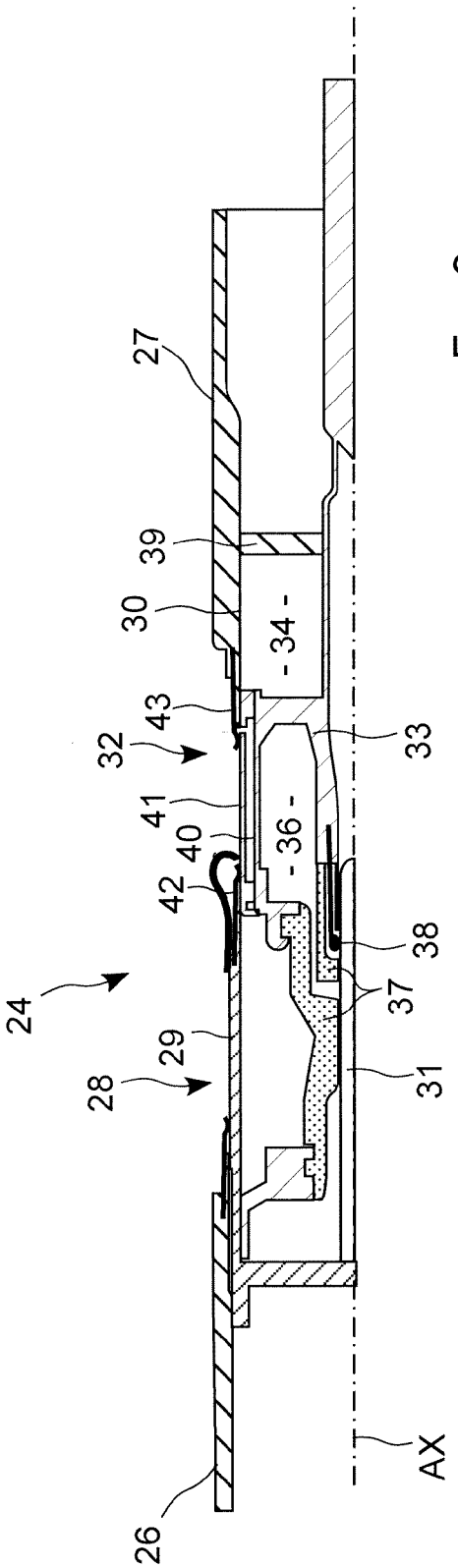
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FIG. 2

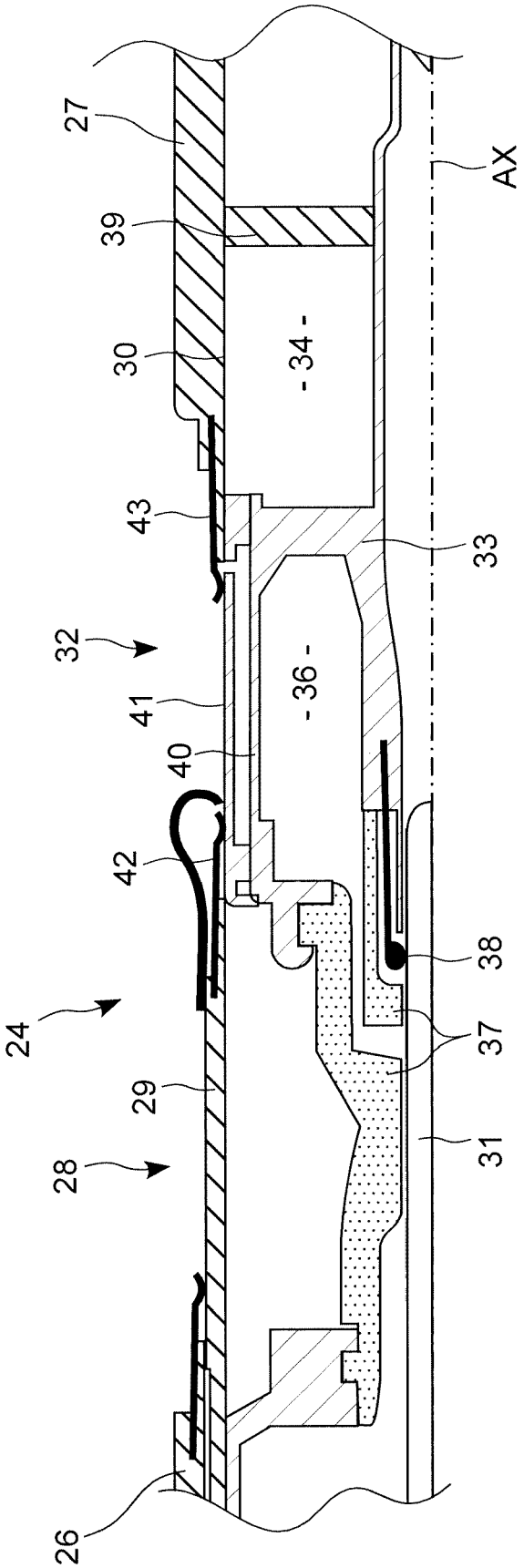
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FIG. 3

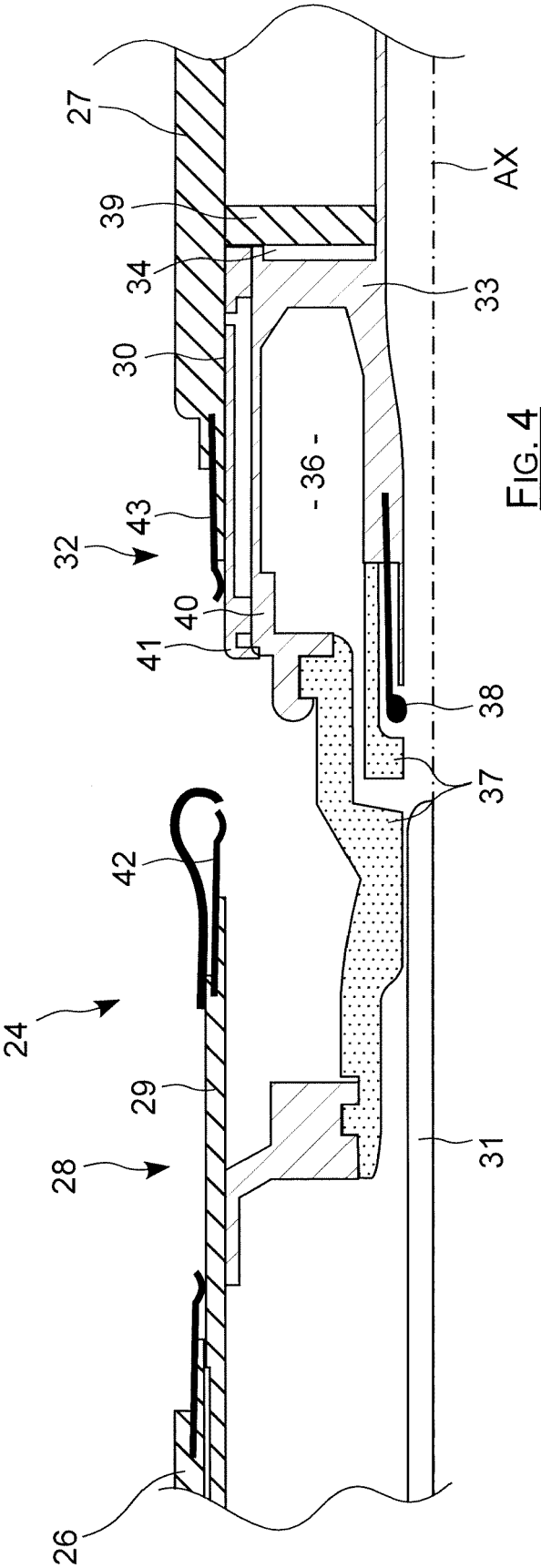
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FIG. 4

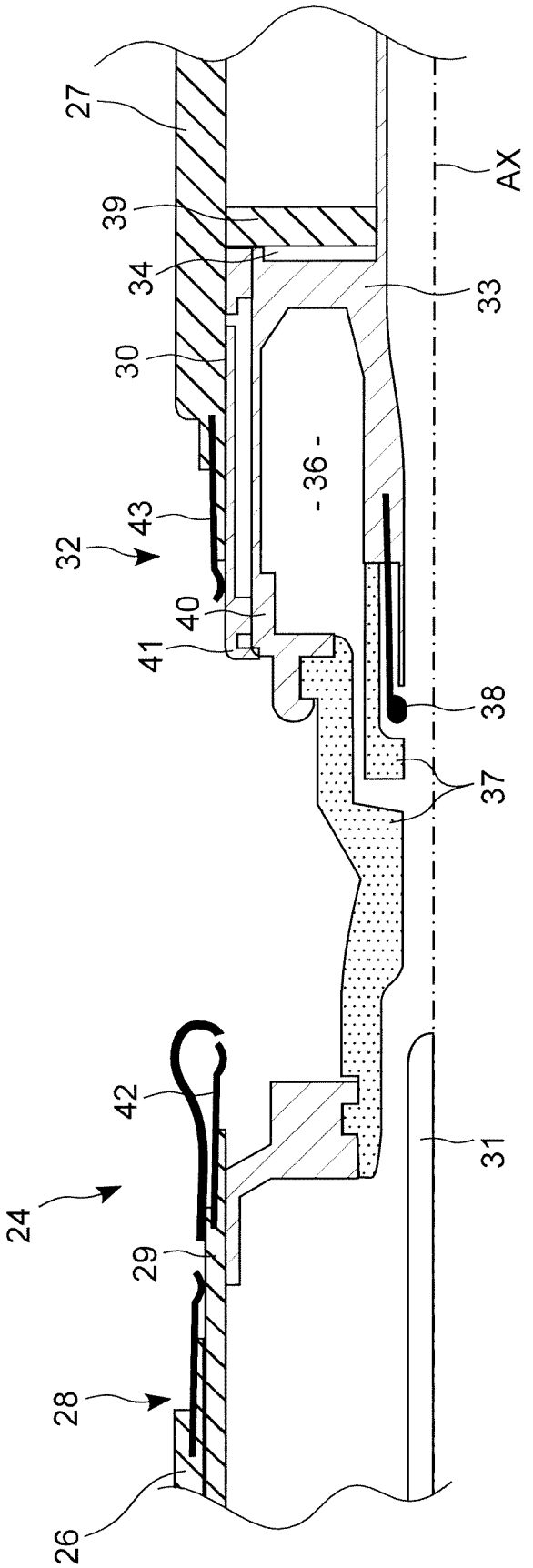

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 17 29 0009

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 450 329 A (ARIMOTO SATOMI [JP] ET AL) 22 May 1984 (1984-05-22)	1-5	INV. H01H33/90 H01H33/70
Y	* column 3, line 42 - column 4, line 10; figures 1-5 *	6	
Y	US 4 577 074 A (PHAM VAN DOAN [FR]) 18 March 1986 (1986-03-18) * column 2, line 42 - column 4, line 9; figures 1,2 *	6	

TECHNICAL FIELDS SEARCHED (IPC)

H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 May 2017	Nieto, José Miguel

CATEGORY OF CITED DOCUMENTS

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12-05-2017

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