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(54) VACUUM SWITCH UNIT AND SWITCH GEAR

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Description

Technical Field

[0001] The present invention relates to a vacuum switch unit constituting an essential part of switchgear (for example, enclosed type switchboard) applied to reception and distribution facilities and to the switchgear in which such a vacuum switch unit is used. More particularly, the invention relates to a construction of vacuum switch unit capable of improving structural reliability, improving assembling efficiency and achieving downsizing, and to a construction of switchgear in which the vacuum switch unit is used.

Background Art

[0002] Generally in a switchgear, circuit apparatus such as circuit breaker, disconnecting switch, a transformer, and bus bars, etc. are arranged for each functional unit in accordance with a receiving system or a connecting system, and in such a construction, a vacuum switch unit forms an essential part thereof. Such a vacuum switch is disclosed in US-A-3 527 911.

[0003] Fig. 32 is a schematic view showing a construction of a conventional vacuum switch unit disclosed in, for example, the Japanese Patent Publication (unexamined) No. 18528/1989.

[0004] In the drawing, reference numeral 1 is a cylindrical vacuum switch (vacuum circuit breaker) forming a main body of the vacuum switch unit, numeral 1a is a stationary electrode of the vacuum switch 1, and numeral 1b is a movable electrode of the vacuum switch 1.

[0005] In this regard, a vacuum vessel charged with any gas is sometimes used as the vacuum switch 1, and this type of vacuum switch is also included in the vacuum switch hereinafter.

[0006] Numeral 200 is a stationary-electrode-side connection contact terminal of which one end side is fixedly arranged on the stationary electrode 1a of the vacuum switch 1. Numeral 300 is a movable-electrode-side connection contact terminal of which one end side is fixedly arranged on the movable electrode 1b of the vacuum switch 1 through a shunt 300a. The mentioned stationary-electrode-side connection contact terminal 200 and the movable-electrode-side connection contact terminal 300 both extending in a direction crossing a central axis (indicated by S in the drawing) of the vacuum switch 1 at right angles are formed in parallel to each other.

[0007] In the other ends of the stationary-electrode-side connection contact terminal 200 and the movable-electrode-side connection contact terminal 300, one is connected to a power supply circuit conductor and the other is connected to a load circuit conductor.

[0008] The vacuum switch 1, the stationary-electrode-side connection contact terminal 200, and the movable-electrode-side connection contact terminal 300 constitute a vacuum switch unit 400.

[0009] In addition, either the vacuum switch 1 itself or the vacuum switch unit 400 comprised of the vacuum switch 1, the stationary-electrode-side connection contact terminal 200 and the movable-electrode-side connection contact terminal 300 is frequently referred to as "vacuum valve" in the field of art.

[0010] Numerals 140 and 150 are insulators each for insulating and supporting the stationary-electrode-side connection contact terminal 200 and the movable-electrode-side connection contact terminal 300. Numeral 160 is a mold frame that fixedly supports the other end sides of the stationary-electrode-side connection contact terminal 200 and the movable-electrode-side connection contact terminal 300 and is arranged so as to lighten a load on the vacuum switch unit 400.

[0011] Fig. 33 is an example showing a construction of switchgear (for example, enclosed type switchboard) in which the conventional vacuum switch unit shown in Fig. 32 is used.

[0012] As shown in the drawing, the vacuum switch 1, the stationary-electrode-side connection contact terminal 200, and the movable-electrode-side connection contact terminal 300 constitute one vacuum switch unit covering one phase (i.e., the conventional vacuum switch unit 400 shown in Fig. 32) . A group or plural groups of vacuum switch units each covering three phases are arranged in the switchgear (for example, enclosed type switchboard) used in reception and distribution facilities.

[0013] In the example of Fig. 33, a group of vacuum switch units each covering three phases are arranged vertically in the switchboard.

[0014] For example, in a case where a main bus conductor 80 is used as a conductor on the power supply side, the main bus conductor 80 is connected to the movable-electrode-side connection contact terminal 300 of the upper vacuum switch unit 400 through a power supply side conductor 60.

[0015] Further, the main bus conductor 80 is connected to the stationary-electrode-side connection contact terminal 200 of the lower vacuum switch unit 400 through the power supply side conductor 60.

[0016] A load side cable 190 is connected to the stationary-electrode-side connection contact terminal 200 of the upper vacuum switch unit 400 through a load side conductor 70.

[0017] A load side cable 110 is connected to the movable-electrode-side connection contact terminal 300 of the lower vacuum switch unit 400 through the load side conductor 70.

[0018] The load side cables 110 and 190 are connected to a load apparatus. They are sometimes connected to another enclosed type switchboard.

[0019] Numeral 11 is a sensor such as current sensor or voltage sensor.

[0020] Numeral 500 is a housing for the switchgear (for example, enclosed type switchboard) with an opening/closing door 500a on the front thereof.

[0021] Fig. 34 is a schematic view showing another

example of the construction of the switchgear (for example, enclosed type switchboard) in which the conventional vacuum switch unit 400 shown in Fig. 33 is used.

[0022] In the switchgear (the enclosed type switchboard) shown in Fig. 34, the main bus conductor 80 is connected to the stationary-electrode-side connection contact terminal 200 arranged on the stationary electrode 1a (not shown in the drawing) of the vacuum switch 1 through the power supply side conductor 60.

[0023] The load side cable 190 is connected to the movable-electrode-side connection contact terminal 300 arranged on the movable electrode 1b (not shown) of the vacuum switch 1 through the load side conductor 70 and a long conductor 180.

[0024] Numeral 12 is an auxiliary machine composed of, for example, an instrument transformer, a switch control mechanism, and others. The auxiliary machine 12 is arranged in an upper portion or a lower portion in the switchboard conforming to the position of the vacuum switch 1 (i.e., the position of the vacuum switch unit 400) in the switchgear (enclosed type switchboard) 500.

[0025] The auxiliary machine 12 is connected to the movable-electrode-side connection contact terminal 300 of the vacuum switch unit 400 through the long conductor 180 (there is a case of using a part of the load side cable 190 as the long conductor 180) or a cable 170.

[0026] In addition, numeral 130 is a support member for supporting the load side cable 190 and others.

[0027] A switch mechanism for driving the movable electrode 1b of the vacuum switch 1, a mechanism for opening the vacuum switch unit 400 from the main bus conductor 80, and so on are omitted in the switchgear (enclosed type switchboard) shown in Figs. 33 and 34.

[0028] As described above, in the conventional vacuum switch unit 400 shown in Fig. 32, the stationary-electrode-side connection contact terminal 200 and the movable-electrode-side connection contact terminal 300 forming a pair in order to form a current path to another circuit apparatus is arranged extending in a direction crossing the central axis (indicated by S in the drawing) of the vacuum switch 1 at right angles.

[0029] Therefore, at the time of connecting the vacuum switch unit to another circuit apparatus, any force in the direction indicated by the arrows A in Fig. 32 acts thereon. Accordingly, a heavy burden due to bending load generated at portions indicated with B and C in the drawing is imposed on the stationary electrode 1a and the movable electrode 1b arranged in the direction of the central axis of the vacuum switch 1. This results in lowering reliability on mechanical strength.

[0030] In other words, there is a disadvantage of producing a bending force on the stationary electrode 1a or the movable electrode 1b, whereby end plate part of the vacuum switch 1 connected to the stationary electrode 1a or the movable electrode 1b is deformed or damaged.

[0031] It is therefore necessary for the stationary-electrode-side connection contact terminal 200 and the movable side connection contact terminal 300 to be supported by means of the insulators 140 and 150, or to be fixed by means of the mold frame 160 in order to relieve the load. This brings about problems such as increase in number of the parts, much labor required in assembling work, and increase in cost.

[0032] Fig. 35 is a schematic view showing a condition that the conventional vacuum switch unit is arranged in the housing 500 of the enclosed type switchboard.

[0033] As shown in the drawing, the vacuum switches 1 and the stationary-electrode-side connection contact terminals 200 or the movable-electrode-side connection contact terminals 300 require a space insulation distance L_1 and an earth insulation distance L_2 in the housing 500 of the switchgear (enclosed type switchboard). Therefore, the housing 500 cannot be smaller than a certain size; hence a problem exists in that it is difficult to downsize the switchgear (enclosed type switchboard).

[0034] In the conventional switchgear (enclosed type switchboard) of the construction as shown in Fig. 33 or Fig. 34, the main bus conductor 80 is generally arranged at the rear portion of the vacuum switch unit 400. Moreover, a conductor connected to a power supply side or load side cable or another switchboard is arranged at the further rear portion of the main bus conductor 80.

[0035] In other words, in the conventional switchgear (enclosed type switchboard) having the construction as shown in Fig. 33 or Fig. 34, the main bus conductor 80 arranged at the rear portion of the vacuum switch 1 (i.e., at the rear portion of the vacuum switch unit 400) requires a long power supply side conductor 60 between the main bus conductor 80 and the vacuum switch 1. Furthermore, since the load side/power supply side cables 170, 190 and 110 or other cables connected to another switchboard are arranged at the rear portion of the main bus conductor 80, it is necessary to use a long conductor as those cables.

[0036] Moreover, it is necessary to use the support member 130 for supporting these long conductors 170, 190, 110, etc.

[0037] In the arrangement and the construction in which long conductors are required as described above, a problem exists in that it is difficult to downsize the switchboard and unnecessary cost (material, processing, assembling, and so on) is required.

[0038] Further, in general, the stationary electrode 1a and the movable electrode 1b of the vacuum switch 1 have less mechanical strength against transversal external force as compared with their mechanical strength against longitudinal external force.

[0039] Notwithstanding, the stationary-electrode-side connection contact terminal 200 and the movable-electrode-side connection contact terminals 300 are both arranged in a direction crossing the central axis S of the vacuum switch 1 at right angles. Therefore the stationary electrode 1a and the movable electrode 1b are liable to receive transversal external force. A further problem exists in that structural reliability of the vacuum switch 1 is lowered.

[0040] The present invention was made to solve the above-discussed problems and has an object of providing a vacuum switch capable of improving structural reliability of the vacuum switch in mounting the vacuum switch on the switchgear (for example, enclosed type switchboard) and downsizing the switchgear (for example, enclosed type switchboard).

[0041] Another object of the invention is to provide a switchgear capable of reducing the amount of material, number of parts, and assembling cost and so on, in addition to the advantage of miniaturization and lightening.

Disclosure of Invention

[0042] A vacuum switch unit according to the invention includes the features of claim 1.

[0043] According to the construction described above, any force that acts at the time of connecting the vacuum switch unit to another circuit apparatus applies in a direction parallel to the central axis of the vacuum switch.

[0044] As a result, it is possible to obtain a vacuum tube switch unit capable of relieving greatly the bending stress on the stationary electrode and the movable electrode and improving reliability on its mechanical strength.

[0045] Furthermore, it is not necessary to support the stationary-side connection contact terminal and the movable-electrode-side connection contact terminal by means of glass or mold frame, and therefore it is possible to reduce number of parts and reduce the cost.

[0046] In the mentioned vacuum switch unit according to the invention, the other end side having the contact connection part of either the stationary-electrode-side connection contact terminal or the movable-electrode-side connection contact terminal is formed on the central axis of the vacuum switch.

[0047] According to the construction described above, bending stress is scarcely applied on either the stationary electrode or the movable electrode formed on the central axis of the vacuum switch, and reliability is improved all the more.

[0048] In the mentioned vacuum switch unit according to the invention, the other end side of the stationary-electrode-side connection contact terminal having the contact connection part is formed on the central axis of the vacuum switch, and the other end side of the movable-electrode-side connection contact terminal having the contact connection part is formed so that the other end side extends substantially in parallel to the central axis of the vacuum switch toward the stationary-electrode-side connection contact terminal.

[0049] According to the construction described above, since the vacuum switch is further downsized in the direction of central axis, it is possible to achieve a reliable and compact vacuum tube switch unit.

[0050] Further, in the vacuum switch unit according to the invention, the vacuum switch, the stationary-electrode-side connection contact terminal and the movable-electrode-side connection contact terminal are preferably formed integrally into one body of an organic insulating material.

[0051] According to the construction described above, since insulating property is improved and leakage distance is shortened, it is possible to downsize the vacuum tube switch unit itself and downsize the switchgear.

[0052] In the vacuum switch unit according to the invention, switch unit members each covering three phases are preferably formed integrally into one body of an organic insulating material.

[0053] According to the construction as described above, insulating property is improved and leakage distance is shortened. Therefore it is possible to downsize the vacuum tube switch unit covering three phases and downsize the switchgear, and furthermore, it is possible to improve efficiency in assembling switchgear in which the vacuum switch unit is used.

[0054] A switchgear according to the invention includes the features of claim 1

[0055] According to the construction described above, since the vacuum tube switch unit, in which reliability is improved and cost is reduced, is used, it is possible to obtain switchgear improved in reliability of the switchgear and reduced in cost.

[0056] In the mentioned switchgear according to the invention, the vacuum switch unit is preferably comprised of a vacuum switch including a substantially cylindrical vacuum switch, a stationary-electrode-side connection contact terminal of which one end is fixed to a stationary electrode of the vacuum switch and the other end side is provided with a contact connection part that comes in contact with and is connected to the first circuit conductor, the stationary-electrode-side connection contact terminal being formed on a central axis of the vacuum switch, and a movable-electrode-side connection contact terminal of which one end is fixed to a movable electrode of the vacuum switch and the other end side is provided with a contact connection part that comes in contact with and is connected to the second circuit conductor, the movable-electrode-side connection contact terminal being formed in parallel to the central axis of the vacuum switch.

[0057] According to the construction described above, since the stationary-electrode-side connection contact terminal is formed on the central axis of the vacuum switch, any bending stress is scarcely applied to the stationary electrode at the time of assembling the vacuum switch unit. Furthermore, reliability of the vacuum switch unit is improved and the vacuum switch unit is downsized in the direction of central axis and, as a result, the switchgear is further improved in reliability and downsized.

[0058] In the switchgear according to the invention, the first circuit conductor is preferably disposed horizontally, the vacuum switch unit be arranged so that the central axis of the vacuum switch thereof extends vertically crossing the first circuit conductor at right angles, and the second circuit conductor is formed so that an end thereof extends toward the bottom side.

[0059] According to the construction described above, since the vacuum switch unit is arranged vertically, reliability is improved and the cost is reduced, it is possible to obtain downsized switchgear diminished in depth. Furthermore, the cable connected to the second circuit conductor is easily led in from the bottom side of the switchgear.

[0060] In the mentioned switchgear according to the invention, the first circuit conductor is preferably disposed perpendicularly, the vacuum switch unit be arranged so that the central axis of the vacuum switch thereof extends horizontally crossing the first circuit conductor at right angles, and the second circuit conductor is formed so that an end thereof extends toward the bottom side.

[0061] According to the construction described above, not only reliability is improved and the cost is reduced, and further since the vacuum switch unit is arranged horizontally, it is possible to obtain downsized switchgear diminished in height. Furthermore, the cable connected to the second circuit conductor is easily led in from the bottom side of the switchgear.

[0062] In the mentioned switchgear according to the invention, the first circuit conductor is preferably disposed horizontally, the vacuum switch unit be arranged so that the central axis of the vacuum switch thereof is arranged in parallel to the first circuit conductor, and the second circuit conductor is formed so that an end thereof extends toward the bottom side.

[0063] According to the construction described above, since the first circuit conductor is also arranged horizontally, the switchgear is further downsized in height.

[0064] In the mentioned switchgear according to the invention, the first circuit conductor is preferably disposed horizontally, the vacuum switch unit is arranged so that the central axis of the vacuum switch thereof extends vertically crossing the first circuit conductor at right angles, and the second circuit conductor is formed so that an end thereof extends toward the top side crossing the first circuit conductor with a predetermined distance therefrom.

[0065] According to the construction described above, reliability is improved and the const is reduced, and since the vacuum switch unit is arranged vertically, it is possible to obtain downsized switchgear diminished in depth. Furthermore, the cable connected to the second circuit conductor is easily led in from the topside of the switchgear.

[0066] In the mentioned switchgear according to the invention, the first circuit conductor is preferably disposed perpendicularly, the vacuum switch unit is arranged so that the central axis of the vacuum switch thereof extends horizontally crossing the first circuit conductor at right angles, and the second circuit conductor is formed so that an end thereof extends toward the backside crossing the first circuit conductor with a predetermined distance therefrom.

[0067] According to the construction described above, reliability is improved and the const is reduced, and since the vacuum switch unit is arranged horizontally, it is possible to obtain downsized switchgear diminished in height. Furthermore, the cable connected to the second circuit conductor is easily led in from the backside of the switchgear.

[0068] In the mentioned switchgear according to the invention, the vacuum switch unit is preferably constructed so that either a combination of the stationary-electrode-side connection contact terminal and the first circuit conductor or a combination of the movable-electrode-side connection contact terminal and the second circuit conductor is formed into a U-shape at a portion proximate to the mentioned vacuum switch.

[0069] According to the construction described above, reliability is improved and the const is reduced, and since it is possible to shorten the distance between the vacuum tube switch unit and the first circuit conductor or the second circuit conductor, it is possible to further downsize the switchgear.

[0070] In the mentioned switchgear according to the invention, a sensor or an auxiliary machine is preferably arranged in the vicinity of the stationary-electrode-side connection contact terminal or the movable-electrode-side connection contact terminal.

[0071] According to the construction described above, reliability is improved and the const is reduced, and since the sensor or the auxiliary machine is arranged making use of the space efficiently in the vicinity of the stationary-electrode-side connection contact terminal or the movable-electrode-side connection contact terminal, it is possible to further downsize the switchgear.

[0072] In the mentioned switchgear according to the invention, the switchgear preferably includes a plurality of vacuum switch units, and the plural vacuum switch units are arranged and mounted side by side forming a straight line.

[0073] According to the construction described above, reliability is improved and the const is reduced, and since the space for mounting the plural vacuum switch units is reduced, it is possible to further downsize the switchgear.

[0074] In the mentioned switchgear according to the invention, the switchgear preferably includes three vacuum switch units, and the three vacuum switch units are arranged and mounted so that the central axes of the vacuum switches of the three vacuum switch units are respectively located on the vertexes of a triangle. .

[0075] According to the construction described above, reliability is improved and the const is reduced, and since the space for mounting the three vacuum switch units covering three phases is further reduced, it is possible to further downsize the switchgear.

[0076] In the mentioned switchgear according to the invention, among parts of the vacuum switch unit and various parts arranged in the vicinity of the vacuum switch unit, adjacent parts or parts connected to each other are integrally formed into one or plural components of an organic insulating material.

[0077] According to the construction described above, reliability is improved and the const is reduced, and since

the various parts are formed into one or plural components, not only it is easy to manage the parts but also it is easy to assemble the parts inside the switchgear. Furthermore, the parts are integrally composed of an organic insulating material, it possible to improve the insulating property and downsize the switchgear.

Brief Description of Drawings

[0078]

Fig. 1 is a schematic view showing a construction of a vacuum switch unit according to Embodiment 1.
Fig. 2 is a schematic view showing a construction example of vacuum switch unit different from Fig. 1 according to Embodiment 1.
Fig. 3 is a schematic view showing a construction example of vacuum switch unit still different from Fig. 1 according to Embodiment 1.
Fig. 4 is a side view showing the construction of the vacuum switch unit shown in Fig. 3.
Fig. 5 is a side view showing a construction of a modification of the vacuum switch unit shown in Fig. 3.
Fig. 6 is a front view showing a construction of a vacuum switch unit according to Embodiment 2, which is in accordance with the invention.
Fig. 7 is a sectional view showing a construction of a vacuum switch unit according to Embodiment 3.
Fig. 8 is a sectional view showing a construction of vacuum switch unit different from Fig. 7.
Fig. 9 is a partially sectional perspective view showing a construction of a vacuum switch unit covering three phases according to Embodiment 4.
Fig. 10 is a partially sectional perspective view showing a construction of vacuum switch unit different from Fig. 9 covering three phases according to Embodiment 4.
Figs. 11 (a) and (b) are schematic views each showing a construction of an essential part of switchgear according to Embodiment 5 of the invention.
Figs. 12 (a) and (b) are schematic views each showing a modification of the switchgear according to Embodiment 5 of the invention.
Fig. 13 is a schematic view showing a construction of an essential part of switchgear according to Embodiment 6 of the invention.
Fig. 14 is a schematic view showing a construction of an essential part of switchgear according to Embodiment 7 of the invention.
Fig. 15 is a view showing a construction of an essential part of switchgear according to Embodiment 8 of the invention.
Fig. 16 is a perspective view showing a construction of an essential part of switchgear according to Embodiment 9 of the invention.
Fig. 17 is a perspective view showing a construction of an essential part of switchgear according to Embodiment 10 of the invention.
Fig. 18 is a perspective view showing a construction of an essential part of switchgear according to Embodiment 11 of the invention.
Figs. 19 (a) and (b) are schematic views each showing a construction of an essential part of switchgear according to Embodiment 12 of the invention.
Fig. 20 is a schematic view showing a construction of an essential part of switchgear according to Embodiment 13 of the invention.
Fig. 21 is a schematic view showing a construction of an essential part of switchgear according to Embodiment 14.
Fig. 22 is a schematic view showing a construction of an essential part of switchgear according to Embodiment 15.
Fig. 23 is a perspective view showing a construction of an essential part of switchgear according to Embodiment 16.
Fig. 24 is a perspective view showing a construction of an essential part of switchgear according to Embodiment 17.
Fig. 25 is a schematic view showing a construction of an essential part of switchgear according to Embodiment 18 of the invention.
Fig. 26 is a schematic view showing a construction of an essential part of switchgear according to Embodiment 19 of the invention.
Figs. 27 (a) and (b) are schematic views each showing a construction of the essential part of the switchgear according to Embodiment 19 of the invention.
Fig. 28 is a view showing a construction of an essential part of switchgear according to Embodiment 20 of the invention.
Fig. 29 is a perspective view showing a construction of an essential part of switchgear according to Embodiment 21 of the invention.
Fig. 30 is a perspective view showing a construction of an essential part of switchgear according to Embodiment 22 of the invention.
Figs. 31 (a) and (b) are schematic views each showing a construction of an essential part of switchgear according to Embodiment 23 of the invention.
Fig. 32 is a schematic view showing a construction of a vacuum switch unit according to a prior art.
Fig. 33 is a schematic view showing an internal construction of the switchgear according to the prior art.
Fig. 34 is a schematic view showing an internal construction of switchgear according to another prior art.
Fig. 35 is a schematic view showing a relation between a space insulation distance and an earth insulation distance when the vacuum witch unit is arranged in the switchgear according to the prior art.

Best Mode for Carrying Out the Invention

[0079] Best mode for carrying out the invention is hereinafter described with reference to the accompanying drawings to explain the invention in detail.

[0080] In the drawings, the same referenced numerals indicate the same or like parts.

Embodiment 1.

[0081] Fig. 1 is a schematic view showing a construction of a vacuum switch unit according to Embodiment 1; Fig. 2 is a schematic view showing a construction example different from Fig. 1 of the vacuum switch unit according to Embodiment 1; and Fig. 3 is a schematic view showing a construction example of vacuum switch unit still different from Figs. 1 and 2 according to Embodiment 1.

[0082] Fig. 4 is a side view showing the construction of the vacuum switch unit shown in Fig. 3 (i.e., a view of the vacuum switch unit shown in Fig. 3 taken from the rear portion (right side in Fig. 3) on the central axis), and Fig. 5 is a view showing a construction of a modification of the vacuum switch unit shown in Figs. 3 and 4.

[0083] Referring to Fig. 1, numeral 1 is a vacuum switch where a stationary electrode 1a and a movable electrode 1b are arranged on the central axis opposite to each other, and numerals 21 and 31 are a stationary-electrode-side connection contact terminal and a movable-electrode-side connection contact terminal forming a pair, and which are respectively formed of L-shaped plates of which one end sides are connected and fixed to respectively the stationary electrode 1a and the movable electrode 1b of the vacuum switch 1.

[0084] As shown in the drawing, a connection contact part 21a on the other end side of the stationary-electrode-side connection contact terminal 21 and a connection contact part 31a on the other end side of the movable-electrode-side connection contact terminal 31 are arranged in parallel to the central axis (indicated by S) of the cylindrical vacuum switch 1 and come near to each other.

[0085] In other words, the connection contact part 21a on the other end side of the stationary-electrode-side connection contact terminal 21, of which one end is connected to the stationary electrode 1a, is parallel to the central axis S of the cylindrical vacuum switch 1 and is formed into an L-shape extending toward the movable electrode 1b, and the connection contact part 31a on the other end side of the movable-electrode-side connection contact terminal 31, of which one end is connected to the movable electrode 1b, is parallel to the central axis S of the cylindrical vacuum switch 1 and is formed into an L-shape extending toward the stationary electrode 1a.

[0086] It is preferable that the space distance between the connection contact part 21a and the connection contact part 31a is as large as possible, and the connection contact part 21a and the connection contact part 31a are arranged symmetrical putting the central axis of the vacuum switch 1 between them.

[0087] Numeral 41 is a vacuum switch unit comprised of the vacuum switch 1, the stationary-electrode-side connection contact terminal 21, and the movable-electrode-side connection contact terminal 31.

[0088] In the vacuum switch unit 41 constructed as shown in Fig. 1, since the connection contact parts 21a and 31a formed on the other end sides of the stationary-electrode-side connection contact terminal 21 and the movable-electrode-side connection contact terminal 31 are arranged in parallel to the central axis S of the vacuum switch 1, any force that acts at the time of connecting the vacuum switch unit to another circuit apparatus is applied in a direction parallel to the central axis S of the vacuum switch 1.

[0089] As a result, it is possible to greatly relieve the bending stress on the portion where the stationary electrode 1a and the stationary-electrode-side connection contact terminal 21 are connected and on the portion where the movable electrode 1b and the movable-electrode-side connection contact terminal 31 are connected. Thus reliability on mechanical strength is greatly improved.

[0090] Furthermore, unlike the conventional vacuum switch unit, it is not necessary to support the stationary-electrode-side connection contact terminal and the movable-electrode-side connection contact terminal with any insulator and a mold frame, and it is therefore possible to reduce number of parts resulting in reduction in cost.

[0091] In the construction in Fig. 1, although the connection contact parts 21a and 31a formed on the other end sides of the stationary-electrode-side connection contact terminal 21 and the movable-electrode-side connection contact terminal 31 are arranged in parallel to the central axis of the vacuum switch 1 and adjacent to each other, it is also preferable that a vacuum switch unit 42 is constructed so that the connection contact parts 12a and 31a are arranged in parallel to the central axis S of the vacuum switch 1 extending away from each other as shown in Fig. 2. In this construction also the same advantages as described above are obtained.

[0092] Further, as shown in Figs. 3 and 4, it is also preferable that a vacuum switch unit 43 is constructed so that the connection contact part 22a on the other end side of the stationary-electrode-side connection contact terminal 22 connected to the stationary electrode 1a is arranged in parallel to the central axis S in a manner of extending away (i.e., a direction extending away from the movable electrode 1b) and the connection contact part 31a on the other end side of the movable side connection contact terminal 31 connected to the movable electrode 1b is arranged in parallel to the central axis S and in a direction coming near the stationary electrode 1a in the same manner as the case of Fig. 2. In this construction also the same advantages as described above are obtained.

[0093] Furthermore, as shown in Fig. 5, it is also preferable that a vacuum switch unit 44 constructed so that the stationary side connection contact part 22 and the movable side connection contact part 31 are arranged with a tilt of a predetermined angle between them putting the central axis of the vacuum switch 1 between them.

In this construction also the same advantages as described above are obtained as a matter of course.

[0094] As described above, according to this embodiment, in the vacuum switch unit comprising an essential part of the switchgear (enclosed type switchboard) and in which a pair of connection contact terminals forming a current path to another circuit apparatus are arranged at the ends on the stationary-electrode-side and the movable-electrode-side respectively, since both of the connection contact terminals are arranged so that their connection contact parts are substantially parallel to the central axis of the vacuum valve, it is possible to provide a vacuum switch unit that makes it possible to improve reliability on mechanical strength and reduce the cost.

Embodiment 2.

[0095] Fig. 6 is a schematic view showing a construction of a vacuum switch unit according to Embodiment 2 of the invention.

[0096] In the drawing, numeral 1 is a vacuum switch in which a stationary electrode 1a (not shown in the drawing) and a movable electrode 1b are arranged on the central axis S and face each other.

[0097] Numeral 23 is a cylindrical stationary-electrode-side connection contact terminal of which one end side is connected and fixed to the stationary electrode 1a of the vacuum switch 1, and a connection contact part 23a on the other end side is arranged on the central axis S of the vacuum switch 1.

[0098] Numeral 33 is a movable-electrode-side connection contact terminal composed of a plate part 33a of which one end side is connected and fixed to the movable electrode 1b and a cylindrical connection contact part 33b connected and fixed to this plate part 33a and arranged in parallel to the central axis S of the vacuum switch 1.

[0099] The vacuum switch 1, the stationary-electrode-side connection contact terminal 23, and the movable-electrode-side connection contact terminal 33 described above, form a vacuum switch unit 45.

[0100] As described above, according to Embodiment 2, the connection contact part 33b of the movable-electrode-side connection contact terminal 33 connected and fixed to the movable electrode 1b side is arranged in parallel to the central axis S of the vacuum switch 1 and, furthermore, the connection contact part 23a of the stationary-electrode-side connection contact terminal 23 connected and fixed to the stationary electrode 1a is arranged on the central axis S of the vacuum switch 1. Therefore bending stress is scarcely applied to the portion where the stationary electrode 1a and the stationary-electrode-side connection contact terminal 23 are connected, and reliability on mechanical strength is further improved.

Embodiment 3

[0101] Fig. 7 is a sectional view showing a construction of a vacuum switch unit according to Embodiment 3.

[0102] Fig. 8 is a sectional view showing a construction of the vacuum switch unit different from Fig. 7 according to embodiment 3.

[0103] In Fig. 7, numeral 51 is an injection-molded member composed an organic insulating material such as resin and formed into one body so as to cover or coat the vacuum switch unit 41 of the construction shown in Fig. 1 (Embodiment 1), and the connection contact part 21a formed on the other end side of the stationary-electrode-side connection contact terminal 21 and the connection contact part 31a formed on the other end side of the movable-electrode-side connection contact terminal 31 are exposed on the surface.

[0104] As described above, according to Embodiment 3, since the injection-molded member 51 composed of an organic insulating material such as resin is formed into one body so as to cover the vacuum switch unit 41, it is possible to shorten the space insulation distance L_1 shown in Fig. 35 to a great extent and downsize the enclosed type switchboard, and the injection-molded member 51 tightly fits on the surface of the vacuum switch unit 41. As a result, it is possible to shorten the leakage distance and downsize the vacuum switch unit 41 itself.

[0105] Although the above description shows a construction in which the injection-molded member 51 is formed into one body so as to cover the vacuum switch unit 41 of Embodiment 1, the same advantages are obtained by a construction in which an injection-molded member 52 composed of an organic insulating material such as resin is formed into one body so as to cover the vacuum switch unit 45 of Fig. 6 (Embodiment 2) as shown in Fig. 8.

[0106] As described above, according to this embodiment, since both connection contact terminals are formed into one body composed of an organic insulating material so as to cover the vacuum switch unit according to Embodiment 1 or Embodiment 2, it is possible to provide a vacuum switch unit that makes it possible to shorten the space insulation distance to a great degree and downsize the switchgear (enclosed type switchboard) in which the vacuum switch unit is accommodated.

Embodiment 4.

[0107] Fig. 9 is a partially sectional perspective view showing a construction of a vacuum switch unit integrally covering three phases according to Embodiment 4.

[0108] Fig. 10 is partially sectional perspective view showing a construction of the vacuum switch unit different from Fig. 9 integrally covering three phases according to embodiment 4.

[0109] In Fig. 9, numeral 53 is an injection-molded member composed of an organic insulating material such as resin or the like, and the injection-molded member 53

is formed into one body so as to integrally cover the three vacuum switch units 41 (i.e., the vacuum switch shown in Fig. 1) disposed side by side for integrally covering three phases, and the connection contact part 21a of the stationary-electrode-side connection contact terminal 21 and the connection contact part 31a of the movable-electrode-side connection contact terminal 31 are exposed on the surface.

[0110] As described above, according to Embodiment 4, since the injection-molded member 53 composed of an organic insulating material such as resin is formed into one body so as to cover the three vacuum switch units 41 thereby integrally covering three phases, the vacuum switch units 41 and the switchgear (for example, enclosed type switchgear), in which the vacuum switch units 41 are accommodated, are downsized and, furthermore, it is possible to improve efficiency in assembling in the same manner as in the foregoing Embodiment 3.

[0111] Although the foregoing description shows a construction explained in which the injection-molded member 53 is formed into one body so as to cover the three vacuum switch units 41 of Fig. 1 according to Embodiment 1 put side by side thereby integrally covering three phases, the same advantages as described above are obtained in a construction in which an injection-molded member 54 composed of an organic insulating material such as resin is formed into one body so as to cover three vacuum switch units 45 of Embodiment 2 put side by side thereby integrally covering three phases as shown in Fig. 10.

[0112] Although, in the foregoing embodiments, each connection contact part of the stationary side or movable side connection contact terminal of the vacuum switch unit is arranged on the central axis of the vacuum switch 1 or in parallel to the central axis, it is a matter of course that arranging each connection contact part at a very small angle with the central axis is applicable, provided that the generated bending stress does not affect the mechanical strength.

[0113] Although atmosphere in the switchgear (for example, enclosed type switchgear), in which the vacuum switch unit is accommodated, is not mentioned in the foregoing embodiments, it is preferable to adopt any air atmosphere or any gaseous atmosphere, provided that the organic insulating material is not deteriorated in performance.

[0114] As described above, according to this embodiment, since the vacuum switch units for integrally covering three phases are formed into one body composed of an organic insulating material such as resin, it is possible to provide a vacuum switch unit integrally covering three phases that makes it possible to improve efficiency in assembling.

Embodiment 5.

[0115] Figs. 11 (a) and (b) are schematic views each showing an essential part (i.e., portion on which a vacuum switch unit is mounted) of switchgear (for example, enclosed type switchboard) according to Embodiment 5.

[0116] In Figs. 11 () and (b), numeral 1 is a cylindrical vacuum switch. This vacuum switch 1 is provided with a stationary electrode 1a fixed to an internal stationary contact (i.e., stationary electrode) at one end thereof on the central axis S of this vacuum switch 1 and a movable electrode 1b fixed to a movable contact (i.e., a movable electrode) at the other end thereof.

[0117] Numeral 24 is a stationary-electrode-side connection contact terminal of which one end is fixed to the stationary electrode 1a, and numeral 34 is a movable-electrode-side connection contact terminal of which one end is fixed to the movable electrode 1b through a shunt 34a of a flexible copper strand.

[0118] This cylindrical vacuum switch 1 is mounted so that the stationary electrode 1a and the movable electrode 1b extend vertically (i.e., in the direction perpendicular to the plane where the switchgear is mounted) and the cylindrical vacuum switch 1 can move to a predetermined position in the foregoing vertical direction by an opening mechanism not shown.

[0119] The movable electrode 1b is driven vertically by a switch mechanism (not shown), thereby opening or closing the contact (electrode) in the cylindrical vacuum switch 1.

[0120] The movable-electrode-side connection contact terminal 34 is fixed to the movable electrode 1b through the shunt 34a, and therefore the movable electrode 1b can move vertically regardless of the movable-electrode-side connection contact terminal 34 at the time of opening and closing the contact (electrode).

[0121] The stationary-electrode-side connection contact terminal 24 is composed of a conductive material such as copper plate, and the other end thereof extends in the same direction as the central axis S of the vacuum switch 1 passing through the stationary electrode 1a and the movable electrode 1b and slides coming in contact with a first circuit conductor 61 (for example, power supply side conductor).

[0122] The movable-electrode-side connection contact terminal 34 is also composed of a conductive material such as copper plate, and the other end thereof is bent upward so as to be substantially parallel to the central axis S at a portion proximate to the cylindrical vacuum switch 1.

[0123] A top end thereof is disposed to slide coming in contact with a second circuit conductor 71 (for example, load side conductor).

[0124] In this construction, an elastic contact member 34b is arranged at the end of the movable-electrode-side connection contact terminal 34 in some cases.

[0125] The vacuum switch 1, the stationary-electrode-side connection contact terminal 24, and the movable-electrode-side connection contact terminal 34, form a vacuum switch unit 46.

[0126] Fig. 11 (a) shows a state that the vacuum switch unit 46 is separated from the first circuit conductor (for

example, power supply side conductor) 61 and the second circuit conductor 71 (for example, load side conductor), and Fig. 11(b) shows state that the vacuum switch unit 46 moves to a predetermined position by the opening mechanism not shown, whereby the connection contact terminals 24 and 34 of the vacuum switch unit 46 slide coming in contact with the first circuit conductor 61 and the second circuit conductor 71 respectively.

[0127] Either the stationary-electrode-side connection contact terminal 24 or the movable-electrode-side connection contact terminal 34 is connected to a power supply circuit, and the remaining terminal is connected to a load circuit.

[0128] That is, the power supply side and the load side are reversed in some cases.

[0129] As shown in Fig. 11, although the movable-electrode-side connection contact terminal 34 is bent upward with a round portion R so as to be substantially parallel to the central axis S at a portion proximate to the cylindrical vacuum switch 1, it is also preferable that the movable-electrode-side connection contact terminal 34 is simply bent into an L-shape without the round portion R as a matter of course.

[0130] This round portion R makes it possible to relieve stress on the portion in which the movable-electrode-side connection contact terminal 34 is mounted on the movable electrode 1b

[0131] Figs. 12 (a) and (b) shows a case that a current transformer 13 is disposed near the bent portion of the movable-electrode-side connection contact terminal 34 in the vacuum switch unit portion of the switchgear shown in Fig. 11.

[0132] The current transformer 13 is arranged effectively utilizing a space in the bent portion of the movable-electrode-side connection contact terminal 34, and this contributes to downsizing of the switchgear.

[0133] As described above, according to this embodiment, since sliding contact between the stationary-electrode-side connection contact terminal fixed to the stationary electrode of the vacuum switch, of which central axis is arranged vertically, and the first circuit conductor, as well as sliding contact between the movable-electrode-side connection contact terminal fixed to the movable electrode and the second circuit conductor, is arranged so as to slide in the direction extending the central axis of the vacuum switch, it is possible to greatly relieve the bending stress on the stationary electrode and the movable electrode of the vacuum switch.

[0134] As a result, it is possible to improve reliability on mechanical strength of the vacuum switch unit put into practical use, and achieve a switchgear in which structural reliability is improved in vertically ascending and descending the vacuum switch unit.

Embodiment 6.

[0135] Fig. 13 is a schematic view showing a construction of an essential part (portion on which a vacuum switch unit is mounted) of switchgear according to Embodiment 6.

[0136] In the drawing, numeral 1 is a cylindrical vacuum switch, numeral 1a is a stationary electrode, numeral 1b is a movable electrode, numeral 24 is a stationary-electrode-side connection contact terminal, numeral 34 is a movable-electrode-side connection contact terminal, numeral 34a is a shunt, and numeral 34b is a contact member.

[0137] This embodiment differs from the switchgear according to the foregoing Embodiment 5 in the aspect that disposing the power supply side conductor 61 shown in Fig. 11 is omitted and the stationary-electrode-side connection contact terminal 24 directly slides coming in contact with a main bus conductor 80.

[0138] Referring to Fig. 13, the main bus conductor 80 is U-shaped in section, and is arranged so that the stationary-electrode-side connection contact terminal 24 of the vacuum switch unit 46 slides coming in contact with an substantially U-shaped groove of the main bus conductor 80 when the vacuum switch unit 46 moves to a predetermined position by an opening mechanism not shown.

[0139] In other words, the main bus conductor 80 is arranged at a portion proximate to the vacuum switch unit 46 without any other mechanism (for example, the power supply side conductor 61 in Fig. 12) between the main bus conductor 80 and the stationary-electrode-side connection contact terminal 24 extending in the same direction as the central axis S passing through the stationary electrode 1a and the movable electrode 1b, whereby the stationary-electrode-side connection contact terminal 24 slides vertically coming in contact with the main bus conductor 80 arranged horizontally (i.e., in the direction parallel to the plane on which the switchgear is mounted).

[0140] This construction makes it possible to obtain switchgear in which a current path is formed with an extremely short distance in addition to the advantages of the switchgear obtained by the foregoing Embodiment 5.

Embodiment 7.

[0141] Fig. 14 is a schematic view showing a construction of an essential part (portion on which a vacuum switch unit is mounted) of switchgear according to Embodiment 7.

[0142] As shown in Fig. 14, in the switchgear according to this embodiment, the movable-electrode-side connection contact terminal 34 is bent upward forming an L-shape to be substantially parallel to the central axis S at a portion proximate to the cylindrical vacuum switch 1, and an end thereof is arranged to slide coming in contact with a junction 71a of the second circuit conductor (for example, load side conductor) 71.

[0143] The second circuit conductor 71 is bent downward from the sliding contact portion (i.e., the junction 71a) in a direction substantially parallel to the central axis

S of the cylindrical vacuum switch 1.

[0144] That is, the movable-electrode-side connection contact terminal 34 and the second circuit conductor 71 are formed into a U-shape (inverted U-shaped configuration) at a portion proximate to the vacuum switch 1.

[0145] According to this construction, it is possible to obtain switchgear constructed so that the cylindrical vacuum switch 1 is connected to and comes in contact with another conductor (for example, the load side cable 110 or the like) on the power supply side or on the load side with an extremely short distance from the cylindrical vacuum switch 1.

[0146] As described above, in this embodiment, the vacuum switch unit is arranged so that the central axis of the vacuum switch extends vertically. Thus, the stationary-electrode-side connection contact terminal fixed to the stationary electrode of the vacuum switch comes in contact with and is connected to the power supply side circuit conductor (for example, the main bus conductor) arranged horizontally, and the movable-electrode-side connection contact terminal, of which one end is fixed to the movable electrode of the vacuum switch, is bent into an L-shape at a portion proximate to the cylindrical switch so as to be parallel to the central axis of the vacuum switch, whereby the end thereof comes in contact with and is connected to the U-shaped junction of the load side circuit conductor, and this load side circuit conductor is arranged in a direction parallel to the central axis of the vacuum switch (i.e., vertically). Therefore, it is possible to greatly relieve the bending stress on the stationary electrode and the movable electrode of the vacuum switch and downsize the switchgear in depth. As a result, it is possible to achieve structurally reliable and downsized switchgear.

[0147] Furthermore, in this construction, since the load side circuit conductor is arranged downward, and this makes it easy to lead in the cable located on the load side from the bottom of the switchgear.

[0148] In the foregoing example shown in Fig. 14, although the movable-electrode-side connection contact terminal 34 and the second circuit conductor (for example, load side conductor) 71 are formed into a U-shape (inverted U-shaped configuration) at a portion proximate to the vacuum switch 1, it is also preferable that the stationary-electrode-side connection contact terminal 24 and the first circuit conductor (for example, power supply side conductor) 61 are formed into a U-shape (inverted U-shaped configuration) at a portion proximate to the vacuum switch 1. In this construction also the same advantages are obtained.

Embodiment 8.

[0149] Fig. 15 is a schematic view showing a construction of an essential part (portion on which a vacuum switch unit is mounted) of switchgear according to Embodiment 8.

[0150] This embodiment differs from the foregoing Embodiment 6 (Fig. 13) or Embodiment 7 (Fig. 14) in the aspect that a sensor 11 or an auxiliary machine 12 is arranged in the vicinity of the second circuit conductor (load side conductor) 71.

[0151] As shown in the drawing, in the switchgear according to this embodiment, the switchgear is provided with the movable-electrode-side connection contact terminal 33 fixed to the cylindrical vacuum switch 1 and the second circuit conductor 71 that comes in contact with and is connected to the movable-electrode-side connection contact terminal 33, and in which the sensor 11 such as current sensor or voltage sensor or the auxiliary machine 12 such as zero-phase current transformer is arranged in the vicinity of the second circuit conductor 71.

[0152] It is also preferable that the sensor 11 or the auxiliary machine 12 is arranged in the vicinity of the main bus conductor 80 or the stationary-electrode-side connection contact terminal 24.

[0153] It is also preferable that an auxiliary machine (not shown) such as instrument voltage transformer or instrument current transformer is arranged likewise.

[0154] Although the vacuum switch unit shown in the foregoing Embodiment 2 (Fig. 6) (i.e., the vacuum switch unit 45) is used as the vacuum switch unit in the switchgear shown in Fig. 15, the invention is not limited to thereto, and it is also preferable to use the vacuum switch unit 46 constructed as shown in the foregoing Embodiment 6 (Fig. 13) or Embodiment 7 (Fig. 14) as a matter of course.

[0155] According to this embodiment, in addition to the advantages of the switchgear according to the foregoing Embodiment 7, since the sensor or the auxiliary machine is arranged in the vicinity of the second circuit conductor (load side conductor), it is possible to further downsize the switchgear.

Embodiment 9.

[0156] Fig. 16 is a schematic view showing a construction of an essential part (portion on which vacuum switch units are mounted) of switchgear according to Embodiment 9.

[0157] In the switchgear according to this embodiment, plural vacuum switch units are arranged forming a straight line as shown in Fig. 16.

[0158] Fig. 16 shows a construction in which the vacuum switch unit 46 constructed as shown in the foregoing Embodiment 6 (Fig. 13) or Embodiment 7 (Fig. 14) is used as the vacuum switch unit.

[0159] As shown in the drawing, each of the three vacuum switch units 46 covering three phases is arranged so that the stationary-electrode-side connection contact terminal 24 arranged on the top side slides coming in contact with the main bus conductor 80, and the movable-electrode-side connection contact terminal 34 arranged on the bottom side slides coming in contact with the second circuit conductor 71 when the vacuum switch unit 46 is mounted on a predetermined position by an opening

mechanism not shown.

[0160] The three vacuum switch units 46 are arranged and mounted close to each other forming a horizontal straight line as shown in Fig. 16.

[0161] According to this construction, in addition to the advantages of the foregoing Embodiment 8, it is possible to reduce the space for mounting the three vacuum switch units (for three phases) and easily arrange various sensors and auxiliary machines.

[0162] Furthermore, in this construction, since the second circuit conductor (load side circuit conductor) is arranged downward, it is easy to lead in the cable located on the load side from the bottom of the switchgear.

[0163] The vacuum switch units used in this embodiment are not limited to the vacuum switch unit 46 constructed as shown in the foregoing Embodiment 6 (Fig. 13) or Embodiment 7 (Fig. 14), and it is also preferable to use, for example, the vacuum switch unit 45 shown in the foregoing Embodiment 2 (Fig. 6) as a matter of course.

Embodiment 10.

[0164] Fig. 17 is a schematic view showing a construction of an essential part (portion where vacuum switch units are mounted) of switchgear according to Embodiment 10.

[0165] In the switchgear according to this embodiment, plural (three) vacuum switch units are arranged so that the central axes of the vacuum switches are positioned on the vertexes of a triangle respectively when taken from above as shown in Fig. 17.

[0166] Fig. 17 shows a construction in which the vacuum switch unit 46 shown in the foregoing Embodiment 6 (Fig. 13) or Embodiment 7 (Fig. 14) is used as the vacuum switch units.

[0167] As shown in the drawing, the vacuum switch units 46 are arranged so that the stationary-electrode-side connection contact terminal 24 arranged on the top side of each vacuum switch unit 46 slides coming in contact with the main bus conductor 80, and the movable-electrode-side connection contact terminal 34 arranged on the bottom side slides coming in contact with the second circuit conductor 71.

[0168] Each of the vacuum switch units 46 has the same construction as shown in Fig. 14.

[0169] As shown in Fig. 17, the three vacuum switch units 46 are arranged covering three phases with their central axes positioned on the vertexes of a triangle respectively.

[0170] According to this construction, in addition to the advantages of the switchgear according to the foregoing Embodiment 7, it is possible to further reduce the space for mounting the vacuum switch units for covering three phases and easily arrange various sensors and auxiliary machines.

[0171] Furthermore, since the second circuit conductor (the load side circuit conductor) is arranged downward in the same manner as in the foregoing Embodiment 9, it is easy to lead in the cable located on the load side from the bottom of the switchgear.

[0172] In addition, the vacuum switch units used in this embodiment are not limited to the vacuum switch unit 46 constructed as shown in the foregoing Embodiment 6 (Fig. 13) or Embodiment 7 (Fig. 14), and it is also preferable to use, for example, the vacuum switch unit 45 shown in the foregoing Embodiment 2 (Fig. 6) as a matter of course.

Embodiment 11.

[0173] Fig. 18 is a schematic view showing a construction of an essential part (portion on which a vacuum switch unit is mounted) of switchgear according to Embodiment 11.

[0174] In the switchgear according to this embodiment, various parts arranged in the vicinity of the cylindrical vacuum switch vertically mounted are combined into several components as shown in Fig. 18.

[0175] More specifically, referring to Fig. 18, numeral 19a is a component that includes the vacuum switch 1, stationary-electrode-side connection contact terminal (23 or 24) and the movable-electrode-side connection contact terminal (33 or 34) and is formed integrally into one unit composed of an organic insulating material (not shown) by injection molding.

[0176] Numeral 19b is a component that includes the sliding contact portion, where the stationary-electrode-side connection contact terminal (23 or 24) slides coming in contact with the main bus conductor 80, and is formed integrally into one unit composed of an organic insulating material by injection molding.

[0177] Numeral 19c is a component that includes the U-shaped portion (inverted U-shaped portion) of the second circuit conductor 71 shown in Fig. 14 and is formed integrally into one unit of an organic insulating material by injection molding.

[0178] Numerals 19d and 19e are components that include the second circuit conductor 71 and the sensor 11 or the auxiliary machine 12 and are respectively formed integrally into one unit by injection molding.

[0179] Numeral 19f is a component that includes the remaining portion of the second circuit conductor 71 and a part of another conductor 110 and is formed integrally into one unit by injection molding.

[0180] As described above, according to this embodiment, in addition to the advantages of the vacuum switch unit according to the foregoing Embodiment 7, combining the various parts into several components further makes it easy to manage the parts, and this performs the advantage of making it easy to assemble the parts inside the switchgear.

[0181] Furthermore, insulating property between the adjacent vacuum switch units is improved.

[0182] In the foregoing description, constructions of the vacuum switch 1 capable of interrupting an electric

current, the stationary-electrode-side connection contact terminal (23 or 24), the movable-electrode-side connection contact terminal (33 or 34), the main bus conductor 80, the second circuit conductor 71, etc. are described. The invention is likewise applicable to any other vacuum switch unit having other function such as disconnection and grounding as a matter of course.

[0183] Although the vacuum switches of an organic insulating material disposed in the air is described in the foregoing constructions, the invention is also applicable to a construction used in gas atmosphere, provided that there is no possibility that the organic insulating material is not deteriorated in the gas.

Embodiment 12.

[0184] Figs. 19 (a) and (b) are schematic views each showing a construction of an essential part (portion on which a vacuum switch unit is mounted) of switchgear according to Embodiment 12.

[0185] In the drawing, numeral 1 is a cylindrical vacuum. This vacuum switch 1 is provided with a stationary electrode 1a connected to an internal stationary contact (i.e., stationary electrode) at an end of the central axis S of this vacuum switch 1 and a movable electrode 1b connected to a movable contact point (i.e., movable electrode) at the other end thereof.

[0186] Numeral 24 is a stationary-electrode-side connection contact terminal of which one end is fixed to the stationary electrode bar 1a, and numeral 34 is a movable-electrode-side connection contact terminal of which one end is fixed to the movable electrode 1b through a shunt 34a of a flexible copper strand.

[0187] Numeral 61 is a first circuit conductor (for example, power supply side conductor), and numeral 71 is a second circuit conductor (for example, load side conductor).

[0188] In this embodiment, the cylindrical vacuum switch 1 is mounted so that the stationary electrode 1a and the movable electrode 1b extends horizontally, for example, in the back and forth direction when the switchgear is viewed from the front, and the vacuum switch 1 can move horizontally to a predetermined position by a opening mechanism not shown.

[0189] The movable electrode 1b is driven horizontally (i.e., on a plane parallel to the plane on which the switchgear is mounted and in the back and forth direction when the switchgear is viewed from the front) by a switch mechanism (not shown), thereby opening or closing the internal contact (electrode) of the cylindrical vacuum switch 1.

[0190] Since the movable-electrode-side connection contact terminal 34 is fixed to the movable electrode 1b through the shunt 34a, the movable electrode 1b can move horizontally regardless of the movable-electrode-side connection contact terminal 34 at the time of opening and closing the contact (electrode).

[0191] The stationary-electrode-side connection contact terminal 24 is composed of a conductive material such as copper plate, and the other end thereof extends in the same direction as the central axis S of the vacuum switch 1 passing through the stationary electrode 1a and the movable electrode 1b and slides coming in contact with the first circuit conductor 61 (for example, power supply side conductor).

[0192] The movable-electrode-side connection contact terminal 34 is also composed of a conductive material such as copper plate, and the other end thereof is bent transversally so as to be substantially parallel to the central axis S at a portion proximate to the cylindrical valve 1.

[0193] An end (i.e., end opposite to the end fixed to the movable electrode 1b) of the movable-electrode-side connection contact terminal 34 is arranged to slide coming in contact with the second circuit conductor 71 (for example, load side conductor).

[0194] In this case, an elastic contact member 34b is disposed at the end of the movable-electrode-side connection contact terminal 34 in some cases.

[0195] The vacuum switch 1, the stationary-electrode-side connection contact terminal 24, and the movable-electrode-side connection contact terminal 34, form the vacuum switch unit 46.

[0196] Fig. 19 (a) shows a state that the vacuum switch unit 46 is separated from the first circuit conductor (for example, power supply side conductor) 61 and the second circuit conductor 71 (for example, load side conductor), and Fig. 19(b) shows a state that the vacuum switch unit 46 moves to a predetermined position by the opening mechanism not shown and slides coming in contact with the first circuit conductor 61 and the second circuit conductor 71.

[0197] In addition, either the stationary-electrode-side connection contact terminal 24 or the movable-electrode-side connection contact terminal 34 is connected to a power supply circuit, and the other is connected to a load circuit. That is, the power supply side and the load side are reversed in some cases.

[0198] As described above, according to this embodiment, the vacuum switch unit is arranged so that the central axis of the vacuum switch extends horizontally, and the stationary-electrode-side connection contact terminal fixed to the stationary electrode of the vacuum switch comes in contact with and is connected to the power supply side circuit conductor (for example, main bus conductor) disposed vertically. Further, the movable-electrode-side connection contact terminal of which one end is fixed to the movable electrode of the vacuum switch is bent into an L-shape in proximity to the vacuum switch so as to be parallel to the central axis of the vacuum switch, an end thereof comes in contact with and is connected to the U-shaped joint of the load side circuit conductor, and this load side circuit conductor is disposed in the direction parallel to the central axis of the vacuum switch (i.e., horizontally) . Therefore, it is possible to greatly relieve the bending stress on the stationary electrode and the movable electrode of the vacuum switch and downsize the switchgear in height (i.e., the vertical size) and, as a

result, it is possible to obtain structurally reliable and downsized switchgear.

Embodiment 13.

[0199] Fig. 20 is a schematic view showing a construction of an essential part (portion on which a vacuum switch unit is mounted) of switchgear according to Embodiment 13.

[0200] In the drawing, numeral 1 is a cylindrical vacuum switch, numeral 1a is a stationary electrode, numeral 1b is a movable electrode, numeral 24 is a stationary-electrode-side connection contact terminal, numeral 34 is a movable-electrode-side connection contact terminal, numeral 34a is a shunt, and numeral 34b is a contact member.

[0201] This embodiment differs from the switchgear according to the foregoing Embodiment 12 in the aspect that disposing the first circuit conductor (the power supply side conductor) 61 shown in Fig. 19 is omitted and the stationary-electrode-side connection contact terminal 24 directly slides coming in contact with the main bus conductor 80.

[0202] Referring to Fig. 20, numeral 80 is a main bus conductor of substantially U-shape in section and is disposed vertically. This main bus conductor 80 is arranged so that the stationary-electrode-side connection contact terminal 24 of the vacuum switch unit 46 slides coming in contact with an substantially U-shaped groove of the main bus conductor 80 when the vacuum switch unit 46 has moved to a predetermined position by any opening mechanism not shown.

[0203] In other words, the main bus conductor 80 is disposed in proximity to the vacuum switch unit 46 without interposing any other mechanism (for example, the power supply side conductor 61 in Fig. 19) between the main bus conductor 80 and the stationary-electrode-side connection contact terminal 24 extending in the same direction as the central axis S passing through the stationary electrode 1a and the movable electrode 1b, and the stationary-electrode-side connection contact terminal 24 slides horizontally and comes in contact with the main bus conductor 80 disposed vertically.

[0204] This construction makes it possible to obtain switchgear in which a current path can be formed with an extremely short distance in addition to the advantages of the switchgear according to the foregoing Embodiment 12.

Embodiment 14.

[0205] Fig. 21 is a schematic view showing a construction of an essential part (portion on which a vacuum switch unit is mounted) of switchgear according to Embodiment 14.

[0206] As shown in Fig. 21, in the switchgear according to this embodiment, the movable-electrode-side connection contact terminal 32 of which one end is fixed to the movable electrode 1b is bent horizontally into an L-shape so as to be substantially parallel to the central axis S of the vacuum switch 1 at a portion proximate to the cylindrical vacuum switch 1.

[0207] The other end of the movable-electrode-side connection contact terminal 32 is disposed to slide and come in contact with the junction 71a of the second circuit conductor 71.

[0208] Furthermore, the second circuit conductor 71 is bent from the sliding contact portion (i.e., the junction 71a) substantially in parallel to the central axis S of the vacuum switch 1 and in a direction opposite to the direction where the movable-electrode-side connection contact terminal 32 is bent (i.e., in the direction of the movable electrode 1b).

[0209] That is, the movable-electrode-side connection contact terminal 32 and the second circuit conductor 71 are formed into a U-shape at a portion proximate to the vacuum switch 1.

[0210] The other end of the stationary-electrode-side connection contact terminal 22 of which one end is fixed to the stationary electrode 1a is disposed to slide coming in contact with a junction 61a formed at an end of the first circuit conductor 61.

[0211] The first circuit conductor 61 is bent from the sliding contact portion (i.e., the junction 61a) substantially in parallel to the central axis S of the vacuum switch 1 and in a direction opposite to the direction of the stationary-electrode-side connection contact terminal 22 (i.e., in the direction of the movable electrode 1b)

[0212] That is, the stationary-electrode-side connection contact terminal 22 and the first circuit conductor 61 are formed into a U-shape at a portion proximate to the vacuum switch 1.

[0213] A junction 61b is formed at the other end of the first circuit conductor 61 and slides coming in contact with another circuit conductor (for example, the main bus conductor 80) disposed horizontally.

[0214] According to this construction, in addition to the advantages of the switchgear according to the foregoing Embodiment 12, it is possible to obtain switchgear having a construction in which the vacuum switch 1 is connected to and is in contact with another conductor (for example, the main bus conductor 80 or the like) on the power supply side or on the load side with an extremely short distance from the vacuum switch 1.

[0215] Further, since the other end of the second circuit conductor 71 opposite to the junction 71a is bent downward, it is easy to lead in the cable located on the load side from the bottom of the switchgear.

[0216] In the foregoing example shown in Fig. 21, although both combination of the stationary-electrode-side connection contact terminal 22 and the first circuit conductor 61 and combination of the movable-electrode-side connection contact terminal 32 and the second circuit conductor 71 are formed into U-shape at apportion proximate to the vacuum switch 1, it is also preferable that only either the combination of the stationary-electrode-

side connection contact terminal 22 and the first circuit conductor 61 or the combination of the movable-electrode-side connection contact terminal 32 and the second circuit conductor 71 is formed into a U-shape at a portion proximate to the vacuum switch 1. In this construction also the same advantages are obtained.

[0217] Further, although the foregoing description shows an example in which the second circuit conductor 71 is formed into a U-shape at a portion proximate to the vacuum switch 1, it is also preferable to form the second circuit conductor 71 not into a U-shape but into a straight line.

[0218] In this case (i.e., in the case where the second circuit conductor 71 is constructed forming a straight line), it is easy to lead in the cable located on the load side from the back of the switchgear to the second circuit conductor.

Embodiment 15.

[0219] Fig. 22 is a schematic view showing a construction of an essential part (portion on which a vacuum switch unit is mounted) of switchgear according to Embodiment 15.

[0220] The switchgear according to this embodiment is characterized by arranging a sensor 11 or an auxiliary machine 12 in the vicinity of the first circuit conductor 61 or the second circuit conductor 71 in addition to the feature of the switchgear according to the foregoing Embodiment 14.

[0221] That is, as shown in the drawing, in the switchgear according to this embodiment, the stationary-electrode-side connection contact terminal 22 and the first circuit conductor 61 are formed into a U-shape at a portion proximate to the vacuum switch 1 and, furthermore, this first circuit conductor 61 is provided with the sensor 11 such as current sensor or voltage sensor.

[0222] Likewise, the movable-electrode-side connection contact terminal 32 and the second circuit conductor 71 are formed into a U-shape at a portion proximate to the vacuum switch 1 and, furthermore, this second circuit conductor 71 is provided with the auxiliary machine 12 such as zero-phase current transformer.

[0223] According to this construction, in addition to the advantages of the switchgear according to the foregoing Embodiment 12, it is relatively easy to arrange the sensor 11 or the auxiliary machine 12 even in the case of a switchgear in which the vacuum switch 1 is connected to and is in contact with another conductor on the power supply side or on the load side with an extremely short distance from the vacuum switch 1.

Embodiment 16.

[0224] Fig. 23 is a schematic view showing ae construction of an essential part (portion on which vacuum switch units are mounted) of switchgear according to Embodiment 16.

[0225] As shown in the drawing, in the switchgear according to this embodiment, plural (for example, three units covering three phases) vacuum switch units as shown in the foregoing Embodiment 15 (Fig. 22) are arranged horizontally forming a straight line.

[0226] More specifically, as shown in Fig. 23, three vacuum switch units (for covering three phases), in each of which the first circuit conductor 61 joined (comes in contact with and is connected to) to the stationary-electrode-side connection contact terminal 22 is provided with the sensor 11 and the second circuit conductor 71 jointed to the movable-electrode-side connection contact terminal 32 is provided with the auxiliary machine (for example, a zero-phase current transformer) 12, are arranged horizontally forming a straight line.

[0227] According to this construction, in addition to the advantages of the switchgear according to the foregoing Embodiment 12, it is possible to reduce the space for mounting the vacuum switch units and arrange easily various sensors and auxiliary machines.

[0228] Furthermore, since the other end of the second circuit conductor 71 opposite to the junction 71a is bent downward, it is easy to lead in the cable located on the load side from the bottom of the switchgear.

Embodiment 17.

[0229] Fig. 24 is a schematic view showing a construction of an essential part (portion on which vacuum switch units are mounted) of switchgear according to Embodiment 17.

[0230] As shown in the drawing, in the switchgear according to this embodiment, the vacuum switch units as shown in the foregoing Embodiment 15 (Fig. 22) are arranged horizontally and mounted so that central axis S of each vacuum switch 1 of the vacuum switch units is positioned on each vertex of a triangle respectively.

[0231] That is, as shown in Fig. 24, three vacuum switch units (for covering three phases), in each of which the first circuit conductor 61 joined to the stationary-electrode-side connection contact terminal 22 is provided with the sensor 11 and the second circuit conductor 71 jointed to the movable-electrode-side connection contact terminal 32 is provided with the auxiliary machine 12 such as zero-phase current transformer, are arranged so that they are positioned on the vertexes of a triangle respectively.

[0232] According to this construction, in addition to the advantages of the switchgear according to the foregoing Embodiment 12, it is possible to further reduce the space for mounting the three vacuum switch units (for covering three phases) and easily arrange various sensors and auxiliary machines.

[0233] Furthermore, since the other end of the second circuit conductor 71 opposite to the junction 71a is bent downward, it is easy to lead in the cable located on the load side from the bottom of the switchgear.

Embodiment 18.

[0234] Fig. 25 is a schematic view showing a construction of an essential part (portion on which a vacuum switch unit is mounted) of switchgear according to Embodiment 18.

[0235] In the switchgear according to this embodiment, various parts disposed in the vicinity of the cylindrical vacuum switch arranged horizontally are combined into several components as shown in Fig. 25.

[0236] That is, referring to Fig. 25, numeral 19a is a component that includes the cylindrical valve 1, the stationary-electrode-side connection contact terminal 22 and the movable-electrode-side connection contact terminal 32 formed integrally into one unit composed an organic insulating material (not shown) by injection molding.

[0237] Numeral 19b is a component that includes the sliding contact portion of the stationary-electrode-side connection contact terminal 22 and the main bus conductor 80 formed integrally into one unit composed of an organic insulating material by injection molding.

[0238] Numeral 19c is a component that includes the inverted U-shaped portion of the second circuit conductor 71 shown in Fig. 21 formed into one unit by injection molding.

[0239] Numerals 19d and 19e are components including the second circuit conductor 71 and the sensor 11 or the auxiliary machine 12 such as zero-phase current transformer formed integrally into one unit by injection molding.

[0240] Numeral 19f is a component including the remaining portion of the second circuit conductor 71 and a part of the other conductor 110 formed integrally into one unit by injection molding.

[0241] As described above, in the switchgear according to this embodiment, in addition to the advantages of the vacuum switch unit according to the foregoing Embodiment 12, combining the various parts into several components further makes it easy to manage the parts, and this performs the advantage of making it easy to assemble the parts inside the switchgear. Furthermore, insulating property between the adjacent vacuum switch units is improved.

[0242] In the foregoing description, constructions of the vacuum switch 1 capable of interrupting an electric current, the stationary-electrode-side connection contact terminal 22, the movable-electrode-side connection contact terminal 32, the main bus conductor 80, the second circuit conductor 71, etc. are described. The invention is likewise applicable to any other cylindrical valve having other function such as disconnection and grounding as a matter of course.

[0243] Although the vacuum switches of an organic insulating material disposed in the air is described in the foregoing constructions, the invention is also applicable to a construction used in gas atmosphere, provided that there is no possibility that the organic insulating material is not deteriorated in the gas.

Embodiment 19.

[0244] Figs. 26 and 27 (a) and (b) are schematic views each showing a construction of an essential part (portion on which a vacuum switch unit is mounted) of switchgear according to Embodiment 19.

[0245] In the drawing, numeral 1 is a cylindrical vacuum switch.

[0246] This vacuum switch 1 is provided with a stationary electrode 1a (not shown) connected to an internal stationary contact (stationary electrode) at the center (central portion of the upper end in the drawings) of an end of the vacuum switch 1 and a movable electrode 1b connected to a movable contact (movable electrode) at the other end thereof.

[0247] Numeral 23 is a stationary-electrode-side connection contact terminal of which one end is fixed to the stationary electrode 1a (not shown), and numeral 33 is a movable-electrode-side connection contact terminal of which one end is fixed to the movable electrode 1b through a shunt (not shown) of a flexible copper strand.

[0248] The vacuum switch 1, the stationary-electrode-side connection contact terminal 23 and the movable-electrode-side connection contact terminal 33, form a vacuum switch unit.

[0249] This vacuum switch unit is mounted so that the stationary electrode 1a (not shown) and the movable electrode 1b are arranged vertically and the vacuum switch unit can move vertically to a predetermined position by an opening mechanism (not shown).

[0250] The movable electrode 1b is driven vertically by a switch mechanism (not shown), thereby opening or closing the contact (electrode) in the vacuum switch 1.

[0251] The movable-electrode-side connection contact terminal 33 is fixed to the movable electrode 1b through the shunt, and therefore the movable electrode 1b can move vertically regardless of the movable-electrode-side connection contact terminal 33 at the time of opening and closing the contact (electrode).

[0252] Numeral 1c is an insulating member interposed between the cylindrical vacuum switch 1 and the parting mechanism (not shown).

[0253] The stationary-electrode-side connection contact terminal 23 is formed of a conductive material such as copper plate or copper bar, and the other end thereof extends in the same direction as the central axis S of the vacuum switch 1 passing through the stationary electrode 1a (not shown) and the movable electrode 1b and slides coming in contact with the main bus conductor 80.

[0254] Likewise the movable-electrode-side connection contact terminal 33 is formed of a conductive material such as copper plate, and the other end thereof is provided with a circuit conductor 72a (corresponding the connection contact part 33b in Fig. 6) that extends upward substantially in parallel to the central axis S at a portion proximate to the cylindrical vacuum switch 1.

[0255] A circuit conductor 72b slides coming in contact with this circuit conductor 72a and is connected to the circuit conductor 72a, whereby the circuit conductor 72b extends upward crossing a side face of the main bus conductor 80 close to each other.

[0256] In a case where plural main bus conductors 80 are disposed, the circuit conductor 72b is arranged to extend through between the main bus conductors 80.

[0257] Furthermore, a circuit conductor 72c is connected to the circuit conductor 72b crossing the side face of the main bus conductor 80 close to each other.

[0258] Fig. 26 shows a state that the vacuum switch unit is separated from the main bus conductor 80 and the circuit conductor 72b.

[0259] Fig. 27 (a) shows a state that the vacuum switch unit moves to a predetermined position by the opening mechanism not shown and is mounted on the main bus conductor 80 and the circuit conductor 72b.

[0260] That is, Fig. 27 (a) shows a state that the end of the stationary-electrode-side connection contact terminal 23 of the vacuum switch 1 slides coming in contact with the main bus conductor 80, and the end of the movable-electrode-side connection contact terminal 33 slides coming in contact with the circuit conductor 72b through the circuit conductor 72a.

[0261] In addition, Fig. 27 (b) is a side view of Fig. 27 (a).

[0262] Either the stationary-electrode-side connection contact terminal 23 or the movable-electrode-side connection contact terminal 33 is connected to a power supply circuit, and the other is connected to a load circuit.

[0263] In short, the power supply side and the load side are reversed in some cases.

[0264] In addition, the vacuum switch unit used in this embodiment is not limited to the vacuum switch unit (i.e., the vacuum switch unit 45) constructed as shown in the foregoing Embodiment 2 (Fig. 6). It is also preferable to use the vacuum switch unit (i.e., the vacuum switch unit 46) of the construction as shown in the foregoing Embodiment 6 (Fig. 13) or Embodiment 7 (Fig. 14) as a matter of course.

[0265] As described above, according to this embodiment, the vacuum switch unit is arranged so that the central axis of the vacuum switch extends vertically. The stationary-electrode-side connection contact terminal fixed to the stationary electrode of the vacuum switch comes in contact with and is connected to the power supply side circuit conductor (for example, the main bus conductor) arranged horizontally. The movable-electrode-side connection contact terminal of which one end is fixed to the movable electrode of the vacuum switch is formed into an L-shape in proximity to the vacuum switch so as to be parallel to the central axis of the vacuum switch. One end thereof crosses the power supply side circuit conductor and comes in contact with and is connected to the junction of the load side circuit conductor arranged upward in a vertical direction. Consequently, it is possible to greatly relieve the bending stress on the stationary electrode and the movable electrode of the vacuum switch and downsize the switchgear in depth and, as a result, it is possible to achieve structurally reliable and downsized switchgear.

[0266] Furthermore, according to this construction, the load side circuit conductor is disposed upward, and this makes it easy to lead in the cable located on the load side from the top of the switchgear.

Embodiment 20.

[0267] Fig. 28 is a schematic view showing a construction of an essential part (portion on which a vacuum switch unit is mounted) of switchgear according to Embodiment 20.

[0268] This embodiment differs from the switchgear (Fig. 26) according to the foregoing Embodiment 19 in the aspect that the sensor 11 or the auxiliary machine 12 such as zero-phase current transformer is arranged in the vicinity of the circuit conductor 72b.

[0269] That is, as shown in the drawing, the switchgear according to this embodiment includes the movable-electrode-side connection contact terminal 33 fixed to the movable electrode 1b of the cylindrical vacuum switch 1, the circuit conductor 72a (corresponding to the connection contact part 33b in Fig. 6) joined thereto, and the circuit conductor 72b. This switchgear is characterized by arranging the sensor 11 or the auxiliary machine 12 such as zero-phase current transformer in the vicinity of the circuit conductor 72b.

[0270] It is also preferable that the sensor 11 or the auxiliary machine 12 is arranged in the vicinity of the main bus conductor 80 or the stationary-electrode-side connection contact terminal 23.

[0271] The vacuum switch unit used in this embodiment is not limited to the vacuum switch unit 45 constructed as shown in the foregoing Embodiment 2 (Fig. 6), and it is also preferable to use the vacuum switch unit (i.e., the vacuum switch unit 46) constructed as shown in the foregoing Embodiment 6 (Fig. 13) or Embodiment 7 (Fig. 14) as a matter of course.

[0272] According to this embodiment, in addition to the advantages of the switchgear according to the foregoing Embodiment 19, it is possible to arrange various sensors and auxiliary machines making efficient use of the space, and this makes it possible to further downsize the switchgear.

Embodiment 21.

[0273] Fig. 29 is a schematic view showing a construction of an essential part (portion on which vacuum switch units are mounted) of switchgear according to Embodiment 21.

[0274] As shown in the drawing, in the switchgear according to this embodiment, plural (for example, three units corresponding to three phases) vacuum switch units are arranged vertically forming a straight line.

[0275] That is, the vacuum switch 1 is arranged so that the stationary electrode 1a (not shown) of the vacuum switch 1 is located at the top and the movable electrode 1b at the bottom.

[0276] The stationary-electrode-side connection contact terminal 23 disposed on the stationary electrode 1a (not shown) side is formed on upper side extending upward, and an end of the stationary-electrode-side connection contact terminal 23 is disposed so as to slide coming in contact with the main bus conductor 80 and slide coming in contact with the circuit conductor 72a (corresponding to the connection contact part 33b in Fig. 6) formed at an end of the movable-electrode-side connection contact terminal 33 disposed on lower side and with the circuit conductor 72b.

[0277] The mentioned construction is the same as that shown in Fig. 28. The three vacuum switch units are mounted vertically forming a straight line as shown in Fig. 29.

[0278] According to this construction, in addition to the advantages of the switchgear according to the foregoing Embodiment 19, it is possible to reduce the space for mounting the vacuum switch units and arrange easily various sensors and auxiliary machines.

Embodiment 22.

[0279] Fig. 30 is a schematic view showing a construction of an essential part (portion on which a vacuum switch unit is mounted) of switchgear according to Embodiment 22.

[0280] As shown in the drawing, in the switchgear according to this embodiment, various parts arranged in the vicinity of the cylindrical vacuum switch are combined into several components.

[0281] That is, in Fig. 30, numeral 19a is a component that includes the cylindrical vacuum switch 1 for covering three phases, the stationary-electrode-side connection contact terminal 22, and the movable-electrode-side connection contact terminal 32 formed integrally into one unit composed of an organic insulating material 20a by injection molding.

[0282] Numeral 19b is a component that includes the portions where the stationary-electrode-side connection contact terminal 22 slides coming in contact with the main bus conductor 80 for covering three phases formed into one unit composed of an organic insulating material 20b by injection molding.

[0283] Numeral 19c is a component including the circuit conductor 72b shown in Fig. 28, the sensor 11, and the auxiliary machine 12 such as zero-phase current transformer formed integrally into one unit by injection molding.

[0284] As described above, in the switchgear according to this embodiment, in addition to the advantages of the switchgear according to the foregoing Embodiment 19, forming the various parts to be arranged integrally into one unit of an organic insulating material by injection molding, i.e., combining them into one or plural components makes it possible to largely shorten the required space insulating distance.

[0285] As a result, it is possible to downsize the enclosed type switchboard and reduce the manufacturing cost owing to reduction in raw materials.

[0286] Furthermore, not only it is easy to manage the parts, but also it is also easy to assemble the parts inside the switchgear.

[0287] Although the foregoing description mentions to the construction of the cylindrical vacuum switch 1 capable of interrupting an electric current, the stationary-electrode-side connection contact terminal 22, the movable-electrode-side connection contact terminal 32, the main bus conductor 80, the circuit conductors 7a and 7b, and so on, the invention is also applicable to a cylindrical valve having any other function such as disconnecting and grounding in the same manner as a matter of course.

[0288] Although the vacuum switches of an organic insulating material disposed in the air is described in the foregoing constructions, the invention is also applicable to a construction used in gas atmosphere, provided that there is no possibility that the organic insulating material is not deteriorated in the gas.

Embodiment 23.

[0289] Figs. 31 (a) and (b) are schematic views each showing a construction of an essential part (portion on which a vacuum switch unit is mounted) of switchgear according to Embodiment 23.

[0290] In the switchgear according to the foregoing Embodiments 19 to 22, the vacuum switch unit is arranged so that the central axis of the vacuum switch unit crosses the main bus conductor 80 arranged horizontally in the switchgear at right angles (i.e., in vertical direction).

[0291] On the other hand, the switchgear according to this embodiment is characterized by arranging the vacuum switch unit so that the central axis of the vacuum switch unit crosses the main bus conductor 80 arranged perpendicularly (i.e., vertically) in the switchgear at right angles (i.e., in horizontal direction).

[0292] Referring to Figs. 31 (a) and (b), numeral 1 is a cylindrical vacuum switch arranged horizontally.

[0293] This vacuum switch 1 is provided with a stationary electrode 1a (not shown), which is connected to an internal stationary contact (stationary electrode), at the center of an end of the vacuum switch 1 and with a movable electrode 1b connected to a movable contact (a movable electrode) at the other end thereof.

[0294] Numeral 23 is a stationary-electrode-side connection contact terminal of which one end is fixed to the stationary electrode 1a (not shown), and numeral 33 is a movable-electrode-side connection contact terminal of which one end is fixed to the movable electrode 1b through a shunt (not shown) of a flexible copper strand.

[0295] The vacuum switch 1, the stationary-electrode-side connection contact terminal 23, and the movable-

electrode-side connection contact terminal 33, form a vacuum switch unit.

[0296] This vacuum switch unit is mounted so that the stationary electrode 1a (not shown) and the movable electrode 1b extend horizontally and the vacuum switch unit can move horizontally to a predetermined position by an opening mechanism (not shown).

[0297] The movable electrode 1b is driven horizontally by a switch mechanism (not shown), thereby opening or closing the contact (electrode) in the vacuum switch 1.

[0298] Since the movable-electrode-side connection contact terminal 33 is fixed to the movable electrode 1b through the shunt, it is possible to move the movable electrode 1b horizontally regardless of the movable-electrode-side connection contact terminal 33 at the time of opening and closing the contact (electrode).

[0299] Numeral 1c is an insulating member interposed between the cylindrical vacuum switch 1 and the opening mechanism (not shown).

[0300] The stationary-electrode-side connection contact terminal 23 is formed of a conductive material such as copper plate or copper bar, and the other end thereof extends in the same direction as the central axis S of the vacuum switch 1 passing through the stationary electrode 1a (not shown) and the movable electrode 1b and slides coming in contact with the main bus conductor 80 arranged perpendicularly (i.e., vertically).

[0301] The movable-electrode-side connection contact terminal 33 is likewise formed of a conductive material such as copper plate, and the other end thereof is provided with a circuit conductor 72a that extends toward the backside of the switchgear so as to be substantially parallel to the central axis S at a portion proximate to the cylindrical vacuum switch 1.

[0302] A circuit conductor 72b slides coming in contact with the circuit conductor 72a and is connected to the circuit conductor 72a, and the circuit conductor 72b extends toward the backside of the switchgear and crosses a side face of the main bus conductor 80 close to each other.

[0303] In a case where plural main bus conductors 80 are disposed, the circuit conductor 72b is arranged to extend through between the main bus conductors 80.

[0304] Furthermore, a circuit conductor 72c is connected to the circuit conductor 72b crossing the side face of the main bus conductor 80 close to each other.

[0305] Fig. 31(a) shows a state that the vacuum switch unit has moved to a predetermined position by the opening mechanism not shown and is mounted on the main bus conductor 80 and the circuit conductor 72b.

[0306] More specifically, Fig. 31(a) shows a state that the end of the stationary-electrode-side connection contact terminal 23 of the vacuum switch 1 slides coming in contact with the main bus conductor 80, and the end of the movable-electrode-side connection contact terminal 33 slides coming in contact with the circuit conductor 72b through the circuit conductor 72a.

[0307] In addition, Fig. 31(b) is a side view of Fig. 31(a).

[0308] Thus, According to this embodiment, the vacuum switch unit is arranged so that the central axis of the vacuum switch extends horizontally, and the stationary-electrode-side connection contact terminal fixed to the stationary electrode of the vacuum switch comes in contact with and is connected to the power supply side circuit conductor (for example, the main bus conductor) disposed vertically. Further, the movable-electrode-side connection contact terminal of which one end is fixed to the movable electrode of the vacuum switch is formed into an L-shape in proximity to the vacuum switch so as to be parallel to the central axis of the vacuum switch, and the end thereof comes in contact with and is connected to the junction of the load side circuit conductor crossing the power supply side circuit conductor and horizontally extending toward the backside of the switchgear. As a result, it is possible to greatly relieve the bending stress on the stationary electrode and the movable electrode of the vacuum switch and downsize the switchgear in height, and consequently it is possible to achieve structurally reliable and downsized switchgear.

[0309] Furthermore, according to this construction, since the load side circuit conductor extends toward the backside of the switchgear, it is easy to lead in the cable located on the load side horizontally from the back of the switchgear. Industrial Applicability

[0310] As described above, in the vacuum switch unit according to the present invention, it is possible to greatly relieve the bending stress on the stationary electrode and the movable electrode in assembling, and therefore the invention is suited for accomplishing a vacuum switch unit highly reliable on mechanical strength.

[0311] Furthermore, it is not necessary to support the stationary-electrode-side connection contact terminal and the movable-electrode-side connection contact terminal of the vacuum switch unit by means of any support member such as insulators or mold frame, and therefore the invention is suited for accomplishing reliable switchgear in which number of parts is reduced and efficiency in assembling is improved.

Claims

1. A vacuum switch unit comprising:

a substantially cylindrical vacuum switch (1);
a stationary-electrode-side connection contact terminal (23, 24) of which one end is fixed to a stationary electrode (la) of said vacuum switch (1) and the other end side is provided with a contact connection part (23a) that is contactable and connectable to a first circuit conductor disposed in a switchgear; and
a movable-electrode-side connection contact terminal (33, 34) of which one end is fixed to a movable electrode (1b) of said vacuum switch (1) and the other end side is provided with a

contact connection part (33b) that is contactable and connectable to a second circuit conductor disposed in the switchgear;
characterized in that said stationary-electrode-side connection contact terminal (23, 24) and the movable-electrode-side connection contact terminal (33, 34) are formed so that the contact connection parts (21a, 31a) on their other end sides are substantially parallel to a central axis of said vacuum switch (1) and
in that the other end side having the contact connection part of either said stationary-electrode-side connection contact terminal (23, 24) or the movable-electrode-side connection contact terminal (33, 34) is formed on the central axis of said vacuum switch (1).

2. The vacuum switch unit according to claim 1,
characterized in that the other end side of said stationary-electrode-side connection contact terminal (23, 24) having the contact connection part is formed on the central axis of said vacuum switch (1), and the other end side of said movable-electrode-side connection contact terminal (33, 34) having the contact connection part is formed so that the other end side extends substantially in parallel to the central axis of said vacuum switch (1) toward said stationary-electrode-side connection contact terminal (23, 24).

3. A switchgear comprising:

a first circuit conductor (61, 80) and a second circuit conductor (71, 72b) each connected to either a power supply side or a load side; and
a vacuum switch unit (45, 46) including a substantially cylindrical vacuum switch (1), a stationary-electrode-side connection contact terminal (23, 24) of which one end is fixed to a stationary electrode (1a) of said vacuum switch (1) and the other end side is provided with a contact connection part that is contactable and connectable to said first circuit conductor (61, 80), said stationary-electrode-side connection contact terminal (23, 24) being formed on a central axis of said vacuum switch (1), and a movable-electrode-side connection contact terminal (33, 34) of which one end is fixed to a movable electrode (1b) of said vacuum switch (1) and the other end side is provided with a contact connection part that is contactable and connectable to said second circuit conductor (71, 72b), said movable-electrode-side connection contact terminal (33, 34) being formed in parallel to the central axis of said vacuum switch (1); wherein said vacuum switch unit (45, 46) is moveable by an opening mechanism from a position, in which the vacuum switch unit (45, 46) is separated from the first and second circuit conductors (61, 71, 72b, 80), to a predetermined position in said switch gear, in which the contact and connection part of said stationary-electrode-side connection terminal (23, 24) comes into contact with and is connected to said first circuit conductor (61, 80) and the contact and connection part of the movable-electrode-side connection contact terminal (33, 34) comes in contact with and is connected to said second circuit conductor (71, 72b) .

4. The switchgear according to claim 3, wherein said first circuit conductor (61, 80) is disposed horizontally, said vacuum switch unit (45, 46) be arranged so that the central axis of the vacuum switch 1 thereof extends vertically crossing said first circuit conductor (61, 80) at right angles, and said second circuit conductor (71) is formed so that an end thereof extends toward the bottom side.

5. The switchgear according to claim 3, wherein said first circuit conductor (61, 80) is disposed vertically, said vacuum switch unit (45, 46) is arranged so that the central axis of the vacuum switch (1) thereof extends horizontally crossing said first circuit conductor (61, 80) at right angles, and said second circuit conductor is formed so that an end thereof extends toward the bottom side.

6. The switchgear according to claim 3,
characterized in that the first circuit conductor (61, 80) is disposed horizontally, said vacuum switch unit (45, 46) is arranged so that the central axis of the vacuum switch (1) thereof is arranged in parallel to the first circuit conductor, and said second circuit conductor (71) is formed so that an end thereof extends toward the bottom side.

7. The switchgear according to claim 3, wherein said first circuit conductor (80) is disposed horizontally, said vacuum switch unit (45, 46) is arranged so that the central axis of the vacuum switch (1) thereof extends vertically crossing said first circuit conductor (80) at right angles, and said second circuit conductor (72b) is formed so that an end thereof extends toward the top side crossing said first circuit conductor (80) with a predetermined distance therefrom.

8. The switchgear according to claim 3, wherein said first circuit conductor (80) is disposed vertically, said vacuum switch unit (45, 46) is arranged so that the central axis of the vacuum switch (1) thereof is horizontal crossing said first circuit conductor (80) at right angles, and said second circuit conductor (72b) is formed so that an end thereof extends toward the backside crossing said first circuit conductor (80) with a predetermined distance therefrom.

Patentansprüche

1. Vakuumschaltereinheit mit:

einem im Wesentlichen zylindrischen Vakuumschalter (1);
einem Verbindungskontaktanschluss (23, 24) der stationären Elektrodenseite, von dem ein Ende an einer stationären Elektrode (1a) des Vakuumschalters (1) befestigt ist, und wobei die andere Endseite mit einem Kontaktverbindungsteil (23a) versehen ist, der mit einem ersten Schaltungsleiter, der in einer Schalteinrichtung angeordnet ist, kontaktierbar und verbindbar ist; und
einem Verbindungskontaktanschluss (33, 34) der bewegbaren Elektrodenseite, von dem ein Ende an einer bewegbaren Elektrode (1b) des Vakuumschalters (1) befestigt ist, und wobei die andere Endseite mit einem Kontaktverbindungsteil (33b) versehen ist, der mit einem zweiten Schaltungsleiter, der in der Schalteinrichtung angeordnet ist, kontaktierbar und verbindbar ist;
dadurch gekennzeichnet, dass der Verbindungskontaktanschluss (23, 24) der stationären Elektrodenseite und der Verbindungskontaktanschluss (33, 34) der bewegbaren Elektrodenseite derart ausgebildet sind, dass die Kontaktverbindungsteile (21a, 31a) an ihren anderen Endseiten im Wesentlichen parallel zu einer Mittelachse des Vakuumschalters (1) sind, und
dadurch, dass die andere Endseite mit dem Kontaktverbindungsteil entweder des Verbindungskontaktanschlusses (23, 24) der stationären Elektrodenseite oder des Verbindungskontaktanschlusses (33, 34) der bewegbaren Elektrodenseite an der Mittelachse des Vakuumschalters (1) ausgebildet ist.

2. Vakuumschaltereinheit nach Anspruch 1, **dadurch gekennzeichnet, dass** die andere Endseite des Verbindungskontaktanschlusses (23, 24) der stationären Elektrodenseite, die den Kontaktverbindungsteil aufweist, an der Mittelachse des Vakuumschalters (1) ausgebildet ist und die andere Endseite des Verbindungskontaktanschlusses (33, 34) der bewegbaren Elektrodenseite, die den Kontaktverbindungsteil aufweist, derart ausgebildet ist, dass sich die andere Endseite im Wesentlichen parallel zur Mittelachse des Vakuumschalters (1) in Richtung zum Verbindungskontaktanschluss (23, 24) der stationären Elektrodenseite erstreckt.

3. Schalteinrichtung, mit:

einem ersten Schaltungsleiter (61, 80) und einem zweiten Schaltungsleiter (71, 72b), von denen jeder entweder mit einer Energieversorgungsseite oder einer Lastseite verbunden ist; und
einer Vakuumschaltereinheit (45, 46) mit einem im Wesentlichen zylindrischen Vakuumschalter (1), einem Verbindungskontaktanschluss (23, 24) der stationären Elektrodenseite, von dem ein Ende an einer stationären Elektrode (1a) des Vakuumschalters (1) befestigt ist, und wobei die andere Endseite mit einem Kontaktverbindungsteil versehen ist, der mit dem ersten Schaltungsleiter (61, 80) kontaktierbar und verbindbar ist, wobei der Verbindungskontaktanschluss (23, 24) der stationären Elektrodenseite an einer Mittelachse des Vakuumschalters (1) ausgebildet ist, und einem Verbindungskontaktanschluss (33, 34) der bewegbaren Elektrodenseite, von dem ein Ende an einer bewegbaren Elektrode (1b) des Vakuumschalters (1) befestigt ist, und wobei die andere Endseite mit einem Kontaktverbindungsteil versehen ist, der mit dem zweiten Schaltungsleiter (71, 72b) kontaktierbar und verbindbar ist, wobei der Verbindungskontaktanschluss (33, 34) der bewegbaren Elektrodenseite parallel zu der Mittelachse des Vakuumschalters (1) ausgebildet ist;
wobei die Vakuumschaltereinheit (45, 46) durch einen Öffnungsmechanismus aus einer Position, in der die Vakuumschaltereinheit (45, 46) von dem ersten und dem zweiten Schaltungsleiter (61, 71, 72b, 80) getrennt ist, in eine vorbestimmte Position in der Schalteinrichtung bewegbar ist, in welcher der Kontakt- und Verbindungsteil des Verbindungsanschlusses (23, 24) der stationären Elektrodenseite mit dem ersten Schaltungsleiter (61, 80) in Kontakt gelangt und mit ihm verbunden ist, und der Kontakt- und Verbindungsteil des Verbindungskontaktanschlusses (33, 34) der bewegbaren Elektrodenseite mit dem zweiten Schaltungsleiter (71, 72b) in Kontakt gelangt und mit ihm verbunden ist.

4. Schalteinrichtung nach Anspruch 3, bei welcher der erste Schaltungsleiter (61, 80) horizontal angeordnet ist, wobei die Vakuumschaltereinheit (45, 46) so angeordnet ist, dass sich die Mittelachse des Vakuumschalters (1) von ihr vertikal erstreckt, wobei sie den ersten Schaltungsleiter (61, 80) im rechten Winkel kreuzt, und wobei der zweite Schaltungsleiter (71) so ausgebildet ist, dass sich ein Ende von ihm zu der Unterseite hin erstreckt.

5. Schalteinrichtung nach Anspruch 3, bei welcher der erste Schaltungsleiter (61, 80) vertikal angeordnet ist,
wobei die Vakuumschaltereinheit (45, 46) so angeordnet ist, dass sich die Mittelachse des Vakuumschalters (1) von ihr horizontal erstreckt, wobei sie

den ersten Schaltungsleiter (61, 80) im rechten Winkel kreuzt, und wobei der zweite Schaltungsleiter so ausgebildet ist, dass sich ein Ende von ihm zu der Unterseite hin erstreckt.

6. Schalteinrichtung nach Anspruch 3, **dadurch gekennzeichnet, dass** der erste Schaltungsleiter (61, 80) horizontal angeordnet ist, wobei die Vakuumschaltereinheit (45, 46) so angeordnet ist, dass die Mittelachse des Vakuumschalters (1) von ihr parallel zu dem ersten Schaltungsleiter angeordnet ist, und wobei der zweite Schaltungsleiter (71) so ausgebildet ist, dass sich ein Ende von ihm zu der Unterseite hin erstreckt.

7. Schalteinrichtung nach Anspruch 3, bei welcher der erste Schaltungsleiter (80) horizontal angeordnet ist, wobei die Vakuumschaltereinheit (45, 46) so angeordnet ist, dass sich die Mittelachse des Vakuumschalters (1) von ihr vertikal erstreckt, wobei sie den ersten Schaltungsleiter (80) im rechten Winkel kreuzt, und wobei der zweite Schaltungsleiter (72b) so ausgebildet ist, dass sich ein Ende von ihm zu der Oberseite hin erstreckt, wobei es den ersten Schaltungsleiter (80), mit einem vorbestimmten Abstand von ihm, kreuzt.

8. Schalteinrichtung nach Anspruch 3, bei welcher der erste Schaltungsleiter (80) vertikal angeordnet ist, wobei die Vakuumschaltereinheit (45, 46) so angeordnet ist, dass die Mittelachse des Vakuumschalters (1) von ihr horizontal ist, wobei sie den ersten Schaltungsleiter (80) im rechten Winkel kreuzt, und wobei der zweite Schaltungsleiter (72b) so ausgebildet ist, dass sich ein Ende von ihm zu der Rückseite hin erstreckt, wobei es den ersten Schaltungsleiter (80), mit einem vorbestimmten Abstand von ihm, kreuzt.

Revendications

1. Une unité de commutation sous vide comprenant :

   un interrupteur sous vide pratiquement cylindrique (1) ;
   une borne de contact de connexion au côté de l'électrode stationnaire (23, 24) dont une extrémité est fixée à une électrode stationnaire (1a) dudit interrupteur sous vide (1) et dont le côté de l'autre extrémité est pourvu d'une pièce de connexion de contact (23a) qui peut entrer en contact et se connecter à un premier conducteur de circuit placé dans un appareillage de commutation ; et
   une borne de contact de connexion au côté électrode mobile (33, 34) dont une extrémité est fixée à une électrode mobile (1b) dudit interrupteur sous vide (1) et dont le côté de l'autre extrémité est pourvue d'une pièce de connexion de contact (33b) qui peut entrer en contact et se connecter à un second conducteur de circuit placé dans l'appareillage de commutation ;
   caractérisée en ce que ladite borne de contact de connexion au côté de l'électrode stationnaire (23, 24) et la borne de contact de connexion au côté de l'électrode mobile (33, 34) sont formées de telle sorte que les pièces de connexion de contact (21a, 31a) sur leurs côtés des autres extrémités sont pratiquement parallèles à un axe central dudit interrupteur sous vide (1) et
   en ce que le côté de l'autre extrémité composée de la pièce de connexion de contact de soit ladite borne de contact de connexion au côté de l'électrode stationnaire (23, 24) soit la borne de contact de connexion au côté de l'électrode mobile (33, 34) est formée sur l'axe central dudit interrupteur sous vide (1).

2. L'unité de commutation sous vide selon la revendication 1,
   caractérisée en ce que le côté de l'autre extrémité de ladite borne de contact de connexion au côté de l'électrode stationnaire (23, 24) composée de la pièce de connexion de contact est formée sur l'axe central dudit interrupteur sous vide (1), et le côté de l'autre extrémité de ladite borne de contact de connexion au côté de l'électrode mobile (33, 34) composée de la pièce de connexion de contact est formée de telle sorte que le côté de l'autre extrémité se déplace pratiquement parallèlement à l'axe central dudit interrupteur sous vide (1) dans une direction de ladite borne de contact de connexion au côté de l'électrode stationnaire (23, 24).

3. Un appareillage de commutation comprenant :

   un premier conducteur de circuit (61, 80) et un second conducteur de circuit (71, 72b) chacun connecté soit à un côté d'une source d'alimentation soit à un côté d'une charge ; et
   une unité de commutation sous vide (45, 46) incluant un interrupteur sous vide pratiquement cylindrique (1), une borne de contact de connexion au côté de l'électrode stationnaire (23, 24) dont une extrémité est fixée à une électrode stationnaire (1a) dudit interrupteur sous vide (1) et le côté de l'autre extrémité est pourvue d'une pièce de connexion de contact qui peut entrer en contact et se connecter audit premier conducteur de circuit (61, 80), ladite borne de contact de connexion au côté de l'électrode stationnaire (23, 24) étant formée sur un axe central dudit interrupteur sous vide (1), et une borne de contact de connexion au côté de l'électrode mobile (33, 34) dont une extrémité est fixée à une

électrode mobile (1b) dudit interrupteur sous vide (1) et dont le côté de l'autre extrémité est pourvue d'une pièce de connexion de contact qui peut entrer en contact et se connecter audit second conducteur de circuit (71, 72b), ladite borne de contact de connexion côté de l'électrode mobile (33, 34) étant dans une configuration parallèle à l'axe central dudit interrupteur sous vide (1) ; dans lequel ladite unité de commutation sous vide (45, 46) peut se déplacer au moyen d'un mécanisme d'ouverture à partir d'une position, dans laquelle l'unité de commutation sous vide (45, 46) est séparée des premier et second circuits conducteurs (61, 71, 72b, 80), jusqu'à une position prédéterminée dans ledit appareillage de commutation, dans lequel la pièce de contact et de connexion de ladite borne de connexion au côté de l'électrode stationnaire (23, 24) entre en contact avec et est connectée audit premier conducteur de circuit (61, 80) et la pièce de contact et de connexion de la borne de contact de connexion au côté de l'électrode mobile (33, 34) entre en contact avec et est connectée audit second conducteur de circuit (71, 72b).

4. L'appareillage de commutation selon la revendication 3, dans lequel ledit premier conducteur de circuit (61, 80) est placé horizontalement, ladite unité de commutation sous vide (45, 46) étant disposée de telle sorte que l'axe central de l'interrupteur sous vide 1 de celle-ci se déplace verticalement traversant ledit premier conducteur de circuit (61, 80) de façon perpendiculaire, et ledit second conducteur de circuit (71) est formé de telle sorte qu'une extrémité de celle-ci se déplace en direction du côté inférieur.

5. L'appareillage de commutation selon la revendication 3, dans lequel ledit premier conducteur de circuit (61, 80) est placé verticalement,
ladite unité de commutation sous vide (45, 46) étant disposée de telle sorte que l'axe central de l'interrupteur sous vide (1) de celle-ci se déplace horizontalement traversant ledit premier conducteur de circuit (61, 80) de façon perpendiculaire, et ledit second conducteur de circuit est formé de telle sorte qu'une extrémité de celle-ci se déplace en direction du côté inférieur.

6. L'appareillage de commutation selon la revendication 3,
caractérisé en ce que le premier conducteur de circuit (61, 80) est placé horizontalement, ladite unité de commutation sous vide (45, 46) est disposée de telle sorte que l'axe central de l'interrupteur sous vide (1) de celle-ci soit disposé parallèlement au premier conducteur de circuit, et ledit second conducteur de circuit (71) est formé de telle sorte qu'une extrémité de celle-ci se déplace en direction du côté inférieur.

7. L'appareillage de commutation selon la revendication 3, dans lequel ledit premier conducteur de circuit (80) est placé horizontalement, ladite unité de commutation sous vide (45, 46) est disposée de telle sorte que l'axe central de l'interrupteur sous vide (1) de celle-ci se déplace verticalement traversant ledit premier conducteur de circuit (80) de façon perpendiculaire, et ledit second conducteur de circuit (72b) est formé de telle sorte qu'une extrémité de celle-ci se déplace dans une direction du côté supérieur traversant ledit premier conducteur de circuit (80) à une distance prédéterminée de celui-ci.

8. L'appareillage de commutation selon la revendication 3, dans lequel ledit premier conducteur de circuit (80) est placé verticalement, ladite unité de commutation sous vide (45, 46) est disposée de telle sorte que l'axe central de l'interrupteur sous vide (1) de celle-ci traverse horizontalement ledit premier conducteur de circuit (80) de façon perpendiculaire, et ledit second conducteur de circuit (72b) est formé de telle sorte qu'une extrémité de celle-ci se déplace dans une direction du côté arrière traversant ledit premier conducteur de circuit (80) à une distance prédéterminée de celui-ci.

Fig. 1

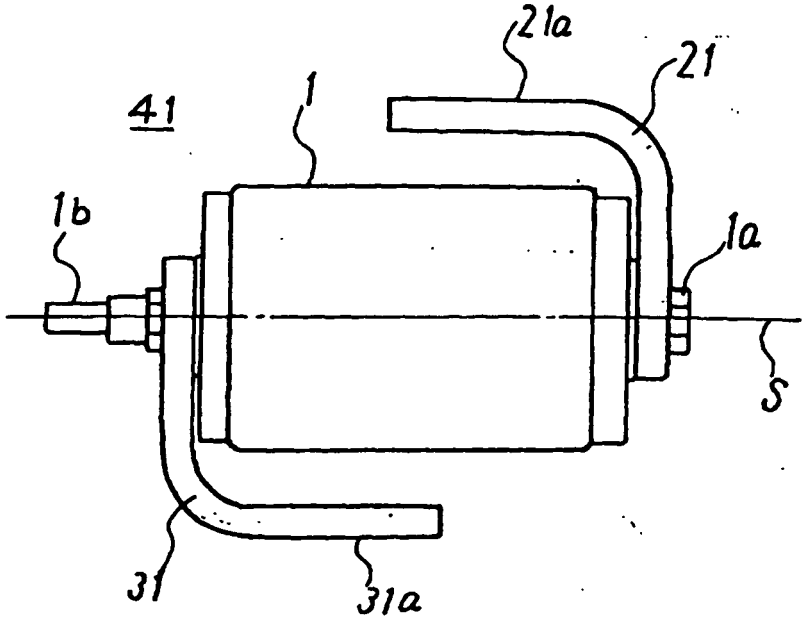


Fig. 2

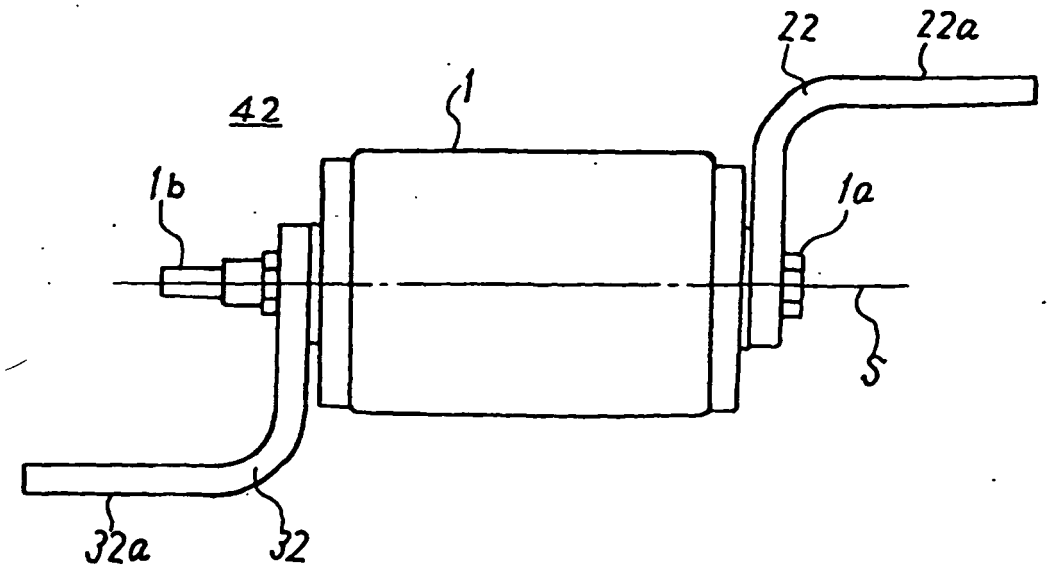


Fig. 3

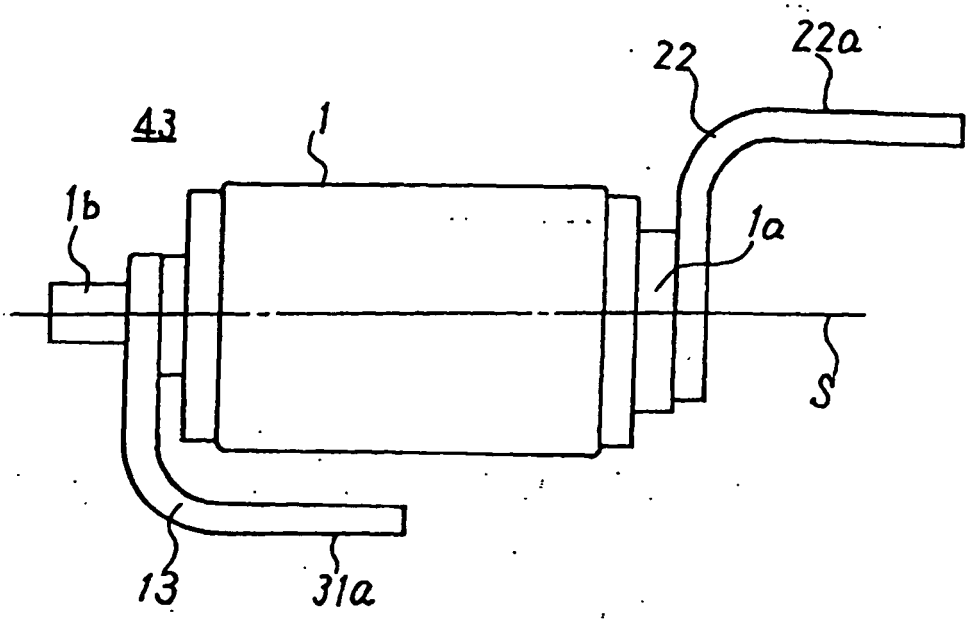


Fig. 4

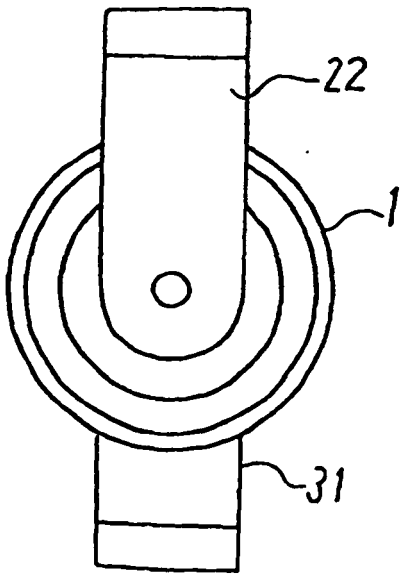


Fig. 5

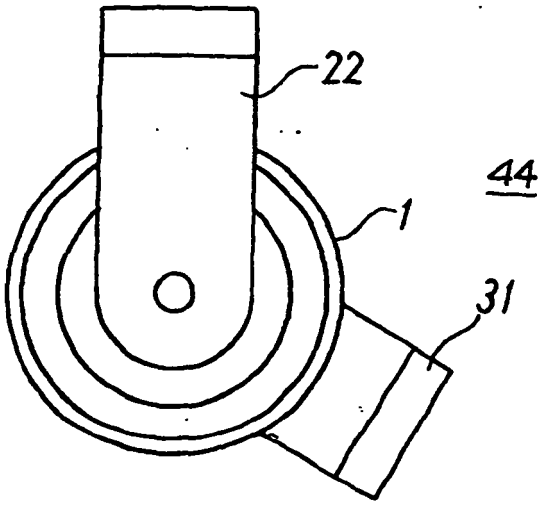


Fig. 6

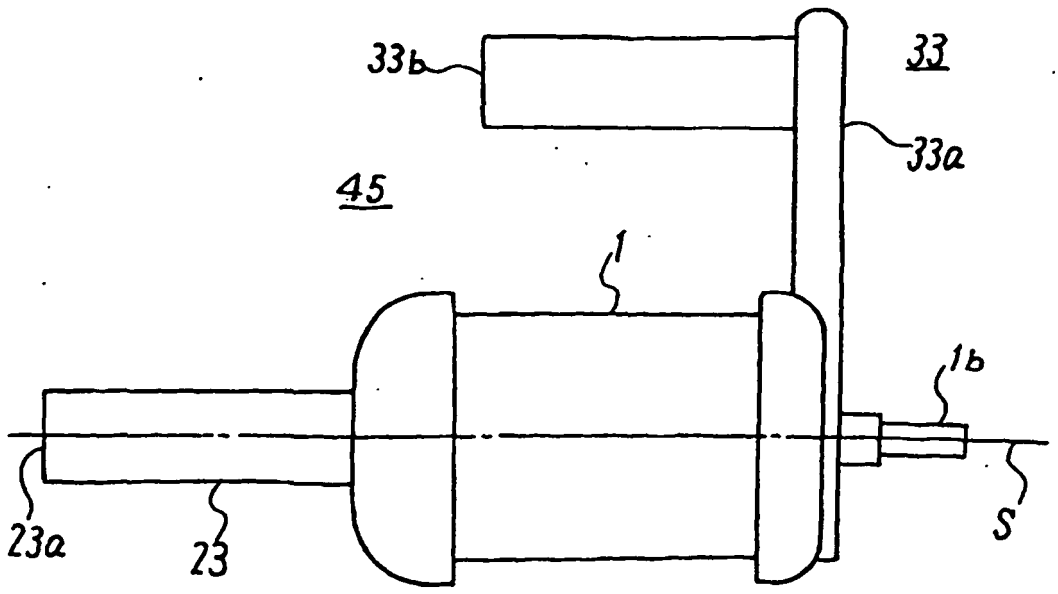


Fig. 7

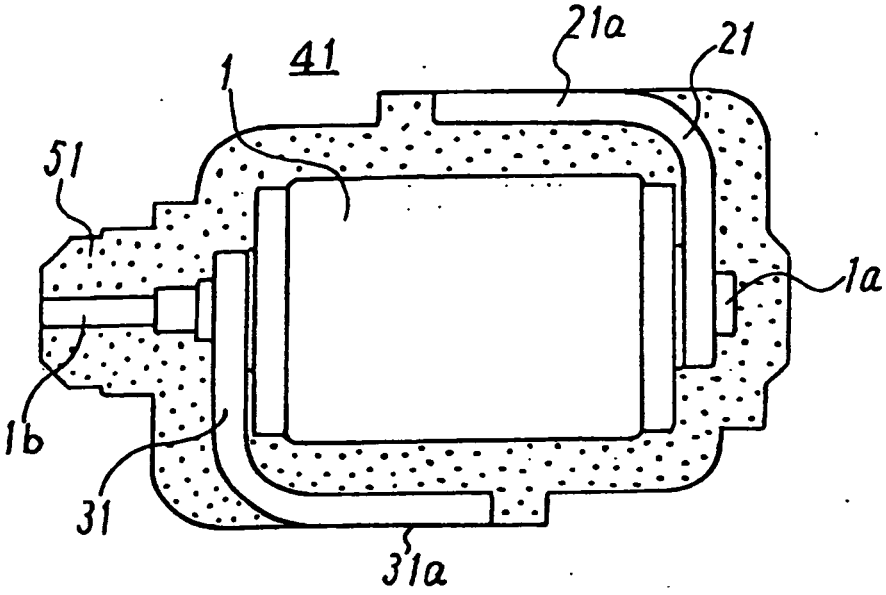


Fig. 8

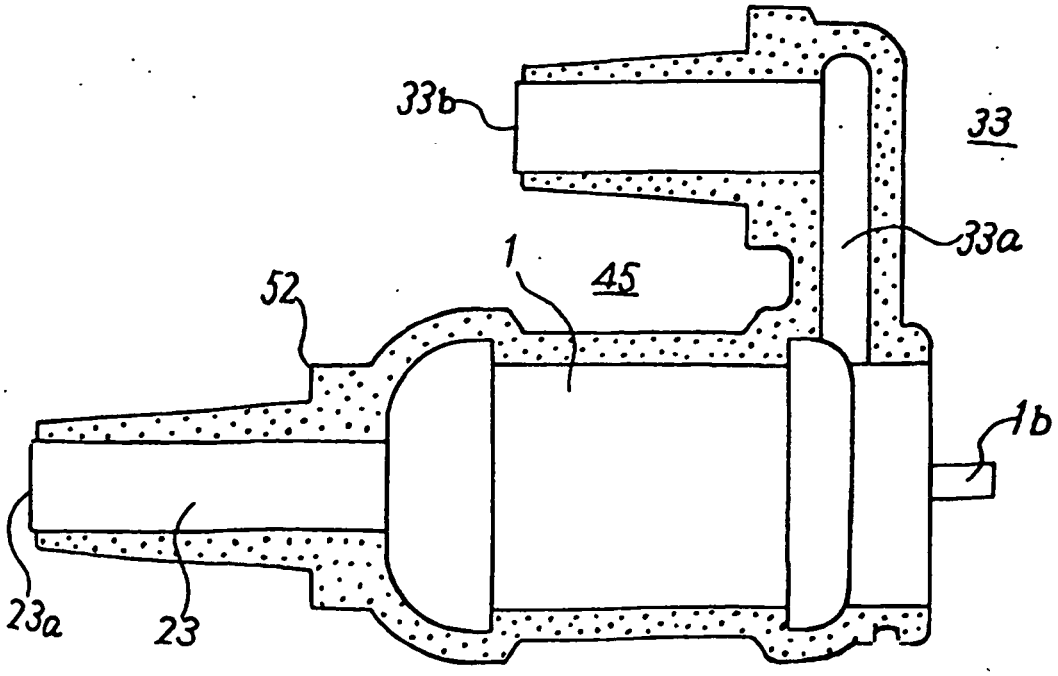


Fig. 9

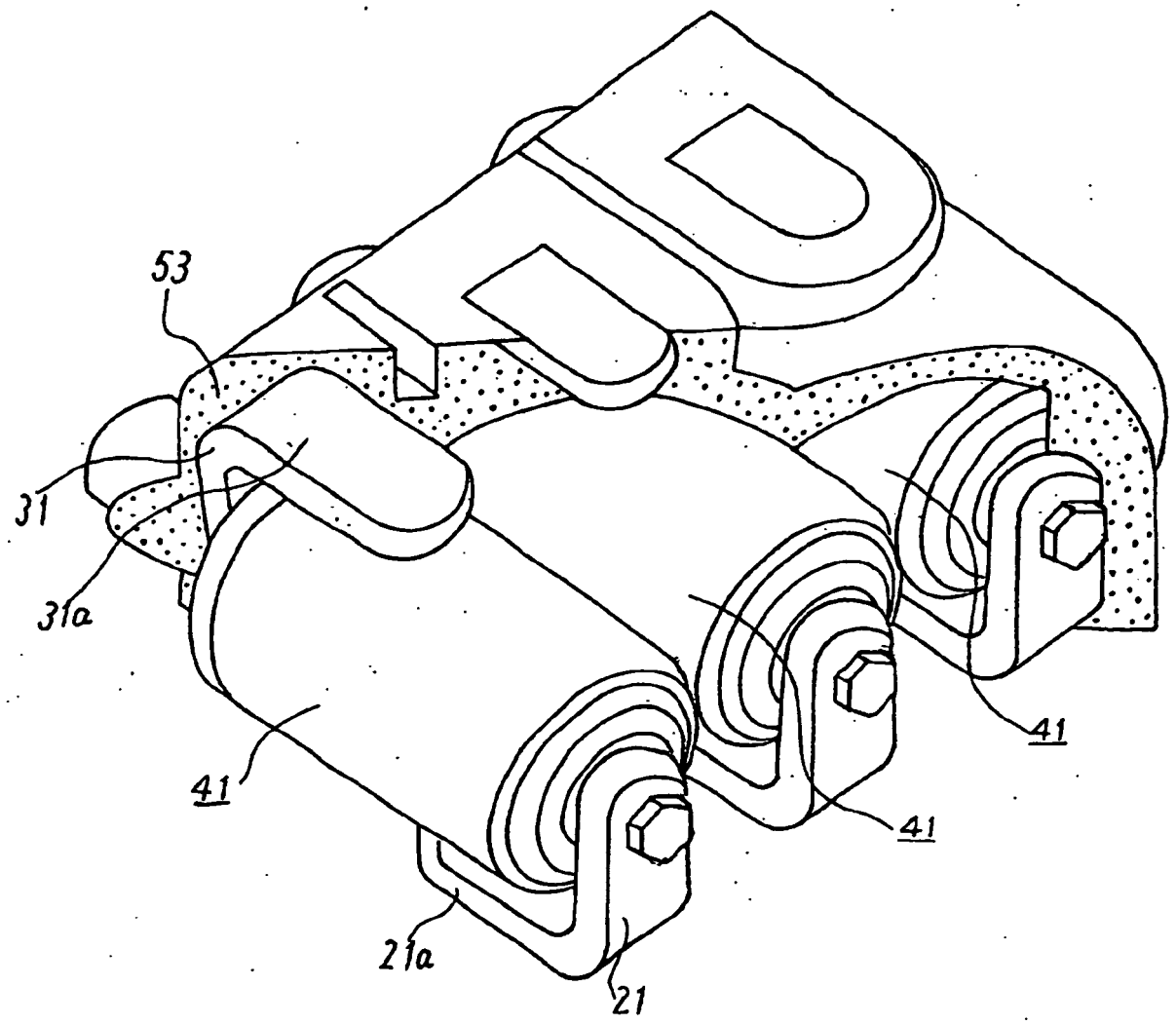


Fig. 10

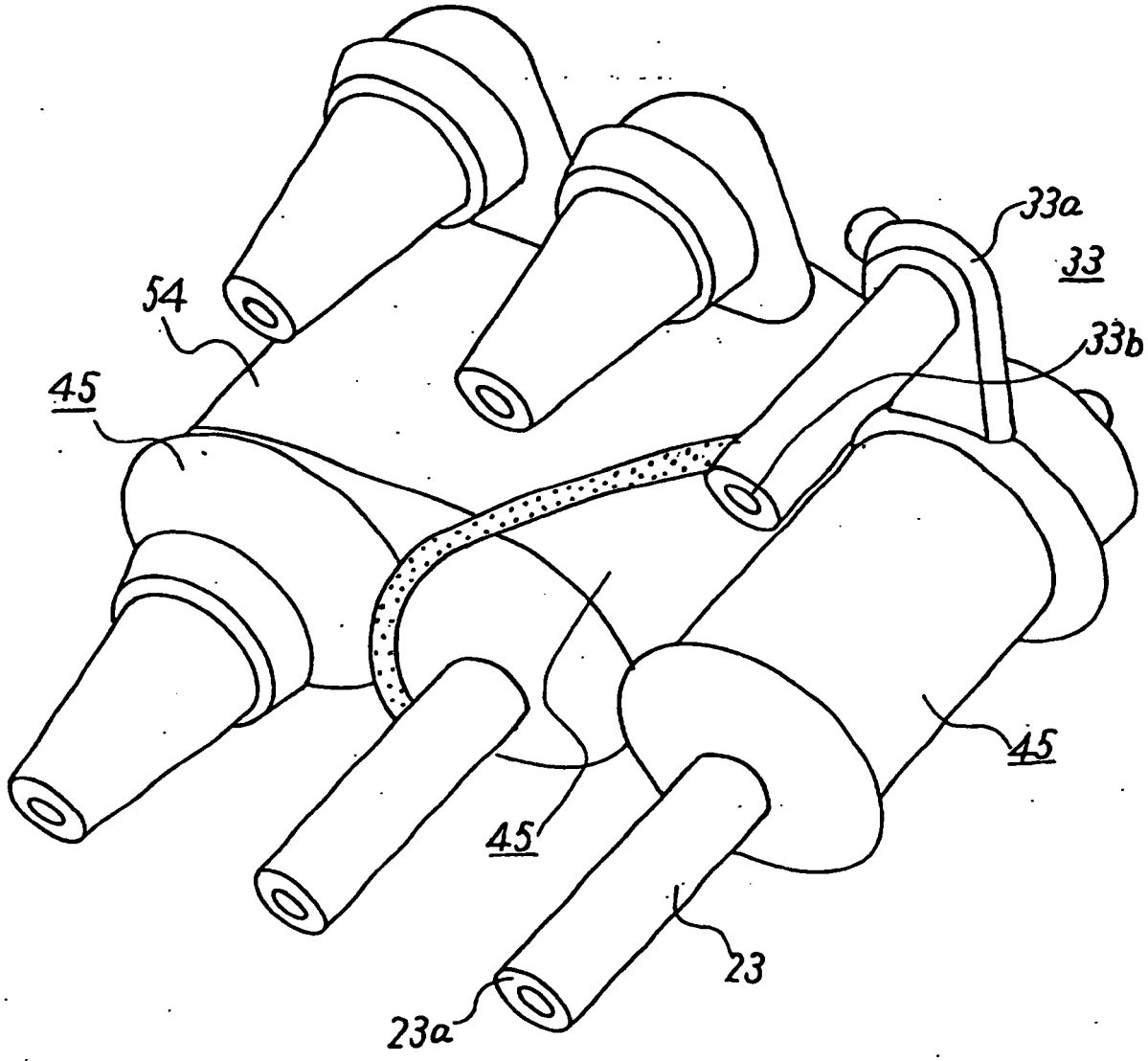


Fig. 11

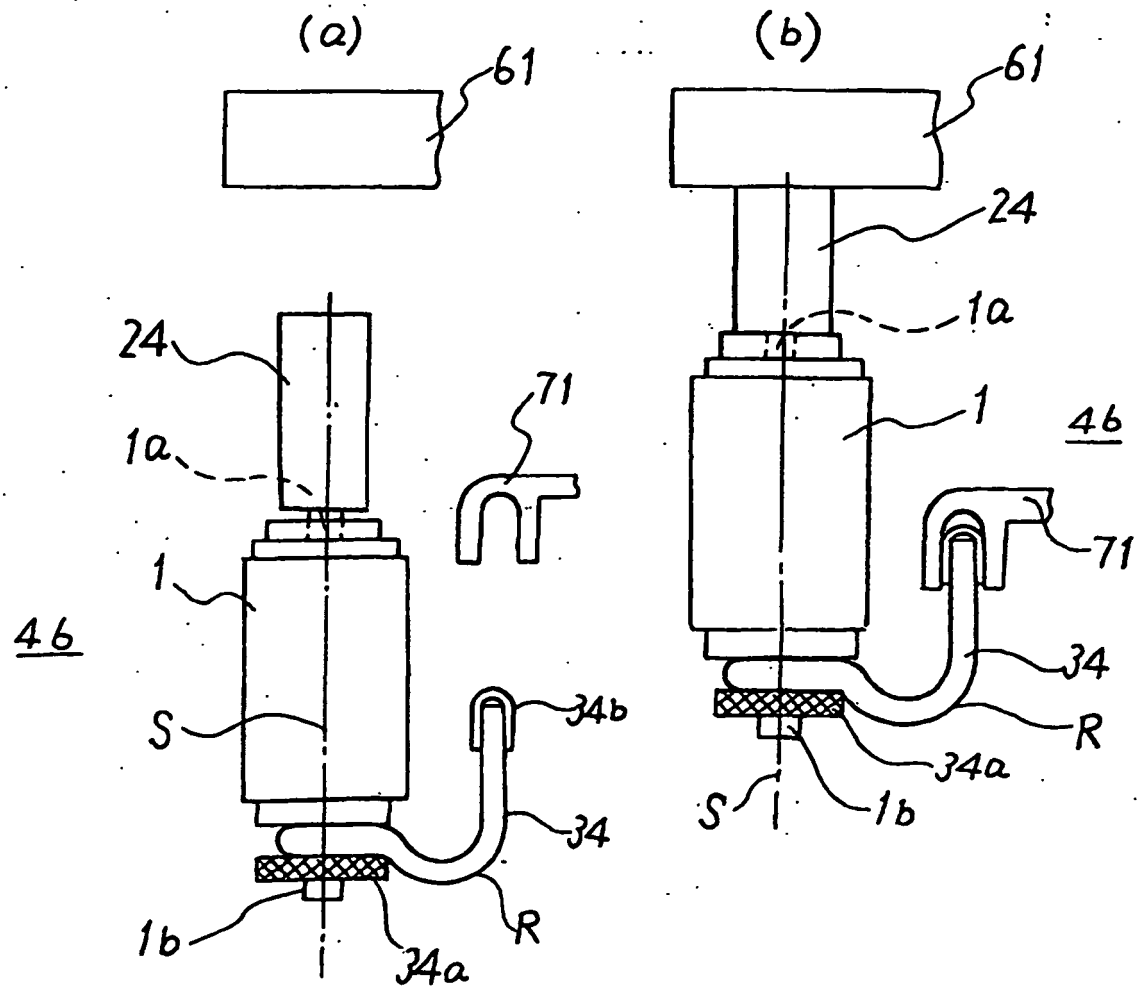


Fig. 12

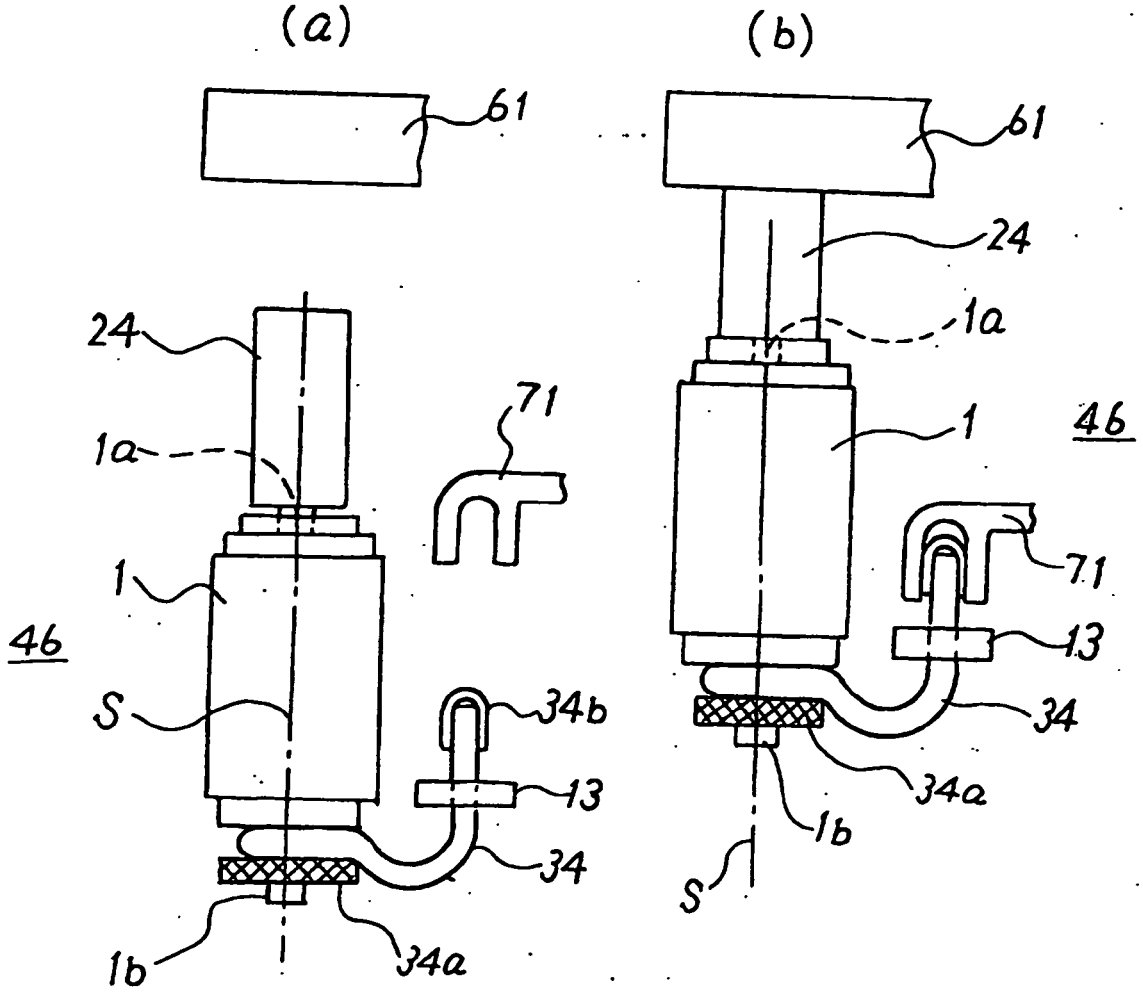


Fig. 13

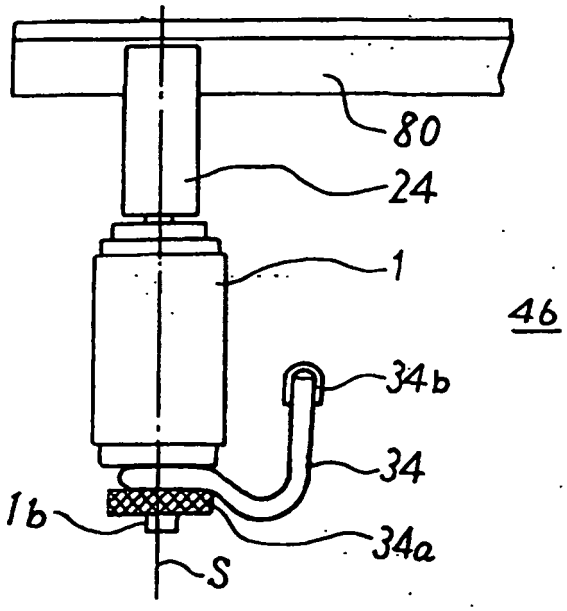


Fig. 14

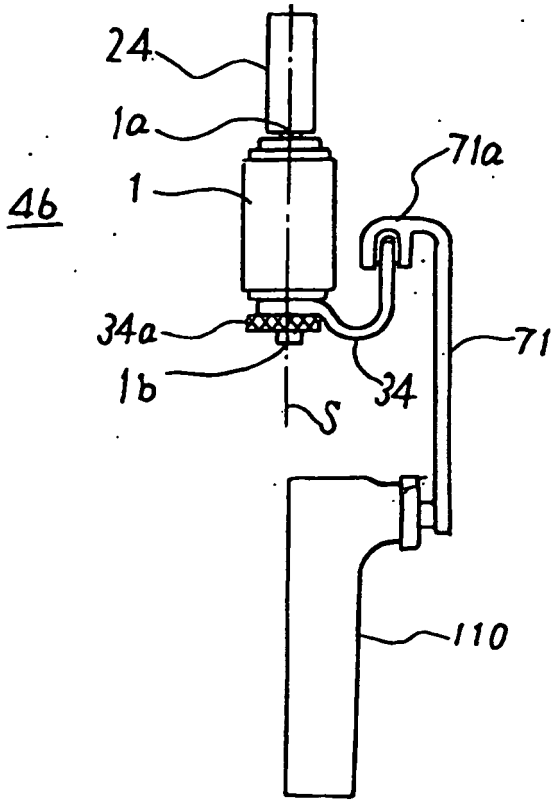


Fig. 15

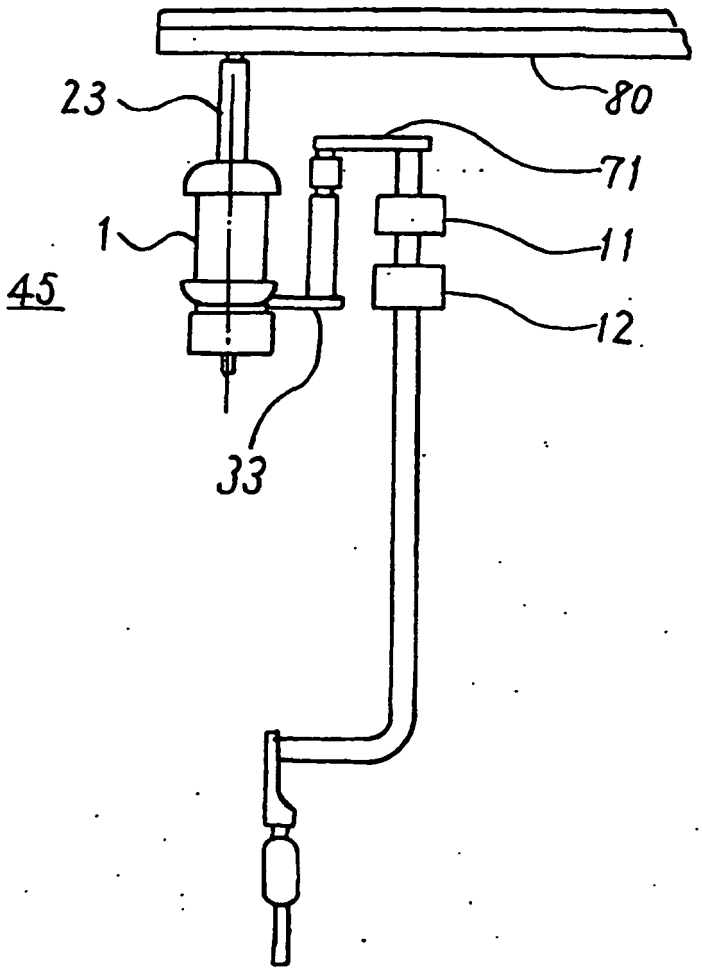


Fig. 16

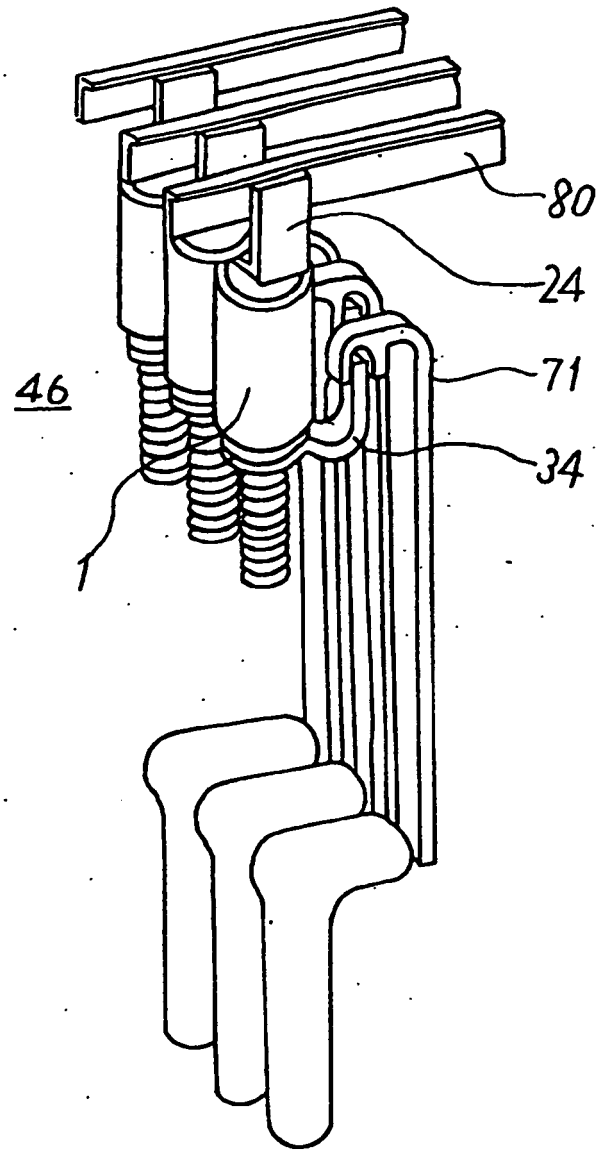


Fig. 17

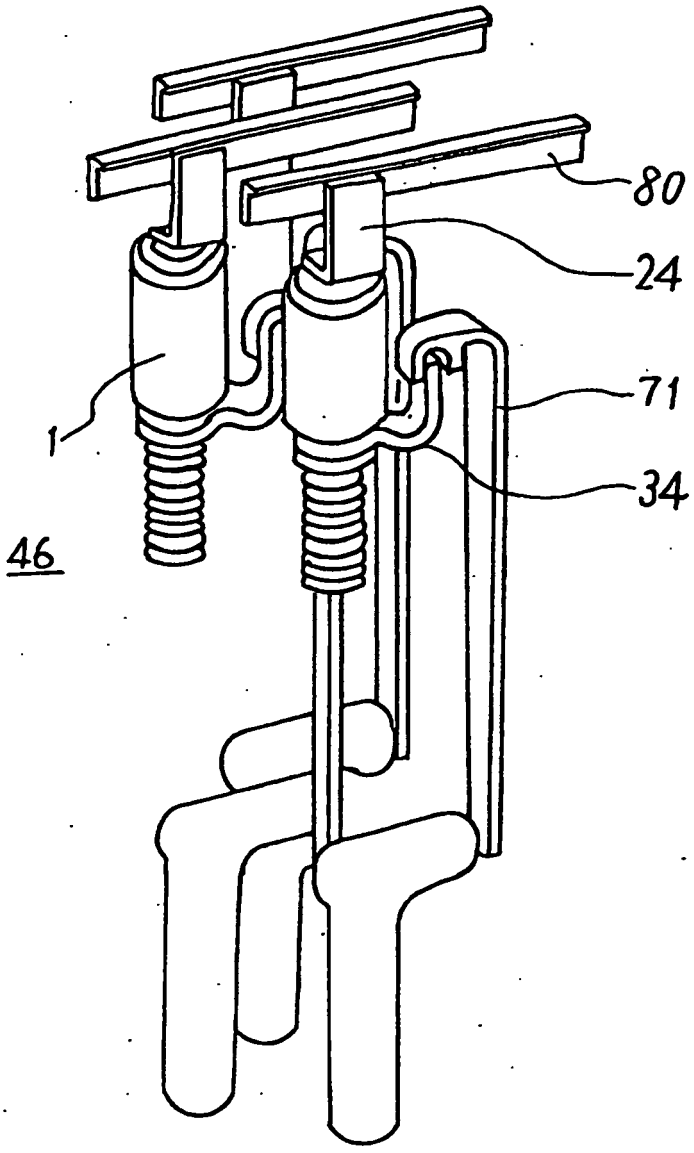


Fig. 18

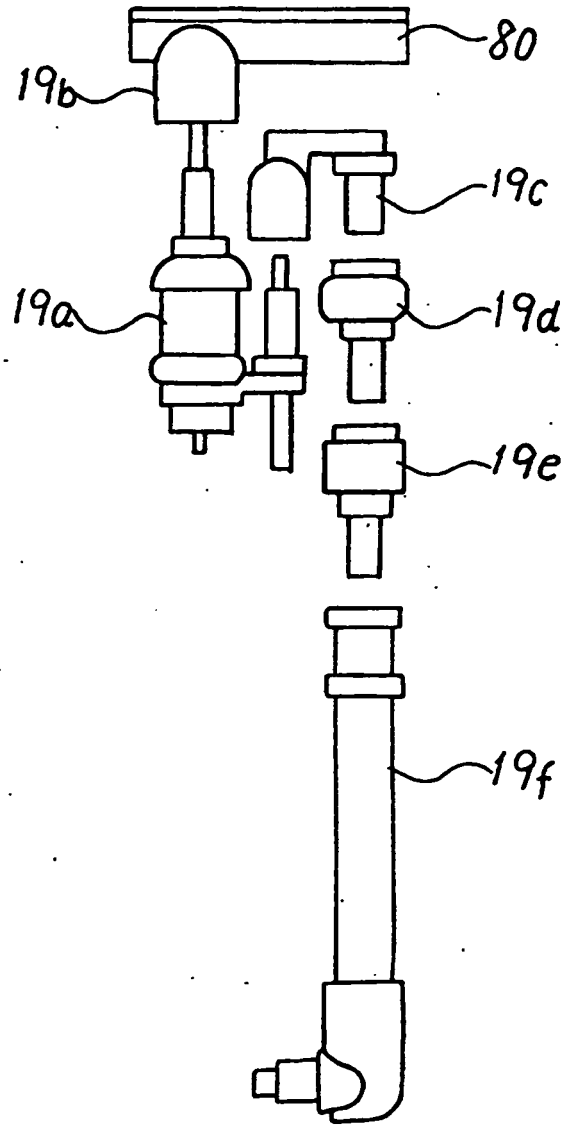


Fig. 19

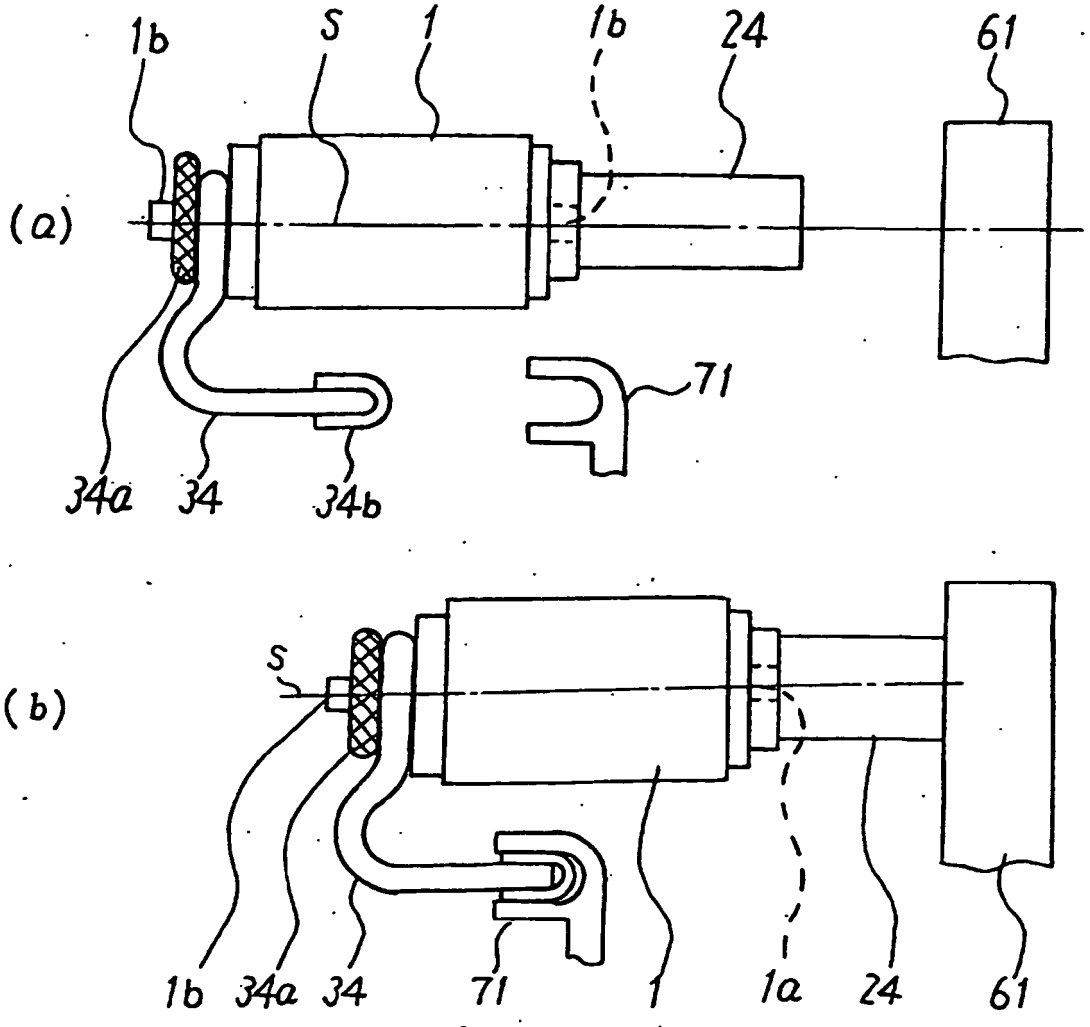


Fig. 20

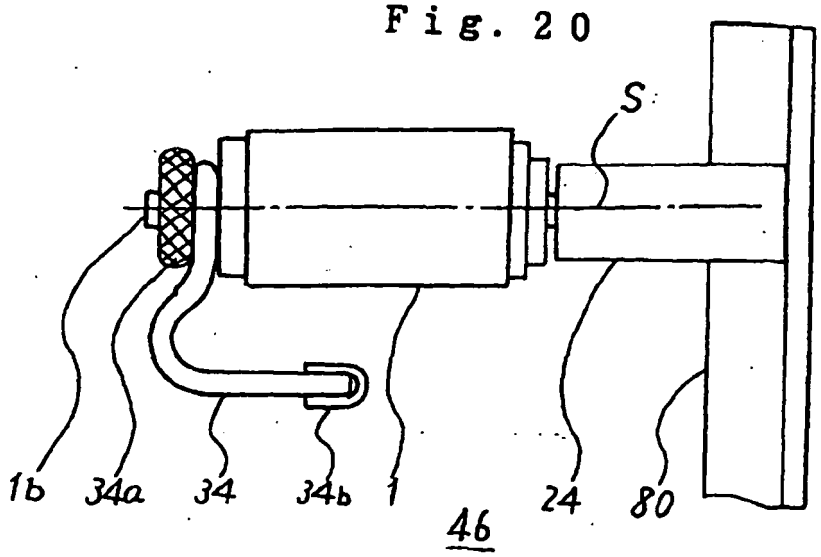


Fig. 21

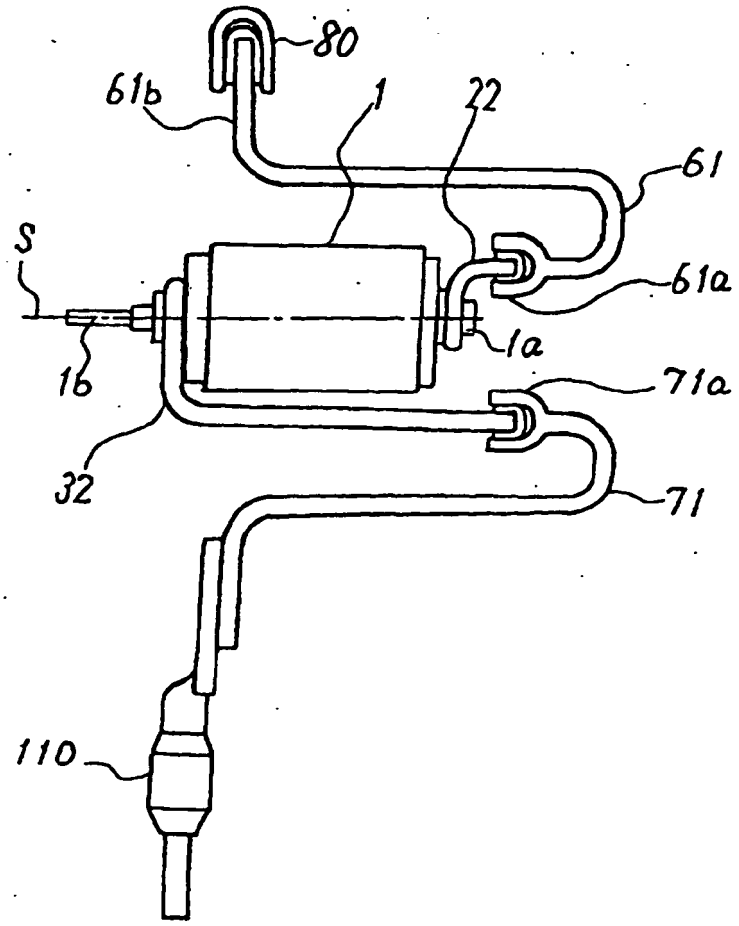


Fig. 22

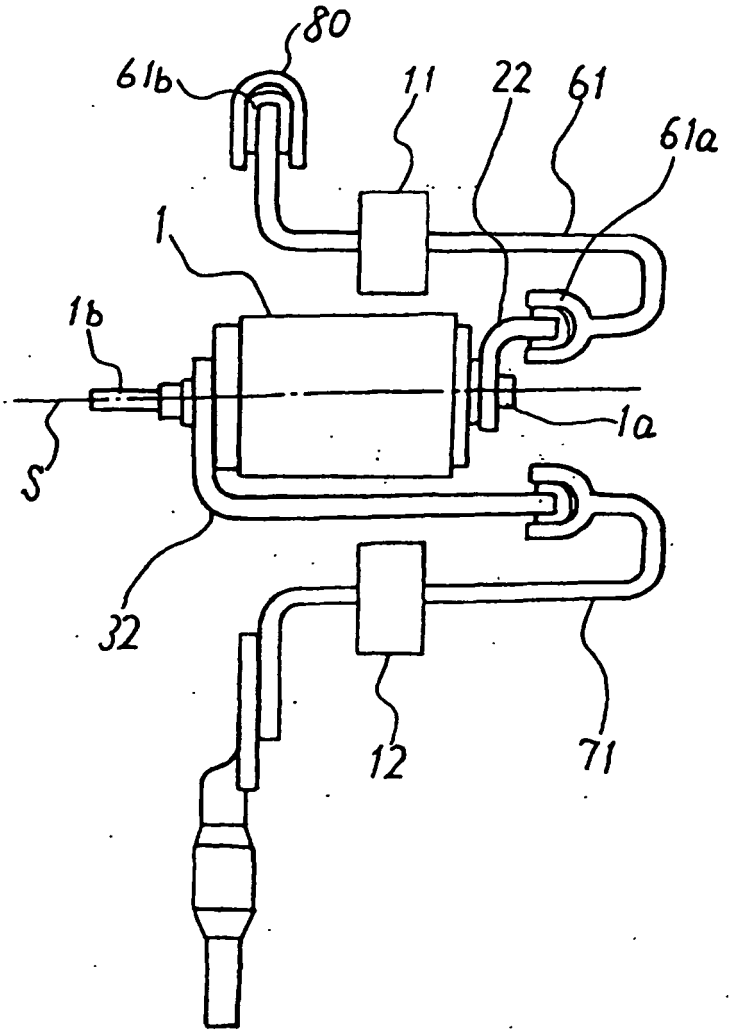


Fig. 23

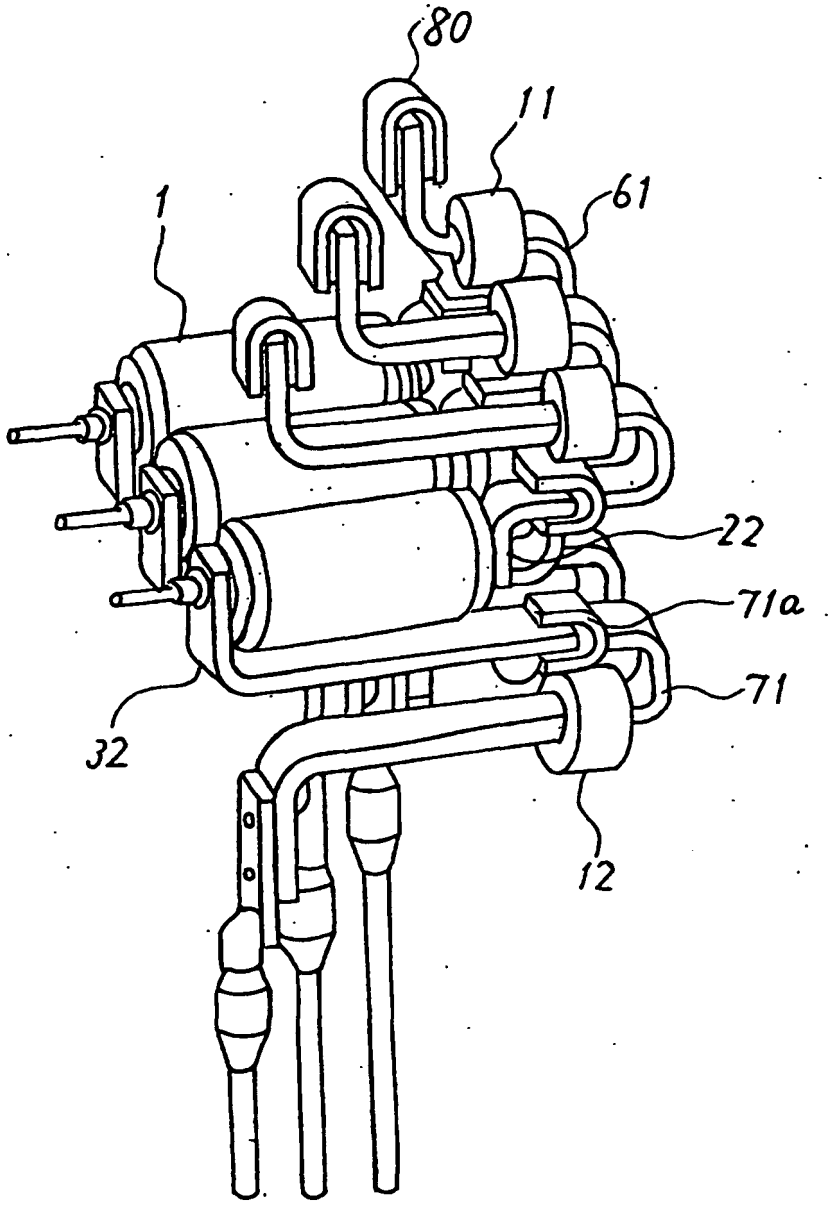


Fig. 24

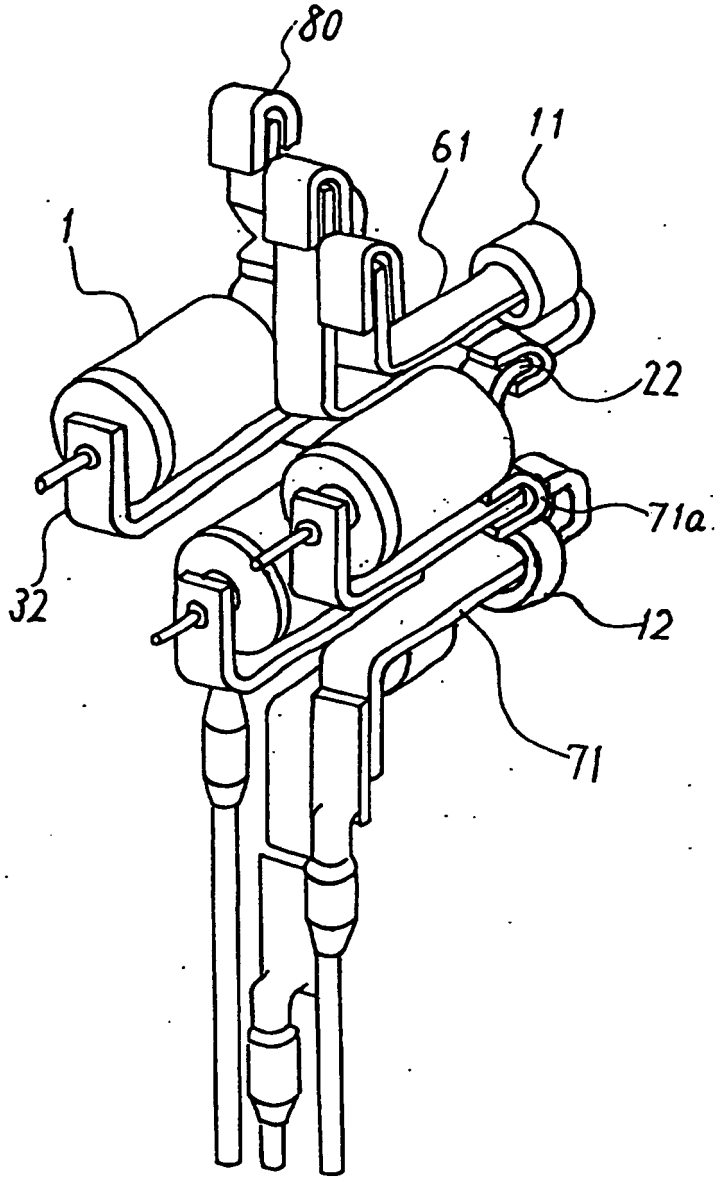


Fig. 25

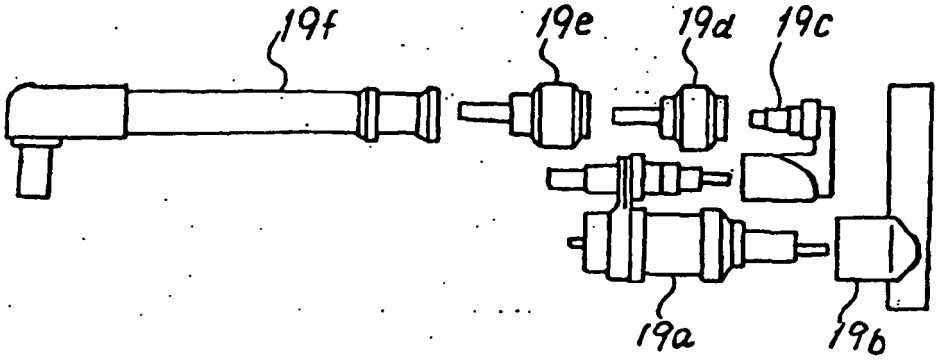


Fig. 26

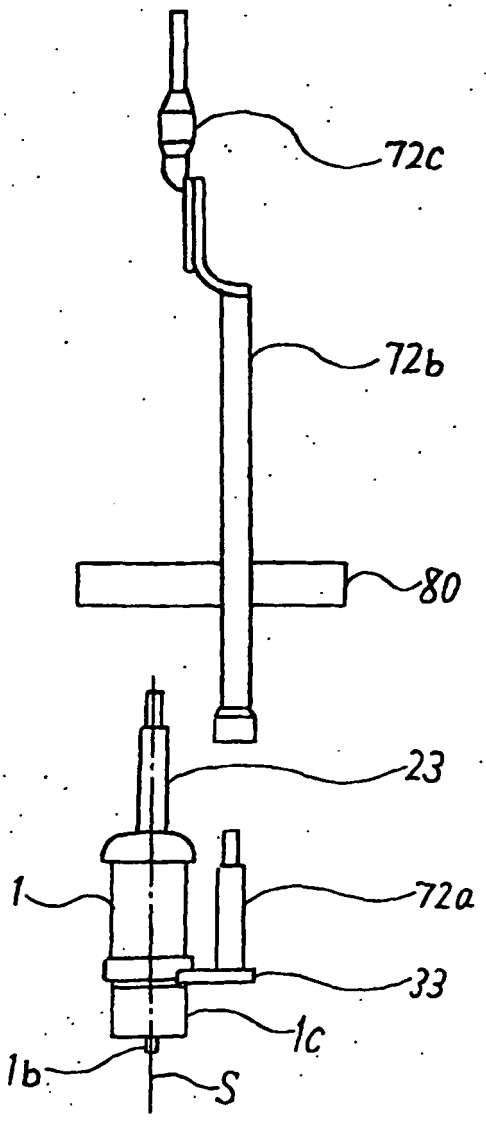


Fig. 27

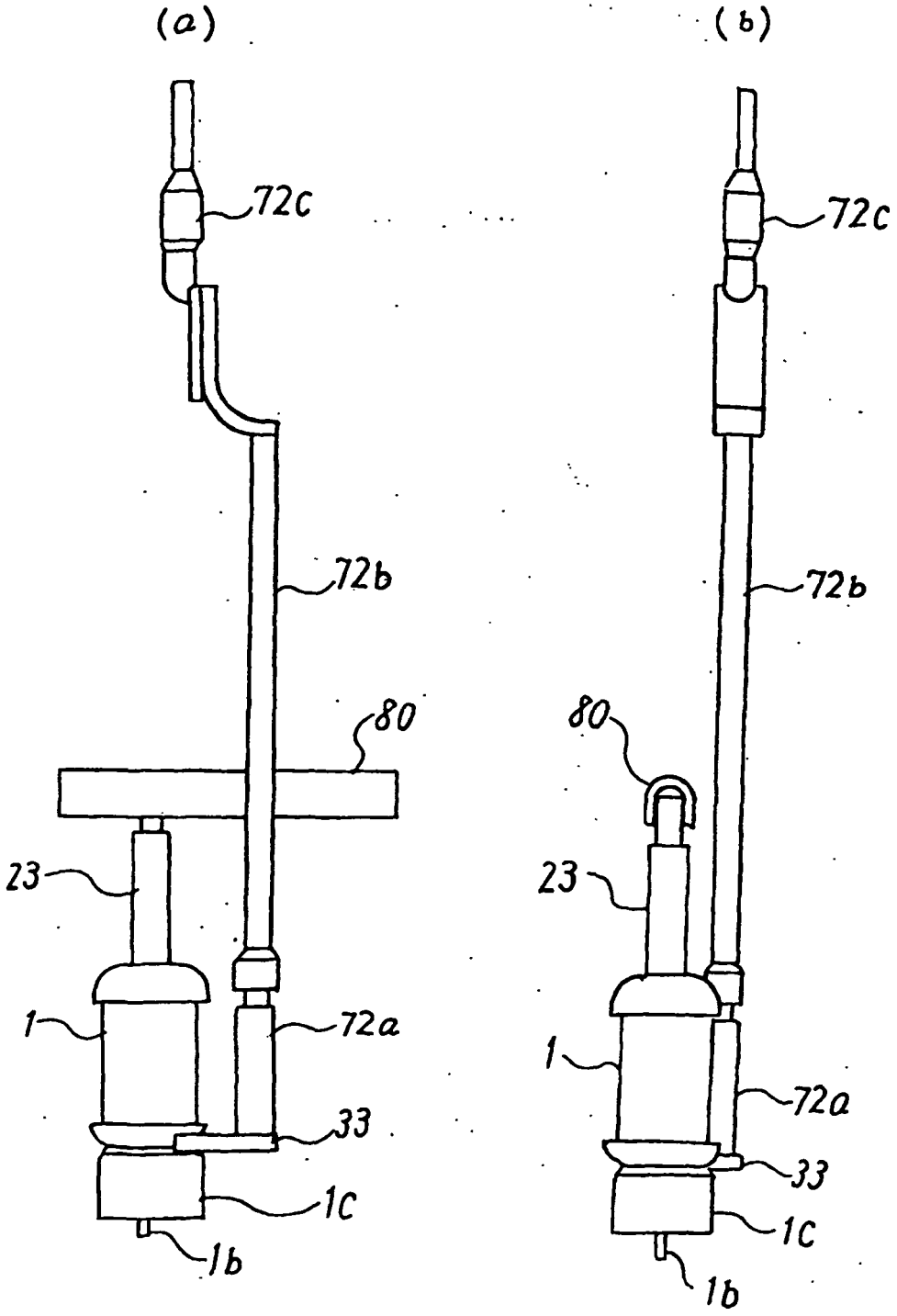


Fig. 28

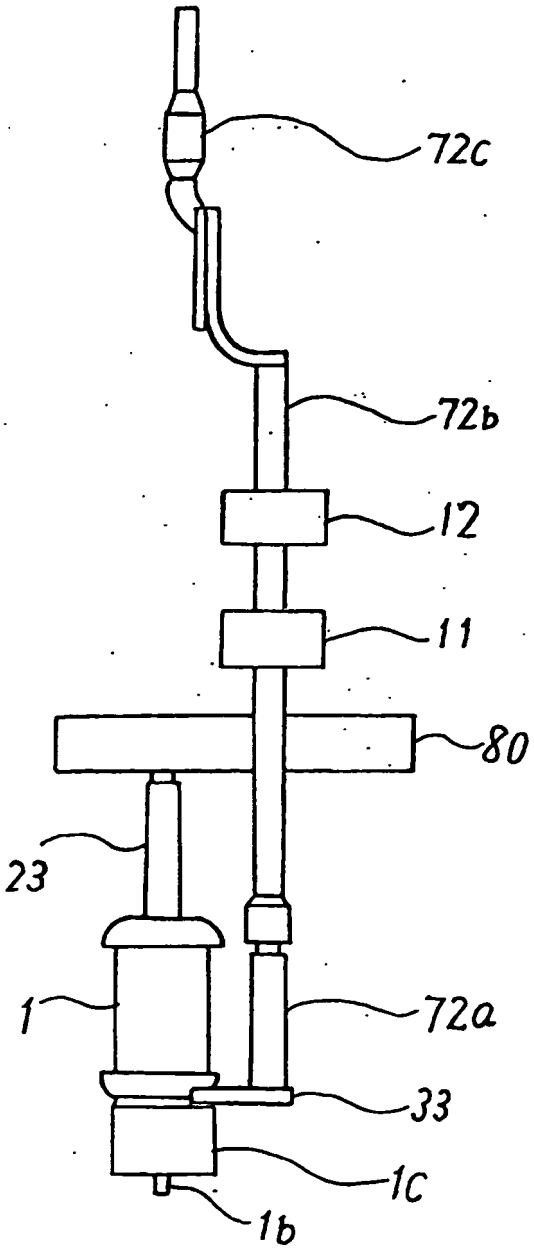


Fig. 29

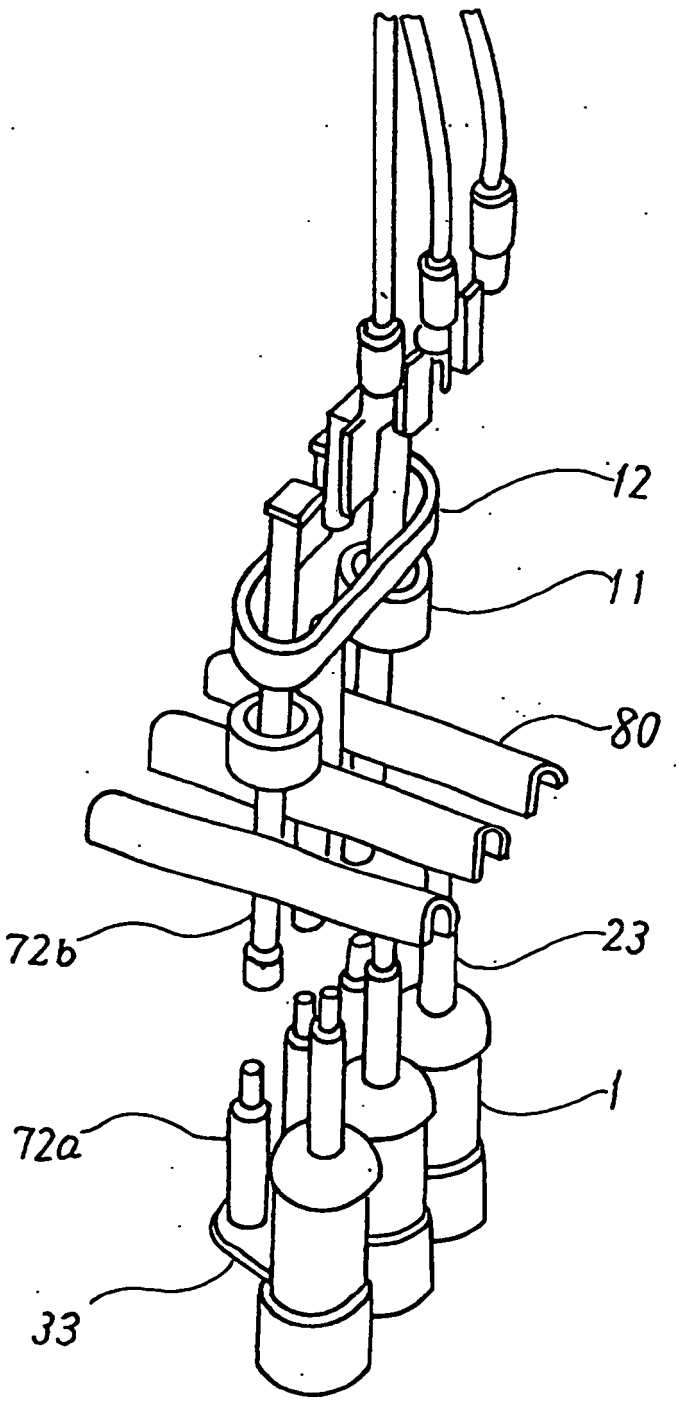


Fig. 30

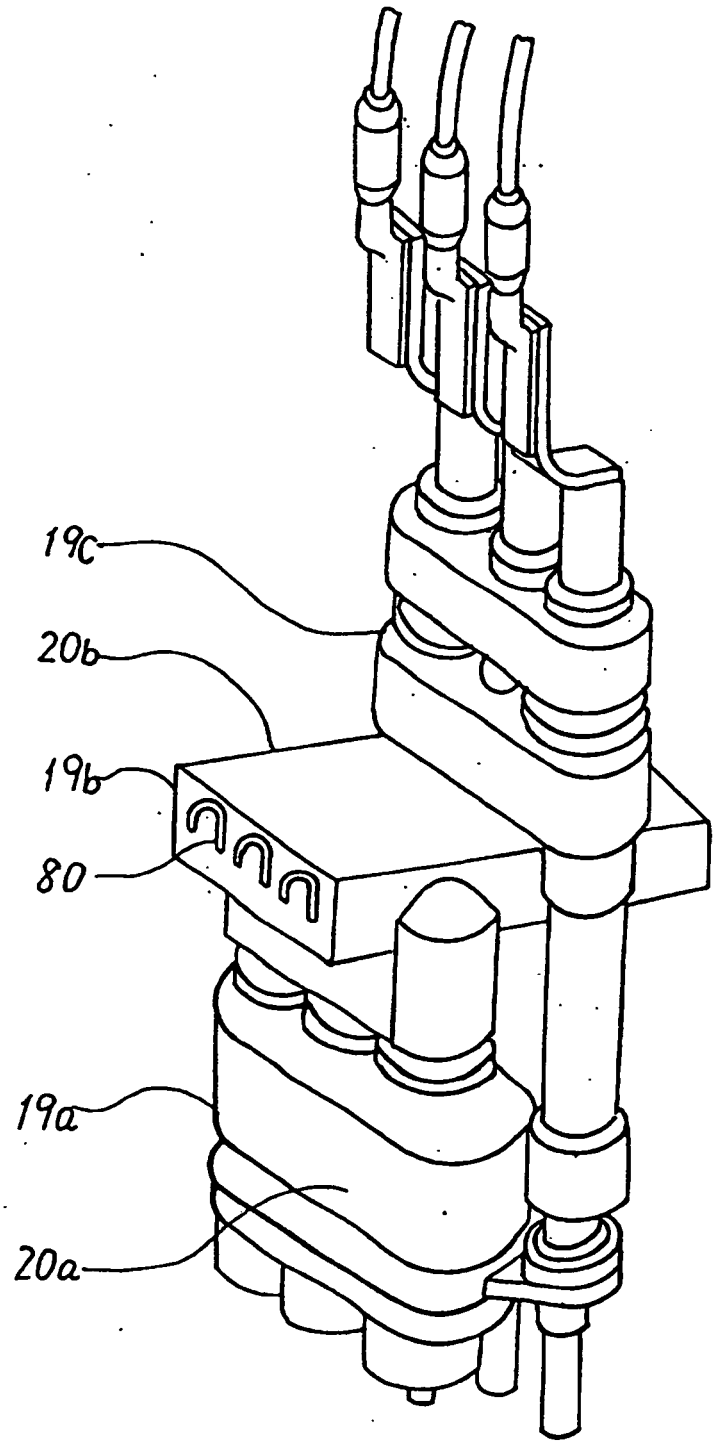


Fig. 31

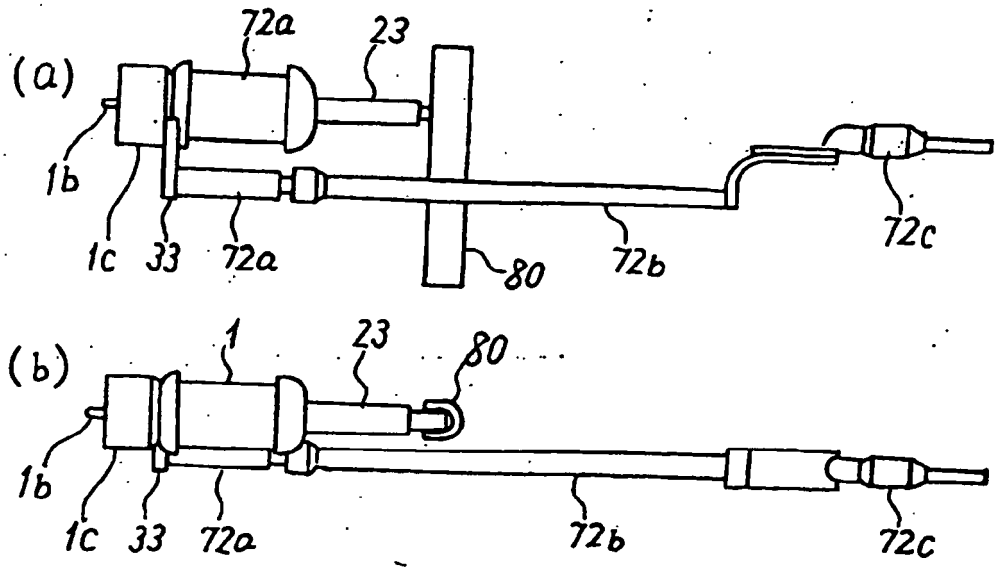

(a)
72a
23
1b
1c
33
72a
80
72b
72c
(b)
1
23
80
1b
1c
33
72a
72b
72c

Fig. 32

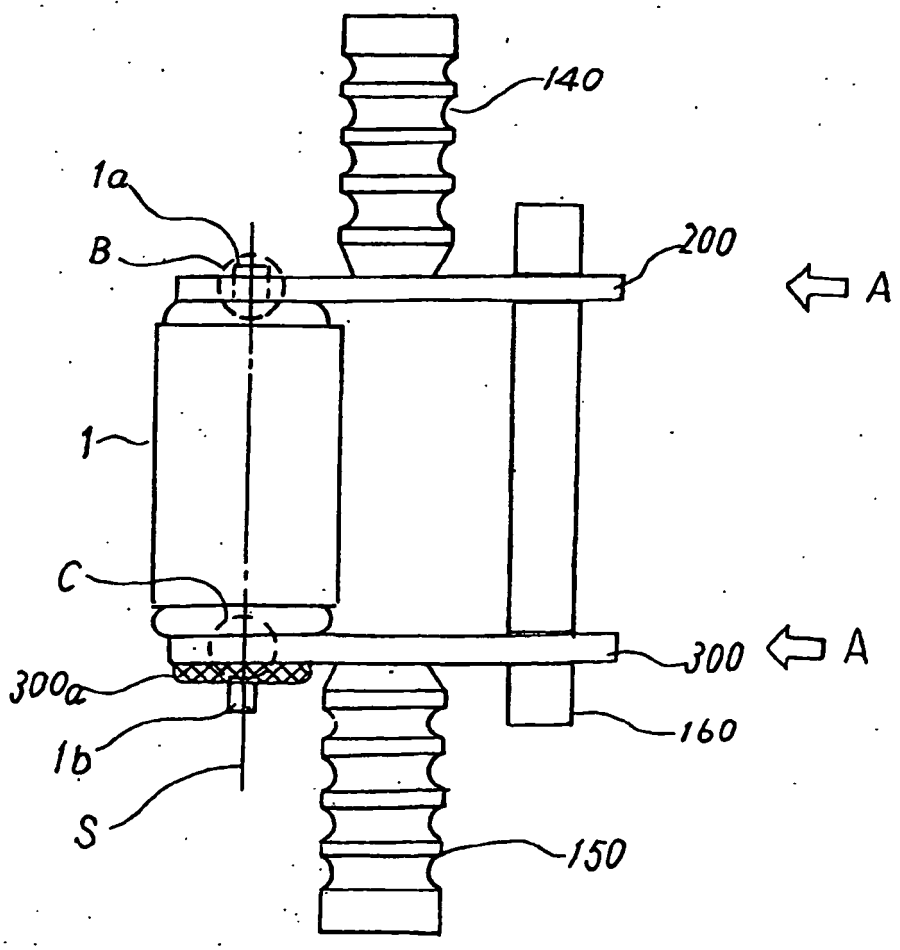

140
1a
B
200
A
1
C
300
A
300a
160
1b
S
150

Fig. 33

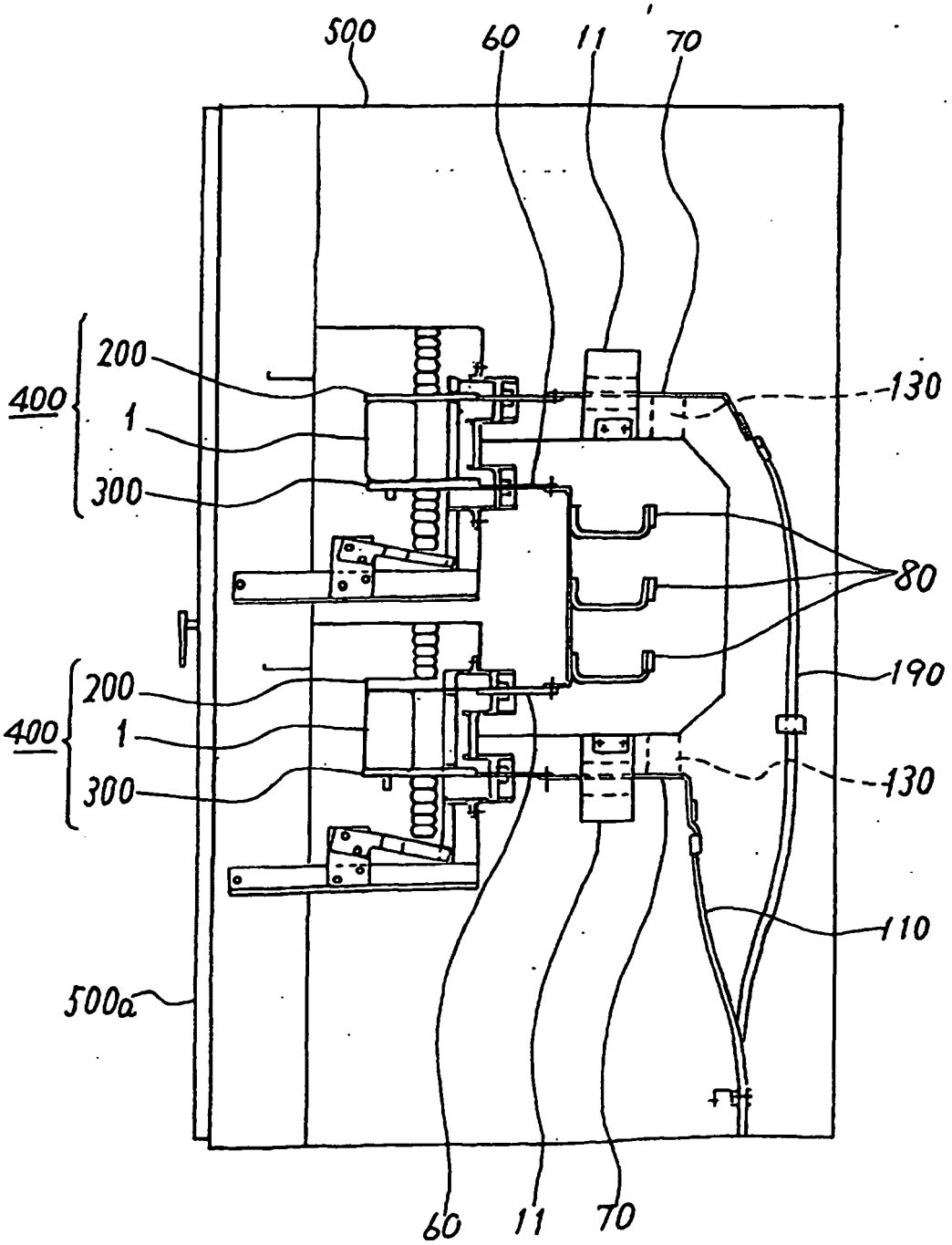

500
60
11
70
200
400
1
300
130
80
190
200
400
1
300
130
110
500a
60
11
70

Fig. 34

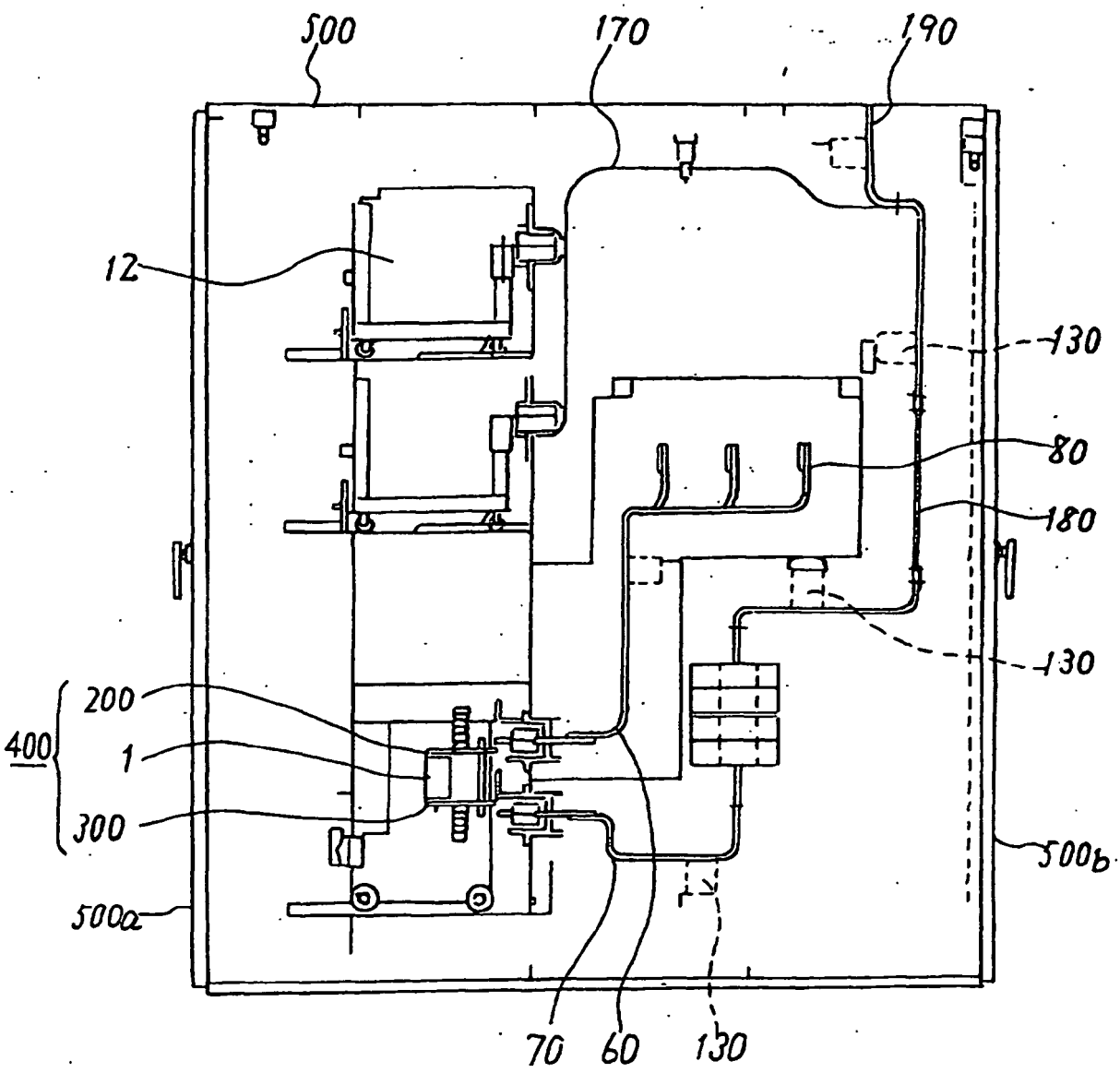
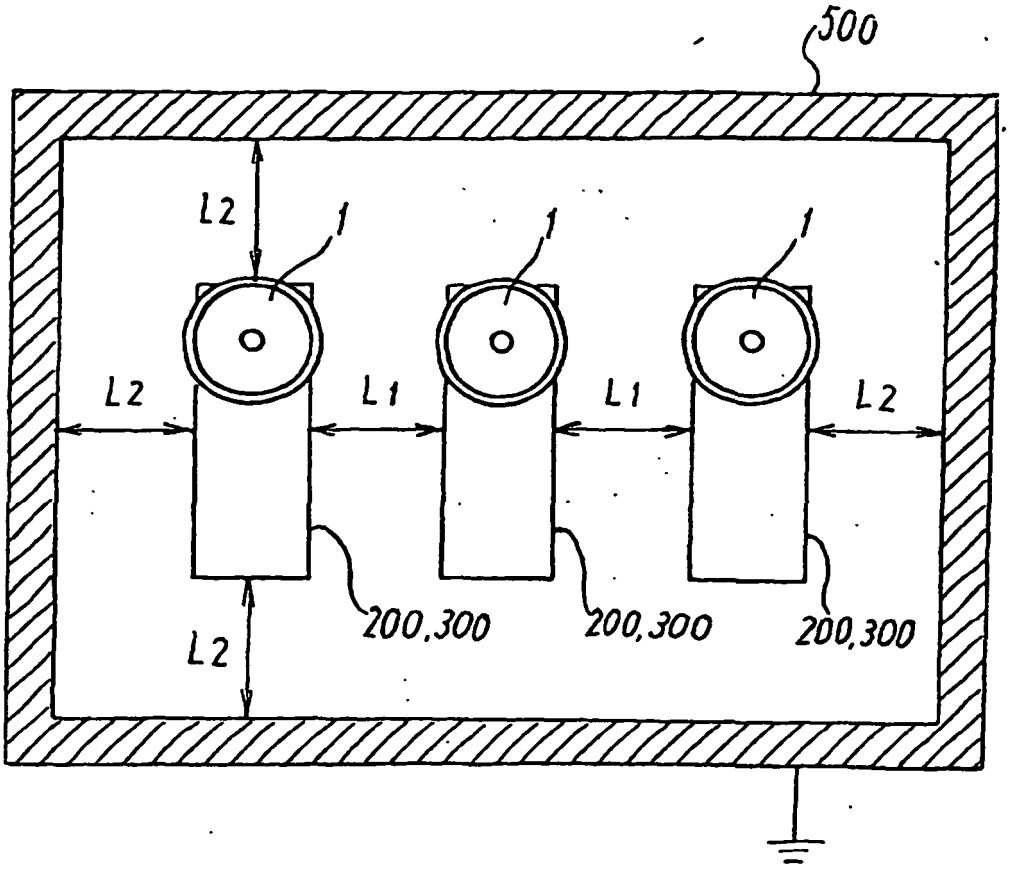


Fig. 35



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 3527911 A **[0002]**
- JP 1018528 A **[0003]**