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(54) Gas-insulated high-voltage circuit breaker

(57) The gas-insulated high-voltage circuit breaker comprises a heating volume (40) which during a breaking operation is connected with an arcing zone and which is provided for receiving pressurized arcing gases, a piston-cylinder arrangement with a movable (53) and a stationary part (54) which enclose a compression volume (51), a first flow duct (62) connecting the compression volume (51) with the heating volume (40) and an intermediate valve (60) for closing the first flow duct (62) when the gas pressure in the heating volume (40) is higher than the gas pressure in the compression volume (51).

During a breaking operation a movable unit (27) executes a stroke along an axis (A) with respect to the stationary part (54) of the piston-cylinder arrangement (50) in the course of which a mechanically pressurized insulating gas is generated in the compression volume (51), a first (21) and a second arcing (31) contact disconnect at a first value of the stroke and the second arcing contact (31) travels a second flow duct (26) extended from the arcing zone through an insulating nozzle (23, 24) to an exhaust volume.

In order to enable an increase of the pressure build-up in the heating volume (40) without increasing the energy for mechanically generating a pressure build-up in the compression volume (51) the circuit breaker further comprises a control device (70) for keeping the first flow duct (62) in the beginning of the breaking operation closed and for opening the first flow duct (62) when the stroke achieves a second value at a time in which the second arcing contact (31) starts to release the second flow duct (26).

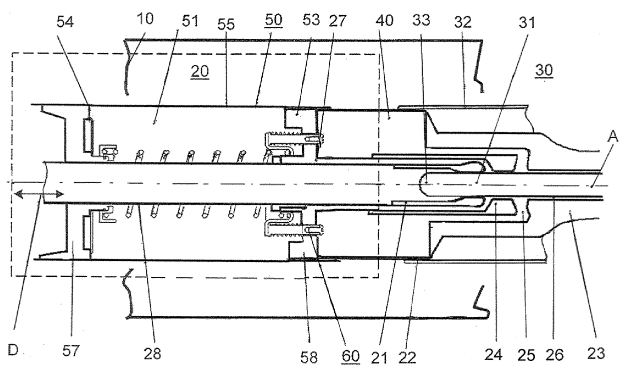

Fig.1

EP 2 816 581 A1

Description

TECHNICAL FIELD

[0001] The invention relates to a gas-insulated high-voltage circuit breaker according to the introductory part of claim 1 which is operated according to the self-blast method.

[0002] In the self-blast method the circuit breaker uses the energy of a switching arc for generating and for storing a pressurized arc extinguishing gas in a heating volume. After current-zero the arc extinguishing gas enables a hot gas clearance of a gap which is arranged between two arcing contacts and thus enables the breaking of a current to be interrupted.

[0003] A mechanically operated piston-cylinder arrangement with a movable and a stationary part which parts enclose a compression volume assists the switching arc in generating the arc extinguishing gas. Insulating gas which during the breaking operation mechanically is pressurized and stored in the compression volume enables a sufficient hot gas clearance in the gap after current zero in the case of breaking a weak current.

[0004] The heating volume and the compression volume communicate by means of a flow duct. In order to avoid an undesired high pressure in the compression volume an intermediate valve is provided which closes the flow duct when the gas pressure in the heating volume is higher than the gas pressure in the compression volume.

PRIOR ART

[0005] A circuit breaker of the afore-mentioned type is described in US 5,898,149. The described circuit breaker comprises a blowout volume which during breaking a current is connected to an arcing zone in which a switching arc then burns between two arcing contacts. A mechanically operated compression volume communicates via a flow channel with the blowout volume. A valve closes the flow channel in the event of overpressure in the blowout volume.

[0006] During a breaking process the mechanically generated pressure build-up in the compression volume is partly distributed through the valve in the blowout volume and lost through the flow to the arcing contacts.

[0007] DE 29 44 205 A1 describes a circuit breaker with a device for controlling the pressure build-up in a compression volume of a mechanically operated piston-cylinder arrangement. The control device comprises a valve having a pivotably arranged disk as movable valve member and a seat as stationary valve member. The control device further comprises a tube which is fixedly secured to the disk and which is provided with a guideway having two axially extended sections and an inclined section arranged between these two sections.

[0008] In a breaking process a stationary pin of the control device in function of the stroke of a movable arcing contact enters the inclined section of the guideway and thus causes pivoting of the disk. During pivoting openings of the disk and openings of the seat are aligned and form channels which enable pre-compressed gas to escape the compression volume at a desired stroke.

DESCRIPTION OF THE INVENTION

[0009] It is an object of the invention as described in the patent claims to specify a gas-insulated high-voltage circuit breaker of the afore-mentioned type which enables an increase of the pressure build-up in the heating volume without increasing the energy for mechanically generating the pressure build-up in the compression volume.

[0010] The invention supplies a gas-insulated high-voltage circuit breaker comprising a heating volume which during a breaking operation is connected with an arcing zone and which is provided for receiving pressurized arcing gases, a piston-cylinder arrangement with a movable part and a stationary part which enclose a compression volume, a first flow duct connecting the compression volume with the heating volume, and an intermediate valve for closing the first flow duct when the gas pressure in the heating volume is higher than the gas pressure in the compression volume.

[0011] During a breaking operation of the circuit breaker a movable unit executes a stroke along an axis with respect to the stationary part of the piston-cylinder arrangement in the course of which a mechanically pressurized insulating gas is generated in the compression volume, a first and a second arcing contact disconnect at a first value of the stroke and the second arcing contact travels a second flow duct extended from the arcing zone through an insulating nozzle to an exhaust volume.

[0012] The circuit breaker further comprises a control device for keeping the first flow duct in the beginning of the breaking operation closed and for opening the first flow duct when the stroke achieves a second value at a time in which the second arcing contact starts to release the second flow duct.

[0013] The control device keeps the first flow duct during the breaking operation closed and opens the first flow duct only at a defined stroke of the movable unit, that means at an instant in which the second arcing contact begins to release the second flow duct. At that instant the pressure in the compression volume for reason of the stroke and the pressure in the heating volume for reason of back-heating with an switching arc have achieved an optimized value. Now a heating channel is enabled to introduce pressurized insulating gas with a comparatively high pressure from the compression volume and the heating volume into the arcing zone. Thus the switching performance can be improved remarkably without increasing the mechanical energy needed for generating the pressurizing insulating gas which is required for thermally blowing the switching arc in the arcing zone and thus for interrupting a current successfully.

[0014] In a first embodiment of the circuit breaker according to the invention the control device can comprise a spring system which is arranged in the compression volume and which comprises at least two springs connected in series, the movable part of the piston-cylinder arrangement can support a first end of at least a first of the at least two springs, a stationary part of the piston-cylinder arrangement can support a first end of a second of the at least two springs, and the control device can further comprise an actuating member which is mechanically coupled with the movable valve member of the intermediate valve and which supports a second end of the first and a second end of the second spring.

[0015] The actuating member can comprise at least one first pin which is guided through the first flow duct, wherein a first end of the first pin is firmly connected with the movable valve member and a second end of the first pin comprises a head which supports the second end of the first spring.

[0016] The actuating member can further comprise a ring body resting with a first annular surface on the head and with an opposing second annular surface on the second end of the second spring.

[0017] The movable valve member can be designed as a plane annular disk and first ends of the first and of at least a second pin are fixedly secured to the plane annular disk.

[0018] In the closed position of the circuit breaker the at least first spring can be preloaded. The spring system can be adjusted such that a pre-load of the second spring compensates the pre-load of the at least first spring at the second value of the stroke.

[0019] The at least first and resp. or the second spring can be designed as a coil spring. The second spring and the actuating member can then be coaxially arranged on the movable unit.

[0020] In a second embodiment the circuit breaker according to the invention the control device can comprise a pilot valve being arranged on the outlet of the compression volume into the first flow duct and a cam control for controlling a movable valve member of the pilot valve in function of the stroke of the movable unit.

[0021] The cam control can comprise a stationary pin and a tubular cam carrier, the cam carrier can pivotably be born on the movable unit and can comprise a connection section and a tubular section which holds a first guideway, the first guideway can receive the stationary pin, and the connection section can receive a connection part of the pilot valve.

[0022] The first guideway can comprise two axially extended sections being displaced from each other in axial and in circumferential direction and a third section connecting the two axially extended sections.

[0023] The connection section can comprise an radially extended flange which can pivotably be born and hold on the outlet of the compression volume and which can comprise at least one hole being aligned with the first flow duct when during the breaking operation the stationary pin has finished travelling in the third section of the first guideway. Alternatively the connection section can comprise a second guideway which extends with an offset in circumferential and in axial direction and which receives a guidance pin integrated in the movable pilot valve member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] These and other characteristics of the invention will be clear from the following description of preferential forms, given as non-restrictive examples, with reference to the attached drawings, wherein:

Fig.1 is a longitudinal section of a first embodiment of a high-voltage circuit breaker according to the invention in the final closed position, which section is extended along an axis A,

Fig.2 an enlarged view of a bordered part of the high-voltage circuit breaker according to fig.1,

Fig.3 a part of the enlarged view according to fig.2 during a breaking operation of the high-voltage circuit breaker,

Fig.4 a longitudinal section of a second embodiment of the circuit breaker according to the invention during a breaking operation,

Fig.5 a longitudinal section of third embodiment of the circuit breaker according to the invention in the closed position,

Fig.6 the embodiment according to fig.5 during a breaking operation, and

Fig.7 a cam carrier of the embodiment according to figures 5 and 6.

DETAILD DESCRIPTION OF PREFERENTIAL EMBODIMENTS OF THE INVENTION

[0025] In the figures same reference symbols are used for identical parts and repetitive reference symbols may be omitted.

[0026] The embodiments of the high-voltage circuit breaker according to the invention shown in figures 1 to 7 comprise a tubular housing 10 which is extended along an axis A. The housing 10 receives a contact assembly with two contact members 20, 30 and is filled with an insulating gas having arc-extinguishing properties, in particular a gas on the basis of sulfur hexafluoride, nitrogen or carbon dioxide or a mixture comprising one or more of these gases. Typically the insulating gas is pressurized up to some bar, for instance five to eight bar.

[0027] The contact member 20 resp. 30 in coaxial arrangement comprises an arcing contact 21 resp. 31 and a nominal contact 22 resp. 32 which surrounds the corresponding arcing contact 21 resp. 31. The contact member 20 comprises an insulating nozzle 23 which is preferably manufactured of a polymer on the basis of a polytetrafluorethylene (PTFE) and which is kept in coaxial arrangement between the arcing contact 21 lying inside and the hollow nominal contact 22 lying outside. The contact member 20 further comprises an auxiliary insulating nozzle 24 which is supported on the free end of the tulip-shaped, hollow arcing contact 21. The auxiliary nozzle 24 encircles the free end of arcing contact 21 and together with the surrounding insulating nozzle 23 borders an annular heating channel 25. In the shown closed position of the circuit breaker the arcing contact 31 passes the insulating nozzle 23 and closes an axially extended flow duct 26 of the nozzle 23. The hollow arcing contact 21 receives a head 33 of the arcing contact 31 which is shaped as a plug.

[0028] During a breaking operation of the circuit breaker the heating channel 25 connects an arcing zone with a heating volume 40. The heating volume is connected with a cylindrically shaped compression volume 51 of a puffer device. The puffer device is designed as a piston-cylinder arrangement 50 and comprises a movable part 53 and a stationary part 54 which enclose the compression volume 51. A metallic tube 55 resp. a hollow contact carrier 28 of the arcing contact 21 border the compression volume 51 in the radial direction to the outside resp. to the inside, whereas two radially extended metallic disks 57, 58 form the two end faces of the compression volume 51 and thus border the compression volume in the axial direction.

[0029] The disk 58 separates the heating volume 40 and the compression volume 51 and functions as the piston resp. the movable part 53 of the piston-cylinder arrangement 50. The hollow arcing contact 21, the nominal contact 22, the insulating nozzle 23, the auxiliary nozzle 24, the heating channel 25, the heating volume 40 and the movable part 53, in particular the disk 58, are firmly connected as a movable unit 27 and can be moved along the axis A by means of a drive D.

[0030] The disk 57 is firmly connected to a first of two stationary current terminals of the circuit breaker and supports the metallic tube 55. The disk 57 and the metallic tube 55 function as the cylinder resp. the stationary part 54 of the piston-cylinder arrangement 50.

[0031] An intermediate valve 60 is arranged on the disk 58. As can be seen in fig.2 the intermediate valve 60 comprises a movable valve member 61 and several flow ducts 62 which penetrate the disk 58 and connect the compression volume 51 with the heating volume 40. The flow ducts 62 are distributed equally in circumferential direction in the disk 58. The movable valve member 61 is arranged in the heating volume 40 and closes the flow ducts 62 when a gas pressure in the heating volume 40 is higher than a gas pressure in the compression volume 51. A control device 70 is arranged in the compression volume 51.

[0032] In the embodiment according to figures 1 to 3 the control device 70 comprises a spring system 80 (Fig. 2) which is arranged in the compression volume 51 and which includes several small coil springs 81 and a large central coil spring 82 being extended along the tubular contact carrier 28 of the arcing contact 21. The small springs 81 are connected in parallel and in series with the large spring 82. The movable part 53 resp. the disk 58 supports first ends of the small springs 81. The stationary part 54 resp. the disk 57 supports a first end of the large central spring 82.

[0033] The control device 70 further comprises an actuating member 85 which is mechanically coupled with the movable valve member 61 of the intermediate valve 60 and which supports second ends of the small springs 81 and the second end of the large central spring 82. The actuating member 85 comprises pins 86. Each pin 86 is separately guided in one of the flow ducts 62. A first end of the pin 86 is firmly connected to the movable valve member 61 and a second end of the pin 86 comprises a head 87 which supports the second end of the small springs 81. The actuating member 85 further comprises a ring body 88 resting with a first annular surface on the heads 87 of the pins 86 and with an opposing second annular surface on the second end of the large central spring 82.

[0034] The movable valve member 61 is designed as a plane annular disk. The first ends of the pins 86, which pins are guided through the flow ducts 62 to the heating volume 40, are firmly connected to the plane annular disk.

[0035] As shown in fig.2 in the closed position of the circuit breaker the large central spring 82 is nearly not preloaded, whereas the small springs 81 are preloaded and keep the intermediate valve 60 closed. During an operation for breaking a small current the mechanical drive D moves the arcing contact 21 resp. the movable unit 27 to the left. The movable unit 27 executes a stroke with respect to the stationary part 54 of the piston-cylinder arrangement 50, during which stroke pressurized insulating gas is generated in the compression volume 51. After a disconnection of the nominal contacts 22, 32 a current to be interrupted commutates into a current path which includes the arcing contacts 21, 31. When the commutation of the current is finished, the arcing contacts 21, 31 disconnect at a first value of the stroke. At the first value of the stroke a first gas pressure dominates the compression volume. An arc is struck between the separated arcing contacts 21 and 31 which heats up and generates pressurized arcing gas in an arcing zone (not shown). When the arcing contact 31 who travels the flow duct 26 releases the heating channel 25 the hot pressurized arcing gases are guided via the heating channel 25 to the heating volume 40 which is provided for receiving and storing the pressurized arcing gases.

[0036] In order to avoid in the beginning of the arc formation a gas flow from the compression volume 51 to the heating volume 40 and to the arcing zone the intermediate valve 60 and thus also the flow ducts 62 are kept closed by means of the control device 70. The intermediate valve 60 opens only at a second value of the stroke which exceeds the first value. The gas pressure in the compression volume 51 then exceeds the afore-mentioned first gas pressure considerably.

[0037] As long as the intermediate valve 60 remains closed a comparatively high gas pressure can be built up by the energy of the drive in the compression volume 51 and by back-heating also in the heating volume 40. Since in the closed position the arcing contact 31 has entered the hollow arcing contact 21 at the first value of the stroke the insulating gas provided in the compression volume 51 is compressed to the first pressure which is higher than the pressure in the closed position. The increased preload of the small springs 81 keeps the valve 60 closed until the stroke achieves the second value. The gas pressure in the compression volume 51 then has achieved a second value which exceeds the before-defined first pressure.

[0038] As shown in fig.3 now the force of the large spring 82 is stronger than the force of the small springs 81 and forces the intermediate valve 60 to open at the higher second pressure of the pressurized insulating gas in the compression volume 51. At the same time the head 33 of the arcing contact 31 releases the flow duct 26 of the nozzle 23. Now stored gases in the arcing zone, the heating volume 40 and the compression volume 51 can pass the nozzle 23 and can blow the arc beyond current zero until the current is interrupted. The comparatively high pressures in the compression volume 51 and in the heating volume 40 are useful for a successful breaking of a low current without increasing the drive energy. A gas pressure in the compression volume 51 with a well-sized second value and thus a relative high pressure also in the heating volume 40 can be achieved if the intermediate valve 60 opens only at a time as the arcing contact 31 is going to release the flow duct 26 of the insulating nozzle 23.

[0039] Afterwards the intermediate valve 60 opens completely and remains open in the final open position of the circuit breaker. The large central spring 82 and the small springs 81 then reach their maximum preload.

[0040] In the two embodiments according to figures 4 to 7 the control device 70 comprises a pilot valve 90 which is arranged on the outlet of the compression volume 51 into the flow ducts 62.The control device 70 further comprises a cam control 100 for controlling a movable valve member 91 of the pilot valve 90 in function of the stroke of the movable unit 27.

[0041] The cam control 100 comprises a stationary pin 101 and a tubular cam carrier 102. The cam carrier 102 is pivotably born on the movable unit 27 resp. the hollow contact carrier 28 of the movable arcing contact 21 and comprises a connection section 103 and a tubular section 104 which holds a guideway 105. The guideway receives the stationary pin 101. The connection section 103 receives a connection part of the movable pilot valve member 91.

[0042] The guideway 105 is illustrated in Fig.7 and comprises two axially extended sections 105a und 105b. These two sections are displaced from each other in the axial and in the circumferential direction. A third section 105c of the guideway 105 connects the two axially extended sections 105a und 105b.

[0043] In the embodiment according to fig. 4 the connection section 103 comprises an radially extended flange 106 which is hold on the disk 58 and thus on the outlet of the compression volume 51 by means of a stop 58a. The stop 58a is arranged on the stationary disk 58 and prevents a movement of the tubular cam carrier 102 in the axial direction. The flange 106 is extended in parallel with the disk 58 and comprises a number of holes 107 which correspond the number of the flow ducts 62 and which can be aligned with the flow ducts 62 as shown in fig.4.

[0044] In the closed position of the circuit breaker according to fig.4 the stationary pin 101 is located on the left end of the section 105a of the guideway. The flange 106 has a position in which the holes 107 meet parts of the disk 58 which do not comprise an aperture of the flow duct 62. Thus the pilot valve 90 is closed and any flow of insulating gas from the compression volume 51 to the heating volume 40 is interrupted.

[0045] During an operation for breaking a small current the arcing contact 21 resp. the movable unit 27 and thus the cam carrier 102 moves to the left. At the afore-mentioned first value of the stroke of the movable unit 27 the arcing contacts 21, 31 separate and a small switching arc is drawn between the heads of the arcing contacts 21, 31. Since in the closed position the arcing contact 31 has entered the hollow arcing contact 21 at the first value of the stroke the insulating gas provided in the compression volume 51 is compressed to the first pressure which is higher than the pressure in the closed position. The pilot valve 90 remains closed until the stroke achieves a second value in which the stationary pin 101 enters the section 105c of the guideway 105. The travelling of the pin 101 in the section 105c rotates the cam carrier 102 around the axis A. The rotation angle is designed such that at the end of the rotation, that means when the stationary pin 101 enters the section 105b, the holes 107 are aligned with the flow ducts 62. The pilot valve 90 then is completely open and rather strongly precompressed insulating gas escapes the compression volume 51 and via intermediate valve 60, heating volume 40 and heating channel can enter the arcing zone and can blow the switching arc. The stationary pin 101 travels the section 105b and keeps the pilot valve 90 completely open. The pilot valve 90 remains completely open in the final open position of the circuit breaker.

[0046] In contrast to the embodiment according to fig. 4 in the embodiment according to figures 5 to 7 the connection section 103 does not comprise the flange 106 but as shown in fig.7 a guideway 108 which extends with an offset in circumferential and in axial direction and which receives a pin 92 (figures 5 and 6) integrated in the movable valve member 91 of the pilot valve 90.

[0047] In the closed position of the circuit breaker shown in fig.5 the annularly shaped movable valve member 91 closes the flow ducts 62 and prevents any gas exchange between the compression volume 51 and the heating volume 40.

[0048] During an opening operation of the circuit breaker the arcing contact 21 resp. the movable unit 27 and thus the cam carrier 102 moves to the left. The pin 92, which is arranged in the guideway 108, prevents any axial displacement of the movable valve member 91 with respect to the disk 58. Thus the pilot valve 90 remains closed as long as the stationary pin 101 travels the section 105a of the guideway 105. When the stroke of the movable unit 27 achieves the second value in which the stationary pin 101 enters the section 105c of the guideway 105 the pin 101 rotates the cam carrier 102 around the axis A. The rotation of the cam carrier 105 causes the pin 92 to move along the guideway 108 and to displace the movable valve member 91 from the disk 58 along the axis A. As shown in fig.6 thus also the pilot valve 90 according to this embodiment opens at the second gas pressure and rather strongly precompressed insulating gas escapes the compression volume 51 and via intermediate valve 90, heating volume 40 and heating channel can enter the arcing zone and can blow the switching arc. The stationary pin 101 travels the section 105b and keeps the pilot valve 90 completely open. The pilot valve 90 remains completely open in the final open position of the circuit breaker.

List of Reference Signs

[0049]

10	housing
20	contact member
21	arcing contact
22	nominal contact
23	insulating nozzle
24	auxiliary insulating nozzle
25	heating channel
26	flow duct
27	movable unit
28	tubular contact carrier of the arcing contact 21
30	contact member
31	arcing contact
32	nominal contact
33	head of the arcing contact 31
40	heating volume
50	piston-cylinder arrangement
51	compression volume
53	movable part of the piston-cylinder arrangement
54	stationary part of the piston-cylinder arrangement
55	tube
57, 58	disks
58a	stop
60	intermediate valve
61	movable valve member
62	flow ducts
70	control device
80	spring system
81	small springs
82	large spring
85	actuating member
86	pins
87	head of a pin 91
88	ring body
90	pilot valve
91	movable valve member
92	pin
100	cam control
101	stationary pin
102	cam carrier
103	connection section
104	tubular section
105	guideway
105a, 105b,105 c	sections of the guideway
106	flange
107	holes
108	guideway
A	axis
D	drive

Claims

1. A gas-insulated high-voltage circuit breaker comprising
a heating volume (40) which during a breaking operation is connected with an arcing zone and which is provided for receiving pressurized arcing gases,
a piston-cylinder arrangement (50) with a movable part (53) and a stationary part (54) which enclose a compression volume (51),
a first flow duct (62) connecting the compression volume (51) with the heating volume (40), and
an intermediate valve (60) for closing the first flow duct (62) when the gas pressure in the heating volume (40) is higher than the gas pressure in the compression volume (51),
wherein during a breaking operation a movable unit (27) executes a stroke along an axis (A) with respect to the stationary part (54) of the piston-cylinder arrangement (50) in the course of which a mechanically pressurized insulating gas is generated in the compression volume (51), a first (21) and a second arcing (31) contact disconnect at a first value of the stroke and the second arcing contact (31) travels a second flow duct (26) extended from the arcing zone through an insulating nozzle (23, 24) to an exhaust volume, **characterised in**
that the circuit breaker further comprises a control device (70) for keeping the first flow duct (62) in the

beginning of the breaking operation closed and for opening the first flow duct (62) when the stroke achieves a second value at a time in which the second arcing contact (31) starts to release the second flow duct (26).

2. The circuit breaker according to claim 1, **characterised in that** the control device (70) comprises a spring system (80) which is arranged in the compression volume (51) and which comprises at least two springs (81, 82) connected in series,
that the movable part (53) of the piston-cylinder (50) arrangement supports a first end of at least a first (81) of the at least two springs,
that a stationary part (54) of the piston-cylinder (50) arrangement supports a first end of a second (82) of the at least two springs (81, 82), and
that the control device (70) further comprises an actuating member (85) which is mechanically coupled with the movable valve member (61) of the intermediate valve (60) and which supports a second end of the first (81) and a second end of the second spring (82).

3. The circuit breaker according to claim 2, **characterised in that** the actuating member (85) comprises at least one first pin (86) which is guided through the first flow duct (62), wherein a first end of the first pin (86) is firmly connected with the movable valve member (61) and a second end of the first pin (86) comprises a head (87) which supports the second end of the first spring (81).

4. The circuit breaker according to claim 3, **characterised in that** the actuating member (85) further comprises a ring body (88) resting with a first annular surface on the head (87) and with an opposing second annular surface on the second end of the second spring (82).

5. The circuit breaker according to claim 4, in which the movable valve member (61) is designed as a plane annular disk, **characterised in that** first ends of the first (86) and of at least a second pin (86) are fixedly secured to the plane annular disk.

6. The circuit breaker according to one of claims 2 to 5, **characterised in that** in the closed position of the circuit breaker the at least first spring (81) is preloaded.

7. The circuit breaker according to claim 6, **characterised in that** the spring system (80) is adjusted such that a pre-load of the second spring (82) compensates the pre-load of the at least first spring (81) at the second value of the stroke.

8. The circuit breaker according to one of claims 2 to 7, **characterised in that** at least one of the first (81) and the second spring (82) is designed as a coil spring.

9. The circuit breaker according to claim 8, **characterised in that** the second spring (82) and the actuating member (85) are coaxially arranged on the movable unit (27).

10. The circuit breaker according to claim 1, **characterised in that** the control device (70) comprises a pilot valve (90) being arranged on an outlet of the compression volume (51) into the first flow duct (62) and a cam control (100) for controlling a movable valve member (91) of the pilot valve (90) in function of the stroke of the movable unit (27).

11. The circuit breaker according to claim 10, **characterised in that** the cam control (100) comprises a stationary pin (101) and a tubular cam carrier (102),
that the cam carrier (102) is pivotably born on the movable unit (27) and comprises a connection section (103) and a tubular section (104) which holds a first guideway (105), and
that the first guideway (105) receives the stationary pin (101) and the connection section (103) a connection part of the pilot valve (90).

12. The circuit breaker according to claim 11, **characterized in that** the first guideway (105) comprises two axially extended sections (105a, 105b) being displaced from each other in axial and in circumferential direction and a third section (105c) connecting the two axially extended sections (1 05a, 105b).

13. The circuit breaker according to claim 12, **characterized in that** the connection section comprises an radially extended flange (106) which is pivotably born and hold on the outlet of the compression volume (51) and which comprises at least a hole (107) being at least partly aligned with the first flow duct (62) when during the breaking operation the stationary pin (101) has finished travelling in the third section (1 05c) of the first guideway (105).

14. The circuit breaker according to one of claims 11 or 12, **characterized in that** the connection section comprises a second guideway (108) which extends with an offset in circumferential and in axial direction and which receives a guidance pin (92) integrated into the movable pilot valve member (91).

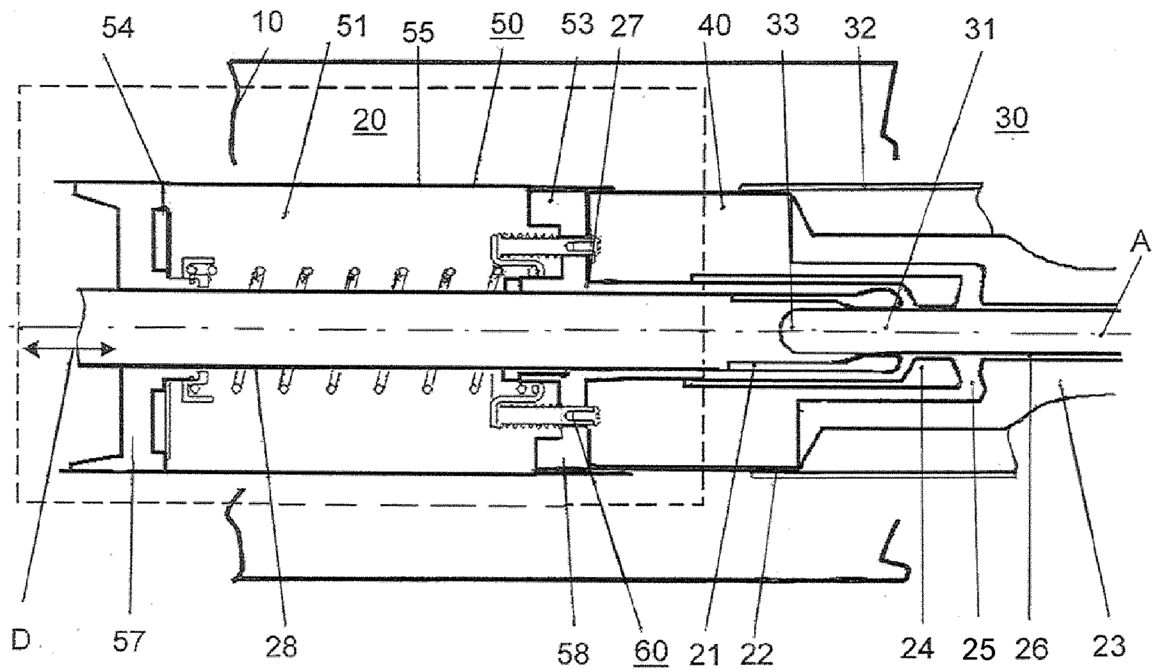
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Fig.1

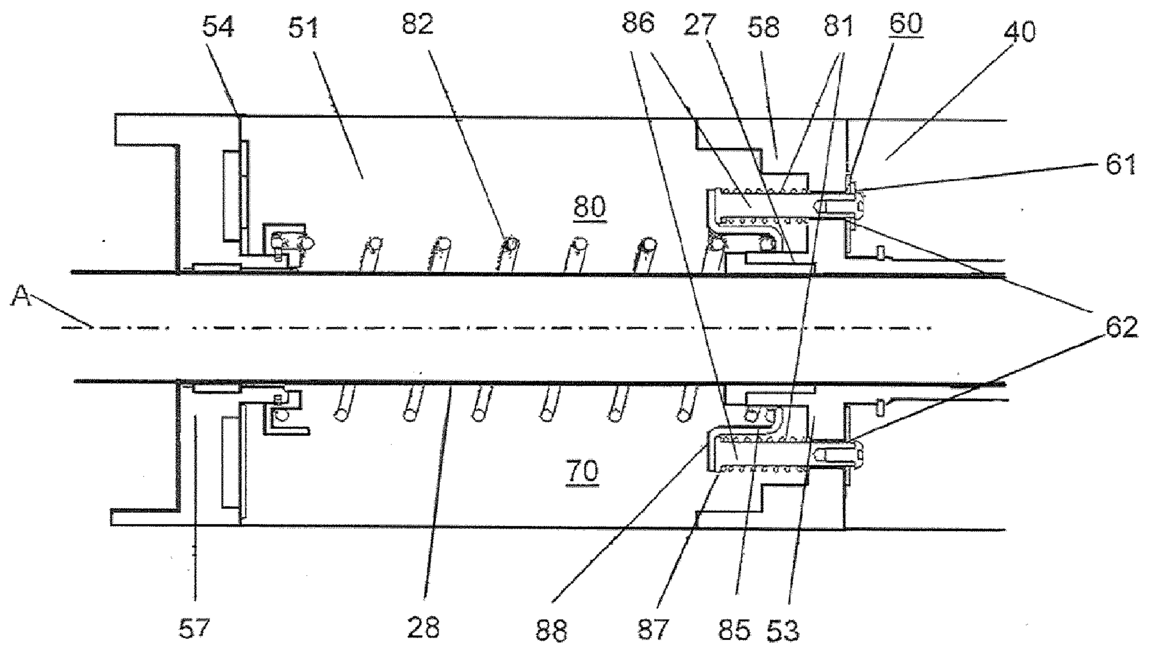
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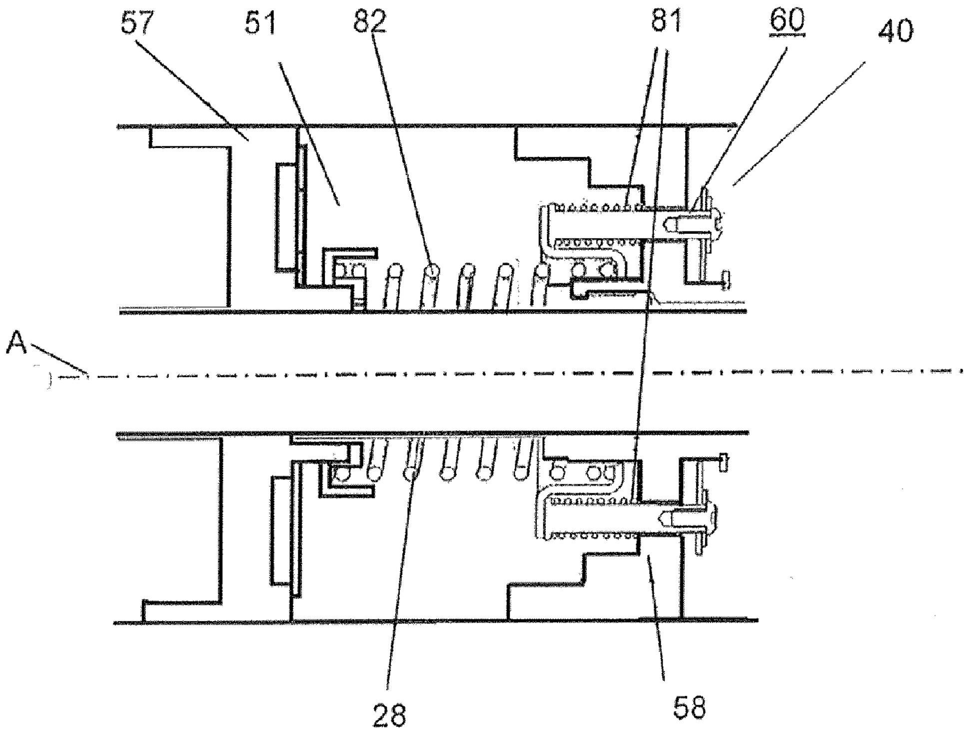
Fig.2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58

Fig.3

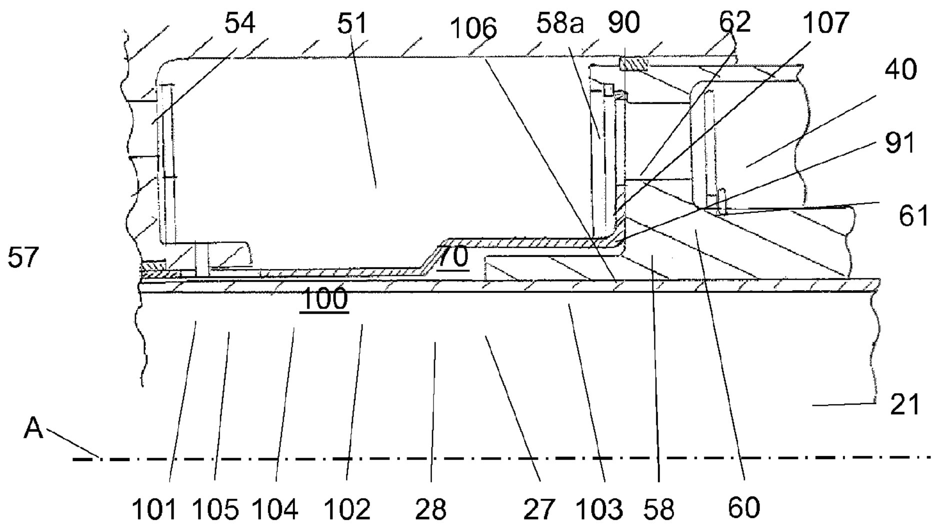
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Fig.4

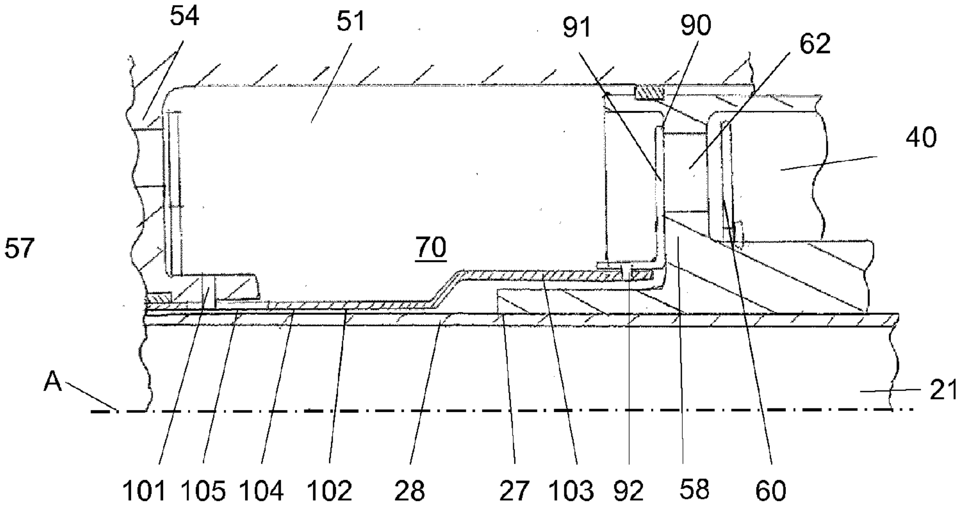

Fig.5

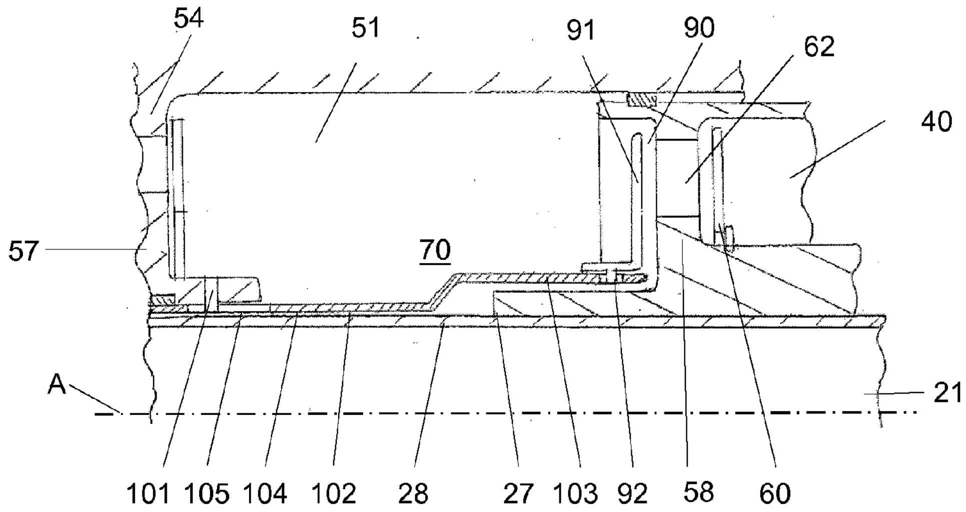

Fig.6

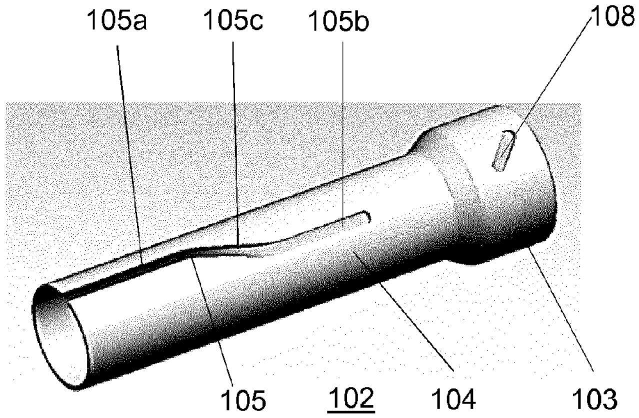

Fig.7

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EUROPEAN SEARCH REPORT

Application Number
EP 13 17 2583

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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	8 November 2013	Glaman, C

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