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(54) **Disconnecter-fitted vacuum breaker**

Vakuumschalter mit Trennschalter

Interrupteur à vide avec sectionneur

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] This invention relates to vacuum breakers which break main circuits. In particular, it concerns disconnecter-fitted vacuum breakers which are provided with disconnectors which are connected in series with the vacuum breakers, and which are fitted in insulating gas chambers.

2. Description of the Related Art

[0002] Fig. 10 shows an example of a gas-insulated switchgear in which is housed a prior art vacuum breaker together with a disconnector. Partition 51a, which divides box 51 into front and rear gas compartments, is provided vertically and slightly forward (to the left in the drawing) of the center of metal box 51 which is of hermetically sealed construction. Partition 51b, which is designed with a difference in level, is mounted in the horizontal direction on the upper part of the rear side of partition 51a. Partition 51c is also mounted vertically on the rear end of this partition 51b. Low voltage chamber 51f is constructed in front of partition 51a.

[0003] Front door 51d is provided at the front end of box 51, while rear door 51e is mounted at the rear end of box 51. Sulphur hexafluoride gas (hereafter called "insulating gas") is sealed between partition 51a and partition 51c.

[0004] At the same time, three insulated bushings 57 are provided through the ceiling between partition 51a and partition 51c. Three-phase disconnector 54A is mounted on the upper part of partition 51a with its rear side connected to insulated bushings 57 via conductor 60A. Disconnector unit 54a is mounted at the rear of disconnector 54A. Earth disconnector 54b is assembled on the upper part of this disconnector unit 54a. Beneath disconnector 54A, mechanism 55a which operates vacuum breaker 52 is provided on the front side of partition 51a and projecting through it.

[0005] The lower end of disconnector unit 54a is connected to the upper pole of vacuum breaker 52 via insulated spacer 58 which is thrust through the bottom of partition 51b. Bus chamber 64A is formed between partition 51a and partition 51c and the upper side of partition 51b. Cable chamber 64C is formed on the rear side of partition 51c.

[0006] Moreover, in bus chamber 64B, which is formed between partition 51a and partition 51c and the lower side of partition 51b, disconnector 54B, which is connected to the lower pole of vacuum breaker 52, is mounted on the lower part of partition 51a. A disconnector unit 54a and an earth disconnector unit 54b are also assembled on the rear part of this disconnector 54B. Lightning arrester 53 is provided through the bottom end

of partition 51a. This lightning arrester 53 is connected by a conductor to the front end of cable head 65 which is secured to the upper part of the rear side of partition 51c.

[0007] A pair of current transformers 56B are mounted one above the other in the center part of cable chamber 64C. High-voltage bridging polyethylene cable 64, which rises from the back of the installation surface with which metal box 51 is provided, passes through these current transformers 56B. 66 is a metal fitting for securing the cable.

[0008] In gas-insulated switchgear composed in this way, reduction of installation space has been designed by making metal box 51 smaller and by sealing insulating gas inside metal box 51 and thus increasing the dielectric strength between the electrical devices housed inside it and any earthed metal, between one electrical device and another, and between electrical devices and conductors.

[0009] However, with gas-insulated switchgear, even further size-reduction is required in order to make transport and installation easier and to reduce installation space. Also, constructing the internally housed vacuum breakers, etc., vertically with multiple devices and multiple stages has been examined.

[0010] However, in prior art disconnector-fitted vacuum breakers, as shown in Fig. 10, these component parts are arranged vertically. Thus, there is the limitation that only one vacuum breaker and disconnector set can be housed in a box. This is a drawback in achieving practical use of the above multiple stage stacked type gas-insulated switchgear. Document EP 0070 794 discloses a device according to the preamble of claim 1.

SUMMARY OF THE INVENTION

[0011] Therefore, the aim of this invention is to provide a disconnector-fitted vacuum breaker assembly which can be housed in multiple stages vertically in boxes and can lead to the designing of smaller-sized main distribution equipment by arranging a set of vacuum breakers and disconnectors in the horizontal plane and enabling it to perform the respective switching operation.

[0012] Accordingly the present invention provides a disconnector-fitted vacuum breaker comprising an insulating gas chamber housing a vacuum breaker which breaks a main circuit and a disconnector fitted in series with said vacuum breaker;

characterised in that said vacuum breaker comprises multiple vacuum bulbs, horizontally mounted on a slidably movable insulating frame, each vacuum bulb having one movable conductive shaft and one fixed conductive shaft,

and also characterised in that said disconnector comprises first main disconnector units mounted on each fixed conductive shaft, and fixed side contacts mounted on the wall of the insulating chamber via a

mounting plate,

whereby said vacuum bulbs are switched by sliding the movable shaft and the disconnecter is switched by linear motion of the insulating frame.

[0013] Preferable the vacuum breaker further comprises second main disconnecter units connected to the movable conductive shafts of said vacuum bulbs.

[0014] Preferably, the insulating frame is driven by sliding rods and the movable shaft is driven by operating rods, the rods passing through airtight shaft bearing sleeves fitted in a mounting plate.

[0015] Preferably, the insulating frame comprises a backplate having a pair of rearwardly extending connector members connected to one set of sliding rods, an upwardly extending portion connected to another set of sliding rods, and a pair of forwardly extending flanges forming a housing for the vacuum bulbs.

[0016] The vacuum breaker may also comprise :

an earth terminal which projects from the conductor connected to the movable conductive shafts of the vacuum bulbs, and a manual earth operating rod, which causes connection to an disconnection from the earth terminal by driving a blade supported on the mounting plate, being passed through the mounting plate and the mechanism frame.

[0017] A main circuit disconnecter may be provided on the rear end of the insulating frame which houses the vacuum bulbs and, at the same time, the vacuum bulb operating drive mechanism and the disconnecter operating mechanism are assembled together in the mechanism frame. Thus, it is possible to operate respectively the vacuum bulbs and the disconnecter.

[0018] A second main circuit disconnecter may be provided which is secured to the movable side of the conductive shafts of the vacuum bulbs;

a mechanism frame, which is pierced by the other ends of driving rods, of each of which one end is secured to the said mounting plate, and which is secured to the other sides of the said sliding rods;

disconnecter unit drive mechanisms which are housed in this mechanism frame and which engage with the other ends of the driving rods, and cause the sliding rods and the insulating frame to move forwards and backwards via the mechanism frame

and

operating unit drive mechanisms which are housed in the mechanism frame and switch the vacuum bulbs by driving the movable shafts of the vacuum bulbs via operating rods which pass through the mounting plate.

[0019] Also, the disconnecter-fitted vacuum breaker may have the characteristic of the sliding rods and the operating rods passing hermetically through airtight shaft bearing sleeves which are hermetically passed through the mounting plate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Fig.1 is a front elevation showing an actual configuration of a disconnecter-fitted vacuum breaker of this invention.

[0021] Fig. 2is an enlarged cross-section of Fig.1 at A - A.

[0022] Fig.3is an enlarged cross-section of Fig.1 at B - B(Note: Between phases).

[0023] Fig.4is an enlarged cross-section of Fig.1 at C - C(Note: In the center of the phase).

[0024] Fig. 5is an enlarged cross-section of Fig.1 at D - D.

[0025] Fig. 6is a partial enlarged detailed drawings showing the main parts of a disconnecter-fitted vacuum breaker of this invention. (a) is a front elevation, (b) is a plan and (c) is a right side elevation.

[0026] Fig. 7is a partial enlarged detailed drawing showing part of a component of a disconnecter-fitted vacuum breaker of this invention.

[0027] Fig. 8is a partial enlarged oblique drawing showing part of a component of a disconnecter-fitted vacuum breaker of this invention.

[0028] Fig.9is a cross-section showing a second actual configuration of the disconnecter-fitted vacuum breaker of this invention.

[0029] Fig. 10is a drawing showing an example of a prior art disconnecter-fitted vacuum breaker and the gas-insulated metal enclosed type switchgear in which this disconnecter-fitted vacuum breaker is housed.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0030] The following is an explanation of an actual configuration of a disconnecter-fitted vacuum breaker of this invention with reference to the drawings.

[0031] In Fig.1 ~Fig.5, the vacuum bulbs are shown in the open state, the main circuit disconnecter unit in the open state except in Fig.4, and the earth disconnecter unit in the closed state except in Fig. 4. They are shown housed in an insulated metal enclosed type switchgear box.

[0032] In Fig.1 ~ Fig.5, the disconnecter-fitted vacuum breaker is mounted on rectangular mounting plate 3 which is the base for this assembled disconnecter-fitted vacuum breaker. Mounting plate 3 is hermetically mounted on partition 18A (shown in Fig.2 ~Fig.5) of the front end of an insulating gas chamber provided in an insulated metal enclosed type switchgear box (not illustrated) via O-ring 3a which is inserted into an O-ring channel formed on the outer periphery of the rear face of mounting plate 3.

[0033] Behind mounting plate 3, the high voltage parts which compose the breaker units, such as insulating frame 13 in which three vacuum bulbs 1 are assembled horizontally, are assembled as described later. In front of mounting plate 3, the operating mechanism parts

which operate the breaker unit are assembled in mechanism frame 4 as explained below. Shafts which support mechanism frame 4 and shafts which switch the vacuum bulbs, etc., are provided between mounting plate 3 and mechanism frame 4, these shafts are hermetically passed through the mounting plate 3, as described below.

[0034] In the meanwhile, as shown in Fig.1 ~ Fig. 3, supporting frame 10 is secured on the left side of the center front of mechanism frame 4. Speed reducer-fitted first motor 2, which closes and opens the main circuit disconnecter units described below, is mounted on the left side of supporting frame 10. Driving screw gear 23A is press-fitted on the output shaft of motor 2 with the aid of a key which is not illustrated.

[0035] Supporting frames 11 are secured to both the top and the bottom of mechanism frame 4, as shown in Fig.1 and Fig.3. Driving shaft 7 is passed vertically through supporting frame 10 and supporting frames 11. The center part of driving shaft 7 is supported via thrust bearings which are inserted in the top and bottom of supporting frame 10. Its top and bottom are supported via radial bearings inserted in the tops and bottoms of supporting frames 11.

[0036] Screw gear 23B, which is of slightly larger diameter than and engages with driving screw gear 23A, is press-fitted on the center part of driving shaft 7 with the aid of a key. Small diameter screw gears 23C are press-fitted on both the top and bottom ends of driving shaft 7 with the aid of keys.

[0037] Fixed rods 21, shown in Fig. 1, Fig.2 and Fig. 3 are passed in the fore and aft direction through top and bottom supporting frames 11. The central parts of these fixed rods 21 pass through through-holes (shown in Fig. 3) formed in mechanism frame 4, and their rear ends are secured to mounting plate 3.

[0038] Large-diameter screw gears 23D are supported so that they are free to rotate on the center parts of fixed rods 21 by bearings in a state in which movement in the axial direction is restricted. The left sides of screw gears 23D (shown in Fig. 1) engage with the above-mentioned screw gears 23C.

[0039] A second motor (not illustrated), for the drive which switches the vacuum bulbs, is mounted in mechanism frame 4 via a supporting frame in a position above motor 2 in Fig. 1. Main shaft 30, for driving the vacuum bulbs and shown in Fig.4, is provided transversely in the lower part of mechanism frame 4. Main shaft 30 is supported via bearings (not illustrated) which are secured to the left and right of mechanism frame 4.

[0040] A screw gear (not illustrated) is press-fitted to the central part of main shaft 30. This driving screw gear engages with the screw gear at the bottom end of a transmission shaft which is provided vertically in mechanism frame 4. A screw gear is also press-fitted to the top end of this transmission shaft, and this screw gear engages with a driving screw gear press-fitted to the output shaft of the above-mentioned second motor.

[0041] The lower ends of levers 31 for each phase are secured via pins 33 to main shaft 30 in positions corresponding to couplings 28 shown in Fig4.

[0042] On the left and right of the center upper part of mechanism frame 4, the front ends of two long sliding rods 20A, shown in Fig. 1, Fig.2 and Fig.3, are inserted from the rear and secured with nuts. Below these sliding rods 20A also, the front ends of two short sliding rods 20B are inserted in symmetrical positions and secured with nuts.

[0043] These sliding rods 20A and 20B pass through almost cylindrical airtight bearing sleeves 22A which are inserted from behind mounting plate 3. In airtight bearing sleeves 22A, three seals (not illustrated) are inserted on their inner peripheries, and O-rings (not illustrated) are inserted in O-ring channels on their outer peripheries. Airtight bearing sleeves 22A are secured to mounting plate 3 by keep plates (not illustrated) which hold down flanges formed on their center parts.

[0044] In the meanwhile, the rear ends of upper long sliding rods 20A pass through mounting holes 13f in trapezoidal securing part 13b formed on the upper part of insulating frame 13, shown in Fig.6, which is provided on the rear of mounting plate 3, and are secured from behind by screwed nuts.

[0045] On the other hand, the rear ends of lower side short sliding rods 20B pass through mounting holes in the center parts of fixed rods 19, shown in Fig. 3, at the front ends of trapezoidal divided parts 13c which project on the left and right in front of insulating frame 13, and are secured from behind by screwed nuts.

[0046] Insulating frame 13 is produced by injection-moulding epoxy resin. Rectangular bulb housing plates 13a1 and 13a2, which form groove 13d which houses vacuum bulb 1, project horizontally on the rear of securing part 13b.

[0047] A pair of divided parts 13c are formed vertically on the lower part of the front face of securing part 13b. Also, through-hole 13e, through which vacuum bulb movable conductive shaft 1a passes, is formed in the lower part of securing part 13b.

[0048] A pair of metal fillers 13g1 are buried vertically at the front end of each divided parts 13c. 3 sets of metal fillers 13g2 are also buried at the rear ends of vacuum bulb housing plates 13a1 and 13a2.

[0049] Countersunk holes are formed in the front faces of the top and bottom ends of fixed rods 19. Bolts are inserted in these countersunk holes, and rods 19 are secured to divided parts 13c by screwing these bolts into metal fillers 13g1 buried at the top and bottom of divided parts 13c of insulating frame 13.

[0050] A compression coil spring 35 is loosely fitted in each above-mentioned coupling 28 in Fig. 4. The front end of a sliding coupling 26 is linked via a pin 26a to the rear end of each coupling 28. The rear part of this sliding coupling 26 passes through airtight bearing sleeve 22A, which is inserted from the front of mounting plate 3, and is secured to the front end of insulated operating rod 25

behind this. Airtight bearing sleeve 22A passes from front to rear through rectangular hole 4a, shown in Fig. 1 and Fig.4, formed in mechanism frame 4.

[0051] The rear end of insulated operating rod 25 is secured to the front end of large diameter connecting copper rod 5. The rear end of connecting copper rod 5 is connected to the front end of movable conductive shaft 1a of vacuum bulb 1 which is housed in groove 13d formed on the back of insulating frame 13.

[0052] Strip-shaped supporting plate 27, shown in Fig. 7, is spliced transversely to the rear face of mounting plate 3. Its top and bottom are secured to mounting plate 3 by eight bolts (not illustrated) which are inserted from the back side of securing holes 27a of supporting plate 27. The loosely-fitting holes shown in Fig.3 and Fig.4 are formed in supporting plate 27 below motor 2 shown in Fig.1 in the positions of the five airtight bearing sleeves 22A. Also, countersunk holes 27b are formed in supporting plate 27 from its front side, and grooved parts 27c are formed to the left and right of its center.

[0053] Insulated supporting base 32, which is formed in a U-shape as shown in the oblique view in Fig.8, is spliced to the rear face of supporting plate 27. Insulated supporting base 32 is secured to supporting plate 27 by bolts (not illustrated) inserted from countersunk holes 27b formed in supporting plate 27. Each above-mentioned insulated operating rod 25 fits loosely in the center of an insulated supporting base 32.

[0054] Insulated supporting base 32 is formed by a rectangular base part 32a and supporting columns 32b which project from each corner of the back face of base part 32a. Meanwhile, circular through-hole 32c is formed in the center of base part 32a. Metal fillers 32d are buried in each corner of the front face of base part 32a and in the rear end of each supporting column 32b.

[0055] Movable side conductor 6A is provided as shown in Fig. 4 on the rear face of insulated supporting base 32. Movable side conductor 6A is secured by bolts inserted in metal fillers 32d in the rear ends of insulated supporting base 32 from countersunk holes formed in its rear face. A through-hole in which connecting copper rod 5 loosely fits is provided in movable side conductor 6A. Contact piece 6a, produced by press-punching from beryllium-copper, is installed in a groove (not illustrated) formed on the inner periphery of this through-hole. Connecting copper rod 5, while free to slide in the axial direction, is thus electrically connected to movable side conductor 6A by the contact pressure due to the elastic reciprocal force of contact piece 6a.

[0056] The lower end of belt-shaped copper strip 12 is connected, as shown in Fig.4, to the upper part of the front face of movable side conductor 6A. The rear end of insulating rod 16, in which metal fillers are secured to both ends, is secured to the front side of the upper end of copper strip 12. The front end of insulating rod 16 is secured to the upper part of mounting plate 3.

[0057] On the upper part of the rear face of copper strip 12, contact 14, for the main circuit disconnecter, is

secured to the rear end of support 12a which projects from the rear face of copper strip 12. Copper strip 15 normally engages with the rear part of contact 14. On the upper part of copper strip 15, support insulator 29, shown by single-dot chain lines, is shown in the state in which its top is mounted on mounting metal fitting 18C of the metal box.

[0058] Fixed side conductor 6B is provided, as shown in Fig.2, Fig.3, Fig.4 and Fig.5, on the rear faces of vacuum bulb housing plates 13a1 and 13a2 which are formed at the top and bottom of the back of insulating frame 13. Fixed side conductor 6B is secured by bolts to metal fillers 13g2 buried in the rear ends of insulating frame 13. Fixed side conductor 6B is connected to fixed side conductive shaft 1b of vacuum bulb 1. Disconnecter movable side contact base 8 is secured to its rear face. Multiple movable side contact pieces 8a project in a ring-shape on the back of movable side contact base 8.

[0059] Behind movable side contact pieces 8a, insulating spacer 9, which is secured to the front of mounting plate 18B of the metal box which houses this disconnecter-fitted vacuum breaker, and fixed side contact 9a, which is provided through insulating spacer 9, are shown by chain lines.

[0060] Small airtight bearing sleeve 22B is press-fitted and secured in the front of mounting plate 3 slightly above the center of the left end, as shown in Fig.1 and Fig.5. Manual shaft 38 is provided through airtight bearing sleeve 22B. Tab 38a is press-fitted on the front end of manual shaft 38 with the aid of a key (shown by broken lines). Small diameter bevel gear 24A is press-fitted with the aid of a key (not illustrated) on the rear end of manual shaft 38.

[0061] Supporting plate 39a, which is formed in a L-shape as shown in Fig.2, is provided on the left side of bevel gear 24A. Its front end is secured to the rear face of mounting plate 3. Supporting plates 39a are mounted symmetrically, as shown by the broken lines in Fig.1 and the solid lines in Fig.2, on both the left side and the right side of the center part of mounting plate 3.

[0062] As shown by the broken lines in Fig.1 and the cross-section in Fig.5, main earthing shaft 39 passes through these supporting plates 39a via bearings (not illustrated). Large diameter bevel gear 24B is press-fitted to the left end of main earthing shaft 39 with the aid of a key which is not illustrated. As shown in Fig.2, bevel gear 24B engages with the above-mentioned small diameter bevel gear 24A.

[0063] The base ends of a pair of earthing blades 17, shown in Fig.2 as L-shaped and in Fig.4 and Fig.5 as rectangular, are secured to main earthing shaft 39. The tips of earthing blades 17 face the lower ends of earthing terminal plate 40 which is brazed to the lower front face of copper strip 12.

[0064] Main earthing shaft 39 is connected via an earth conductor which is not illustrated to an earth bus provided transversely in the bottom of the metal box.

[0065] The following is an explanation of the operation

of a disconnecter-fitted vacuum breaker constructed in this way and assembled in the metal box of gas-insulated metal enclosed type switchgear.

[0066] The switching of vacuum bulb 1 is performed by the forward and reverse rotation of the second motor (not illustrated) which is mounted on the upper left side of mechanism frame 4. That is to say, it is closed by movable conductive shaft 1a traveling backward when main shaft 30 shown in Fig.4 is driven clockwise, and it is opened by movable conductive shaft 1a traveling forward when main shaft 30 is driven anticlockwise.

[0067] At the same time, making and breaking contact between movable side contact pieces 8a and fixed side contact 9a of the main circuit disconnecter is performed by the forward and reverse rotation of first motor 2.

[0068] That is to say, when small diameter driving screw gear 23A, shown in Fig.1, Fig.2 and Fig.3, is driven by the forward rotational drive of motor 2, drive shaft 7 is driven via large diameter screw gear 23B which is engaged with driving screw gear 23A.

[0069] When screw gears 23C on its upper and lower ends rotate in accompaniment with the rotation of drive shaft 7, large diameter screw gears 23D, which are engaged with screw gears 23C, rotate, thus drive the screw gears 23D in the axial direction in Fig.3. Fixed rods 21 shown in Fig.1 and Fig.3, which are inserted so that screw gears 23D are free to be rotated, are driven forward when closing operation, and mechanism frame 4 moves backward by reaction.

[0070] Thus, sliding rods 20A and 20B, which are secured to the front end of mechanism frame 4, are simultaneously pushed backward. At the same time, insulating frame 13, which is secured to the rear ends of sliding rods 20A and 20B, is driven backward. When the rear end surface of mechanism frame 4 makes contact with mounting plate 3, movable side contact pieces 8a fully engage with fixed side contact 9a, as shown in Fig. 4.

[0071] For the opening of a main circuit disconnecter unit which has been closed, revolutions and drives in the reverse direction to all the above closing operations are brought about by the reverse rotational drive of motor 2.

[0072] In this closing and opening operation, the two sets of sliding rods 20A and 20B move in a state in which airtightness is maintained by airtight bearing sleeves 22A. Thus, any flow of insulating gas or air into or out of the main circuit side and the operating mechanism side is prevented.

[0073] When earthing the main circuit side, tab 38a of manual shaft 38 is grasped and rotated. Thus, the driving of earthing blades 17 so that they swing in the direction of the arrow sign in Fig. 4 is performed via main earthing shaft 39, etc.

[0074] However, in a disconnecter-fitted vacuum breaker constructed in this way, the opening operation of movable side contact pieces 8a, which are closed to fixed side contact 9a by the above operation, is performed on condition that vacuum bulb 1 of this vacuum

breaker is opened.

[0075] For that reason, a mechanical interlock which is not illustrated is provided between the drive mechanism which operates vacuum bulb 1 and the drive mechanism which drives the whole of mechanism frame 4. However, in a disconnecter-fitted vacuum breaker constructed in this way, the disconnecter unit and the drive unit which drives this disconnecter unit are assembled as one on mounting plate 3 and in mechanism frame 4. Therefore, the design and assembly of the interlock will not depend on the specifications of the metal box, there is no need to adjust in assembly time, and it is possible to reduce the size of the external configuration of the operating mechanism unit.

[0076] At the same time, the main circuit disconnecter unit composed by movable side contact pieces 8a and movable side contact base 8 is connected or broken by linear motion forwards and backwards. Therefore, its composition is simple and it is possible to reduce the size of its external configuration.

[0077] Also, vacuum bulb housing plates 13a1 and 13a2 of insulating frame 13, which become the supporting members for the main circuit disconnecter unit, become insulating partitions above and below vacuum bulb 1, which is housed horizontally. Therefore, shortening of the insulating gap between members of different potentials positioned above and below the vacuum bulb is possible.

[0078] Furthermore, copper strip 12 is arranged at a right angle to the axial line of vacuum bulb 1, avoiding other copper strips, etc., inside the metal box in which this disconnecter-fitted vacuum breaker is housed. Therefore, the degree of freedom in positioning other devices and copper strips inside the metal box can be increased.

[0079] Consequently, the space for housing a disconnecter-fitted vacuum breaker which includes this interlock can be greatly reduced when compared with the space inside gas-insulated switchgear taken up by both the vacuum breaker and the disconnecter previously described in Fig.10. It can be housed in multiple stages vertically in relation to the inside of the box. Therefore, the floor area for installing gas-insulated metal enclosed type switchgear can be reduced. Also, in the case of providing insulated bushings in the sides of the box, which are passed through the box, connection work between boxes becomes easier. Therefore, in particular, in cases such as installation in the low-ceilinged underground switch rooms of large buildings in cities, the requirements of the users can be met.

[0080] Next, Fig.9 is a vertical cross-section showing a second actual configuration of this invention. This drawing corresponds to Fig.4 which shows the first actual configuration.

[0081] In Fig.9, the points which differ from Fig.4 are that the structure of contact 14 of the main circuit disconnecter above vacuum bulb 1 is composed of the same components as movable side contact base 8 and

movable side contact pieces 8a of the vacuum bulb side, and that this contact can make and break contact with copper strip 15 at the same time as movable side contact pieces 8a. The remainder is identical to Fig.4. Consequently, components which are the same as in Fig.4 have been given the same symbols and their descriptions have been omitted.

[0082] That is to say, the front end of insulating pedestal 33 which is formed roughly in a Z-shape is secured to the central part of the top end rear face of mounting part 13b which projects from the top of insulating frame 13. The bottom of supporting metal fitting 34 which is formed in a U-shape in plan view (not illustrated) is secured to the rear end face of insulating pedestal 33.

[0083] At the same time, the brazed part of the front end of flexible conductor 35, which is formed in a rough U-shape, is secured to the back of the upper end of copper strip 12. The brazed part of the rear end of flexible conductor 35 is secured to the back face of supporting metal fitting 34.

[0084] Flexible conductor 35 is a laminate of thin soft copper plates bent in a U-shape, with end plates laminated on the outsides of both ends, while both ends are brazed.

[0085] Movable side contact base 36 and movable side contact pieces 36a, made of identical components to those in movable side contact base 8 and movable side contact pieces 8a, are secured to the end face of the rear side of flexible conductor 35.

[0086] Copper strip 15B is shown arranged on the gas-insulated metal enclosed type switchgear box, on the lower end of insulator 29.

[0087] When using this actual configuration, there is the advantage of making combined use of the movable parts of the power source side main circuit disconnecter unit behind the vacuum bulb side and the upper load side main circuit disconnecter unit.

[0088] An insulating frame which houses multiple vacuum bulbs horizontally is secured on the one side of multiple sliding rods which are passed through from one side of a mounting plate. Main circuit disconnecter units which are connected to the fixed side conductive shafts of the vacuum bulbs are secured to the rear end of this insulating frame. A mechanism frame, through which passes the other side of a driving rod of which one side is secured to the mounting plate, is secured to the other sides of the sliding rods. A disconnecter unit drive mechanism, which causes the sliding rods and the insulating frame to move forwards and backwards via the other side of the driving rod and the mechanism frame, is housed in the mechanism frame. An operating unit drive mechanism, which drives the movable shafts of the vacuum bulbs via an operating rod which is passed through the mounting plate and thus opens and closes the vacuum bulbs, is housed in the mechanism frame. By these means, the vacuum bulb operating unit drive mechanism and the disconnecter unit drive mechanism are assembled as one in the mechanism frame. Also, the vac-

uum bulbs are arranged horizontally. Therefore, multiple disconnecter-fitted vacuum breakers can be housed in multiple stages vertically in metal boxes. Thus, it is possible to obtain disconnecter-fitted vacuum breakers which will enable size reduction of main distribution equipment.

[0089] An insulating frame which houses multiple vacuum bulbs horizontally is secured on the one sides of multiple sliding rods which are passed through from one side to the other of a mounting plate. First main circuit disconnecter units which are connected to the fixed side conductive shafts of the vacuum bulbs are secured to the rear end of this insulating frame. Second main circuit disconnecter units are provided which are secured to the insulating frame and are connected to the movable side conductive shafts of the vacuum bulbs. A mechanism frame, through which passes the other side of a driving rod of which one side is secured to the mounting plate, is secured to the other sides of the sliding rods. A disconnecter unit drive mechanism, which causes the sliding rods and the insulating frame to move forwards and backwards via the other side of the driving rod and the mechanism frame, is housed in the mechanism frame. An operating rod drive mechanism, which drives the movable shafts of the vacuum bulbs via an operating rod which is passed through the mounting plate and thus opens and closes the vacuum bulbs, is housed in the mechanism frame. Therefore, multiple disconnecter-fitted vacuum breakers can be housed in multiple stages vertically in metal boxes. Thus, it is possible to obtain disconnecter-fitted vacuum breakers which will enable size reduction of main distribution equipment. At the same time, it is possible to obtain disconnecter-fitted vacuum breakers which will enable simultaneous closing and opening of the power source side and load side circuits of vacuum bulbs.

Claims

1. A disconnecter-fitted vacuum breaker comprising an insulating gas chamber housing a vacuum breaker which breaks a main circuit, and also housing a disconnecter fitted in series with said vacuum breaker;

characterised in that said vacuum breaker comprises multiple vacuum bulbs (1), horizontally mounted on a slidably movable insulating frame (13), each vacuum bulb (1) having one movable conductive shaft (1a) and one fixed conductive shaft (1b),

and in that said disconnecter comprises first main disconnecter units (8, 8a) mounted on each fixed conductive shaft(1b), and fixed side contacts (9a) mounted on the wall of the insulating chamber via a mounting plate (18b), whereby said vacuum bulbs (1) are switched by sliding the movable shaft (1 a) and the disconnecter is switched by linear mo-

tion of the insulating frame.

2. A disconnecter-fitted vacuum breaker as claimed in claim 1 further comprising second main disconnecter units connected to the movable conductive shafts (1a) of said vacuum bulbs.
3. A disconnecter-fitted vacuum breaker according to claim 1 or claim 2 in which the insulating frame is driven by sliding rods (20a, 20b) and the movable shaft is driven by operating rods (26), the rods passing through airtight shaft bearing sleeves (22a) fitted in a mounting plate (3).
4. A disconnecter-fitted vacuum breaker according to any one of claims 1 to 3 in which the insulating frame comprises a backplate (3b, 13b) having a pair of rearwardly extending connector members (13c) connected to one set of sliding rods (20b), an upwardly extending portion (13b) connected to another set of sliding rods (20a), and a pair of forwardly extending flanges (13a1, 13a2) forming a housing for the vacuum bulbs.

Patentansprüche

1. Vakuumschalter mit Trennschalter, umfassend eine Isolationsgaskammer, in der ein Trennschalter untergebracht ist, der einen Hauptschaltkreis trennt und die einen Vakuumschalter aufnimmt, der in Reihe angeordnet mit dem Vakuumschalter verbunden ist;
dadurch gekennzeichnet, daß der Vakuumschalter eine Vielzahl Vakuumkolben (1) umfaßt, die horizontal an einem gleitverschieblichen Isolationsgestell (13) befestigt sind, wobei jeder Vakuumkolben (1) eine bewegliche leitfähige Welle (1a) und eine ortsfeste leitfähige Welle (1b) aufweist, und daß der Vakuumschalter eine erste Hauptvakuumshaltereinheit (8, 8a) aufweist, die auf jeder ortsfesten leitfähigen Welle (1b) befestigt ist, und ortsfeste Seitenkontakte (9a) an einer Wand des Isolationsgestells über Befestigungsplatten (18b) befestigt sind, wobei die Vakuumkolben (1) durch Verschieben der beweglichen Welle (1a) geschaltet werden und der Vakuumschalter durch eine lineare Bewegung des Isolationsgestells geschaltet wird.
2. Vakuumschalter mit Trennschalter nach Anspruch 1, weiter umfassend zweite Hauptvakuumshaltereinheiten, die mit den beweglichen leitfähigen Wellen (1a) der Vakuumkolben verbunden sind.
3. Vakuumschalter mit Trennschalter nach Anspruch 1 oder 2, bei dem das Isolationsgestell durch Schubstangen (20a, 20b) angetrieben ist und eine bewegliche Welle durch Steuerstangen (26) ange-

trieben ist, wobei die Stangen durch luftdichte Wellenlagerbuchsen (22a) geführt sind, die in der Befestigungsplatte (3) befestigt sind.

4. Vakuumschalter mit Trennschalter nach einem der Ansprüche 1 bis 3, bei dem das Isolationsgestell eine Rückseitenplatte (3b, 13b) umfaßt, die ein Paar sich rückwärts erstreckender Kontaktmittel (13c) aufweist, die mit einem Satz Schubstangen (20b) verbunden sind, wobei ein sich aufwärts erstreckender Abschnitt (13b) mit einem anderen Satz Schubstangen (20a) verbunden ist, und ein Paar sich vorwärts erstreckender Flansche (13a1, 13a2) ein Gehäuse für die Vakuumkolben bildet.

Revendications

1. Soupape automatique d'admission munie d'un déclencheur comprenant une chambre de gaz isolante abritant une soupape automatique d'admission qui coupe un circuit principal, et comprenant également un déclencheur placé en série avec ladite soupape automatique d'admission ;
caractérisée en ce que ladite soupape automatique d'admission comprend plusieurs ampoules sous vide (1), fixées horizontalement sur un cadre isolant mobile par glissement (13), chaque ampoule sous vide (1) ayant un axe conducteur mobile (1a) et un axe conducteur fixe (1b),
et en ce que ledit déclencheur comprend des premières unités principales de déclencheur (8, 8a) fixées sur chaque axe conducteur fixe (1b), et des contacts latéraux fixes (9a) fixés sur la paroi de la chambre isolante via une plaque de montage (18b), moyennant quoi lesdites ampoules sous vide (1) sont actionnées en glissant l'axe mobile (1a) et le déclencheur est actionné par le mouvement linéaire du cadre isolant.
2. Soupape automatique d'admission selon la revendication 1 comprenant en outre des secondes unités principales de déclencheur connectées aux axes conducteurs mobiles (1a) desdites ampoules sous vide.
3. Soupape automatique d'admission selon la revendication 1 ou la revendication 2 dans laquelle le cadre isolant est entraîné par des tiges coulissantes (20a, 20b) et l'axe mobile est entraîné en actionnant des tiges (26), les tiges passant en travers une chemise étanche portant l'axe (22a) fixée sur une plaque de montage (3).
4. Soupape automatique d'admission munie d'un déclencheur selon l'une quelconque des revendications 1 à 3 dans laquelle le cadre isolant comprend une plaque arrière (3b, 13b) ayant une paire d'élé-

ments connecteurs s'étendant vers l'arrière (13c) reliée à un ensemble de tiges coulissantes (20b), une portion s'étendant vers le haut (13b) reliée à un autre ensemble de tiges coulissantes (20a), et une paire de manchons s'étendant vers l'avant (13a1, 13a2) formant une enveloppe pour les bulles sous vide.

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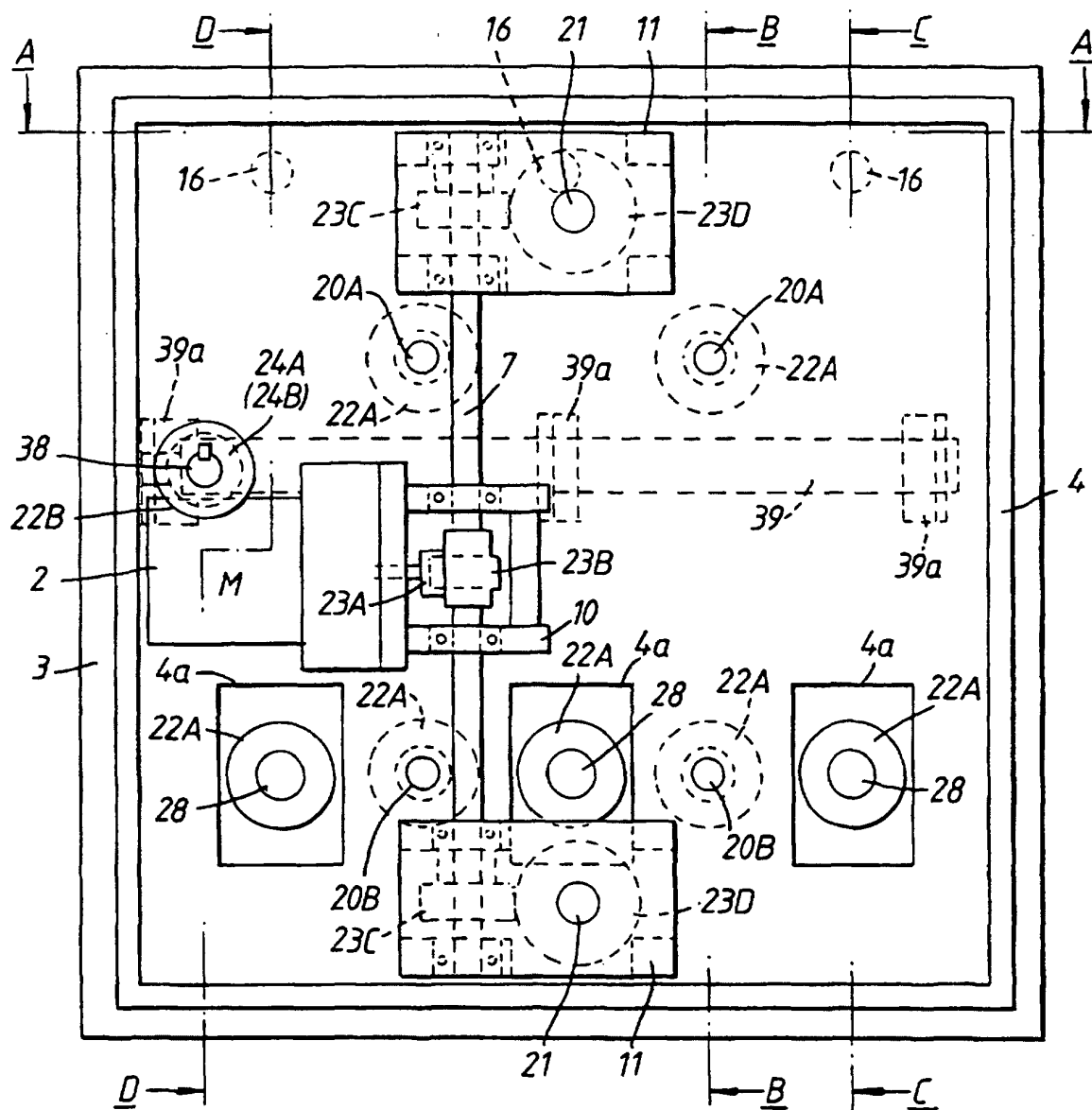


Fig.1

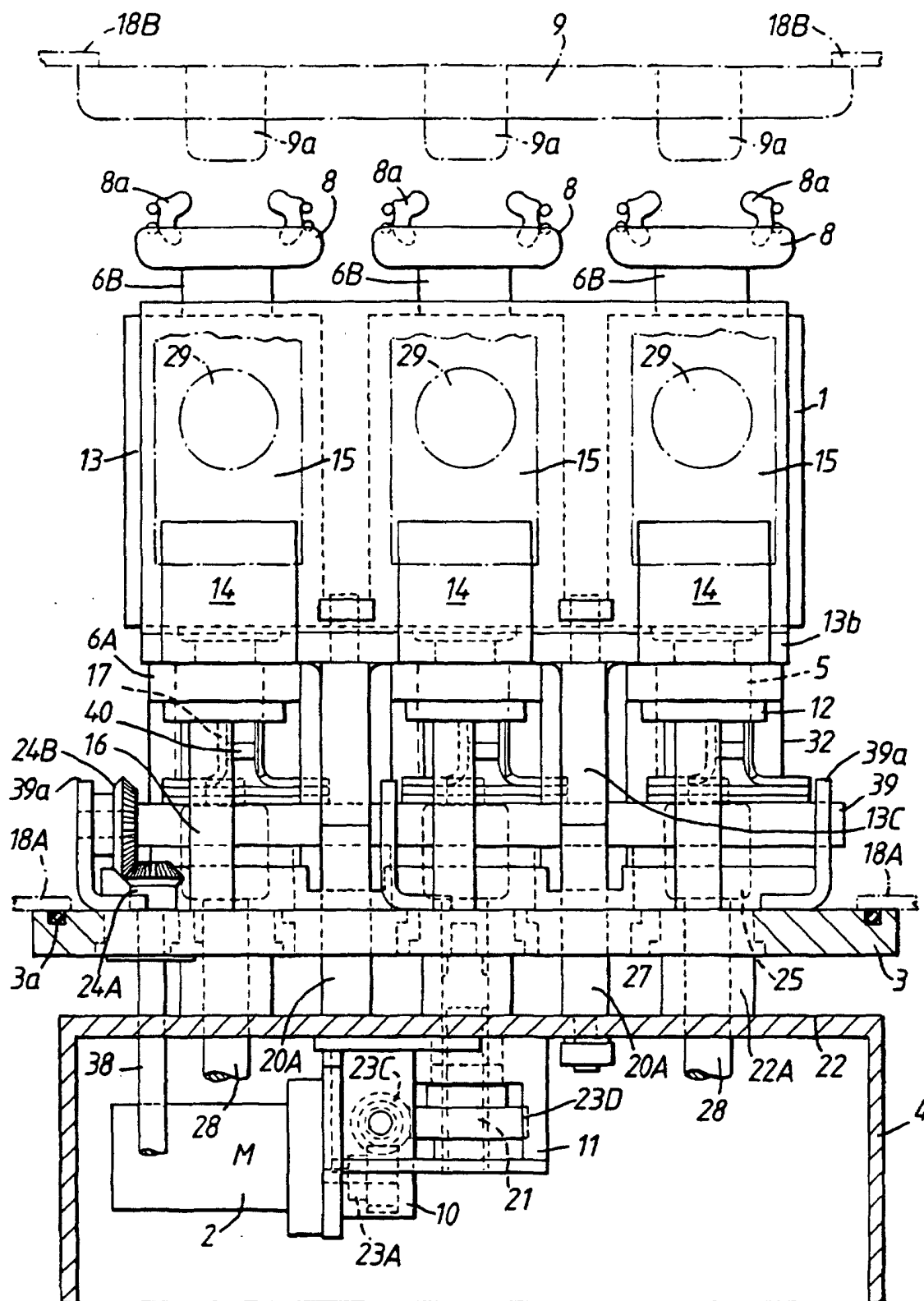
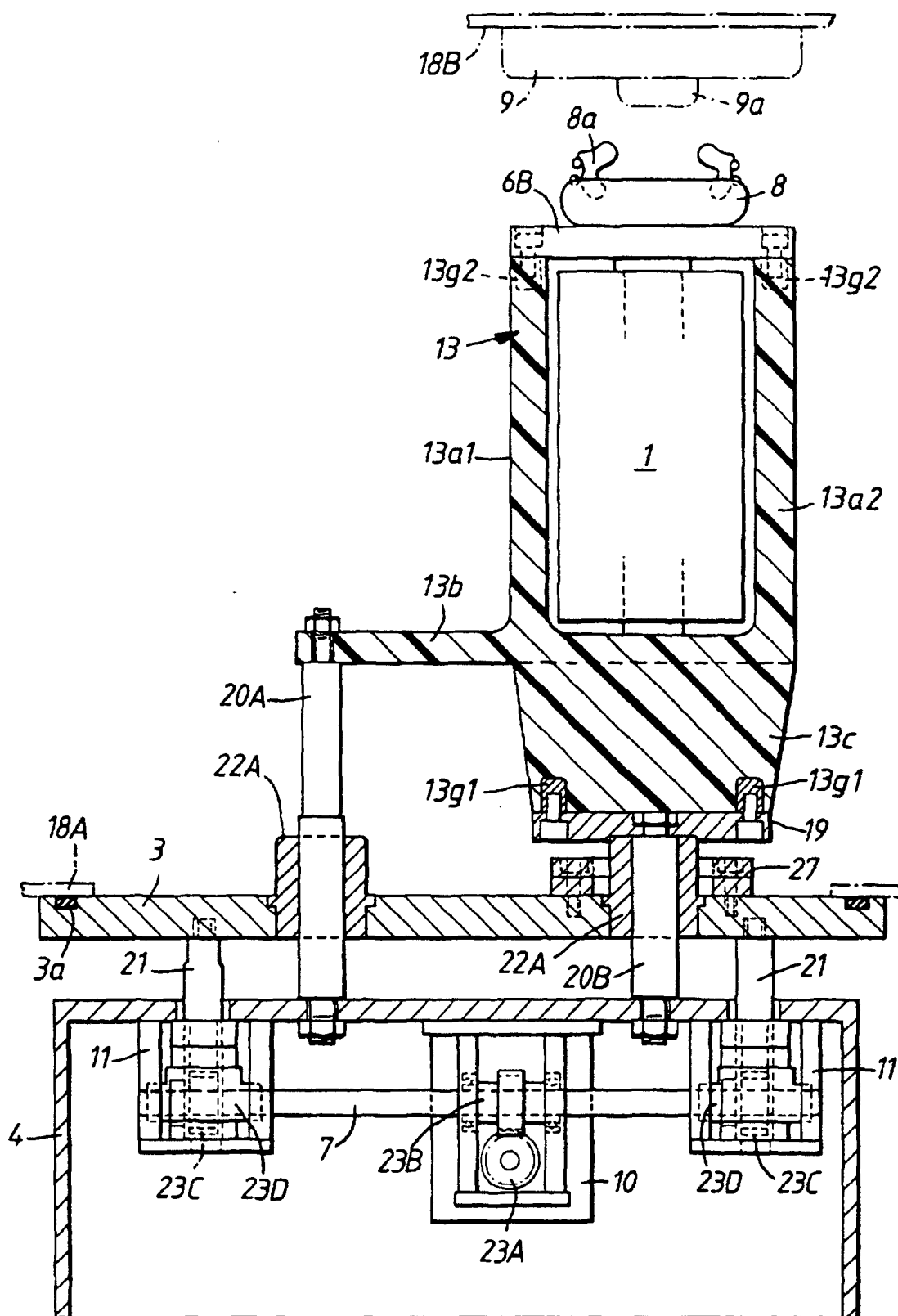


Fig.2



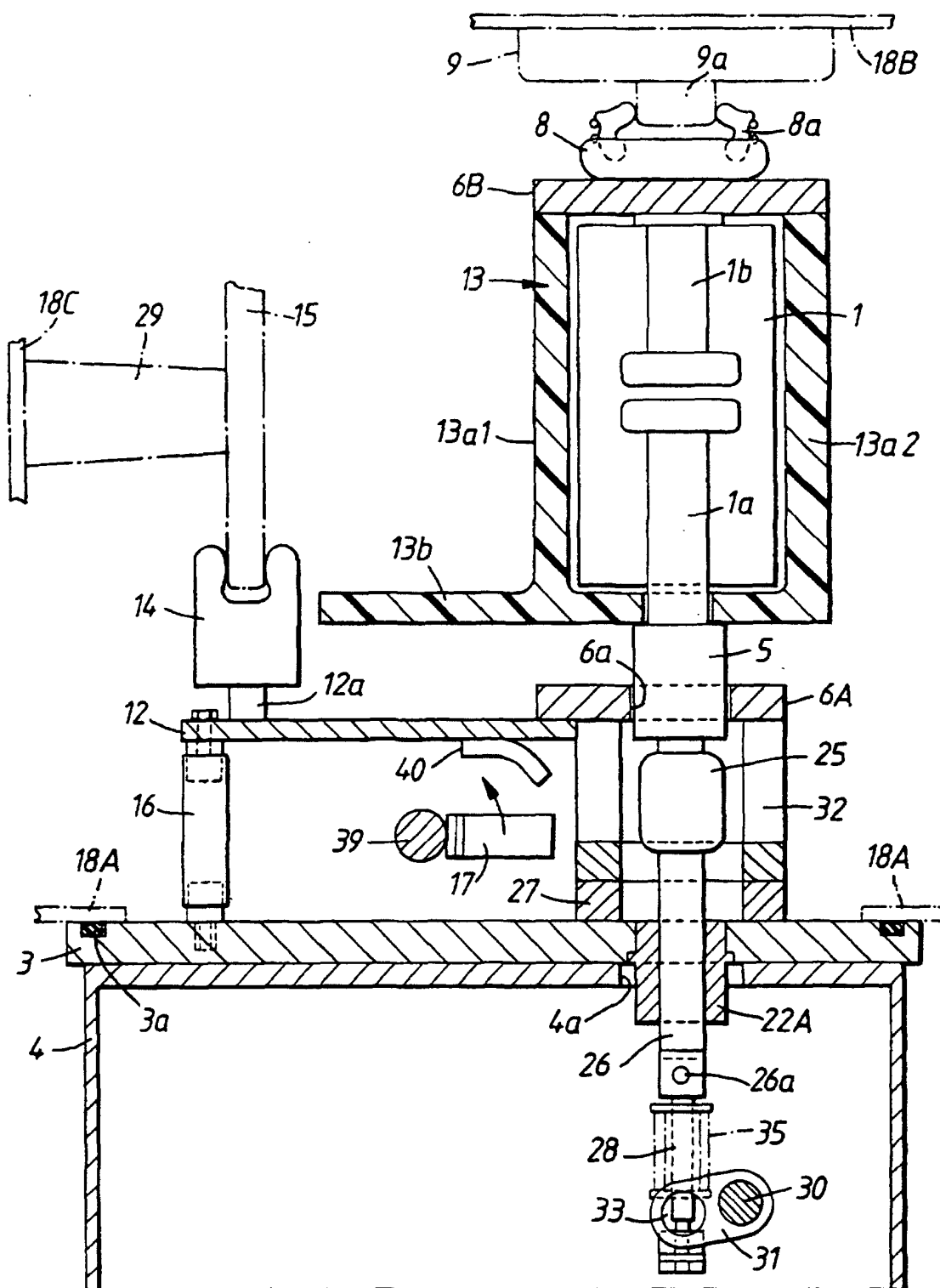


Fig.4

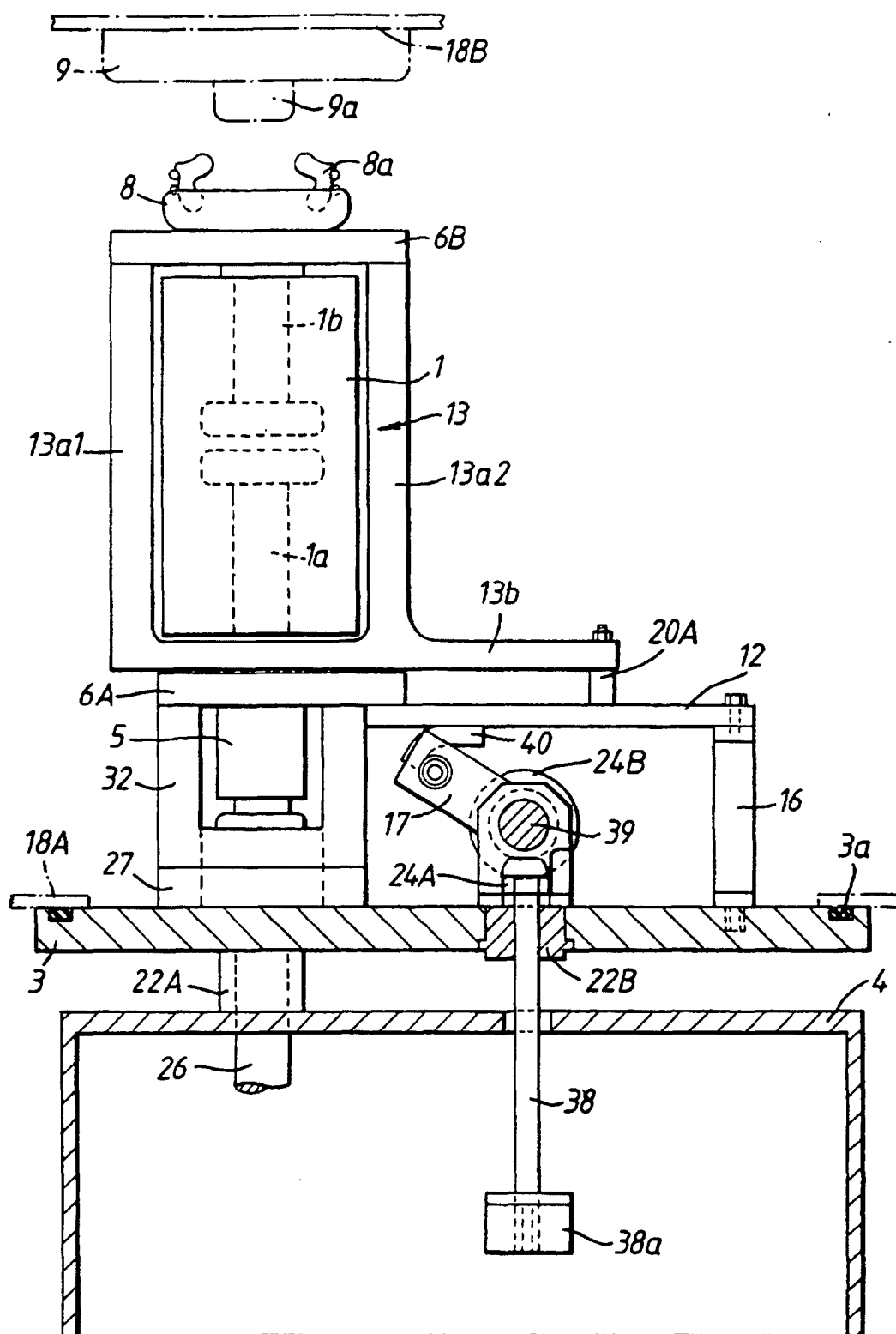


Fig.5

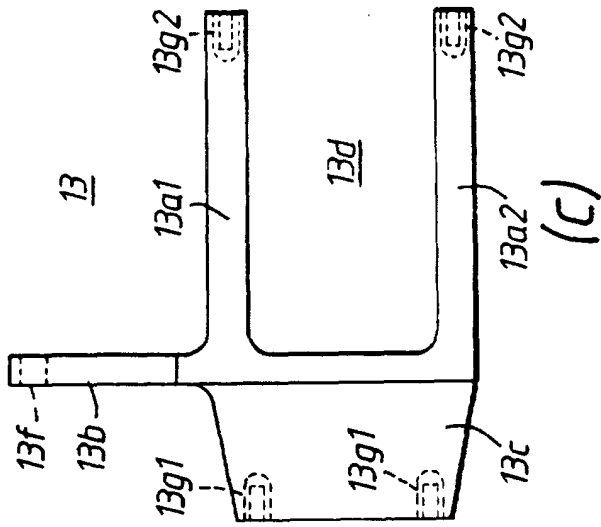
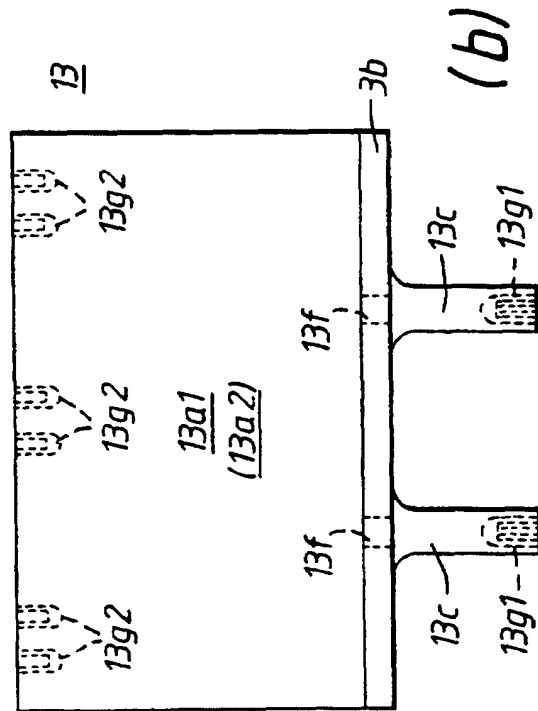
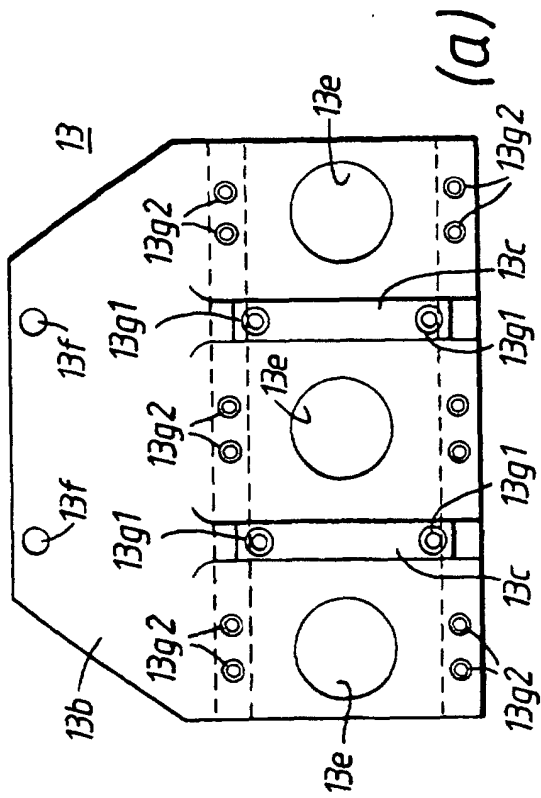


Fig. 6



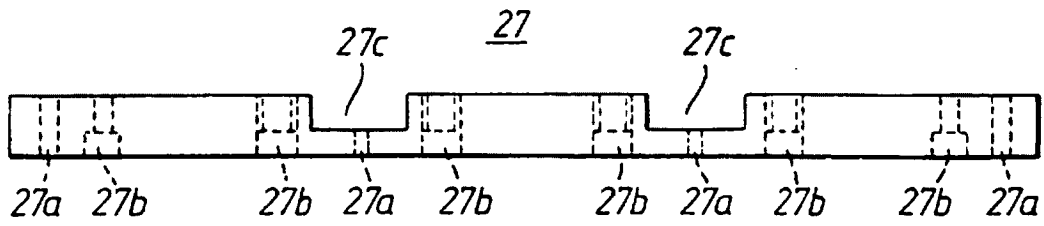


Fig. 7

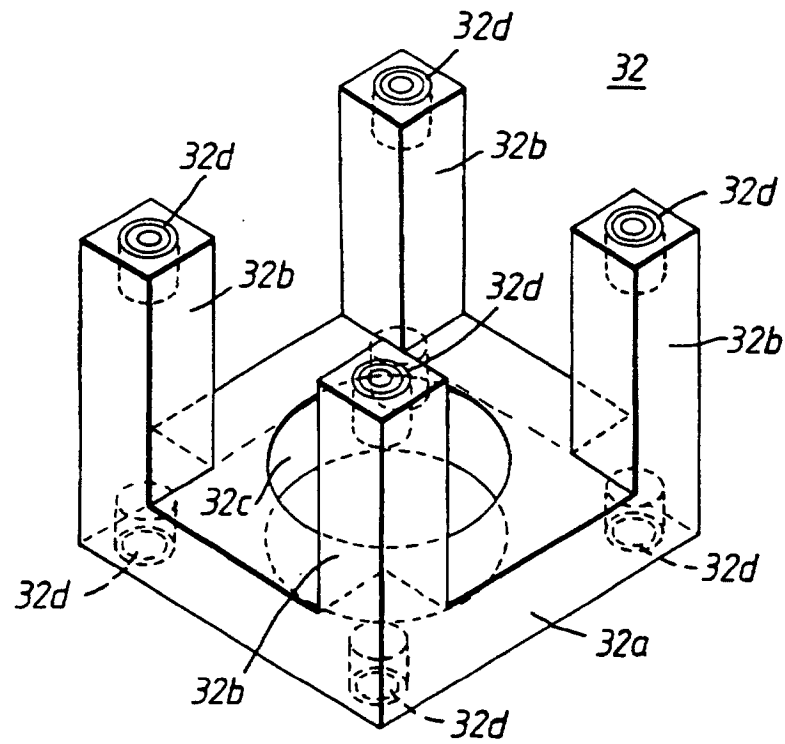


Fig. 8

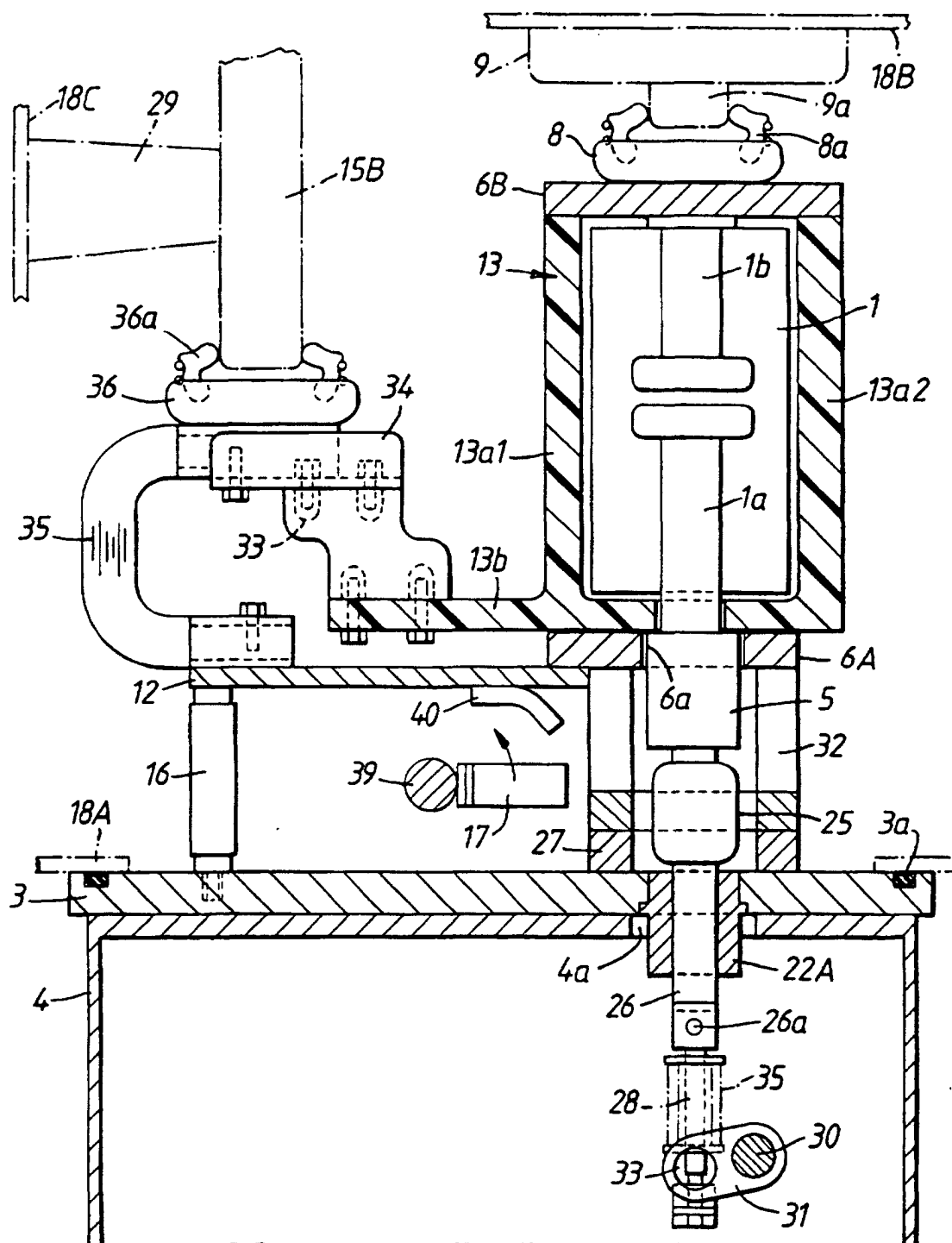


Fig.9

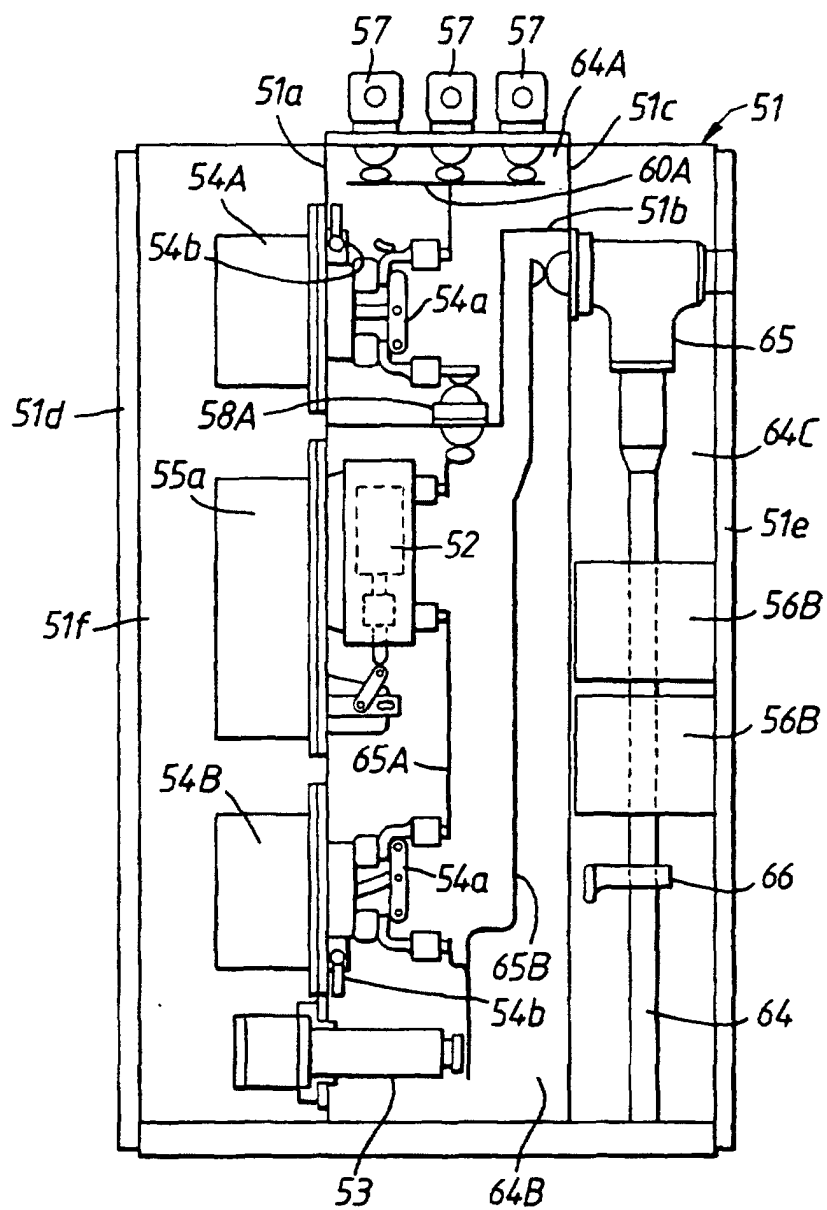


Fig.10