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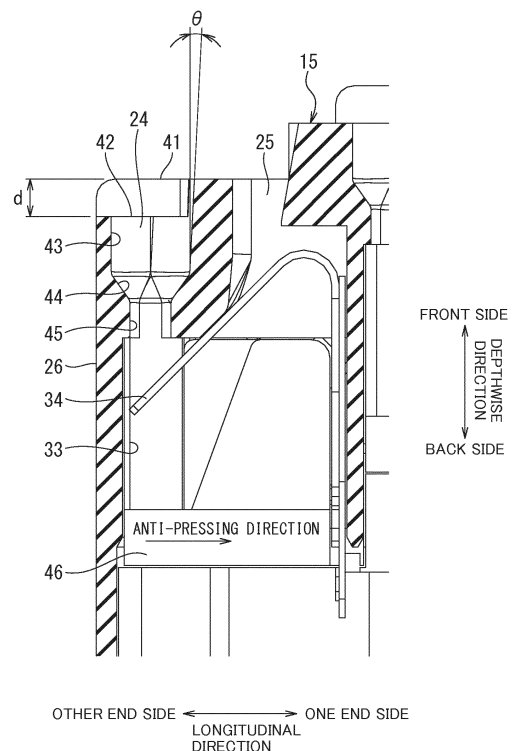
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(54) **CONNECTION TERMINAL STAGE, AND ELECTRIC MACHINE**

(57) A housing (15) includes a first surface (41) having a step (d) and a second surface (42). When a ferrule terminal (18) is inserted, an abutting portion (44) of electrical wire insertion holes (21) and (24) abuts with a tapered surface (19) of a collar portion (17) to inhibit further insertion. The height of the step (d) is set such that, in this state, a proximal end of the collar portion (17) is located between the first surface (41) and the second surface (42).

FIG. 3



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Description

Technical Field

[0001] The present invention relates to a connection terminal block and electrical equipment.

Background Art

[0002] PTL 1 discloses a socket for connecting a relay, a timer, or the like to an external circuit, where a spring terminal structure is employed in which connection with an external circuit requires only insertion of a lead wire into an insertion hole of a housing.

Citation List

Patent Literature

[0003] PTL 1: JP 2002-298943 A

Summary of Invention

Technical Problem

[0004] Lead wires are sometimes used by crimping a ferrule terminal with a collar portion thereto. There have been cases where when inserting a ferrule terminal into an insertion hole of a housing, an operator misunderstood that the insertion has been completed due to a feeling at the time of engagement between the ferrule terminal and a plate spring inside the housing, to result in an insufficient amount of insertion. Additionally, even when the amount of insertion was insufficient, it has been difficult to recognize it at a glance.

[0005] It is an object of the present invention to enable visual recognition of whether the work of inserting a ferrule terminal with a collar portion has been correctly completed or not.

Solution to Problem

[0006] A connection terminal block according to one aspect of the present invention is a connection terminal block capable of holding a ferrule terminal with a collar portion to be inserted into a housing, the housing including a first surface orthogonal to an insertion direction in which the ferrule terminal is inserted, a second surface orthogonal to the insertion direction and arranged at a further back side than the first surface via a step in the insertion direction, an insertion hole passing through from the second surface to an inside of the housing along the insertion direction and allowing for insertion of the ferrule terminal through the hole, and an abutting portion formed on an inner peripheral surface of the insertion hole and configured to, when the ferrule terminal is inserted, abut with a leading end of the collar portion to inhibit further insertion, wherein the step is set in a range such that

when the leading end of the collar portion abuts with the abutting portion, a proximal end of the collar portion is located between the first surface and the second surface.

5 Advantageous Effects of Invention

[0007] According to the present invention, when the ferrule terminal is inserted into the insertion hole and the leading end of the collar portion abuts with the abutting portion, the proximal end of the collar portion is arranged between the first surface and the second surface, whereby it is visually recognizable whether the work of insertion has been correctly completed or not.

15 Brief Description of Drawings

[0008]

20 FIG. 1 is a perspective view of a connection terminal block;

FIG. 2 is a perspective view partially illustrating the inside of the connection terminal block;

FIG. 3 is a cross-sectional view of an electrical wire insertion hole (before insertion);

25 FIG. 4 is a perspective view illustrating a step between a first surface and a second surface (before insertion);

FIG. 5 is a cross-sectional view of the electrical wire insertion hole (after insertion); and

30 FIG. 6 is a perspective view illustrating the step between the first surface and the second surface (after insertion).

Description of Embodiments

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[0009] Hereinafter, embodiments of the present invention will be described with reference to the drawings. Note that respective drawings are schematic, and may be different from actual ones. In addition, the following embodiments exemplify devices and methods for embodying the technological idea of the present invention, and do not specify the structures to those described below. In other words, various modifications can be made to the technological idea of the invention without departing from the technological scope prescribed by the claims.

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<<Structure>>

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[0010] An embodiment is a connection terminal block capable of holding a ferrule terminal with a collar portion to be inserted in a housing, the housing including a first surface orthogonal to an insertion direction in which the ferrule terminal is inserted, a second surface orthogonal to the insertion direction and arranged at a further back side than the first surface via a step in the insertion direction, an insertion hole passing through from the second surface to an inside of the housing along the insertion direction and allowing for insertion of the ferrule terminal

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through the hole, and an abutting portion formed on an inner peripheral surface of the insertion hole and configured to, when the ferrule terminal is inserted, abut with a leading end of the collar portion to inhibit further insertion, in which the step is set in a range such that when the leading end of the collar portion abuts with the abutting portion, a proximal end of the collar portion is located between the first surface and the second surface.

[0011] FIG. 1 is a perspective view of the connection terminal block.

[0012] In the following description, three directions orthogonal to each other in a space will be referred to as widthwise direction, longitudinal direction, and depthwise direction, for convenience.

[0013] A connection terminal block 11 is a terminal socket for connecting a relay to an external circuit. At a longitudinal one end side thereof is formed a primary-side terminal section 12 for coil terminals allowing for connection of primary-side lead wires. At a longitudinal center thereof is formed a relay terminal section 13 allowing for connection of, for example, a relay with four pole contacts. At a longitudinal other end side thereof is formed a secondary-side terminal section 14 allowing for connection of secondary-side lead wires for common terminals, a-contact terminals, and b-contact terminals. The primary-side terminal section 12, the relay terminal section 13, and the secondary-side terminal section 14 are integrated by a housing 15.

[0014] On an upper surface of the housing 15 that is a front side in the depthwise direction, the relay terminal section 13 is arranged at a further back side than the primary-side terminal section 12 and the secondary-side terminal section 14 in the depthwise direction.

[0015] The primary-side terminal section 12 has a spring terminal structure, in which on the upper surface of the housing 15 are formed a plurality of electrical wire insertion holes 21 allowing for insertion of lead wires along the depthwise direction. At a one end side thereof in the widthwise direction are formed two electrical wire insertion holes 21c and 21d for one of the polarities, and at the other end side thereof in the widthwise direction are formed two electrical wire insertion holes 21a and 21b for the other polarity. Accordingly, the primary-side terminal section 12 includes four electrical wire insertion holes 21 in total. The two electrical wire insertion holes 21 having the same polarity are arranged by being shifted in both the widthwise direction and the longitudinal direction. On the upper surface of the housing 15 are formed a plurality of tool insertion holes 22 allowing for insertion of tools along the depthwise direction. Each one tool insertion hole 22 is provided for each of the electrical wire insertion holes 21a to 21d, and arranged at a longitudinal other end side of the section 12 relative to the electrical wire insertion holes 21a to 21d. Accordingly, the primary-side terminal section 12 includes four tool insertion holes 22 in total.

[0016] The relay terminal section 13 has a plug-in terminal structure, in which on the upper surface of the hous-

ing 15 are formed a plurality of plug insertion inlets 23 allowing for insertion of plugs in the depthwise direction. At a longitudinal one end side thereof are formed two plug insertion inlets 23 for coil terminals. At a longitudinal other end side thereof are formed three plug insertion inlets 23 for a common terminal, an a-contact terminal, and a b-contact terminal along the longitudinal direction. The three plug insertion inlets are regarded as one set, and four sets of the three plug insertion inlets are arrayed along the widthwise direction. Accordingly, the relay terminal section 13 includes 14 plug insertion inlets 23 in total.

[0017] The secondary-side terminal section 14 has a spring terminal structure, in which on the upper surface of the housing 15 are formed a plurality of electrical wire insertion holes 24 corresponding to four poles, which holes allow for insertion of lead wires in the depthwise direction. The secondary-side terminal section 14 has three steps whose depthwise heights become lower, in order from the one end side to the other end side in the longitudinal direction. On an upper stage are formed electrical wire insertion holes 24a to 24h, two of which per pole are for, for example, b-contact terminals; on a middle stage are formed electrical wire insertion holes 24i to 24p, two of which per pole are for, for example, a-contact terminals; and on a lower stage are formed electrical wire insertion holes 24q to 24x, two of which per pole are for, for example, common terminals. On each stage, the two electrical wire insertion holes 24 (for example, 24a and 24b) of one electrode are arranged by being displaced in both the widthwise direction and the longitudinal direction. The six electrical wire insertion holes 24 (for example, 24a, 24b, 24i, 24j, 24q, and 24r) are regarded as one set, and four pole sets are arranged in the widthwise direction. Accordingly, the secondary-side terminal section 14 includes 24 electrical wire insertion holes 24 in total. On the upper surface of the housing 15 are formed a plurality of tool insertion holes 25 allowing for insertion of tools in the depthwise direction. On each stage, each one tool insertion hole 25 is provided for each of the electrical wire insertion holes 24a to 24x, and is respectively arranged at a longitudinal one end side of the section 14 relative to the electrical wire insertion holes 24. Accordingly, the secondary-side terminal section 14 includes 24 tool insertion holes 25 in total.

[0018] FIG. 2 is a perspective view partially illustrating an inside of the connection terminal block.

[0019] Since the primary-side terminal section 12 and the secondary-side terminal section 14 are basically of the same structure, the secondary-side terminal section 14 will be exemplified for description hereinbelow.

[0020] In the inside of the housing 15 is provided a blade-receiving spring 31 at a back side of each plug insertion inlet 23 in the depthwise direction. The blade-receiving spring 31 includes a pair of spring pieces facing each other and urging each other to hold a plug inserted between the pair of spring pieces in a sandwiching manner. A spring metal fitting 32 (a conductive terminal mem-

ber) is provided at a back side of each of the electrical wire insertion holes 24a to 24x in the depthwise direction, and each spring metal fitting 32 is attached to an intermediate base 46 that is a base member. The spring metal fitting 32 includes a pressing surface 33 substantially parallel with the depthwise direction and the widthwise direction and a plate spring 34 (an elastic member) biased against the pressing surface 33 and holds a lead wire inserted between the pressing surface 33 and the plate spring 34 in a sandwiching manner. At a further back side than the blade-receiving spring 31 and the spring metal fitting 32 in the depthwise direction is provided a relay conductive plate 35 electrically connecting these components. Two relay conductive plates 35 are provided for coil terminals, and each four for common terminals, a-contact terminals, and b-contact terminals.

[0021] A ferrule terminal 18 with a collar portion 17 is crimped to a lead wire 16 to be inserted into one of the electrical wire insertion holes 24. The ferrule terminal 18 is a bar-shaped crimp terminal for preventing a stranded wire from being loosened to stabilize the quality of electrical connection. At a leading end side of the collar portion 17 is formed a tapered surface 19 whose diameter becomes smaller toward a leading end 17a thereof, and a proximal end 17b side thereof has a diameter larger than a terminal portion 18a of the ferrule terminal 18.

[0022] Next will be a description of the structure of the electrical wire insertion holes 24.

[0023] The electrical wire insertion holes 24 formed on the secondary-side terminal section 14 all have the same structure, and thus, one of the electrical wire insertion holes 24 formed on the lower stage will be exemplified for description hereinbelow.

[0024] FIG. 3 is a cross-sectional view of the electrical wire insertion hole (before insertion).

[0025] The housing 15 includes a first surface 41 orthogonal to the depthwise direction and a second surface 42 orthogonal to the depthwise direction and arranged at a further back side than the first surface 41 via a step d in the depthwise

direction.

[0026] FIG. 4 is a perspective view illustrating the step between the first surface and the second surface (before insertion).

[0027] The first surface 41 is in contact with a side face 26 that is a longitudinal other end side of the housing 15. Accordingly, not the entire periphery of the first surface 41 is surrounded by the step d, and the longitudinal other end side thereof is open.

[0028] As illustrated in FIG. 3, the electrical wire insertion hole 24 includes a large diameter portion 43, an abutting portion 44, and a small diameter portion 45, in order from the second surface 42 toward the inside of the housing 15. The large diameter portion 43 has a diameter slightly larger than the collar portion 17. In the large diameter portion 43, a side of an inner peripheral surface

thereof in an anti-pressing direction relative to the pressing surface 33, i.e., a longitudinal one end side thereof is more inclined by an angle of θ toward the second surface 42 in the anti-pressing direction. The abutting portion 44 is a tapered surface whose diameter becomes smaller toward a back side in the depthwise direction. A tapered angle of the abutting portion 44 relative to the depthwise direction of the housing 15 is larger than an angle of the tapered surface 19 relative to the depthwise direction of the collar portion 17. The small diameter portion 45 of the housing 15 has a diameter smaller than a diameter of the leading end 17a of the collar portion 17 and larger than a diameter of the terminal portion 18a of the ferrule terminal 18.

[0029] FIG. 5 is a cross-sectional view of the electrical wire insertion hole (after insertion).

[0030] When the ferrule terminal 18 is inserted into the electrical wire insertion hole 24, the plate spring 34 is pushed by the terminal portion 18a of the ferrule terminal 18, and is elastically deformed. Then, when the terminal portion 18a of the ferrule terminal 18 is inserted between a leading end of the plate spring 34 and the pressing surface 33, elastic force of the plate spring 34 presses the terminal portion 18a of the ferrule terminal 18 against the pressing surface 33, and inhibits displacement in a pull-out direction. Herein, for convenience of drawing, FIG. 5 indicates a state where there is no inclination in the ferrule terminal 18 with the collar portion 17. However, actually, due to the pressing of the terminal portion 18a of the ferrule terminal 18 against the pressing surface 33 side by the plate spring 34, the ferrule terminal 18 with the collar portion 17 is inclined toward the longitudinal one end side relative to the depthwise direction, and contacts with the pressing surface 33. Accordingly, the diameter of the large diameter portion 43, the angle θ , the tapered angle of the abutting portion 44, the diameter of the small diameter portion 45, and the like are set to readily allow for slight inclination of the ferrule terminal 18 with the collar portion 17 when the ferrule terminal 18 is inserted.

[0031] When the ferrule terminal 18 is inserted, the abutting portion 44 abuts with the leading end 17a of the collar portion 17 to inhibit further insertion. Additionally, the abutting portion 44 is set such that a gap is formed between a leading end of the terminal portion 18a of the ferrule terminal 18 and the intermediate base 46, so that, as illustrated in FIG. 5, the leading end of the terminal portion 18a is adapted not to contact with the intermediate base 46 when the ferrule terminal 18 is inserted. In addition, the step d is set such that when the tapered surface 19 of the collar portion 17 abuts with the abutting portion 44, the proximal end 17b of the collar portion 17 is located between the first surface 41 and the second surface 42. Herein, it is assumed that a ferrule terminal 18 measuring 8.0 mm in length with a collar portion 17 measuring 6.0 mm in length, which measures 14.0 mm in total length, is used. The step d is set in a range of from 1.5 to 2.0 mm.

[0032] Note that when a tool such as, for example, a

flathead screwdriver, is inserted into the tool insertion hole 25, the plate spring 34 is pushed by a leading end of the tool and elastically deformed, whereby the ferrule terminal 18 is released from the elastic force of the plate spring 34, and then allowed to be pulled out.

<<Operation>>

[0033] Next, a major operation of the embodiment will be described.

[0034] There have been cases where when inserting the ferrule terminal 18 into the electrical wire insertion hole 24 of the housing 15, an operator misunderstood that the insertion has been completed due to the feeling at the time of engagement between the ferrule terminal 18 and the plate spring 34 inside the housing 15, to result in an insufficient amount of insertion. In addition, even when the amount of insertion was insufficient, it has been difficult to recognize it at a glance.

[0035] Thus, the first surface 41 having the step d and the second surface 42 are formed on the housing 15. When the ferrule terminal 18 is inserted, the abutting portion 44 of each electrical wire insertion hole 24 abuts with the tapered surface 19 of the collar portion 17 to inhibit further insertion. The height of the step d is set such that, in this state, the proximal end 17b of the collar portion 17 is located between the first surface 41 and the second surface 42.

[0036] FIG. 6 is a perspective view illustrating the step between the first surface and the second surface (after insertion).

[0037] When the ferrule terminal 18 is inserted into the electrical wire insertion hole 24, and the leading end 17a of the collar portion 17 abuts with the abutting portion 44, the proximal end 17b of the collar portion 17 is located between the first surface 41 and the second surface 42. Accordingly, it is visually recognizable whether the work of insertion has been correctly completed or not. Specifically, when the proximal end 17b of the collar portion 17 is positioned between the first surface 41 and the second surface 42, it indicates that insertion has been completed, whereas when the proximal end 17b of the collar portion 17 projects from the first surface 41, it indicates that the amount of insertion is insufficient. In this way, it can be easily recognized by the simple structure that insertion work has been correctly completed, without any need for addition of a new component.

[0038] When the ferrule terminal 18 is inserted into the electrical wire insertion hole 24, the plate spring 34 is pushed by the ferrule terminal 18 and elastically deformed. Then, when the ferrule terminal 18 is inserted between the leading end of the plate spring 34 and the pressing surface 33, the elastic force of the plate spring 34 presses the ferrule terminal 18 against the pressing surface 33, and inhibits displacement in the pull-out direction. Accordingly, loosening and come-off of the ferrule terminal 18 can be inhibited.

[0039] On the other hand, when a tool is inserted into

the tool insertion hole 25, the plate spring 34 pushed by the tool is elastically deformed, whereby the ferrule terminal 18 is released from the elastic force of the plate spring 34. In this way, using a tool facilitates pull-out of the ferrule terminal 18.

[0040] In the electrical wire insertion hole 24, the large diameter portion 43 is larger than the collar portion 17, and the side of the inner peripheral surface in the anti-pressing direction relative to the pressing surface 33 is more inclined by the angle of θ toward the second surface 42 in the anti-pressing direction. In addition, to prevent surface contact between the abutting portion 44 and the tapered surface 19 of the collar portion 17, the tapered angle of the abutting portion 44 and the angle of the tapered surface 19 are made different from each other. Furthermore, the small diameter portion 45 is larger than the ferrule terminal 18. This allows the ferrule terminal 18 with the collar portion 17 to be fitted into the electrical wire insertion hole 24 with some play. Accordingly, the ferrule terminal 18 with the collar portion 17 is allowed to be slightly inclined and can be surely contacted with the pressing surface 33 when the ferrule terminal 18 is inserted, so that the quality of

electrical connection is stabilized.

<<Modification>>

[0041] While the above embodiment has been described the structure in which the abutting portion 44 is the tapered surface, the invention is not limited thereto. It will suffice to inhibit further insertion by its abutment with the leading end of the collar portion 17 when the ferrule terminal 18 is inserted. Thus, the abutting portion 44 may be merely a step.

[0042] While the above embodiment has been described the structure in which the tapered angle of the abutting portion 44 relative to the depthwise direction is larger than the angle of the tapered surface 19 relative to the depthwise direction, the invention is not limited thereto. The tapered angle of the abutting portion 44 relative to the depthwise direction may be made smaller than the angle of the tapered surface 19 relative to the depthwise direction. This facilitates allowing for inclination of the ferrule terminal 18 with the collar portion 17. However, the tapered angle of the abutting portion 44 relative to the depthwise direction may be made coincident with the angle of the tapered surface 19 relative thereto as long as the inclination of the ferrule terminal 18 with the collar portion 17 is allowed by play of the collar portion 17 relative to the large diameter portion 43 or play of the ferrule terminal 18 relative to the small diameter portion 45.

[0043] While the above embodiment has been described the c-contact relay including a-contact terminals and b-contact terminals in combination, the invention is not limited thereto, and is also applicable to a-contact relays and b-contact relays. In addition, while the relay

with the four pole contacts has been described, the invention is also applicable to relays with a single pole contact, two pole contacts, or three pole contacts. Furthermore, the invention is applicable not only to relays but also to timers.

[0044] While the above embodiment has been described the terminal socket for connecting a relay, a timer, or the like to an external circuit, the invention is not limited thereto. In short, the invention is also applicable to any other electrical equipment or auxiliary equipment having a spring terminal structure capable of holding the ferrule terminal 18 with the collar portion 17 inserted into the housing 15.

[0045] While the present invention has been described by referring to the limited number of embodiments, the scope of the invention is not limited thereto. Modifications based on the above disclosure are obvious to those skilled in the art.

Reference Signs List

[0046]

11: Connection terminal block	
12: Primary-side terminal section	
13: Relay terminal section	
14: Secondary-side terminal section	
15: Housing	
16: Lead wire	
17: Collar portion	
17a: Leading end of collar portion	
17b: Proximal end of collar portion	
18: Ferrule terminal	
18a: Terminal portion	
19: Tapered surface	
21: Electrical wire insertion hole	
21a to 21d: Electrical wire insertion holes (for coil terminals)	
22: Tool insertion hole	
23: Plug insertion inlet	
24: Electrical wire insertion hole	
24a to 24h: Electrical wire insertion holes (for b-contact terminals)	
24i to 24p: Electrical wire insertion holes (for a-contact terminals)	
24q to 24x: Electrical wire insertion holes (for common terminals)	
25: Tool insertion hole	
26: Side face	
31: Blade-receiving spring	
32: Spring metal fitting	
33: Pressing surface	
34: Plate spring	
35: Relay conductive plate	
41: First surface	
42: Second surface	
43: Large diameter portion	
44: Abutting portion	

45: Small diameter portion

46: Intermediate base

5 Claims

1. A connection terminal block capable of holding a ferrule terminal with a collar portion to be inserted into a housing, the housing comprising:

a first surface orthogonal to an insertion direction in which the ferrule terminal is inserted;
a second surface orthogonal to the insertion direction and arranged at a further back side than the first surface via a step in the insertion direction;
an insertion hole passing through from the second surface to an inside of the housing along the insertion direction and allowing for insertion of the ferrule terminal through the hole; and
an abutting portion formed on an inner peripheral surface of the insertion hole and configured to, when the ferrule terminal is inserted, abut with a leading end of the collar portion to inhibit further insertion,
wherein the step is set in a range such that when the leading end of the collar portion abuts with the abutting portion, a proximal end of the collar portion is located between the first surface and the second surface.

2. The connection terminal block according to claim 1, comprising a conductive terminal member provided in the inside of the housing, wherein the conductive terminal member includes a pressing surface parallel with the insertion direction and an elastic member biased against the pressing surface and configured to press the ferrule terminal inserted into the insertion hole against the pressing surface.

3. The connection terminal block according to claim 2, wherein the insertion hole includes a large diameter portion allowing for insertion of the collar portion, the abutting portion formed by a tapered surface whose diameter becomes smaller toward the insertion direction, and a small diameter portion allowing for insertion of the ferrule terminal through the portion, in order from the second surface toward the inside of the housing, in which a side of an inner peripheral surface of the large diameter portion located in an anti-pressing direction opposite to the pressing surface is more inclined toward the second surface in the anti-pressing direction.

4. The connection terminal block according to claim 2, comprising a base member configured to hold the conductive terminal member, wherein the abutting portion is set such that when the ferrule terminal is

inserted, a gap is formed between a leading end of the ferrule terminal and the base member.

5. Electrical equipment comprising the connection terminal block according to any one of claims 1 to 4. 5

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FIG. 1

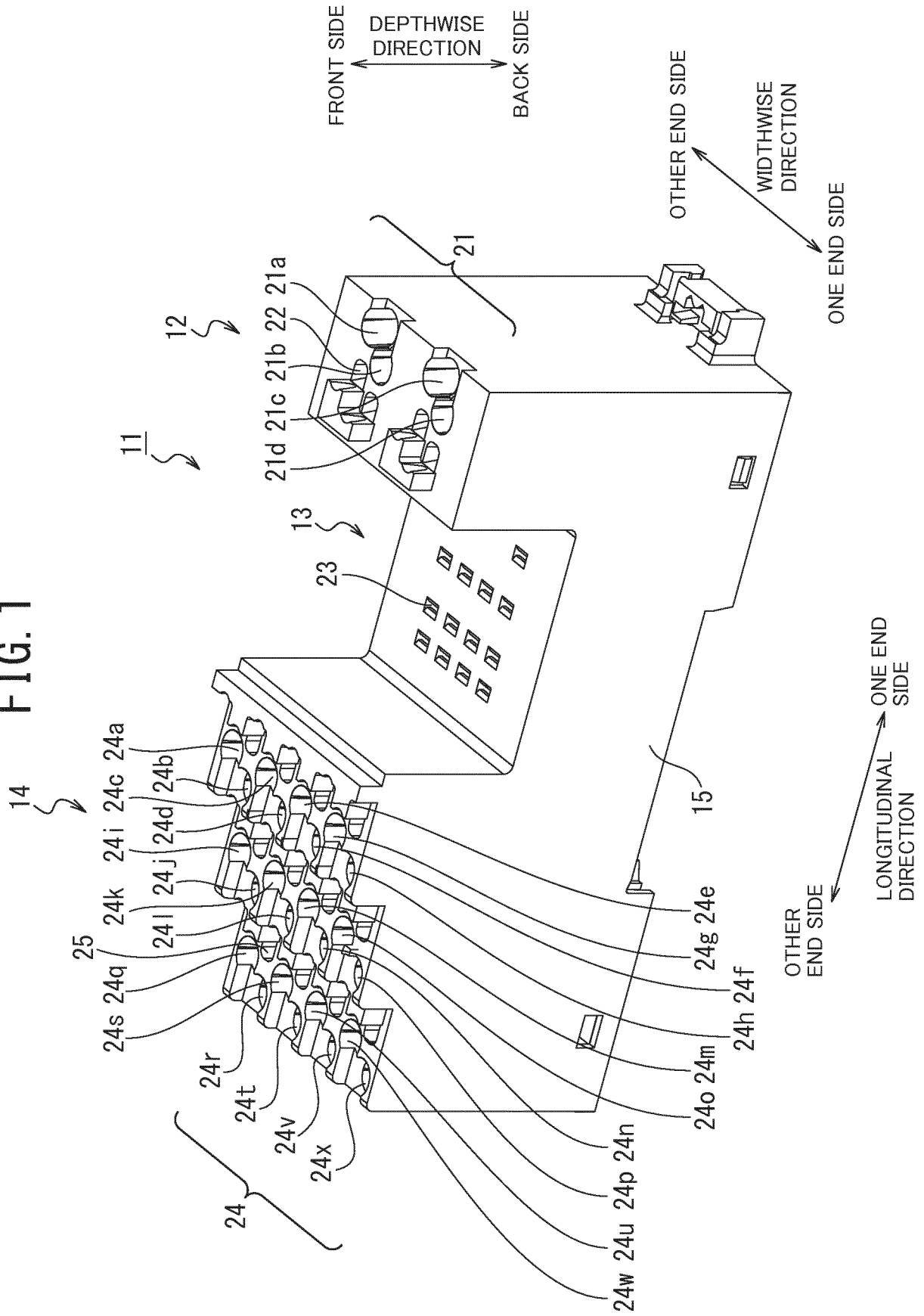


FIG. 2

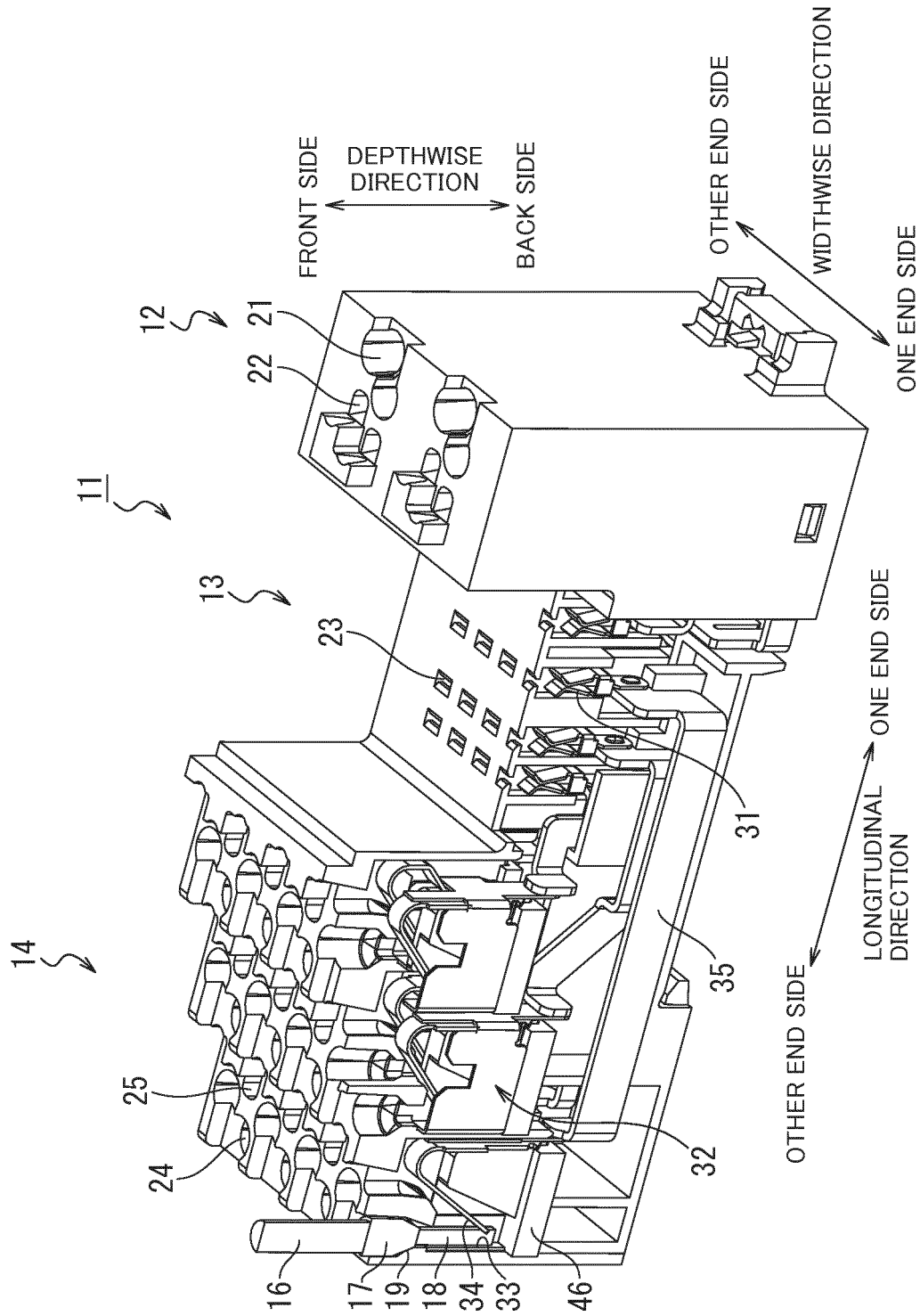


FIG. 3

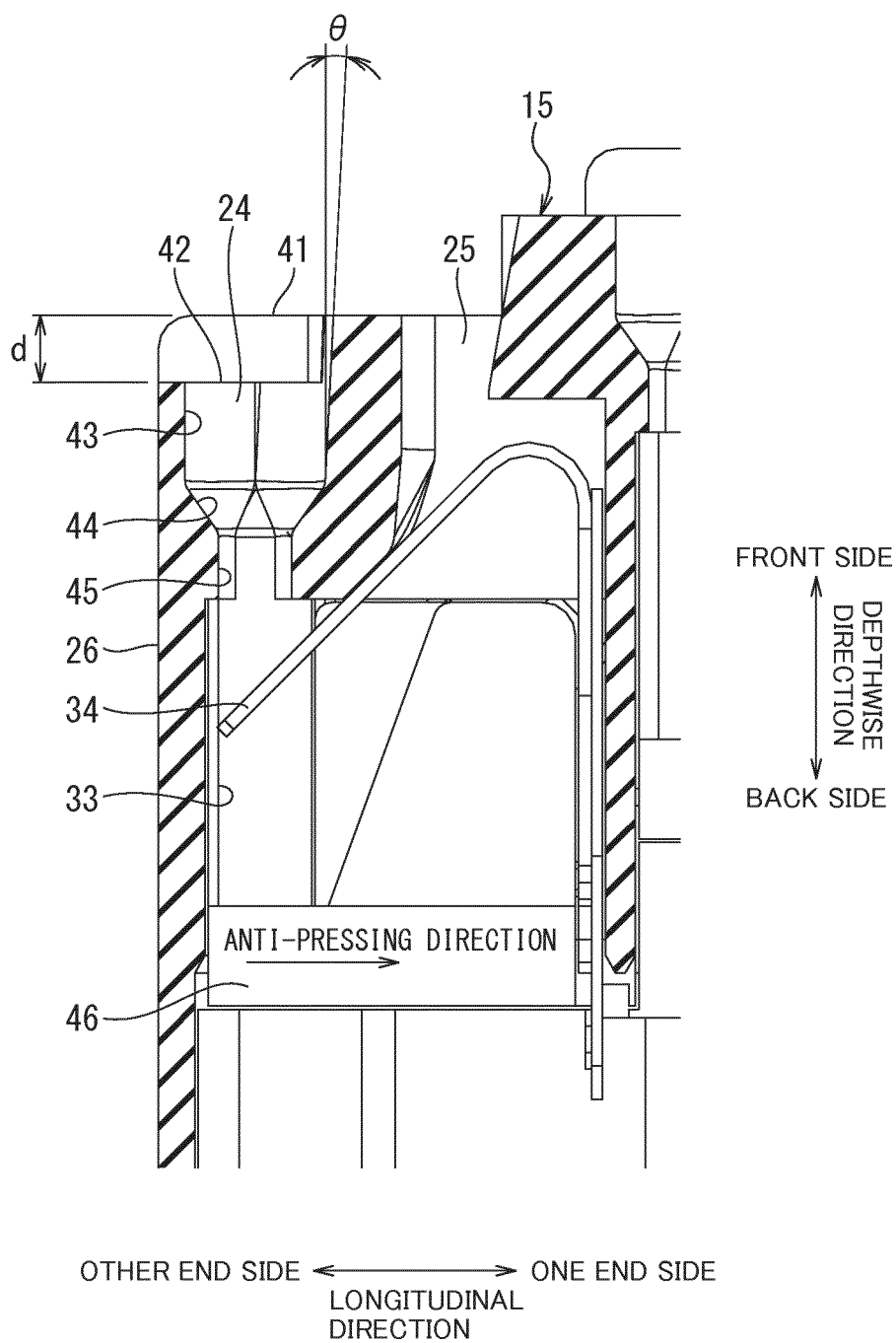


FIG. 4

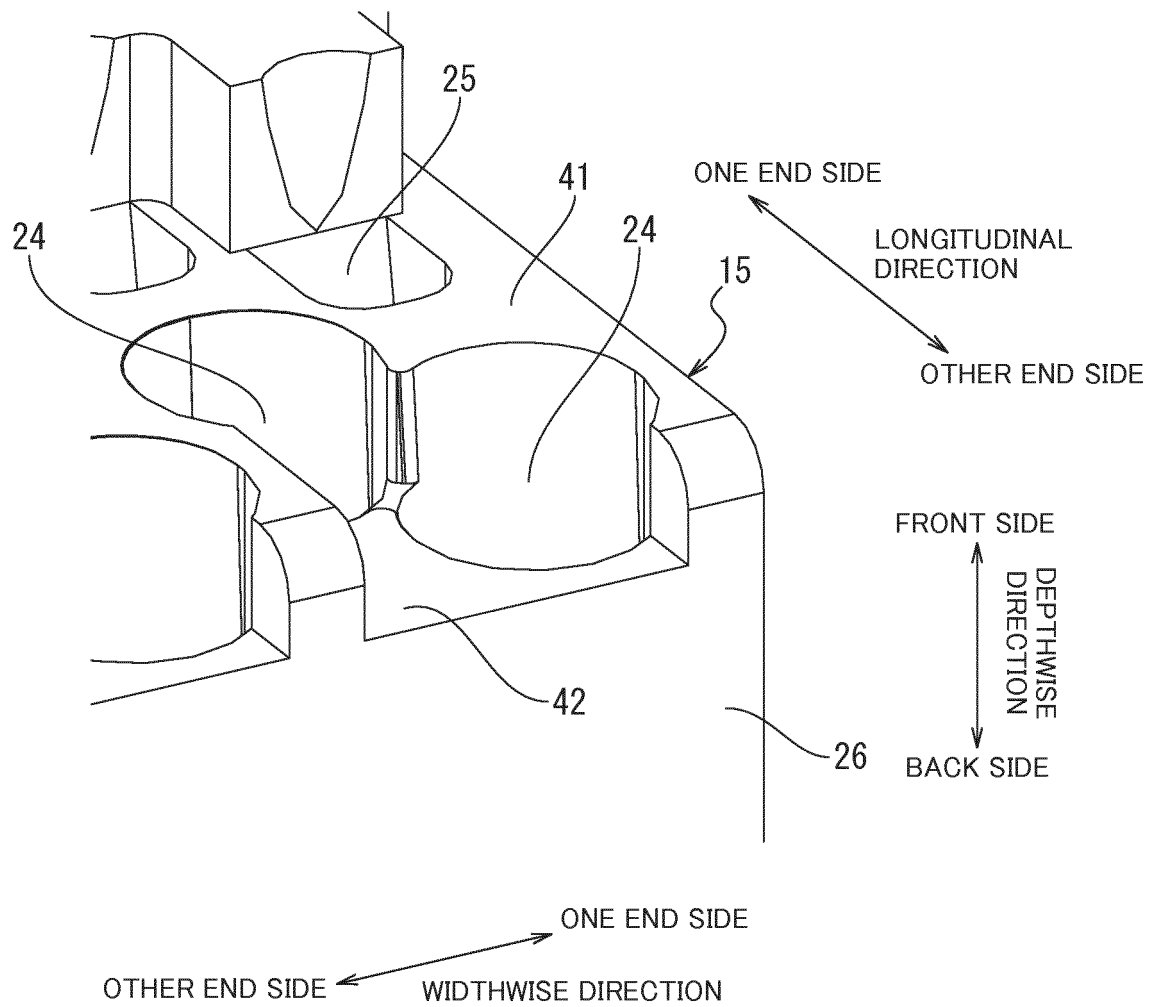


FIG. 5

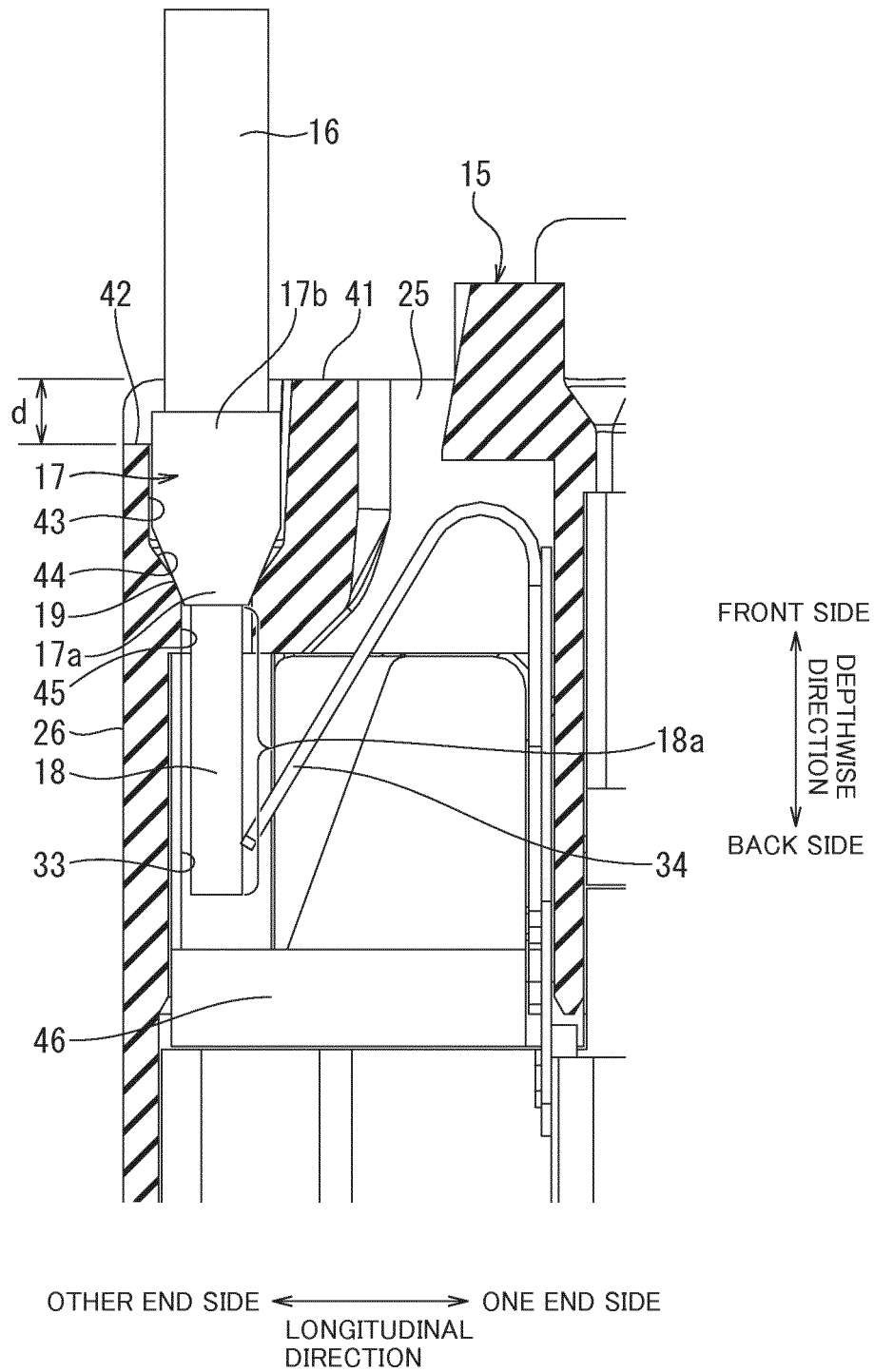
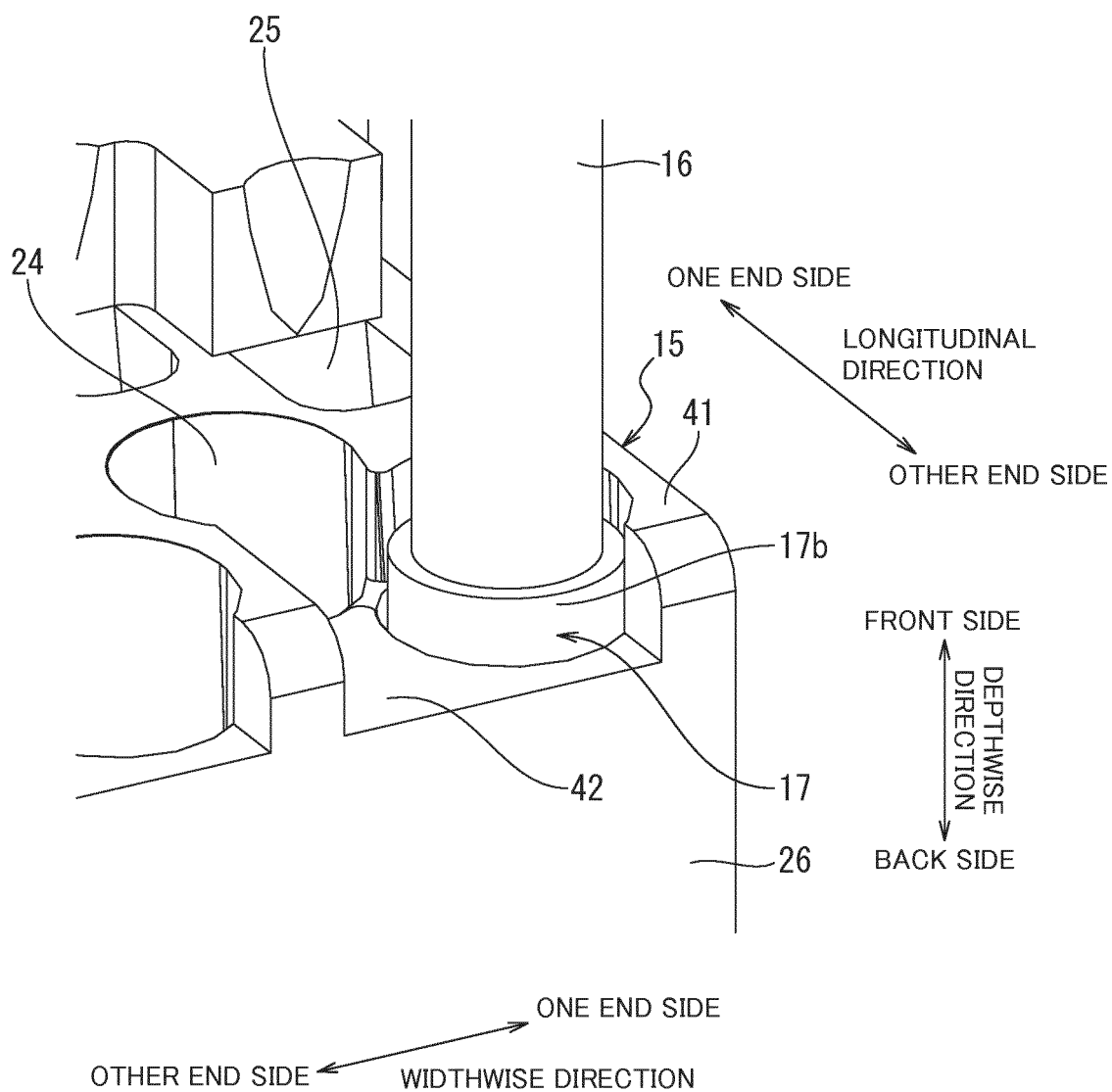


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/005883

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. H01R9/22 (2006.01) i, H01R4/48 (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. H01R9/22-9/28, H01R4/48

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 1971-2018

Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

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.
A	JP 2007-26991 A (TOYO GIKEN KK.) 01 February 2007 (Family: none)	1-5
A	JP 2000-243478 A (MATSUSHITA ELECTRIC WORKS, LTD.) 08 September 2000 (Family: none)	1-5
A	JP 2016-21398 A (INDUSTRIA LOMBARDA MATERIALE ELETTRICO-I.L.M.E. S.P.A.) 04 February 2016 & US 2016/0020543 A1 & DE 102015212898 A1 & CN 105281062 A	1-5



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

06 April 2018 (06.04.2018)

Date of mailing of the international search report

17 April 2018 (17.04.2018)

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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