(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 277 058 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
15.11.2023 Bulletin 2023/46

(21) Application number: **21917459.6**

(22) Date of filing: **07.01.2021**

(51) International Patent Classification (IPC):
H02B 13/035 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H02B 13/035

(86) International application number:
PCT/JP2021/000292

(87) International publication number:
WO 2022/149232 (14.07.2022 Gazette 2022/28)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **MITSUBISHI ELECTRIC CORPORATION**
Chiyoda-ku
Tokyo 100-8310 (JP)

(72) Inventors:
- **MORI Takahiro**
  Tokyo 100-8310 (JP)
- **YOSHIDA Tadahiro**
  Tokyo 100-8310 (JP)
- **MATSUNAGA Toshihiro**
  Tokyo 100-8310 (JP)
- **KAGAWA Koichi**
  Tokyo 100-8310 (JP)
- **MIYATAKE Hideki**
  Tokyo 102-0073 (JP)
- **ONISHI Kenji**
  Tokyo 102-0073 (JP)
- **YOSHIOKA Yoshiki**
  Tokyo 102-0073 (JP)

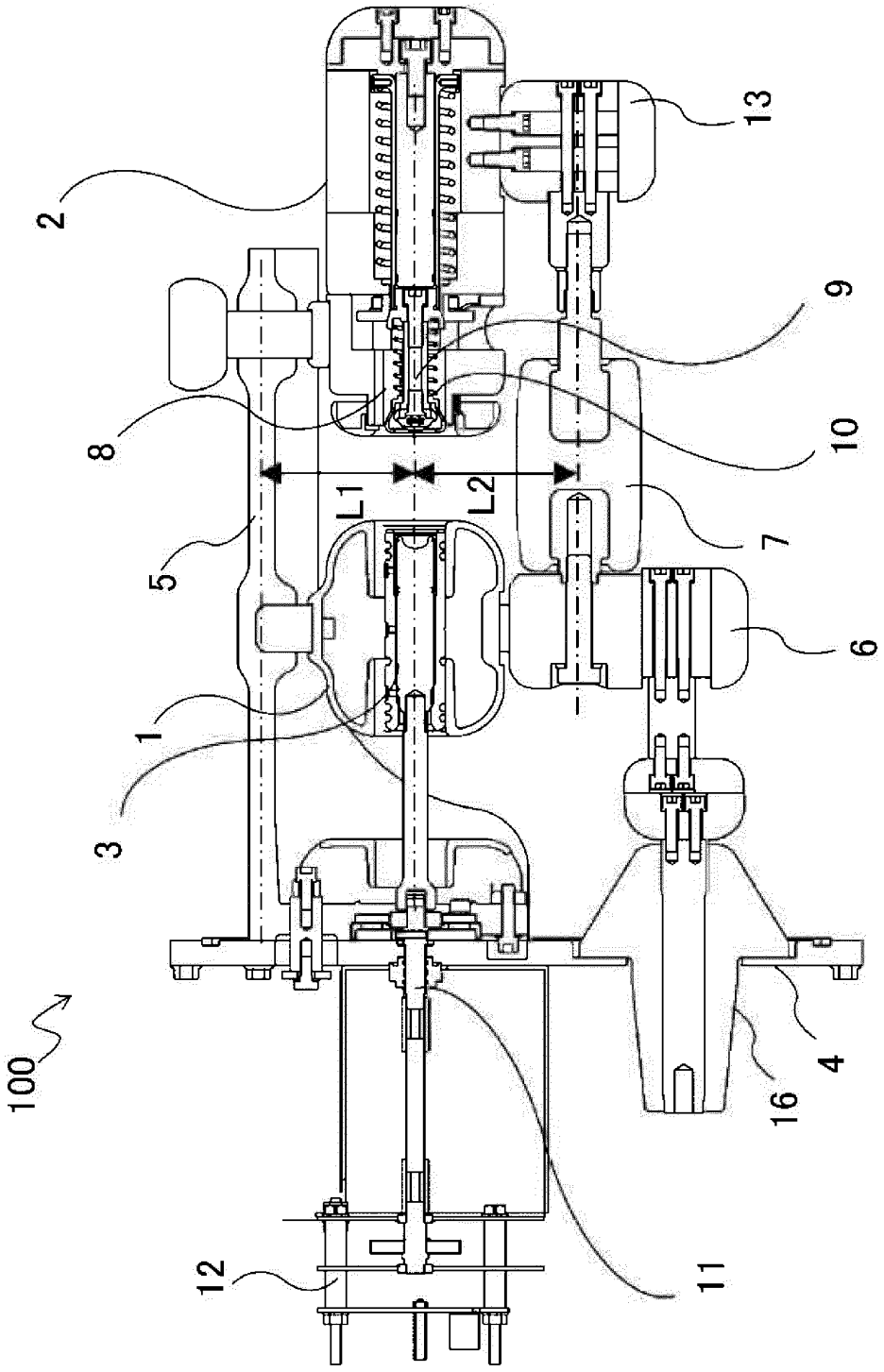
(74) Representative: **Witte, Weller & Partner**
Patentanwälte mbB
Postfach 10 54 62
70047 Stuttgart (DE)

(54) **SWITCHGEAR AND GAS-INSULATED SWITCHGEAR**

(57) A switch (100) includes a fixed-side terminal (2) having a shaft rod (9) and a spring (10) biasing the shaft rod (9), and a movable-side terminal (1) provided so as to be opposed to the fixed-side terminal (2) and including a movable electrode rod (3) which ensures electric conduction to the fixed-side terminal (2) and is contactable therewith/separable therefrom. The fixed-side terminal (2) is supported by a plurality of insulation support portions (5, 7, 15) provided at symmetric positions with respect to an axis on which the movable electrode rod (3) moves, an end of each insulation support portion (5, 7, 15) being fixed. Thus, an impact force at the time of opening is dispersed.

EP 4 277 058 A1

FIG. 1



Description

TECHNICAL FIELD

[0001] The present disclosure relates to a switch and a gas-insulated switchgear.

BACKGROUND ART

[0002] There is known a switch having a quick-acting mechanism (quick-trip mechanism) as an arc extinguishing structure in order to improve the current interruption performance of the switch. The quick-acting mechanism is such a feature that, at the time of opening contacts, the contact opening speed is increased and an arc is elongated to a length needed for arc extinction within a time not causing contact damage, thus improving the interruption performance.

[0003] The applicant has proposed a switch having a structure in which a quick-acting mechanism is not provided in a limited space on the movable electrode rod side (see, for example, Patent Document 1). The switch disclosed in Patent Document 1 operates such that, at the time of closing, a movable electrode rod provided inside a movable-side terminal provided so as to be opposed to a fixed-side terminal is moved to ensure conduction between the fixed-side terminal and the movable-side terminal, and at the time of opening, current between the fixed-side terminal and the movable electrode rod is interrupted by the quick-acting mechanism provided at the fixed-side terminal.

CITATION LIST

PATENT DOCUMENT

[0004] Patent Document 1: Japanese Patent No. 5179278

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0005] The quick-acting mechanism described in Patent Document 1 includes a shaft rod electrically connected to the fixed-side terminal, a contact for receiving an arc generated at the time of opening at an end of the shaft rod, an engagement portion for engaging the shaft rod and the movable electrode rod with each other, and a spring for driving the shaft rod in a direction opposite to the movable-side terminal. Then, at the time of closing between the fixed-side terminal and the movable-side terminal, the movable electrode rod and the shaft rod are engaged with each other, and at the time of opening, the spring is released at a predetermined position, thereby separating the movable electrode rod and the shaft rod from each other and interrupting current. Therefore, by the spring being released at the time of opening, after the movable electrode rod and the shaft rod are separated, an impact force occurs when a movable contact comes into contact with the fixed-side terminal. Conventionally, the movable-side terminal and the fixed-side terminal are supported in a cantilever manner, and great loads occur in directions of support portions of the fixed-side terminal and the movable-side terminal by the impact force occurring at the time of opening/closing. Thus, there have been such constraints that interruption current to an extent that can withstand the impact force needs to be addressed or increase in the speed of the quick-acting mechanism is limited because the impact force increases.

[0006] The present disclosure has been made to solve the above problem, and an object of the present disclosure is to provide a switch having a stable current interruption function while dispersing an impact force occurring at the time of interrupting current.

SOLUTION TO THE PROBLEMS

[0007] A switch according to the present disclosure includes: a fixed-side terminal having a movable contact; and a movable-side terminal which is provided so as to be opposed to the fixed-side terminal and includes a movable electrode rod which ensures electric conduction to the fixed-side terminal and is contactable therewith/separable therefrom. The movable-side terminal is fixed on a side opposite to a side where the movable-side terminal is opposed to the fixed-side terminal. The movable contact has a shaft rod movable coaxially with the movable electrode rod, and a spring biasing the shaft rod. At a time of closing between the fixed-side terminal and the movable-side terminal, an end of the movable electrode rod is engaged with the movable contact. At a time of opening between the fixed-side terminal and the movable-side terminal, in a state in which the movable electrode rod is engaged with the movable contact, the movable electrode rod moves toward the movable-side terminal, so that the spring is energized, and when the movable electrode rod reaches a predetermined position, the spring is released, so that the shaft rod moves toward the fixed-side terminal, thus separating the movable contact from the movable electrode rod. The fixed-side terminal is supported by a plurality of insulation support portions provided at symmetric positions with respect to an axis on which the movable electrode rod moves, an end of each insulation support portion being fixed.

EFFECT OF THE INVENTION

[0008] In the switch according to the present disclosure, the fixed-side terminal is supported from a plurality of directions that are symmetric with respect to the axial direction, whereby an impact force occurring at the time of interrupting current (at the time of closing) is dispersed, thus obtaining a stable current interruption function.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

[FIG. 1] FIG. 1 is a specific part sectional view of a switch (opened state) according to embodiment 1.
[FIG. 2] FIG. 2 is a partially enlarged view of a fixed-side terminal of the switch according to embodiment 1.
[FIG. 3] FIG. 3 is a specific part sectional view of the switch (closed state) according to embodiment 1.
[FIG. 4] FIG. 4 is a specific part sectional view of the switch (during opening operation) according to embodiment 1.
[FIG. 5] FIG. 5 is a specific part sectional view of a switch in a comparative example of embodiment 1.
[FIG. 6] FIG. 6 is a specific part sectional view of a switch (opened state) according to embodiment 2.

DESCRIPTION OF EMBODIMENTS

[0010] Hereinafter, embodiments will be described with reference to the drawings. In the drawings, the same reference characters denote the same or corresponding parts.

[0011] A switch according to each embodiment is used for a gas-insulated switchgear installed at a power reception point of a general consumer or a substation of an electric power company, for example.

Embodiment 1

[0012] Hereinafter, a switch according to embodiment 1 will be described with reference to the drawings.

[0013] FIG. 1 is a specific part sectional view showing the structure of the switch according to embodiment 1. In FIG. 1, the switch 100 is in an opened state. In the switch 100, upper parts of a movable-side terminal 1 and a fixed-side terminal 2 are supported by a first insulation support portion 5 having an end fixed to a flange 4, and the movable-side terminal 1 and the fixed-side terminal 2 are arranged so as to be opposed to each other. A lower part of the movable-side terminal 1 is supported by a support conductor 6 on the movable side connected to the flange 4. At a lower part of the fixed-side terminal 2, a coupling portion 13 is provided for coupling with a second insulation support portion 7, and the second insulation support portion 7 fixed to the support conductor 6 supports the fixed-side terminal 2 by being coupled via the coupling portion 13. The support conductor 6 is connected to and supported by a bushing 16 fixed to the flange 4 and having a conductor at the center and an insulating material surrounding the conductor. The coupling portion 13 has therein counterbores in two directions perpendicular to each other. The fixed-side terminal 2 and the coupling portion 13 are connected by the counterbore on one side, and the second insulation support portion 7 and the coupling portion 13 are connected by the counterbore on the other side perpendicular thereto. Bolts used for the connections protrude from the coupling portion 13, thus suppressing occurrence of electric field concentration.

[0014] The outer shape of the fixed-side terminal 2 is a cylindrical shape. On the movable-side terminal 1 side, a shaft rod 9 of a movable contact 8 is provided along the axis of the cylinder, and a spring 10 is provided around the shaft rod 9.

[0015] In the movable-side terminal 1, the movable electrode rod 3 is provided coaxially with the shaft rod 9 of the fixed-side terminal 2. The switch 100 is closed by engaging one end of the movable electrode rod 3 with the movable contact 8, and the switch 100 is opened by releasing engagement between the movable electrode rod 3 and the movable contact 8. Another end of the movable electrode rod 3 is connected to a movable shaft 11, and the movable shaft 11 is connected to an operation mechanism portion 12 outside the flange 4 via, for example, bellows. The movable shaft 11, the movable electrode rod 3, and the shaft rod 9 are coaxial with each other.

[0016] Next, a quick-acting mechanism having a current interruption function in the switch 100 will be described. FIG. 2 is a partial enlarged view of the fixed-side terminal 2 and shows the structure of the movable contact 8. As described above, the movable contact 8 includes the shaft rod 9 and the spring 10 provided therearound. As described below, at the time of closing, one end of the movable electrode rod 3 is engaged with the movable contact 8 and thus is electrically connected to the shaft rod 9. The shaft rod 9 is positioned by a stationary end 14 at the time of opening. FIG. 3 shows a closed state of the switch 100. FIG. 4 shows shifting from the closed state in FIG. 3 to the opened state in FIG. 1, i.e., an opening operation.

[0017] In FIG. 3, at the time of closing, the movable electrode rod 3 moves toward the fixed-side terminal 2 via the movable shaft 11 by the operation mechanism portion 12. Then, the movable electrode rod 3 is inserted into the fixed-side terminal 2, to push the spring 10 and engage with the movable contact 8, so that the movable-side terminal 1 and the fixed-side terminal 2 become electrically conductive to each other.

[0018] In FIG. 4, when the switch 100 starts an opening operation, the movable electrode rod 3 moves toward the movable-side terminal 1 side by the operation mechanism portion 12, and the shaft rod 9 of the movable contact 8 moves toward the movable-side terminal 1 side while engaging with the movable electrode rod 3, so that the spring 10 composing the movable contact 8 is energized so as to extend. When the movable electrode rod 3 or the shaft rod 9 reaches a predetermined position, engagement of the movable contact 8 and the movable electrode rod 3 is released, so that the spring 10 is released. The movable contact 8 is stored into the fixed-side terminal 2 and the movable electrode rod 3 is stored into the movable-side terminal 1, whereby the opening

operation is completed, thus coming into the opened state in FIG. 1.

[0019] During the opening operation to shift from the state in FIG. 4 to the state in FIG. 1, when the spring 10 is released, the movable contact 8 moves into the fixed-side terminal 2 and the shaft rod 9 comes into contact with the stationary end 14, so that an impact force occurs. The switch needs to have a structure for withstanding the impact force. FIG. 5 shows a comparative example of embodiment 1, and is different from FIG. 1 in that the second insulation support portion 7 is not provided and the fixed-side terminal 2 is not supported from below. In the structure as shown in FIG. 5, at the time of opening, the movable contact 8 is stored into the fixed-side terminal 2 and the shaft rod 9 comes into contact with the stationary end 14, so that an impact force occurs. At this time, a load acts on the fixed-side terminal 2 in the horizontal direction. Since the fixed-side terminal 2 is supported with a cantilever structure by the first insulation support portion 5, a load acts on the first insulation support portion 5 upward as shown by an arrow in FIG. 5. In this structure, for improving the current interruption performance, it is conceivable that the load of the spring 10 is increased to increase the opening/closing speed. However, increase in the impact force depending on the stored energy of the spring 10 might cause deformation or breakage of the first insulation support portion 5.

[0020] In embodiment 1, as shown in FIG. 1, FIG. 3, and FIG. 4, the upper part of the fixed-side terminal 2 is supported by the first insulation support portion 5, and the lower part of the fixed-side terminal 2 located at a symmetric position with respect to the movable shaft 11 is supported by the second insulation support portion 7. The first insulation support portion 5 and the second insulation support portion 7 support the fixed-side terminal 2 so as to be parallel and symmetric with respect to the movable shaft 11. That is, the first insulation support portion 5 and the second insulation support portion 7 are provided such that, in FIG. 1, a distance L1 between the movable shaft 11 and the first insulation support portion 5, and a distance L2 between the movable shaft 11 and the second insulation support portion 7, are almost equal to each other.

[0021] In embodiment 1, the structure of the switch for one phase is shown in FIG. 1, FIG. 3, and FIG. 4. However, in a switch for three phases, three of such devices are arranged in the horizontal direction. That is, the switch is configured such that three devices are arranged in the depth direction in the drawings. In this case, the first insulation support portions 5 and the second insulation support portions supporting the fixed-side terminals 2 are arranged on the upper and lower sides, whereby the distances between the devices for three phases can be reduced.

[0022] Desirably, the first insulation support portion 5 and the second insulation support portion 7 are formed by using, for example, epoxy resin, etc., and are adjusted such that the elastic deformation amounts of the first insulation support portion 5 and the second insulation support portion 7 become equivalent to each other when an opening/closing impact occurs, thus forming such a structure that a load does not act unevenly on only one of the first insulation support portion 5 and the second insulation support portion 7. With this structure, propagation of an impact force to the flange 4 supporting the switch 100 can be suppressed. Thus, without increasing the strength of the flange 4, it becomes possible to increase the opening/closing speed so as to improve the current interruption performance.

[0023] As described above, in the switch 100 according to embodiment 1, the fixed-side terminal 2 is supported by the first insulation support portion 5 and the second insulation support portion 7 at symmetric positions with respect to the movable shaft 11, and the first insulation support portion 5 and the second insulation support portion 7 are parallel with the movable shaft 11 and each have an end fixed by the flange 4. Thus, an impact force in an opening/closing operation of the switch 100 can be dispersed by the first insulation support portion 5 and the second insulation support portion 7, whereby it becomes possible to provide a switch having a stable current interruption function.

[0024] In addition, the fixed-side terminal 2 is supported by the first insulation support portion 5 and the second insulation support portion 7 and thus a load is dispersed therebetween, whereby the mechanical strengths of the first insulation support portion 5, the second insulation support portion 7, and the operation mechanism portion 12 can be designed to be lower than in conventional art. As a result, the switch can be downsized, thus leading to reduction in the installation space of the switch and cost reduction of the switch.

Embodiment 2

[0025] Hereinafter, a switch according to embodiment 2 will be described with reference to FIG. 6.

[0026] FIG. 6 is a specific part sectional view showing the structure of the switch according to embodiment 2. In FIG. 6, the switch 100 is in an opened state. Difference from FIG. 1 is that a lower part of the fixed-side terminal 2 is supported by a second insulation support portion 15 directly fixed to the flange 4. The other structures are the same as those in embodiment 1 and therefore description thereof is omitted.

[0027] In FIG. 6, the second insulation support portion 15 is directly fixed to the flange 4, and the support conductor 6 on the movable side is fixed to the flange 4 independently of the second insulation support portion 15. As in embodiment 1, the second insulation support portion 15 and the first insulation support portion 5 are arranged at symmetric positions with respect to the movable shaft 11 and in parallel with the movable shaft 11 such that the distance L1 between the movable shaft 11 and the first insulation support portion 5, and the distance L2 between the movable shaft 11 and the second insu-

lation support portion 15, are almost equal to each other. In addition, the second insulation support portion 15 and the first insulation support portion 5 are adjusted such that their elastic deformation amounts become equivalent to each other. Thus, since the lower part of the fixed-side terminal 2 is directly supported by the second insulation support portion 15, the coupling portion 13 need not be provided as in embodiment 1, so that the number of components can be decreased. The movable-side terminal 1 is supported by the first insulation support portion 5 and the support conductor 6 fixed to the flange 4.

[0028] As described above, according to embodiment 2, the same effects as those in embodiment 1 are provided, and in addition, it is possible to obtain a switch having such a structure that the fixed-side terminal 2 is supported from two directions and loads acting on the first insulation support portion 5 and the second insulation support portion 15 are dispersed, with a decreased number of components.

Other embodiments

[0029] The above embodiments 1 and 2 have shown the examples in which the fixed-side terminal 2 is supported by the insulation support portions from the upper and lower parts as symmetric positions with respect to the movable shaft 11. However, as long as designing can be made such that a load at the time of opening/closing is equivalently dispersed between two support members supporting the fixed-side terminal 2, the support positions are not limited to the upper and lower parts. The support positions may be symmetric positions at an angle shifted from the vertical direction, or may be positions in the horizontal direction with respect to the movable shaft 11.

[0030] The above embodiments 1 and 2 have shown the examples in which the fixed-side terminal 2 is supported by the insulation support portions from the upper and lower parts as symmetric positions with respect to the movable shaft 11. However, the number of the insulation support portions is not limited to two. The insulation support portions may be arranged at equal distances from the movable shaft 11 and at equiangular positions around the movable shaft 11 so that a load can be dispersed.

[0031] In a case of using the switch according to any of the above embodiments 1 and 2 and the other embodiments for a gas-insulated switchgear, components other than the operation mechanism portion, e.g., the movable-side terminal, the fixed-side terminal, the insulation support portions, and the like are stored in a hermetic container in which SF_6 gas, dry air, or the like is sealed, and an opening/closing operation is performed via the operation mechanism portion from the outside of the hermetic container.

[0032] Although the disclosure is described above in terms of various exemplary embodiments and implementations, it should be understood that the various features, aspects, and functionality described in one or more of the individual embodiments are not limited in their applicability to the particular embodiment with which they are described, but instead can be applied, alone or in various combinations to one or more of the embodiments of the disclosure.

[0033] It is therefore understood that numerous modifications which have not been exemplified can be devised without departing from the scope of the present disclosure. For example, at least one of the constituent components may be modified, added, or eliminated. At least one of the constituent components mentioned in at least one of the preferred embodiments may be selected and combined with the constituent components mentioned in another preferred embodiment.

DESCRIPTION OF THE REFERENCE CHARACTERS

[0034]

1 movable-side terminal
2 fixed-side terminal
3 movable electrode rod
4 flange
5 first insulation support portion
6 support conductor
7, 15 second insulation support portion
8 movable contact
9 shaft rod
10 spring
11 movable shaft
12 operation mechanism portion
13 coupling portion
14 stationary end
16 bushing
100 switch
L1 distance between movable shaft and first insulation support portion
L2 distance between movable shaft and second insulation support portion

Claims

1. A switch comprising:

a fixed-side terminal having a movable contact; and
a movable-side terminal which is provided so as to be opposed to the fixed-side terminal and includes a movable electrode rod which ensures electric conduction to the fixed-side terminal and is contactable therewith/separable therefrom, wherein
the movable-side terminal is fixed on a side opposite to a side where the movable-side terminal is opposed to the fixed-side terminal,
the movable contact has a shaft rod movable coaxially with the movable electrode rod, and a

spring biasing the shaft rod,
at a time of closing between the fixed-side terminal and the movable-side terminal, an end of the movable electrode rod is engaged with the movable contact,
at a time of opening between the fixed-side terminal and the movable-side terminal, in a state in which the movable electrode rod is engaged with the movable contact, the movable electrode rod moves toward the movable-side terminal, so that the spring is energized, and when the movable electrode rod reaches a predetermined position, the spring is released, so that the shaft rod moves toward the fixed-side terminal, thus separating the movable contact from the movable electrode rod, and
the fixed-side terminal is supported by a plurality of insulation support portions provided at symmetric positions with respect to an axis on which the movable electrode rod moves, an end of each insulation support portion being fixed.

2. The switch according to claim 1, wherein
the plurality of insulation support portions are provided in parallel with and at equal distances from the axis on which the movable electrode rod moves.

3. The switch according to claim 1 or 2, wherein
the plurality of insulation support portions are made of resin and adjusted to be equivalent in elastic deformation amount.

4. The switch according to any one of claims 1 to 3, wherein
one of the plurality of insulation support portions supports both of the fixed-side terminal and the movable-side terminal.

5. The switch according to claim 4, wherein
one of the plurality of insulation support portions is provided at a position symmetric with the insulation support portion supporting both of the fixed-side terminal and the movable-side terminal, with respect to the axis on which the movable electrode rod moves.

6. The switch according to any one of claims 1 to 5, wherein

a number of the insulation support portions is two, and
one of the insulation support portions supports an upper part of the fixed-side terminal, and another one supports a lower part of the fixed-side terminal.

7. A gas-insulated switchgear comprising the switch according to any one of claims 1 to 6.

FIG. 1

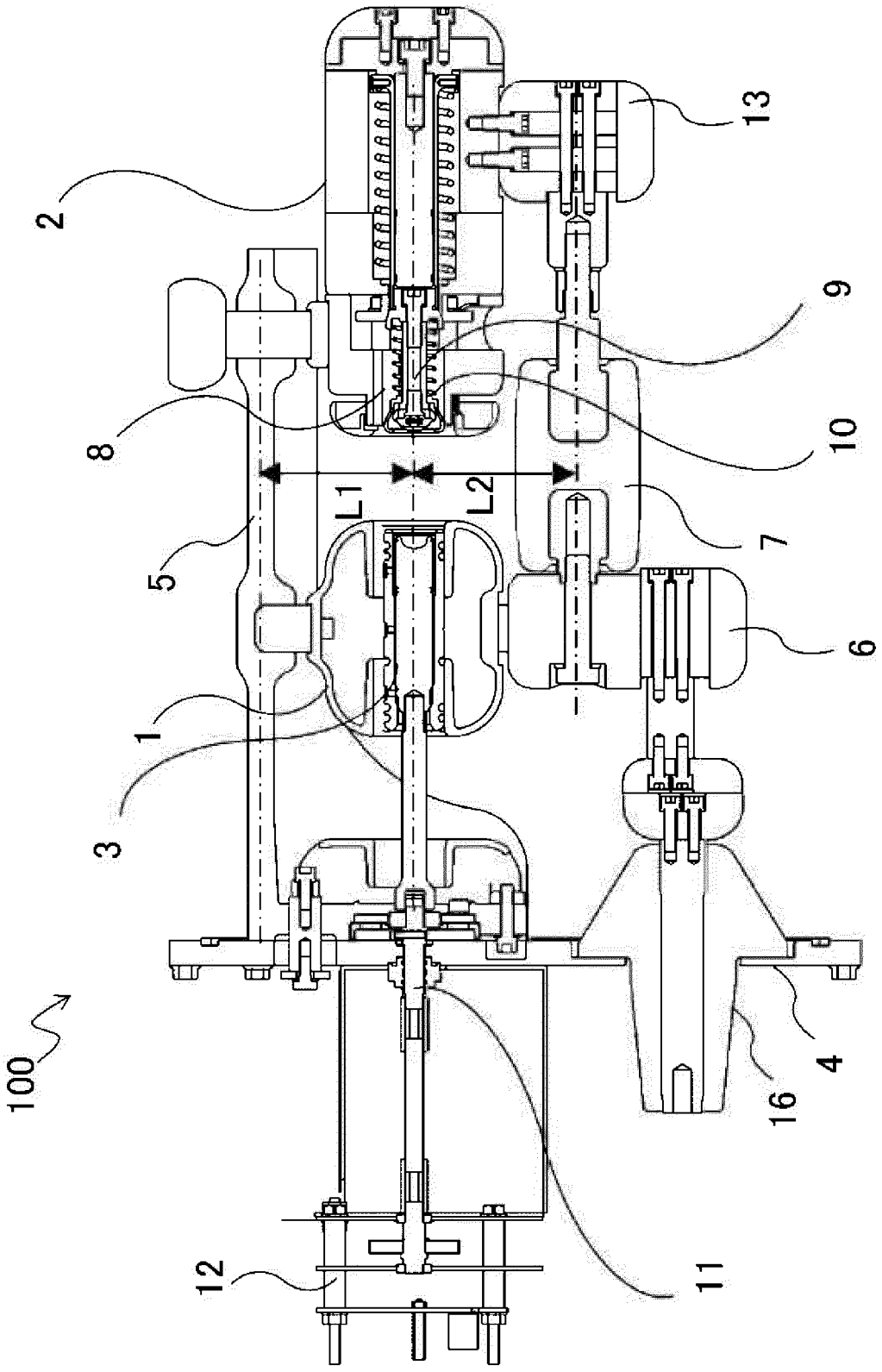


FIG. 2

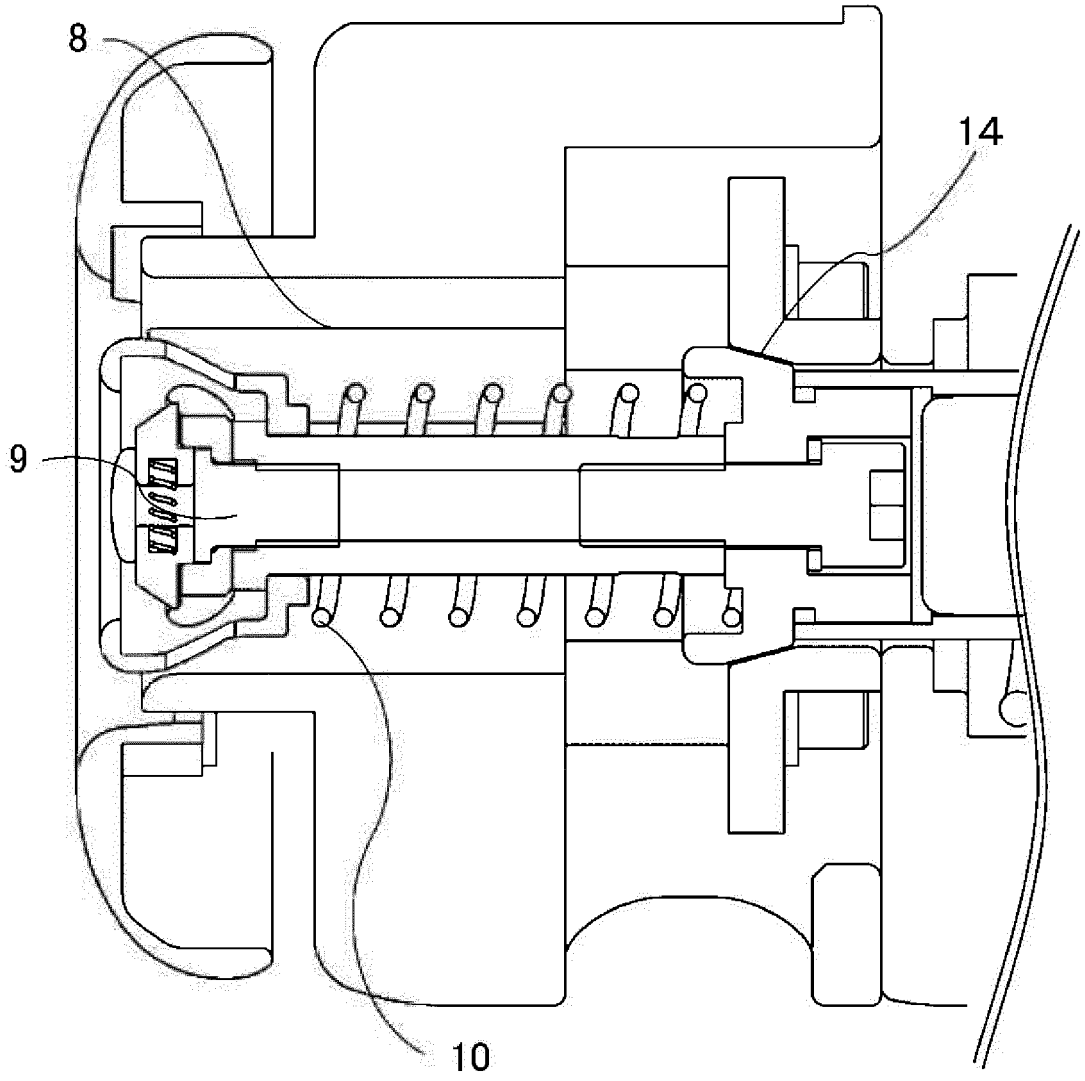


FIG. 3

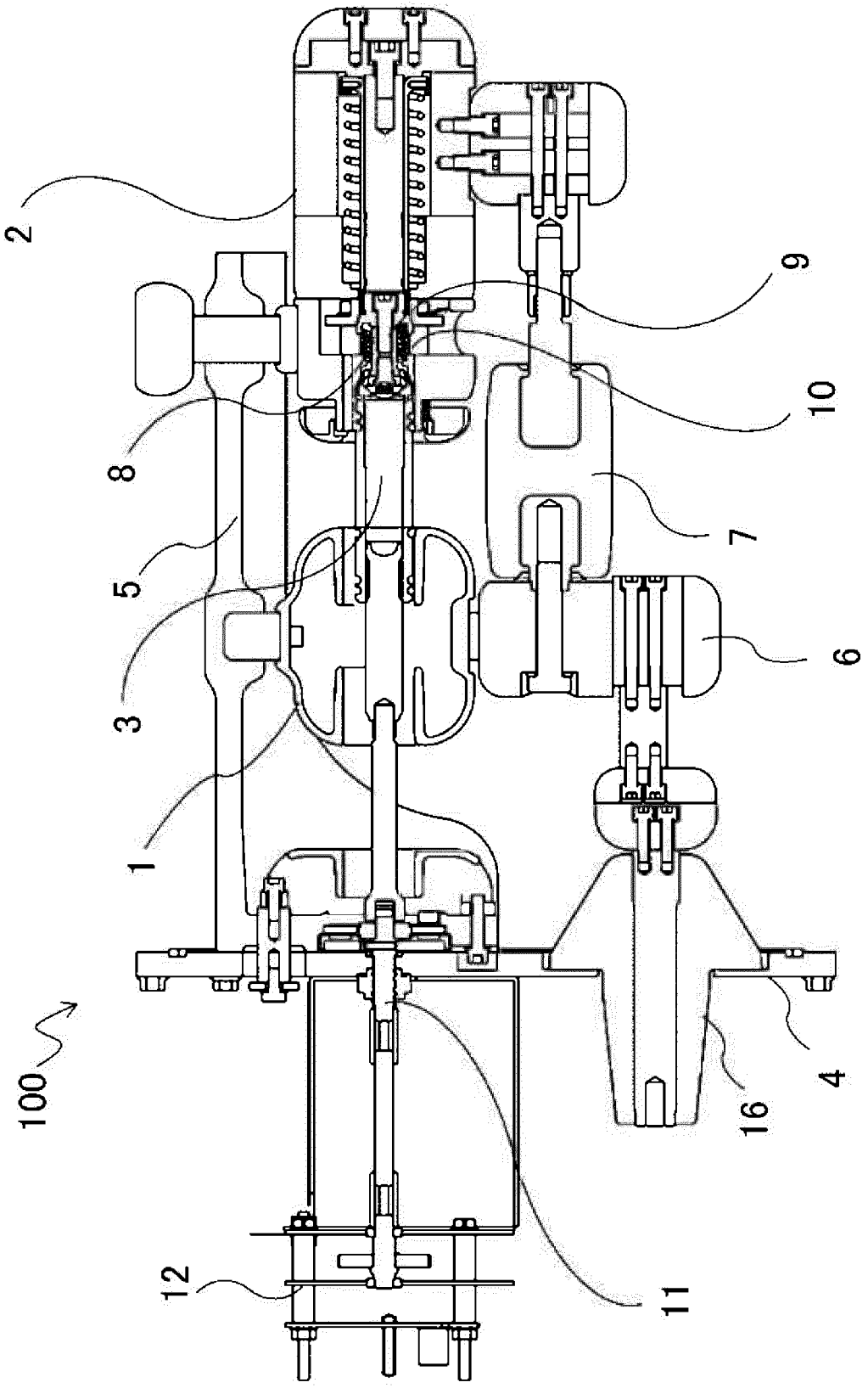


FIG. 4

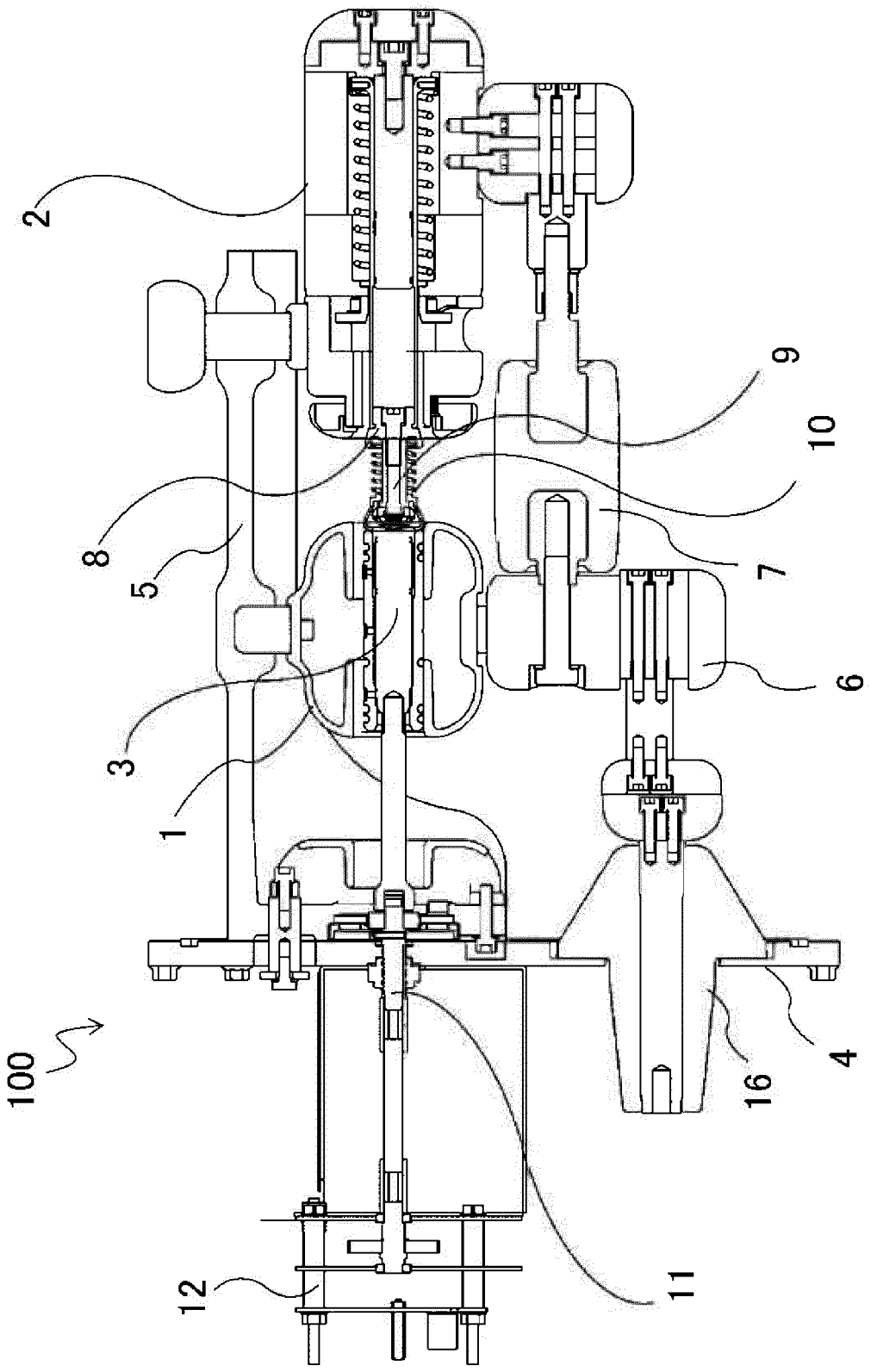


FIG. 5

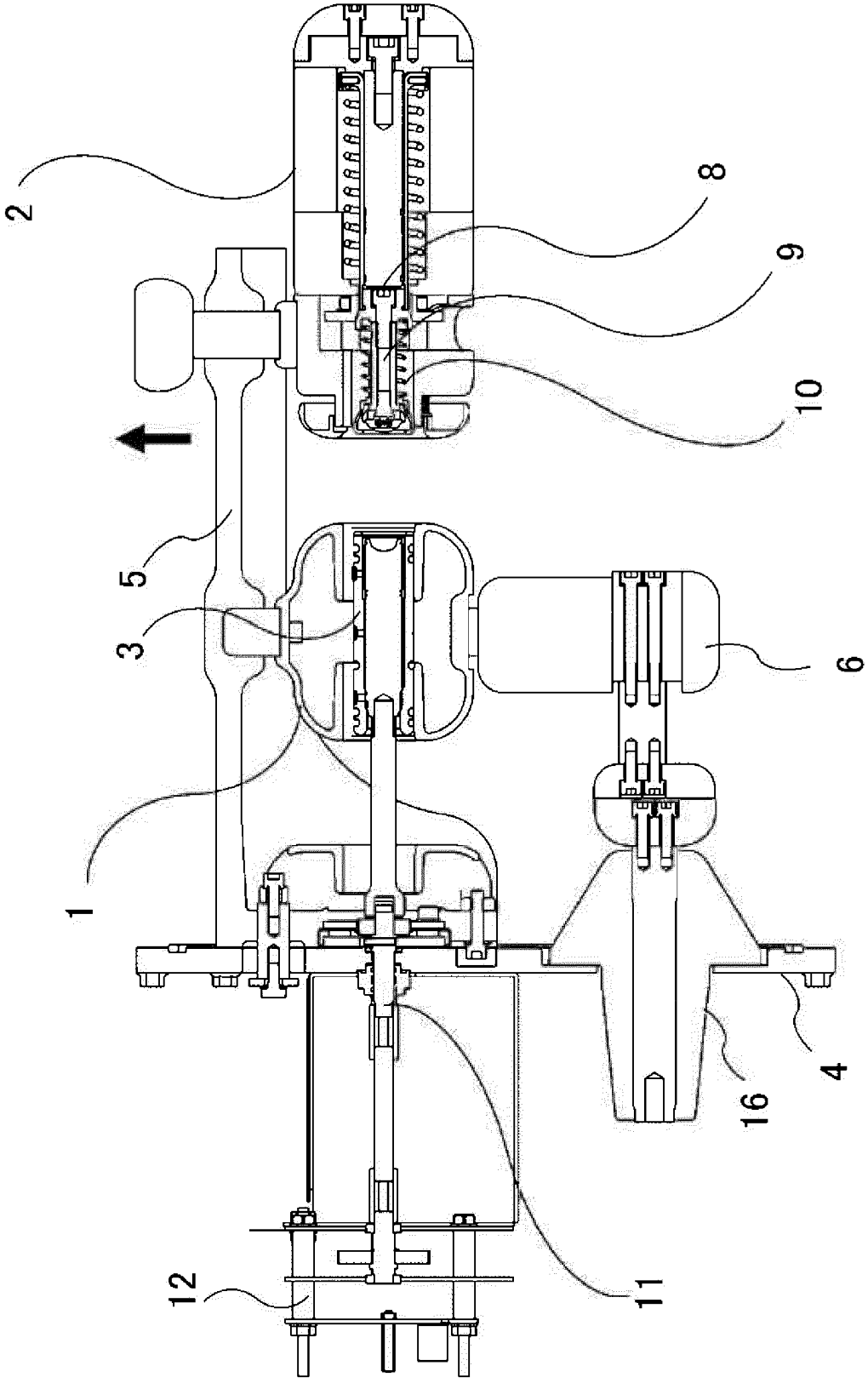
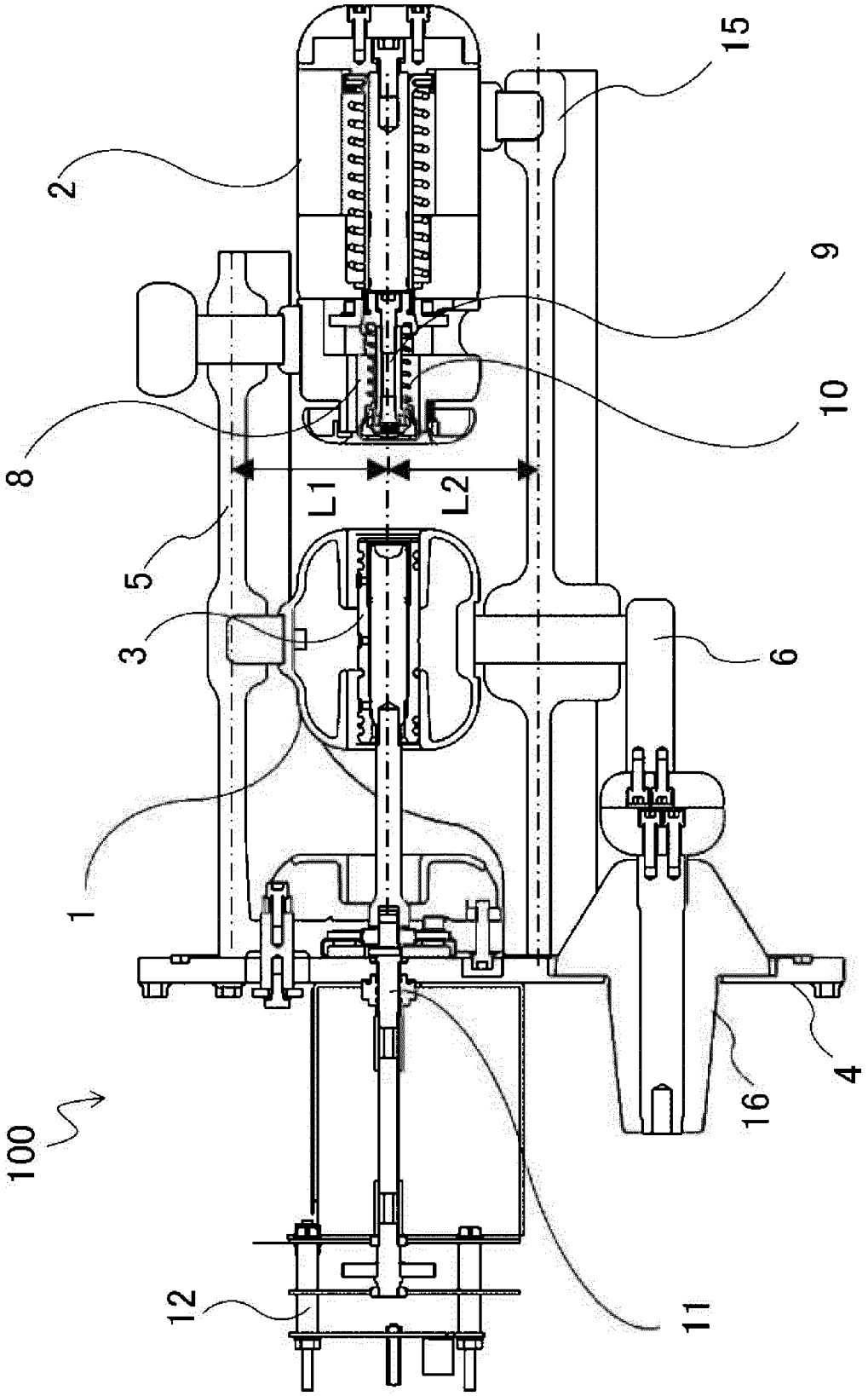


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/000292

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. H02B13/035(2006.01)i
FI: H02B13/035301H

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. H02B13/035

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2021
Registered utility model specifications of Japan 1996-2021
Published registered utility model applications of Japan 1994-2021

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2010-027479 A (MITSUBISHI ELECTRIC CORPORATION) 04 February 2010 (2010-02-04), paragraphs [0008]-[0035], fig. 1-13	1, 4, 5, 7 2, 3, 6
Y	JP 2014-103016 A (MITSUBISHI ELECTRIC CORPORATION) 05 June 2014 (2014-06-05), paragraphs [0001]-[0004], [0013]-[0041], fig. 1-11	1, 4, 5, 7
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 123359/1978 (Laid-open No. 039672/1980) (MEIDENSHA CORPORATION) 14 March 1980 (1980-03-14), specification, pages 2-9, fig. 1, 2	1, 4, 5, 7

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 March 2021	16 March 2021
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2021/000292

JP 2010-027479 A	04 February 2010	(Family: none)
JP 2014-103016 A	05 June 2014	(Family: none)
JP 55-039672 U1	14 March 1980	(Family: none)

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 5179278 B **[0004]**