



(11)

EP 3 955 273 A1

(12)

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

(43) Date of publication:
16.02.2022 Bulletin 2022/07

(51) International Patent Classification (IPC):
H01H 33/666 ^(2006.01)

(21) Application number: **19924617.4**

(52) Cooperative Patent Classification (CPC):
H01H 33/666

(22) Date of filing: **08.04.2019**

(86) International application number:
PCT/JP2019/015294

(87) International publication number:
WO 2020/208676 (15.10.2020 Gazette 2020/42)

(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

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(54) **ELECTROMAGNETIC OPERATING APPARATUS**

(57) A manual operation section (20) which manually operates a plurality of switches (200) all at one time includes a shaft (5) which, being pivotably held on a frame (11) of an electromagnetic operation device main body section (10) which operates each of the switches (200), is disposed spanning a region in which are aligned a plurality of the electromagnetic operation device main body sections (10); a handle portion (7) having a grip portion (9) with which to pivotally operate the shaft (5); a plurality of cams (6) mounted on the shaft (5) so as to correspond to each of the electromagnetic operation device main body sections (10); and a link member (3) which, being provided between the shaft (5) and a movable shaft (1) of each of the electromagnetic operation main body sections (10), is pivotably supported on a rotation shaft (3a) supported on the frame (11), and one end portion and the other end portion of which are in contact respectively with each of the cams (6) and with the movable shaft (1), wherein a configuration is such as to cause the shaft (5) to pivot in accordance with opening operation of the handle portion (7), causing a plurality of the movable shafts (1) to move at the same time via the cams (6) and the link members (3).

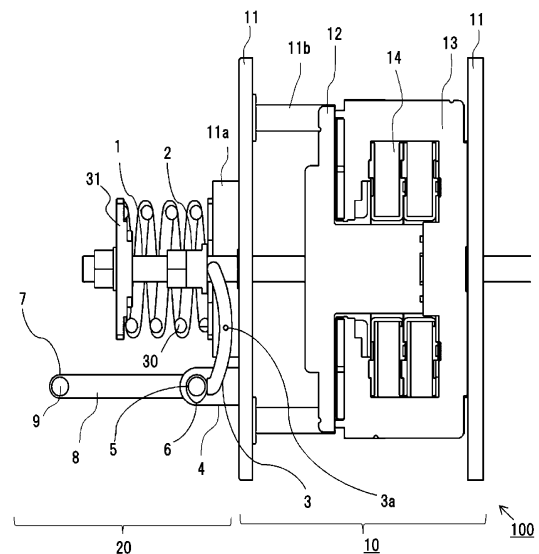


FIG.2

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Description

Technical Field

[0001] The present application relates to the field of an electromagnetic operation device which operates, for example, a switch.

Background Art

[0002] As a switch, there is a vacuum circuit breaker which has incorporated in a vacuum container thereof a movable contact and a fixed contact, wherein opening/closing operation is carried out by causing the movable contact to move. An electromagnetic operation device which operates the switch is configured so as to enable not only electromagnetic operation but manual operation. When manually carrying out opening operation, for example, an operator causes a rotation shaft to pivot, thereby driving a lever fixed to the rotation shaft, and the lever directly pushes a movable shaft of the electromagnetic operation device, thus driving the device. Also, the rotation shaft is configured to be driven using a tool, such as a wrench (for example, refer to PTL 1).

[0003] Also, as a heretofore known switching apparatus, a configuration is disclosed such as to carry out opening/closing operation for three phases' worth of switch portions (switches) all at one time, wherein a handle as another part is mounted on a main shaft (a rotation shaft) when in manual operation, and a drive shaft (a movable shaft) is directly driven with a lever fixed to the main shaft (for example, refer to PTL 2).

Citation List

Patent Literature

[0004]

PTL 1: Japanese Patent No. 5,901,351

PTL 2: Japanese Patent No. 4,668,165

Summary of Invention

Technical Problem

[0005] The electromagnetic operation device of PTL 1 is such that a mechanism portion for manual operation is provided paired with the electromagnetic operation device. For this reason, when a configuration is assumed in which three phases' worth of switches are included in one switching apparatus and an electromagnetic operation device is provided for each of the three phases, it is necessary to carry out manual operation per phase when carrying out manual opening operation, so that an open phase state occurs temporarily.

[0006] Also, in the configurations of PTLs 1 and 2, a structure is such that the movable shaft is directly driven

with the lever fixed to the rotation shaft, thus requiring operation torque high enough to directly rotationally operate the rotation shaft to which the lever is fixed, and there is a problem with operability in that the operation torque increases with an increase in the number of devices to be manually operated all at one time. Also, there is also a problem with operability in that a handle for manual operation, or the like, is not equipped on the device side.

[0007] The present application has been made to solve the problem, and an object of the present application is to provide an electromagnetic operation device which enables manual operation to be carried out for a plurality of switches all at one time and also which is superior in operability.

Solution to Problem

[0008] An electromagnetic operation device disclosed in the present application includes a manual operation section with which to manually carry out opening operation for a plurality of switches all at one time, wherein the manual operation section includes a shaft which, being pivotably held on a frame of an electromagnetic operation device main body section which operates each of the switches, is disposed spanning a region in which are aligned a plurality of the electromagnetic operation device main body sections; a handle portion having a grip portion with which to pivotally operate the shaft; a plurality of cams which are individually mounted on the shaft so as to correspond to each of the plurality of electromagnetic operation device main body sections; and a link member which, being provided between the shaft and a movable shaft of each of the electromagnetic operation device main body sections, is pivotably supported on a rotation shaft supported on the frame, and one end portion and the other end portion of which are in contact respectively with the cam and with the movable shaft, wherein a configuration is such as to cause the shaft to pivot in accordance with opening operation of the handle portion, causing a plurality of the movable shafts to move at the same time via the cams and the link members.

Advantageous Effects of Invention

[0009] According to the electromagnetic operation device disclosed in the present application, a configuration is such that the cam mounted on the shaft is interlocked with the link member, causing the movable shaft to move, so that design margin is higher by the amount equivalent to a larger number of parts interlocking with the shaft than in the case of a configuration in which one member for causing the movable shaft to move is directly mounted on the shaft, and it is easy to adjust the operation torque necessary for manual operation, so that it is possible to operate a plurality of movable shafts all at one time by manually operating the handle portion fixed to the shaft, and thus possible to improve operability.

Brief Description of Drawings

[0010]

[Fig. 1] Fig. 1 is a partial sectional side view showing the outline of an electromagnetic operation device according to a first embodiment.

[Fig. 2] Fig. 2 is an enlarged side sectional view of the electromagnetic operation device.

[Fig. 3] Fig. 3 is a front view of the electromagnetic operation device according to the first embodiment.

[Fig. 4] Fig. 4 is a main portion enlarged plan view of a link member.

[Fig. 5] Fig. 5 is a perspective view of the electromagnetic operation device according to the first embodiment.

[Fig. 6] Fig. 6 is a side view showing a cam and the link member.

[Fig. 7] Fig. 7 is a front view of an electromagnetic operation device according to a second embodiment.

[Fig. 8] Fig. 8 is a side sectional view taken along the line B-B of Fig. 7.

Description of Embodiments

First Embodiment

[0011] A description will be given, using Figs. 1 to 6, of an electromagnetic operation device 100 according to a first embodiment of the present application.

[0012] Fig. 1 is a partial sectional side view showing the electromagnetic operation device 100 according to the first embodiment, the view showing the relation of connection thereof to a switch 200, opening/closing operation of which is performed by the electromagnetic operation device 100. Herein, the switch 200 is, for example, a vacuum circuit breaker, and a switching apparatus is configured of the electromagnetic operation device 100 and the switch 200.

[0013] The electromagnetic operation device 100 includes an electromagnetic operation device main body section 10, which electromagnetically operates the switch 200 when a power source can be used, and a manual operation section 20 used for an operator to manually operate the switch 200 in the event of an emergency, such as a power failure. In Fig. 1, the electromagnetic operation device main body section 10 is disposed in the central portion, the switch 200 is disposed on the right side, the manual operation section 20 is disposed on the left side, and a movable shaft 1 is disposed extending in the left/right direction so as to penetrate these sections. Three phases' worth of switches 200 are disposed aligned on the depth side of Fig. 1, and the face portion at the left end of Fig. 1 is the front of the electromagnetic operation device 100.

[0014] The switch 200 is configured so that a movable contact 201 and a fixed contact 202 axially abut each

other in a vacuum container, and opening/closing of the switch 200 is controlled by the movable shaft 1 connected to the movable contact 201 being operated by the electromagnetic operation device main body section 10 or the manual operation section 20. In Fig. 1, components, such as an insulating portion positioned between the movable contact 201 and the electromagnetic operation device main body section 10 and a conductive portion connected to the two contacts, are omitted from description.

[0015] Fig. 2 is an enlarged side sectional view of the electromagnetic operation device 100, and illustrates the configuration of the electromagnetic operation device main body section 10 with which to drive the movable shaft 1 through electromagnetic operation and the detailed configuration of the manual operation section 20 with which to manually drive the movable shaft 1. Fig. 2 corresponds to a side sectional view taken along the line A-A of Fig. 3 to be described later.

[0016] The electromagnetic operation device main body section 10, being a mechanism section which carries out opening/closing operation for the switch 200 during a usual operation, includes, inside two opposed plate-like frames 11 supported by a frame support portion 11b, a moving core 12 which, being fixed to the movable shaft 1, is configured to move axially through opening/closing operation and a fixed core 13 which is fixed to the frame 11 and provided opposite the moving core 12. The moving core 12 is operated depending on the energized state of a coil 14, and when causing a transition from a closed state to an open state, the moving core 12 moves in the open direction (to the left side) shown by the arrow in Fig. 1 and separates from the fixed core 13. When the moving core 12 separates from the fixed core 13 and a gap occurs between the two cores, the movable shaft 1 is caused to move in the open direction (tripping direction) by a spring member 30 provided in the end portion (the left end portion) of the movable shaft 1 on the side opposite from the switch 200, and the movable contact 201 of the switch 200 separates from the fixed contact 202 and comes into the open state. A spring retainer plate 31 with which to retain the spring member 30 is disposed in the end portion of the moveable shaft 1.

[0017] The manual operation section 20 is a mechanism section with which to switch the switch 200 from the closed state to the open state through the operator's manual operation. As shown in Fig. 2, the manual operation section 20 is provided in one end portion of the movable shaft 1 in which the spring member 30 is disposed, that is, in the end portion on the side not connected to the switch 200. Then, the manual operation section 20 is configured mainly of a link member 3 which axially pushes a flange 2 fixed to the outer peripheral portion of the movable shaft 1, a rotation shaft 3a which pivotably supports the link member 3, a shaft support portion 4 supported on the frame 11, a shaft 5 pivotably supported in the shaft support portion 4, a cam 6 which, being fixed to the shaft 5, is in contact with the link member 3, and

a handle portion 7 formed of an arm portion 8 extending radially outward from the shaft 5 and a grip portion 9 attached to the radially outward end portion of the arm portion 8.

[0018] To give a further description, the shaft 5 is disposed spanning a region in which are aligned the three phases' worth of electromagnetic operation device main body sections 10, and three cams are mounted on the one shaft 5 so as to correspond to each of the three phases' worth of electromagnetic operation device main body sections 10.

[0019] Furthermore, the link member 3, being provided between the shaft 5 and the movable shaft 1 of each of the electromagnetic operation device main body sections 10, is pivotably supported on the rotation shaft 3a supported on the frame 11, and one end portion of the link member 3 is in contact with the cam 6, while the other end is in contact with the flange 2 integrally fixed to the movable shaft 1. The link member 3, being a member which conveys the movement of the cam 6, is formed to dimensions corresponding to the distance between the shaft 5 and the movable shaft 1. The example of Fig. 2 shows the link member 3, the planar shape of which is arcuate, the end portions of which are shaped to protrude to the flange 2 and cam 6 sides, and which has a flat joint surface which comes into contact with the cam 6.

[0020] The electromagnetic operation device 100 of the present application is configured so that the shaft 5 is caused to pivot in accordance with opening operation of the handle portion 7, and the three phases' worth of movable shafts 1 are caused to move at the same time via the cams 6 and the link members 3, thus manually carrying out opening operation for three phases all at one time.

[0021] Fig. 3 is a front view of the electromagnetic operation device 100 in the closed state as observed from the front side. As shown in Fig. 3, the three phases' worth of electromagnetic operation device main body sections 10 are aligned in a line along the axial direction (the left/right direction) of the shaft 5, wherein the movable shafts 1 provided individually in each of the electromagnetic operation device main body sections 10 are disposed in parallel separated from one another, and the movable shafts 1 and the shaft 5 are disposed separated so as to ensure a constant distance for causing the link members 3 to pivot. In Fig. 3, the three movable shafts 1 extend in the depth direction, and one linear grip portion 9 of the handle portion 7 of the manual operation section 20 is held parallel to the shaft 5 below the movable shafts 1.

[0022] Then, in order to make the operator's handle operation easier, the grip portion 9 of the manual operation section 20 is provided exposed on the front side of the tabular frame 11 and is held so as to protrude to the near side of the operator when closing, thus providing a layout superior in operability.

[0023] For example, when closing the switch 200, the grip portion 9 is held in the state of protruding to the near

side of the shaft 5, so that the arm portion 8 extending in the radial direction of the shaft 5 comes into the state of extending in a horizontal direction, and when the range of operation through opening operation is 90 degrees in terms of the angle of rotation of the shaft 5, at the end of the opening operation, as shown by the broken line in Fig. 1, the grip portion 9 is disposed below the shaft 5, and the arm portion 8 comes into the state of extending downward from the shaft 5.

[0024] A configuration can also be adopted such that a stopper or the like (not shown) which has the function of holding the position of the handle portion 7 is provided, preventing the handle portion 7 from moving downward under its own weight.

[0025] Also, the handle portion 7 is adjusted to a weight such as to enable the handle portion 7 to be prevented from pivoting under its own weight. Then, when in the closed state, the movable shaft 1 is pushed to the switch 200 side by the electromagnetic operation device main body section 10, so that the handle portion 7 is configured not to pivot downward spontaneously.

[0026] Also, as shown in Fig. 3, the rotation shaft 3a for pivotably holding the link member 3 is spanned between two frame base portions 11a, which are fixed to the surface portion of the frame 11, across the movable shaft 1. The direction in which the rotation shaft 3a extends is perpendicular to the direction in which the axis of the movable shaft 1 extends, and the distance between the rotation shaft 3a and the movable shaft 1 is adjusted depending on the dimensions of the link member 3.

[0027] Fig. 4 is a main portion enlarged plan view of the link member 3 and illustrates the planar shape of link leading end portions 3b of the link member 3 which are portions in engagement with the movable shaft 1. The example of Fig. 4 shows the state in which the two link leading end portions 3b are disposed in parallel, across the movable shaft 1, in the end portion of the link member 3 on the side which drives the movable shaft 1. A configuration is such that the end portions of the link leading end portions 3b come into contact with the switch 200 side end face of the flange 2 fixed to the movable shaft 1, pivot with the rotation shaft 3a as its fulcrum in accordance with opening operation, and push the end face of the flange 2 to the side opposite from the switch 200.

[0028] Fig. 5 is a perspective view of the electromagnetic operation device 100 when closing as observed from the front side, wherein the grip portion 9 of the handle portion 7 is disposed exposed on the near side, and the arm portions 8 are each provided so as to connect the respective adjacent ends of the shaft 5 and grip portion 9. The handle portion 7 is equipped so as to be integrated with the electromagnetic operation device 100, so that there is no need to attach a handle as another member before manual operation, and it is possible to work on the manual operation immediately in the event of an emergency.

[0029] Also, a square frame body is configured wherein each pair of respective adjacent end portions of the shaft

5 and grip portion 9 is connected by the arm portion 8, so that it is possible to make the status of rotation of the shaft 5 more stable than when a drive force is applied only to one end of the shaft 5. Furthermore, the grip portion 9 is provided in conformity to the width of the three phases' worth of devices which the shaft 5 spans, so that it is possible to ensure a length long enough for an operator to grip the grip portion 9 naturally with both hands when in closing operation. Then, a configuration is such that when opening operation starts, the operator grips the grip portion 9, applies a force downward, and starts to cause the grip portion 9 to pivot, so that it is possible for the operator to operate while placing his/her weight, and it is easy to ensure operation torque required for the manual operation for three phases all at one time.

[0030] In this way, the electromagnetic operation device 100 of the present application has a better operability than heretofore in carrying out the manual operation with the manual operation section 20.

[0031] Next, a description will be given, using Fig. 6, of the operation of the cam 6 and the link member 3 when in opening operation. Fig. 6 is an enlarged side view showing the state in which the cam 6 and the link member 3 interlock with each other.

[0032] In this example, the cam 6 is configured of an egg-shaped plate cam having one apex portion. The base circle of the cam 6 is disposed concentrically with the shaft 5, and an apex portion 6a protruding by a predetermined lift amount from the base circle is attached to the shaft 5 so as to point downward when closing. When the shaft 5 rotates 90 degrees counterclockwise through opening operation, the cam 6 shown by the broken line in Fig. 6 pivots to the position in which the apex portion 6a thereof points rightward, and the apex portion 6a comes into the state of protruding to the axial switch 200 side of the movable shaft 1. In accordance with this, the link member 3 pivots counterclockwise with the rotation shaft 3a as its center (fulcrum), and one end (the lower end) of the link member 3 is pushed to the axial switch 200 side (right side) by the apex portion 6a, while the other end (the upper end) of the link member 3 is pushed to the side (left side) opposite from the axial switch 200 side of the movable shaft 1, driving the movable shaft 1 in the opening direction.

[0033] The cams 6 mounted on the shaft 5 are individually provided on each of the three switches 200, so that the three cams 6 are mounted, separated from one another, on the shaft 5 so as to correspond to the movable shafts 1, and the three cams 6 are disposed in the same shape and in the same direction.

[0034] Also, the distance from the shaft 5 to the apex portion 6a (the point of load) of the cam 6 is set to be smaller than the distance from the grip portion 9 (the point of effort) of the handle portion 7 to the shaft 5 (the fulcrum), thereby enabling the cam 6 to be driven with a lower operation torque according to the principle of leverage.

[0035] Herein, the rotation shaft 3a acting as the ful-

crum of the link member 3 is disposed between the movable shaft 1 and the shaft 5. The rotation shaft 3a can be provided at the midpoint on the line which connects the one end (the point of effort) of the link member 3 in contact with the cam 6 and the other end (the point of load) of the link member 3 in contact with the flange 2 of the movable shaft 1, but can also be provided in another position deviated from the midpoint. For example, in the link member 3, the distance between the point of effort and the fulcrum (the rotation shaft 3a) is adjusted to be larger than the distance between the fulcrum and the point of load, thereby enabling the movable shaft 1 to move in the opening direction with a lower operation torque according to the principle of leverage. Conversely, the distance between the point of effort and the fulcrum is adjusted to be smaller than the distance between the fulcrum and the point of load, thereby enabling the movable shaft 1 to move a larger amount through the opening operation of the movable shaft 1 by the manual operation section 20.

[0036] In this way, the link member 3 is a component part high in the design margin which enables the shape and disposition thereof to be decided according to conditions, such as the scale and inner structure of the electromagnetic operation device 100 and the shapes of the handle portion 7 and the cam 6. Then, the electromagnetic operation device 100 of the present application including the cam 6 and the link member 3 mentioned above is higher in design margin than one of the configuration in which a member (a lever in the prior art) for moving the movable shaft 1 is attached directly to the shaft 5, so that it is possible to adjust the shapes of the cam 6 and the link member 3 so as to enable the manual operation for three phases all at one time within the range of operation torque which can be ensured in the event of an emergency, and thus possible to further improve operability than heretofore.

Second Embodiment

[0037] Next, a description will be given, using Figs. 7 and 8, of an electromagnetic operation device 100 according to a second embodiment of the present application.

[0038] Fig. 7 is a front view of the electromagnetic operation device 100 in the open state as observed from the front side, wherein in the right end position of the shaft 5, a plunger 40 is fixed to the outer surface of the frame 11, and a plunger cam 41 is mounted on the shaft 5 so as to be in contact with the plunger 40. Fig. 8 shows a side sectional view taken along the line B-B of Fig. 7.

[0039] As shown in Fig. 8, the plunger 40, having incorporated therein a compression spring 40a, is configured so as to come into contact with the plunger cam 41, thereby compressing the compression spring 40a and at the same time applying contact pressure to the plunger cam 41. A cam of the same shape as that of the above-described cam 6 can be used as the plunger cam 41,

and the direction of the plunger cam 41 is adjusted so that the contact pressure is highest at the time halfway through opening operation.

[0040] The pivoting range of the shaft 5 when in opening operation is 90 degrees in the same way as in the case of the first embodiment, and the plunger cam 41 is mounted on the shaft 5 so that when the handle portion 7 pivots counterclockwise from nine o'clock to six o'clock in clock position, the pivoting range of the apex portion 6a of the cam 6 interlocking with the handle portion 7 and shaft 5 is from six o'clock to three o'clock, and that the pivoting range of the apex portion of the plunger cam 41 is, for example, shifted 45 degrees counterclockwise as compared with that of the cam 6.

[0041] In the electromagnetic operation device 100 according to the second embodiment, a configuration is such that in the position of the middle of the pivoting range of the shaft 5 when in opening operation, the apex portion of the plunger cam 41 comes into contact with the plunger 40 and compresses the compression spring 40a, so that in the latter half portion of the pivoting range of the shaft 5 in which the apex portion of the plunger cam 41 exceeds the plunger 40, the contact pressure of the compression spring 40a incorporated in the plunger 40 acts so as for the plunger cam 41 to assist opening operation. Accordingly, it is easy to carry out the manual opening operation for the three phases' worth of switches 200 all at one time without depending only on the operator's operational force of operating the handle portion 7.

[0042] The contact pressure of the plunger 40 is highest in the intermediate position of the pivoting range of the shaft 5, so that it is possible to inhibit the movable shaft 1 which has once come into the open state from returning to the closed state and stably hold the open state.

[0043] Furthermore, in the early half portion of the pivoting range of the shaft 5, the contact pressure of the plunger 40 increases gradually as opening operation proceeds, so that when opening operation starts, a force acts such as to restore the handle portion 7 to its previous closed state. Therefore, even though a load is mistakenly put on the handle portion 7, the plunger 40 acts so as to hold the closed state, and it is possible to prevent malfunction.

[0044] In this way, the contact pressure applied from the plunger 40 is increased and reduced in the pivoting range of the shaft 5, and thereby it is also possible, while preventing malfunction, to stably hold the open state or the closed state.

[0045] Although the present application 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.

[0046] It is therefore understood that numerous modifications which have not been exemplified can be devised without departing from the scope of the present application. 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.

Reference Signs List

[0047] 1 movable shaft, 2 flange, 3 link member, 3a rotation shaft, 3b link leading end portion, 4 shaft support portion, 5 shaft, 6 cam, 6a apex portion, 7 handle portion, 8 arm portion, 9 grip portion, 10 electromagnetic operation device main body section, 11 frame, 11a frame base portion, 11b frame support portion, 12 moving core, 13 fixed core, 14 coil, 20 manual operation section, 30 spring member, 31 spring retainer plate, 40 plunger, 40a compression spring, 41 plunger cam, 100 electromagnetic operation device, 200 switch, 201 movable contact, 202 fixed contact

Claims

1. An electromagnetic operation device, comprising:

a manual operation section with which to manually carry out opening operation for a plurality of switches all at one time, the device being **characterized in that** the manual operation section includes:

a shaft which, being pivotably held on a frame of an electromagnetic operation device main body section which operates each of the switches, is disposed spanning a region in which are aligned a plurality of the electromagnetic operation device main body sections;

a handle portion having a grip portion with which to pivotally operate the shaft;

a plurality of cams which are mounted on the shaft so as to correspond to each of the plurality of electromagnetic operation device main body sections; and

a link member which, being provided between the shaft and a movable shaft of each of the electromagnetic operation device main body sections, is pivotably supported on a rotation shaft supported on the frame, and one end portion and the other end portion of which are in contact respectively with the cam and with the movable shaft, wherein

a configuration is such as to cause the shaft

to pivot in accordance with opening operation of the handle portion, causing a plurality of the movable shafts to move at the same time via the cams and the link members.

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2. The electromagnetic operation device according to claim 1, **characterized in that**

the three phases' worth of electromagnetic operation device main body sections are disposed aligned along the axial direction of the shaft, and the three movable shafts individually provided in each of the electromagnetic operation device main body sections are disposed in parallel separated from one another.

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3. The electromagnetic operation device according to claim 1 or 2, **characterized in that**

the handle portion is configured of the one grip portion provided in parallel to the shaft and of arm portions which connect the shaft and the grip portion, and the grip portion is disposed in the state of being exposed on the front side of the electromagnetic operation device.

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4. The electromagnetic operation device according to claim 3, **characterized in that**

the grip portion of the handle portion is configured, when closing, to be held on the near side of the shaft in the front of the electromagnetic operation device, and when opening starts, to be pushed downward and pivot around the shaft.

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5. The electromagnetic operation device according to any one of claims 1 to 4, **characterized in that**

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the manual operation section includes a plunger which, having incorporated therein a compression spring, is fixed to the frame and a plunger cam which, interlocking with the plunger, is fixed to the shaft, wherein

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a configuration is such that in the intermediate position of a rotation range of the shaft when in opening operation, the apex portion of the plunger cam comes into contact with the plunger and compresses the compression spring.

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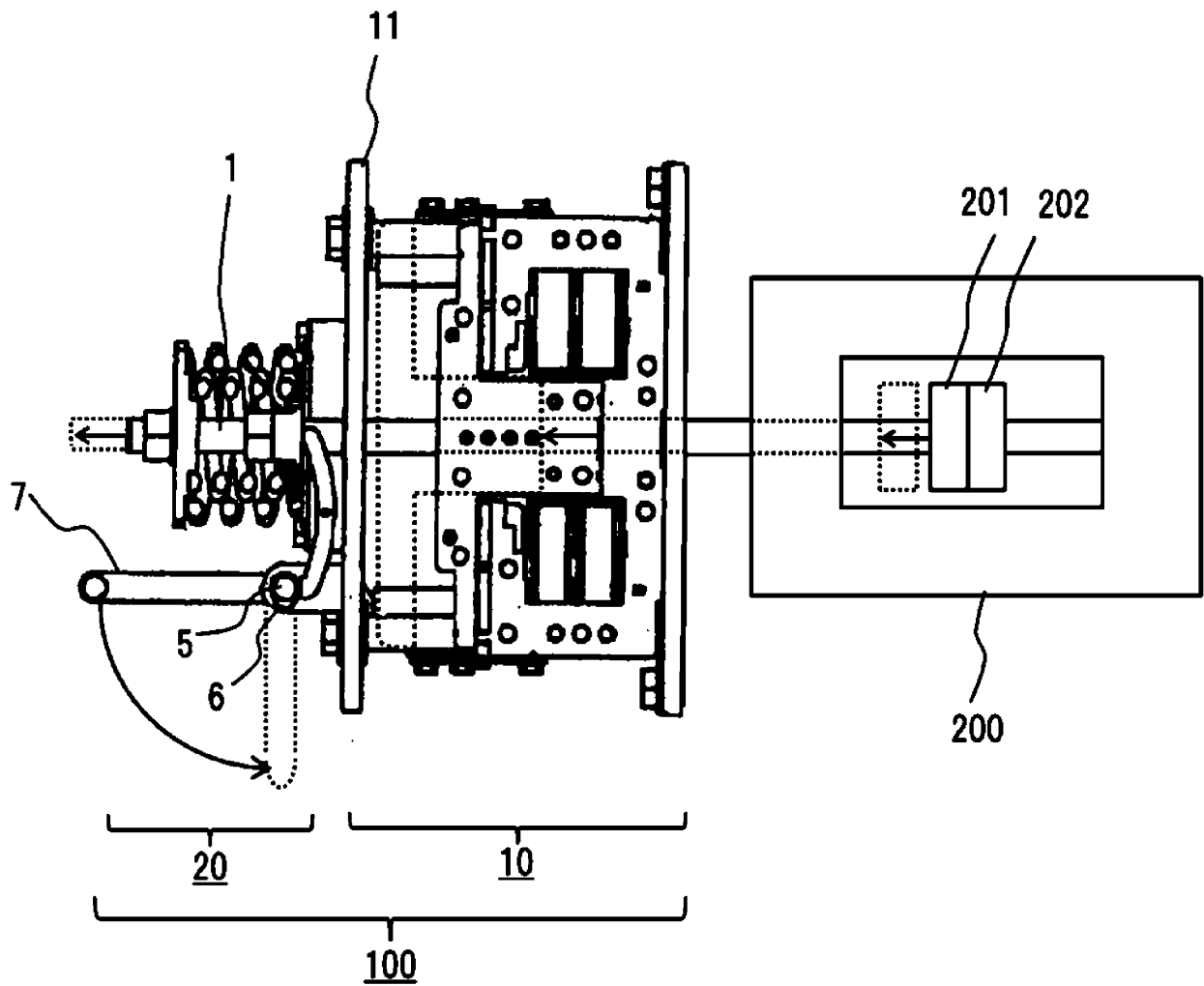


FIG.1

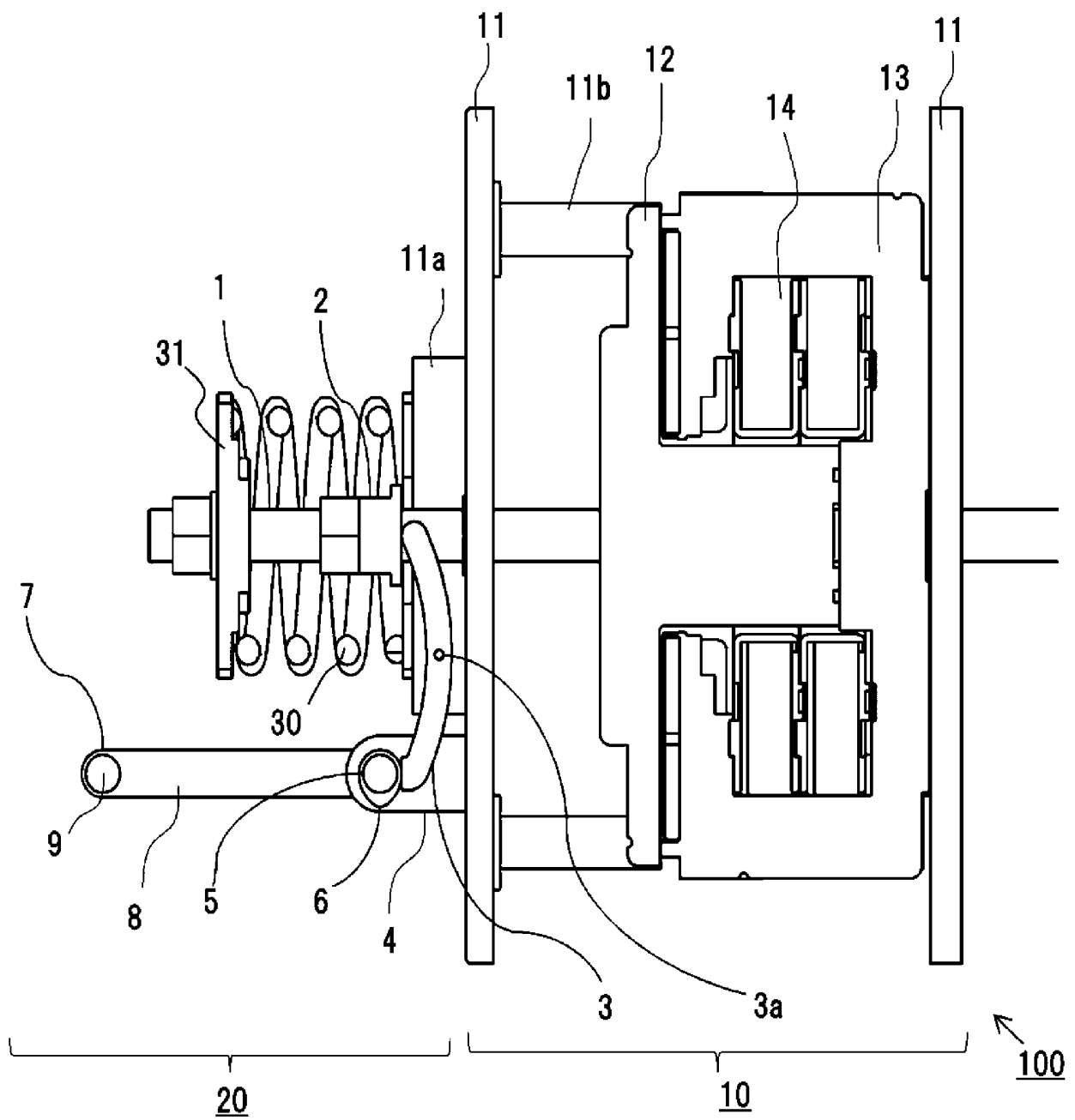


FIG.2

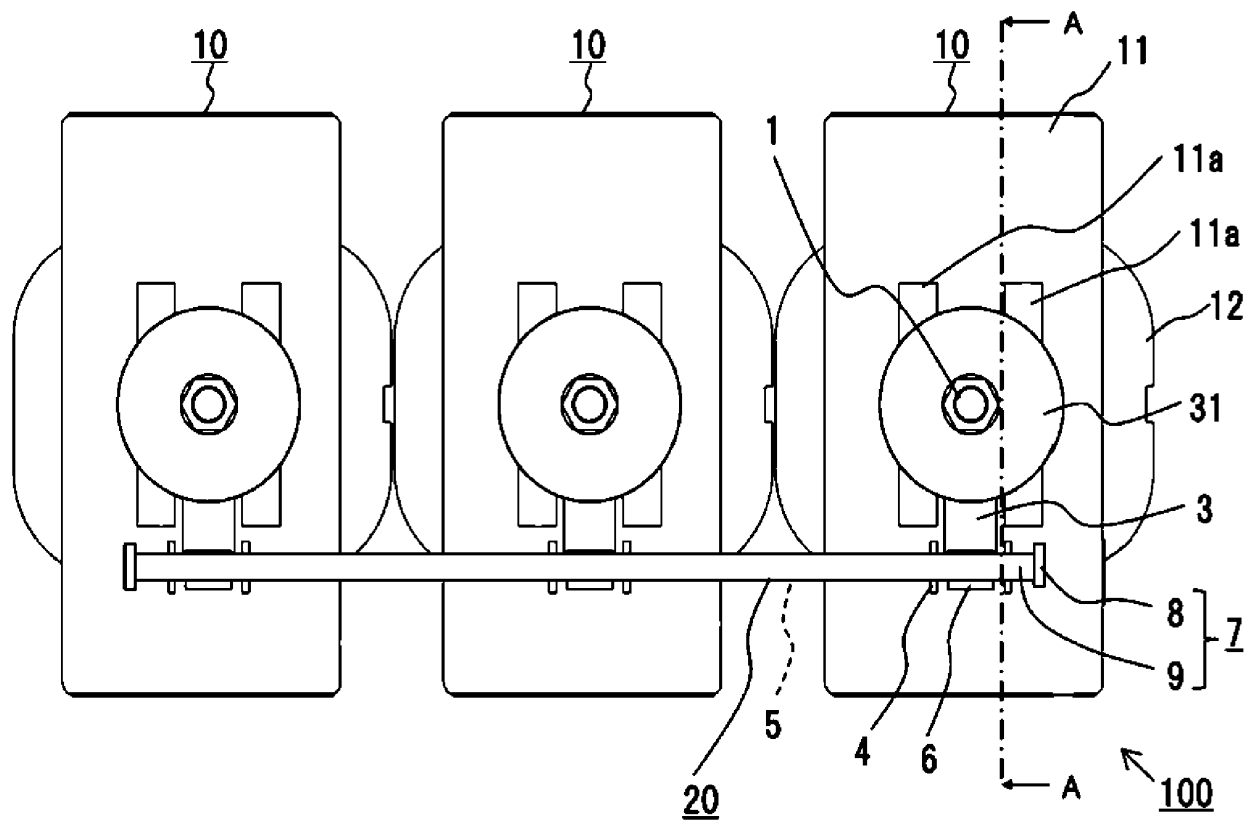


FIG.3

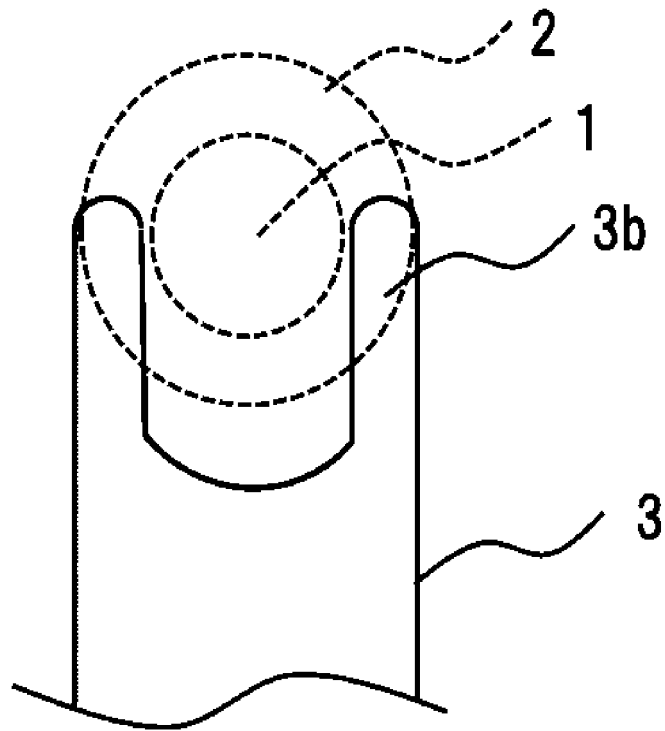


FIG.4

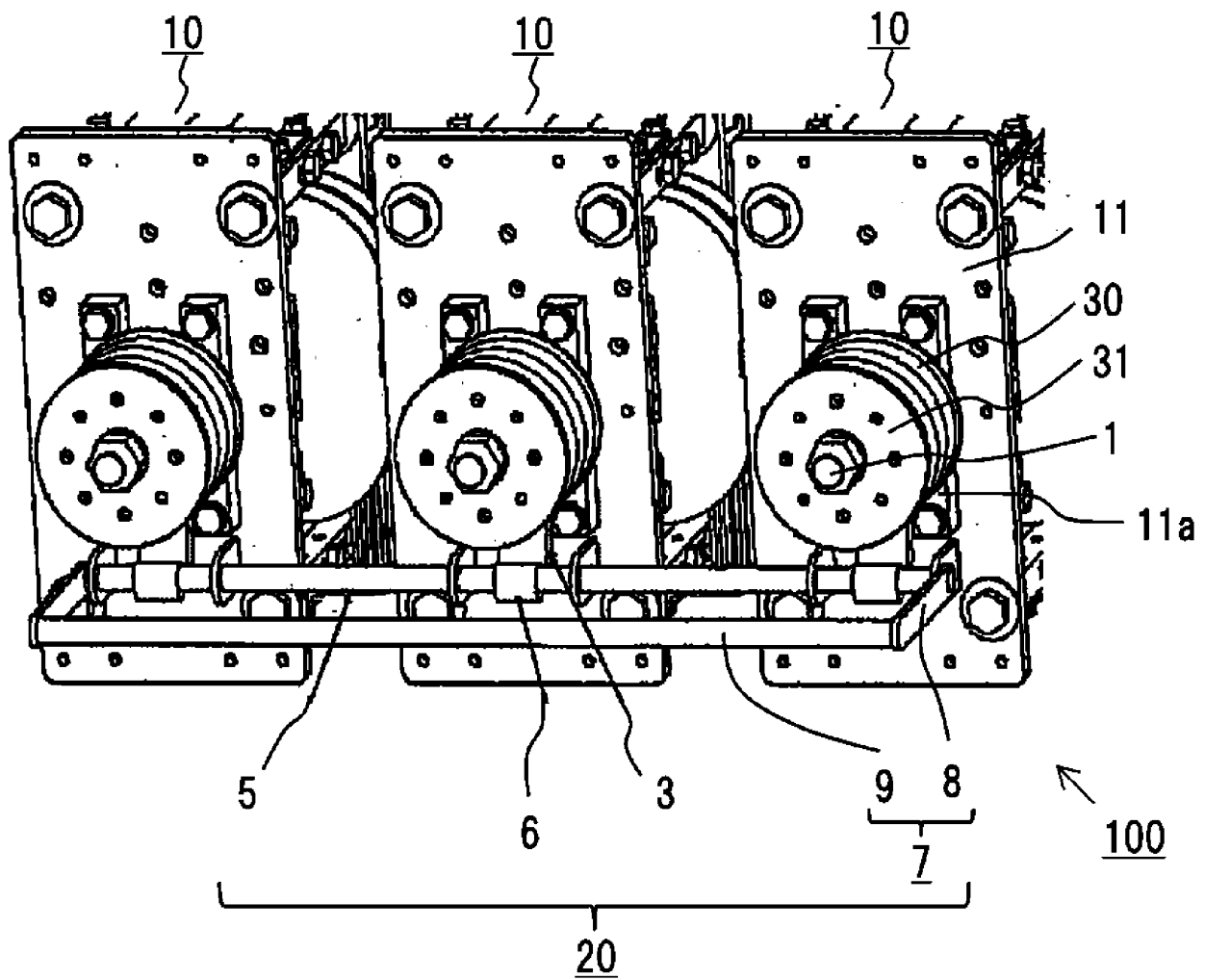


FIG.5

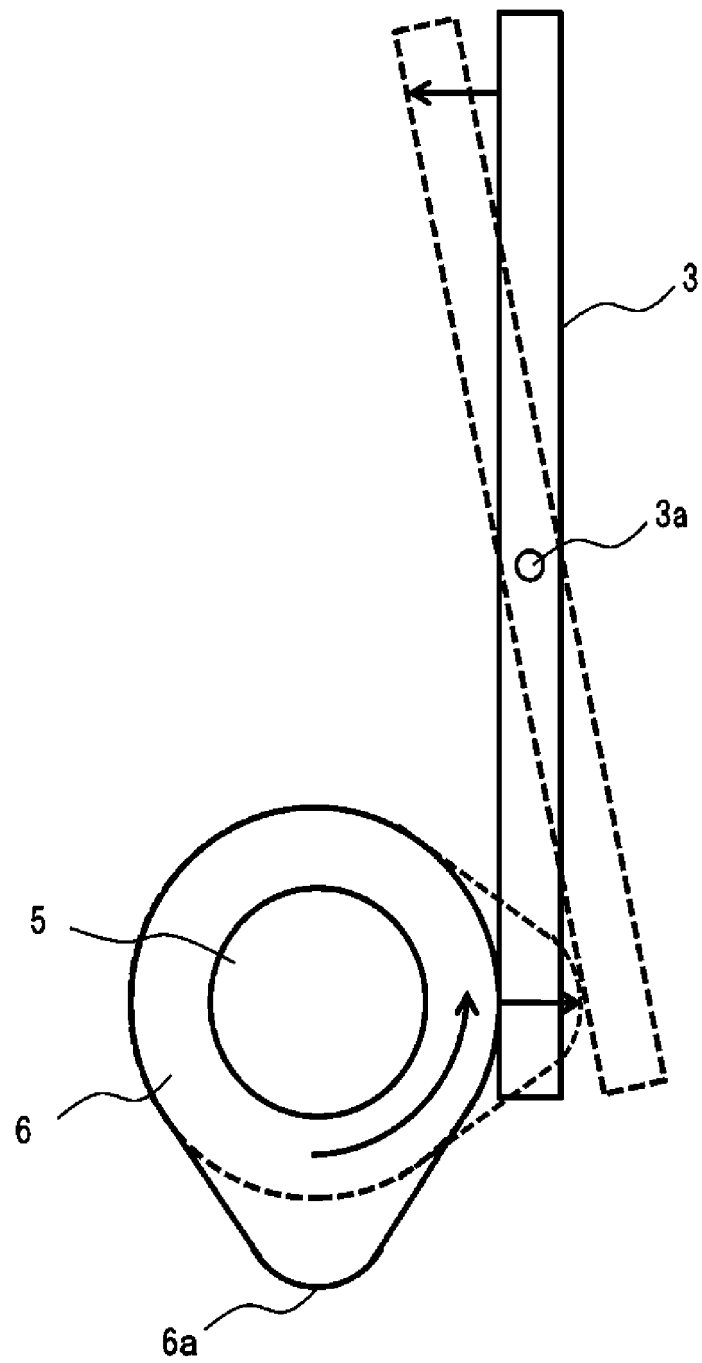


FIG.6

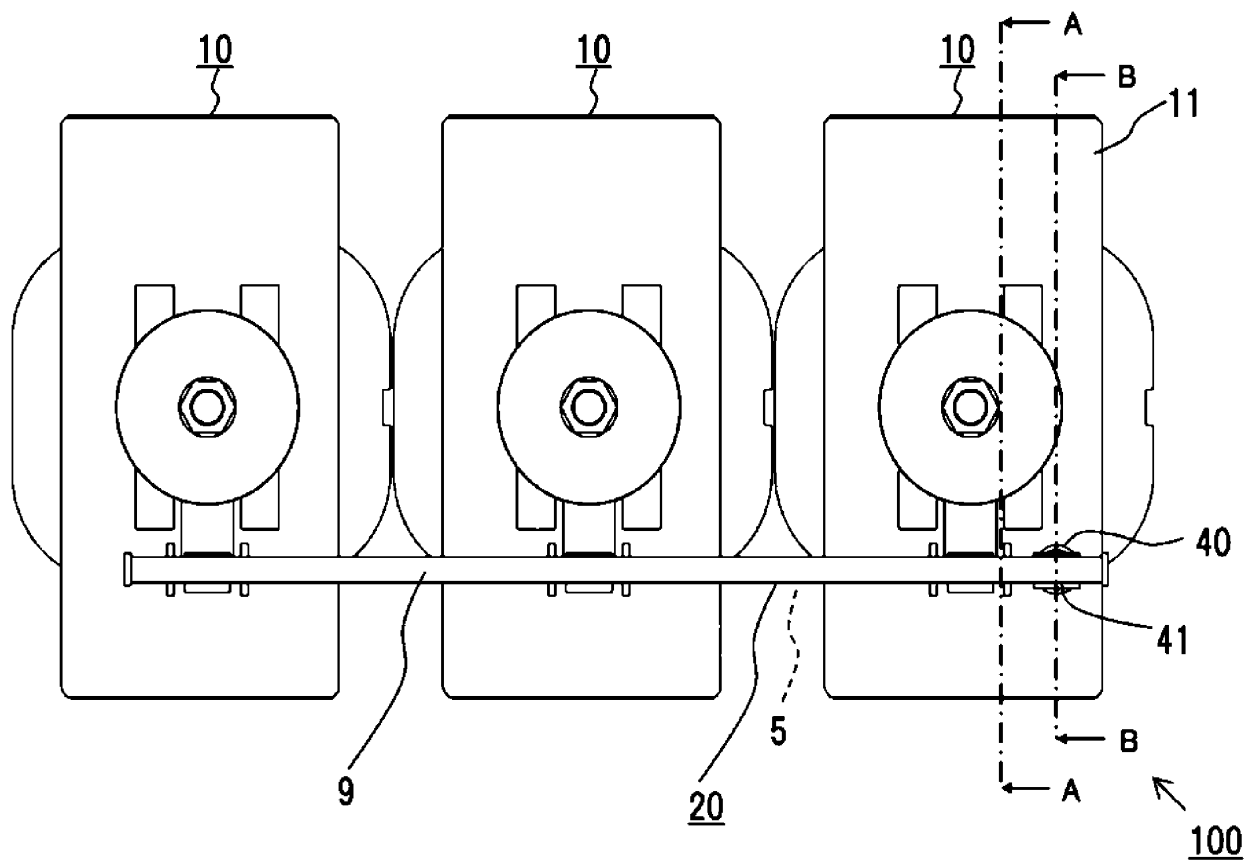


FIG.7

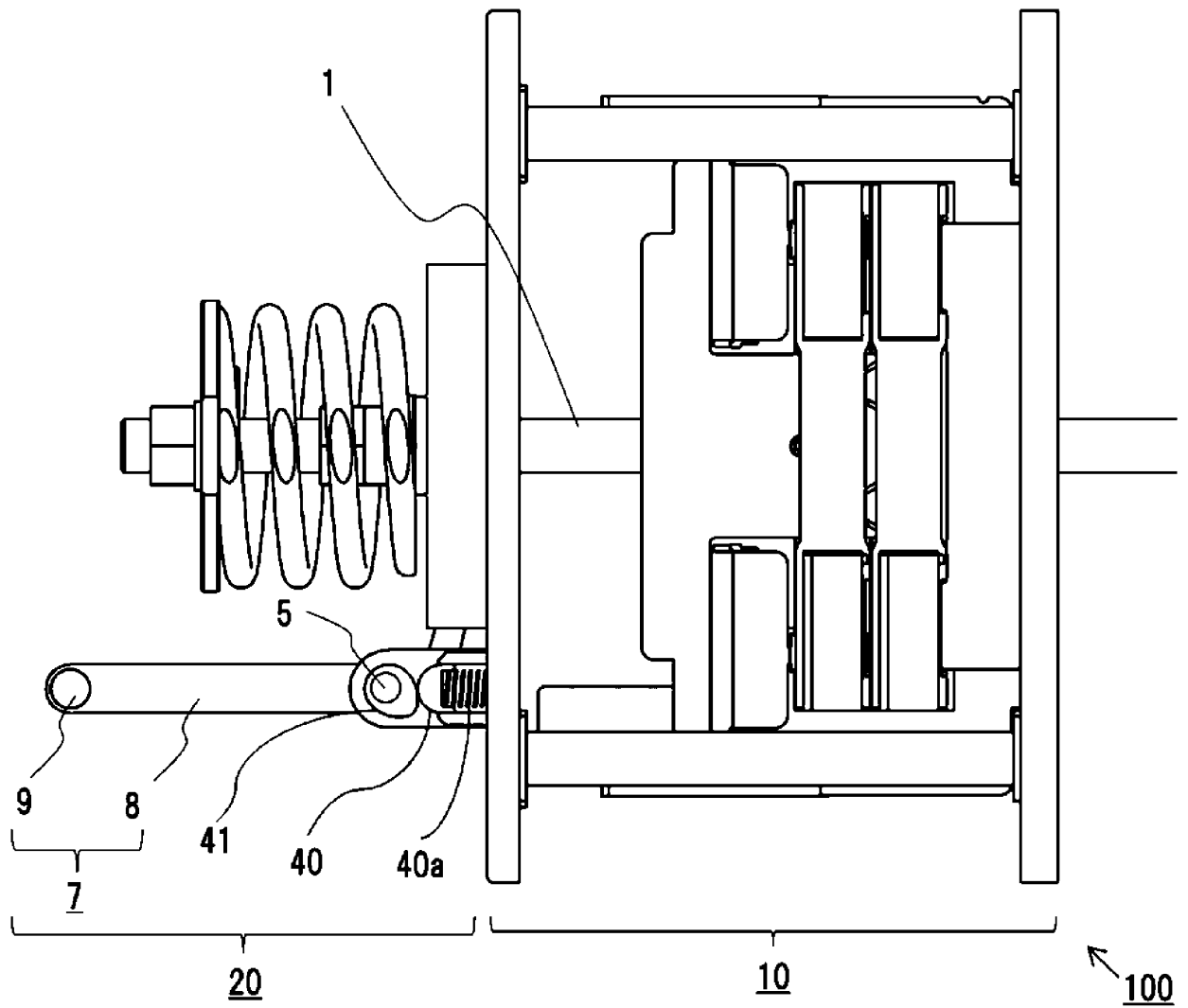


FIG.8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2019/015294

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. H01H33/666 (2006.01) i

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. H01H33/666

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 1971-2019
Registered utility model specifications of Japan 1996-2019
Published registered utility model applications of Japan 1994-2019

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.
X	US 2007/0252667 A1 (EATON CORPORATION) 01 November	1-2
Y	2007, paragraphs [0035]-[0048], fig. 1-6 (Family:	3-4
A	none)	5
Y	US 2016/0141136 A1 (EATON CORPORATION) 19 May	3-4
A	2016, paragraph [0115], fig. 12 (Family: none)	5

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29.05.2019

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Patent documents cited in the description

- JP 5901351 B [0004]
- JP 4668165 B [0004]