



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.10.2016 Bulletin 2016/40

(51) Int Cl.:
H01R 13/66 ^(2006.01) **H01R 13/688** ^(2011.01)
H01R 24/30 ^(2011.01)

(21) Application number: **16160663.7**

(22) Date of filing: **16.03.2016**

(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:
MA MD

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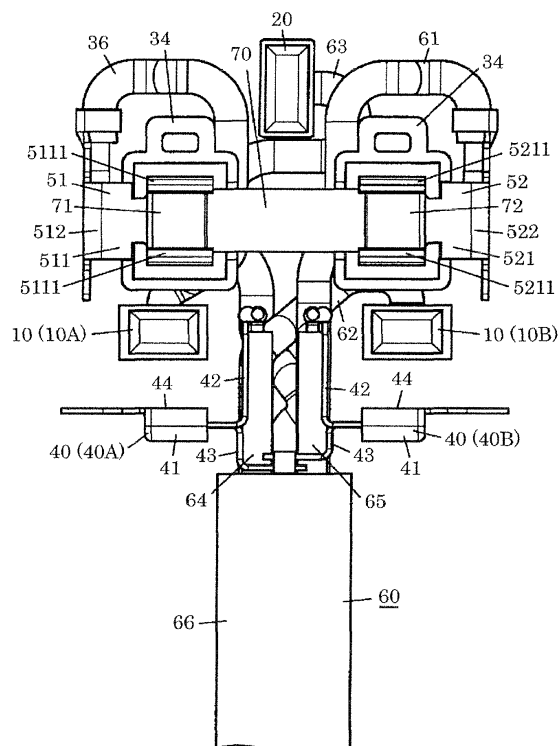
(30) Priority: **31.03.2015 JP 2015074237**

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(54) **BS1363 POWER PLUG WITH FUSE AND TEMPERATURE SENSOR**

(57) A plug according to the present invention includes conductive pins (10) having longitudinal directions parallel to one another; temperature sensor elements (40) which are spaced apart from the conductive pins (10) and detect temperatures of the conductive pins (10); and a fuse holder (50) which holds a fuse (70) that blows when overcurrent flows through a specific conductive pin (10) among the conductive pins (10). Each of the temperature sensor elements (40) is located closer to a corresponding conductive pin (10) among the conductive pins (10) than to the fuse holder (50), and not between the fuse holder (50) and the corresponding conductive pin (10).

FIG. 1



Description

[Technical Field]

[0001] The present invention relates to plugs, and relates in particular to a plug which detects heat generated by a plurality of conductive pins.

[Background Art]

[0002] Patent Literature 1 (PTL 1) discloses a plug which includes two plug blades, a fuse for circuit protection, and a thermistor that detects the temperature of the two plug blades. Use of the plug according to PTL 1 enables detection of heat generated by the two plug blades caused by poor contact between the plug and the receptacle.

[Citation List]

[Patent Literature]

[0003] [PTL 1] Japanese Unexamined Patent Application Publication No. 2014-222612

[Summary of Invention]

[Technical Problem]

[0004] With the plug according to PTL 1, heat is generated when a fuse blows. The heat generated by the fuse could thus change the resistance value of the thermistor. There is, as a consequence, a possibility of causing confusion of the heat generated by the fuse with heat generated by a plurality of conductive pins. Moreover, the heat generated by a pair of conductive pins cannot be detected accurately due to the distant position of the thermistor with respect to the pair of conductive pins.

[0005] An object of the present invention is to provide a plug which can accurately detect heat generated by a plurality of conductive pins and reduce the possibility of causing confusion of heat generated by a fuse with heat generated by the plurality of conductive pins.

[Solution to Problem]

[0006] A plug according to an embodiment of the present invention includes: a plurality of conductive pins having longitudinal directions parallel to one another; a plurality of temperature sensor elements which are spaced apart from the plurality of conductive pins and detect temperatures of the plurality of conductive pins; and a fuse holder which holds a fuse that blows when overcurrent flows through a specific conductive pin among the plurality of conductive pins. Each of the plurality of temperature sensor elements is located closer to a corresponding conductive pin among the plurality of conductive pins than to the fuse holder, and not between

the fuse holder and the corresponding conductive pin.

[Advantageous Effects of Invention]

[0007] The present invention can provide a plug which can accurately detect heat generated by a plurality of conductive pins and reduce the possibility of causing confusion of heat generated by a fuse with heat generated by the plurality of conductive pins.

[Brief Description of Drawings]

[0008]

FIG. 1 illustrates the inner structure of a plug according to an embodiment of the present invention; FIG. 2 is an exploded perspective view of the plug according to the above embodiment; FIG. 3 is a front view of the plug according to the above embodiment; FIG. 4 is a perspective view of the plug according to the above embodiment; FIG. 5 illustrates the inner structure of the plug according to the above embodiment; and FIG. 6 is a cross-section view of FIG. 3 along the line A-A.

[Description of Embodiment]

[Embodiment]

[0009] Hereinafter, a plug according to an embodiment of the present invention will be described with reference to FIG. 1 to FIG. 6.

[0010] The plug according to the present embodiment is of a type known as Type BF (also known as Type G), and is a plug that meets BS 1363. As illustrated in FIG. 2 to FIG. 4, the plug according to the present embodiment includes a plurality of (two in the present embodiment) conductive pins 10, one ground pin 20, plug body 30, a plurality of (two in the present embodiment) temperature sensor elements 40, fuse holder 50, and cable 60. Hereinafter, one of two conductive pins 10 is referred to as first conductive pin 10A, and the other as second conductive pin 10B where necessary. Also, one of two temperature sensor elements 40 is referred to as first temperature sensor element 40A, and the other as second temperature sensor element 40B where necessary.

[0011] As illustrated in FIG. 2, cable 60 includes five lines 61 to 65 and sheath 66 covering five lines 61 to 65. Cable 60 has a first end at which five lines 61 to 65 are exposed from sheath 66, and a second end connected to an arbitrary appliance (for example, a plug or a receptacle). Five lines 61 to 65 are, more specifically, two (first and second) conductive lines 61 and 62, ground line 63, and two (first and second) signal lines 64 and 65. In the present embodiment, first conductive line 61 is a neutral line, whereas second conductive line 62 is a voltage line.

First conductive line 61 corresponds to first conductive pin 10A, second conductive line 62 to second conductive pin 10B, ground line 63 to ground pin 20, first signal line 64 to first temperature sensor element 40A, and second signal line 65 to second temperature sensor element 40B.

[0012] As illustrated in FIG. 2, each of first conductive pin 10A and second conductive pin 10B is formed into a rectangular bar shape with metal. In other words, conductive pins 10 are rectangular pins. Each of conductive pins 10 includes contact 11, line connecting portion 12, and cover 13, for example. Contact 11 has a rectangular bar shape. Contact 11 has a front end to be used for electrical connection with a receptacle compatible with the plug according to the present embodiment. Line connecting portion 12 is formed at the rear end side of contact 11. Line connecting portion 12 has an elongated plate-like shape. Cover 13 covers the midsection of contact 11. Cover 13 is formed of a flame-retarded, electrically insulating resin. In the present embodiment, the midsection of contact 11 is thinner than the front and rear ends of contact 11 such that the surfaces of the front and rear ends of contact 11 and the surface of cover 13 lie in the same plane.

[0013] The plurality of conductive pins 10 have longitudinal directions parallel to one another. In the present embodiment, first conductive pin 10A and second conductive pin 10B have longitudinal directions parallel to a first direction (the front-rear direction of the plug, the left-right direction of FIG. 6), and are spaced apart from one another in a second direction (the left-right direction of the plug, the left-right direction of FIG. 3) orthogonal to the first direction. First conductive pin 10A and second conductive pin 10B have thickness directions parallel to a third direction (the vertical direction of the plug, the vertical direction of FIG. 3) orthogonal to the first direction and the second direction.

[0014] As illustrated in FIG. 2, ground pin 20 is formed into a rectangular bar shape with metal. Like conductive pins 10, ground pin 20 includes contact 21 and line connecting portion 22. The overall size of ground pin 20 is larger than that of conductive pins 10. Ground pin 20 has a longitudinal direction parallel to the longitudinal directions of the plurality of conductive pins 10.

[0015] As illustrated in FIG. 1, fuse holder 50 holds fuse 70. Fuse 70 blows when overcurrent flows through a specific conductive pin (first conductive pin 10A in the present embodiment) among the plurality of conductive pins 10. As illustrated in FIG. 1, fuse holder 50 is spaced apart from first conductive pin 10A and second conductive pin 10B in the third direction (the vertical direction of FIG. 1).

[0016] Fuse holder 50 holds fuse 70 in a detachable manner. In other words, with the plug according to the present embodiment, fuse 70 is exchangeable. Fuse holder 50 includes first terminal 51 which holds first end 71 of fuse 70, and second terminal 52 which holds second end 72 of fuse 70. When fuse holder 50 holds fuse 70,

first terminal 51 and second terminal 52 are electrically connected.

[0017] First terminal 51 is formed of metal and includes holding portion 511 and line connecting portion 512. Holding portion 511 includes a pair of leaf springs 5111 and 5111 that protrude forward and face each other. Holding portion 511 holds first end 71 of fuse 70 using the pair of leaf springs 5111 and 5111. Line connecting portion 512 has a plate-like shape. Line connecting portion 512 is used as a portion for electrically connecting to first conductive pin 10A. As illustrated in FIG. 1, first terminal 51 is spaced apart from first conductive pin 10A in the third direction.

[0018] Second terminal 52 is formed of metal and includes holding portion 521 and line connecting portion 522. Holding portion 521 includes a pair of leaf springs 5211 and 5211 that protrude forward and face each other. Holding portion 521 holds second end 72 of fuse 70 using the pair of leaf springs 5211 and 5211. Line connecting portion 522 has a plate-like shape. Line connecting portion 522 is used as a portion for electrically connecting to the line (first conductive line 61) corresponding to first conductive pin 10A. As illustrated in FIG. 1, second terminal 52 is spaced apart from second conductive pin 10B in the third direction.

[0019] As illustrated in FIG. 1, each of first temperature sensor element 40A and second temperature sensor element 40B includes temperature sensitive portion 41 and a pair of terminals (lead terminals) 42 and 43. Temperature sensitive portion 41 is a portion which detects an ambient temperature. Temperature sensitive portion 41 has a flat plate-like shape and has temperature sensing surface 44 which is flat. Temperature sensor elements 40 are thermistors, for example, and more specifically, positive temperature coefficient (PTC) thermistors. Thus, the resistance value of temperature sensitive portion 41 varies according to the ambient temperature.

[0020] Terminal 43 of first temperature sensor element 40A and terminal 43 of second temperature sensor element 40B are electrically connected. In other words, first temperature sensor element 40A and second temperature sensor element 40B are connected in series.

[0021] The plurality of temperature sensor elements 40 are spaced apart from the plurality of conductive pins 10 and detect the temperatures of the plurality of conductive pins 10. Furthermore, as illustrated in FIG. 1, each of the plurality of temperature sensor elements 40 is located closer to corresponding conductive pin 10 among the plurality of conductive pins 10 than to fuse holder 50, and not between fuse holder 50 and corresponding conductive pin 10. Corresponding conductive pin 10 refers to conductive pin 10 located closest to temperature sensor element 40.

[0022] In the present embodiment in particular, the plurality of temperature sensor elements 40 include first temperature sensor element 40A and second temperature sensor element 40B which is different from first temperature sensor element 40A.

[0023] First temperature sensor element 40A is used for detecting the temperature of first conductive pin 10A. First temperature sensor element 40A can be disposed to be located closer to a corresponding conductive pin (first conductive pin 10A) among the plurality of conductive pins 10 than to fuse holder 50 and not between fuse holder 50 and corresponding conductive pin 10. In other words, first temperature sensor element 40A is located closer to first conductive pin 10A than to fuse holder 50, and is located at a position other than a position between fuse holder 50 and first conductive pin 10A. Stated differently, first temperature sensor element 40A is located on the opposite side of first conductive pin 10A from fuse holder 50. That is to say, first temperature sensor element 40A is disposed such that first conductive pin 10A is located between first temperature sensor element 40A and fuse holder 50 (first terminal 51). In particular, temperature sensing surface 44 of first temperature sensor element 40A faces first conductive pin 10A in the third direction.

[0024] Second temperature sensor element 40B is used for detecting the temperature of second conductive pin 10B. Second temperature sensor element 40B can be disposed to be located closer to a corresponding conductive pin (second conductive pin 10B) among the plurality of conductive pins 10 than to fuse holder 50 and not between fuse holder 50 and corresponding conductive pin 10. In other words, second temperature sensor element 40B is located closer to second conductive pin 10B than to fuse holder 50, and is located at a position other than a position between fuse holder 50 and second conductive pin 10B. Stated differently, second temperature sensor element 40B is located on the opposite side of second conductive pin 10B from fuse holder 50. That is to say, second temperature sensor element 40B is disposed such that second conductive pin 10B is located between second temperature sensor element 40B and fuse holder 50 (second terminal 52). In particular, temperature sensing surface 44 of second temperature sensor element 40B faces second conductive pin 10B in the third direction.

[0025] As illustrated in FIG. 2 to FIG. 4, plug body 30 includes first cover (front cover) 31, second cover (rear cover) 32, shell 33, a pair of terminal covers 34 and 34, fuse cover 35, connecting line 36, and three screws 37. First cover 31, second cover 32, shell 33, the pair of terminal covers 34 and 34, and fuse cover 35 are formed of an electrically insulating resin.

[0026] First cover 31 and second cover 32 constitute housing 38 which houses fuse holder 50, first temperature sensor element 40A, second temperature sensor element 40B, the pair of terminal covers 34 and 34, and connecting line 36.

[0027] First cover 31 is the front wall of housing 38. First cover 31 is the front wall of plug body 30 as well. First cover 31 has a substantially box shape having the rear side opened, and has front surface 311 which is a first surface (front surface) of plug body 30 in the first

direction (front-rear direction).

[0028] As illustrated in FIG. 2, first cover 31 further has a plurality of (two in the present embodiment) conductive-pin insertion holes 312 and ground-pin insertion hole 313. Hereinafter, one of two conductive-pin insertion holes 312 is referred to as first conductive-pin insertion hole 312A, and the other as second conductive-pin insertion hole 312B where necessary. Conductive-pin insertion holes 312 are larger than contacts 11 of conductive pins 10 and smaller than line connecting portions 12 of conductive pins 10. Ground-pin insertion hole 313 is larger than contact 21 of ground pin 20 and smaller than line connecting portion 22 of ground pin 20.

[0029] First cover 31 has storage space 314 provided on front surface 311. Storage space 314 houses fuse 70. First cover 31 has a pair of first through-holes 315 and 315 and a pair of second through-holes 316 and 316 provided on the bottom surface of storage space 314 (see FIG. 5). The pair of first through-holes 315 and 315 allow the pair of leaf springs 5111 and 5111 of first terminal 51 to pass through, respectively. The pair of second through-holes 316 and 316 allow the pair of leaf springs 5211 and 5211 of second terminal 52 to pass through, respectively.

[0030] As illustrated in FIG. 5, first cover 31 has a pair of walls 317 on the rear side. Hereinafter, one of the pair of walls 317 is referred to as first wall 317A, and the other as second wall 317B where necessary. First wall 317A is located between first conductive pin 10A and first temperature sensor element 40A. Second wall 317B is located between second conductive pin 10B and second temperature sensor element 40B. Each of walls 317 has a substantially L-shape.

[0031] As illustrated in FIG. 5, first cover 31 has insertion hole 318 on the side wall for allowing cable 60 to pass through.

[0032] As illustrated in FIG. 2, second cover 32 is the rear wall of housing 38. Second cover 32 has a substantially plate shape. Second cover 32 is attached to the rear side of first cover 31 using three screws 37.

[0033] Housing 38 is formed such that temperature sensor elements 40 are located closer to first cover 31 than to second cover 32.

[0034] As illustrated in FIG. 4, shell 33 covers housing 38 such that cable 60 and the center portion of front surface 311 of first cover 31 are exposed. Shell 33 has a substantially rectangular box shape. Shell 33 is a component formed by insert molding, rather than a component prepared in advance. For this reason, shell 33 is not illustrated in FIG. 2.

[0035] As illustrated in FIG. 6, shell 33 has rear surface 331 serving as a second surface (rear surface) of plug body 30 in the first direction (front-rear direction). As described earlier, with housing 38, temperature sensor elements 40 are located closer to first cover 31 than to second cover 32. Thus, as illustrated in FIG. 6, first temperature sensor element 40A and second temperature sensor element 40B are located closer to the first surface

(311) than to the second surface (rear surface 331).

[0036] The pair of terminal covers 34 and 34 are formed in a plate-like shape. One of the pair of terminal covers 34 and 34 covers the rear surface of holding portion 511 of first terminal 51, and the other covers the rear surface of holding portion 521 of second terminal 52.

[0037] Fuse cover 35 is detachably attached to first cover 31 to cover storage space 314 of first cover 31.

[0038] Connecting line 36 electrically connects first conductive pin 10A and first terminal 51.

[0039] A method of assembling the plug according to the present embodiment will now be briefly described. The following description is a mere example, which is not intended to limit the method of assembling the plug according to the present embodiment.

[0040] First, first conductive pin 10A, second conductive pin 10B, ground pin 20, first temperature sensor element 40A, second temperature sensor element 40B, first terminal 51, and second terminal 52 are attached to first cover 31 (see FIG. 5).

[0041] In particular, first conductive pin 10A is attached to first cover 31 such that contact 11 protrudes from front surface 311 through conductive-pin insertion hole 312A. Second conductive pin 10B is attached to first cover 31 such that contact 11 protrudes from front surface 311 through conductive-pin insertion hole 312B. Ground pin 20 is attached to first cover 31 such that contact 21 protrudes from front surface 311 through ground-pin insertion hole 313.

[0042] First terminal 51 is attached to first cover 31 such that the pair of leaf springs 5111 and 5111 protrude within storage space 314 through the pair of first through-holes 315 and 315. Second terminal 52 is attached to first cover 31 such that the pair of leaf springs 5211 and 5211 protrude within storage space 314 through the pair of second through-holes 316 and 316.

[0043] Next, one of the pair of terminal covers 34 and 34 covers the rear surface of holding portion 511 of first terminal 51, and the other covers the rear surface of holding portion 521 of second terminal 52.

[0044] Next, connections for cable 60 and connections for line 36 are made. Specifically, first conductive line 61 is connected to line connecting portion 522 of second terminal 52. Second conductive line 62 is connected to line connecting portion 12 of second conductive pin 10B. Ground line 63 is connected to line connecting portion 22 of ground pin 20. First signal line 64 is connected to terminal 42 of first temperature sensor element 40A. Second signal line 65 is connected to terminal 42 of second temperature sensor element 40B. Line connecting portion 12 of first conductive pin 10A and line connecting portion 512 of first terminal 51 are connected via connecting line 36. Sheath 66 of cable 60 is disposed in insertion hole 318.

[0045] With such connections, a series circuit of first temperature sensor element 40A and second temperature sensor element 40B is connected between first signal line 64 and second signal line 65.

[0046] Next, second cover 32 is fixed to first cover 31 using three screws 37. Housing 38 is formed in this manner.

[0047] Next, shell 33 is formed by insert molding.

[0048] Lastly, fuse cover 35 is attached to first cover 31.

[0049] With the above assembling method, the plug according to the present embodiment illustrated in FIG. 4 can be obtained. The plug according to the present embodiment includes: a plurality of conductive pins 10 having longitudinal directions parallel to one another; a plurality of temperature sensor elements 40 which are spaced apart from the plurality of conductive pins 10 and detect temperatures of the plurality of conductive pins 10; and fuse holder 50 which holds fuse 70 that blows when overcurrent flows through specific conductive pin 10 among the plurality of conductive pins 10. Each of the plurality of temperature sensor elements 40 is located closer to corresponding conductive pin 10 among the plurality of conductive pins 10 than to fuse holder 50, and not between fuse holder 50 and corresponding conductive pin 10.

[0050] In actual use of the plug according to the present embodiment, fuse 70 is attached to plug body 30. When attaching fuse 70, fuse cover 35 is removed from first cover 31 to expose storage space 314. Fuse 70 is then housed in storage space 314, so that first end 71 of fuse 70 is connected to holding portion 511 of first terminal 51, and second end 72 of fuse 70 is connected to holding portion 521 of second terminal 52. With these connections, first conductive pin 10A is electrically connected to first conductive line 61 via fuse 70 (see FIG. 1).

[Other Embodiments]

[0051] With a plug according to another embodiment of the present invention, the first temperature sensor element (40A) may be located on the opposite side of the first conductive pin (10A) from the second conductive pin (10B). For example, with reference to FIG. 1, the first temperature sensor element (40A) may be located on the left hand side of the first conductive pin (10A).

[0052] With a plug according to another embodiment of the present invention, the second temperature sensor element (40B) may be located on the opposite side of the second conductive pin (10B) from the first conductive pin (10A). For example, with reference to FIG. 1, the second temperature sensor element (40B) may be located on the right hand side of the second conductive pin (10B).

[0053] With a plug according to another embodiment of the present invention, the first temperature sensor element (40A) may be located on the second conductive pin (10B) side of the first conductive pin (10A). For example, with reference to FIG. 1, the first temperature sensor element (40A) may be located on the right hand side of the first conductive pin (10A).

[0054] With a plug according to another embodiment of the present invention, the second temperature sensor element (40B) may be located on the first conductive pin

(10A) side of the second conductive pin (10B). For example, with reference to FIG. 1, the second temperature sensor element (40B) may be located on the left hand side of the second conductive pin (10B).

[0055] The point is, with a plug according to the present invention, it is sufficient as long as the first temperature sensor element (40A) is located closer to the first conductive pin (10A) than to the fuse holder (50) and not between the fuse holder (50) and the first conductive pin (10A). It is sufficient as long as the second temperature sensor element (40B) is located closer to the second conductive pin (10B) than to the fuse holder (50) and not between the fuse holder (50) and the second conductive pin (10B).

[0056] A plug according to another embodiment of the present invention may include three or more conductive pins (10) and one ground pin (20). Even in this case, each of the plurality of temperature sensor elements (40) can be located closer to a corresponding conductive pin (10) among the plurality of conductive pins (10) than to the fuse holder (50) and not between the fuse holder (50) and the corresponding conductive pin (10).

[0057] With a plug according to another embodiment of the present invention, the conductive pins (10) may have a round bar shape. The ground pin (20) may also have a round bar shape.

[0058] A plug according to another embodiment of the present invention may have no fuse cover (35).

[0059] With a plug according to another embodiment of the present invention, the fuse (70) does not have to be exchangeable.

[0060] A plug according to another embodiment of the present invention may have no cable (60). In this case, the plug may have a terminal block to which the cable (60) is detachably connected.

[0061] With a plug according to another embodiment of the present invention, the plug body (30) may be a stationary plug body.

[0062] With a plug according to another embodiment of the present invention, the temperature sensor elements (40) may be negative temperature coefficient (NTC) thermistors. That is to say, any type of temperature sensor elements (40) may be used.

[0063] A plug according to another embodiment of the present invention need not be a plug that meets BS 1363. For example, a plug according to the present invention may be a plug that meets a standard other than BS 1363 (for example, BS 546). That is to say, the present invention is applicable to a plug having at least two pins. The number of lines of the cable (60) is changed according to the number of conductive pins (10), whether or not the ground pin (20) is included, the arrangement of the pins (conductive pins and a ground pin), or the standard.

[Aspects of Present Invention]

[0064] As is clear from the above embodiments, a plug according to a first aspect of the present invention in-

cludes a plurality of conductive pins (10) having longitudinal directions parallel to one another; a plurality of temperature sensor elements (40) which are spaced apart from the plurality of conductive pins (10) and detect temperatures of the plurality of conductive pins (10); and a fuse holder (50) which holds a fuse (70) that blows when overcurrent flows through a specific conductive pin (10) among the plurality of conductive pins (10). Each of the plurality of temperature sensor elements (40) is located closer to a corresponding conductive pin (10) among the plurality of conductive pins (10) than to the fuse holder (50), and not between the fuse holder (50) and the corresponding conductive pin (10).

[0065] Since the plug according to the first aspect includes the plurality of temperature sensor elements (40) which detect the temperatures of the plurality of conductive pins (10), it is possible to accurately detect heat generated by the plurality of conductive pins (10) as compared to the case where the plug includes only one temperature sensor element for the plurality of conductive pins (10). Furthermore, each of the plurality of temperature sensor elements (40) is located away from the fuse holder (50) and close to the corresponding conductive pin. This reduces the possibility of causing confusion of heat generated by the fuse (70) with heat generated by the plurality of conductive pins (10). This, as a result, enables accurate detection of heat generated by the plurality of conductive pins (10) and reduces the possibility of causing confusion of heat generated by the fuse (70) with heat generated by the plurality of conductive pins (10).

[0066] A plug according to a second aspect of the present invention can be achieved by a combination with the first aspect. According to the second aspect, the plurality of conductive pins (10) include a first conductive pin (10A) and a second conductive pin (10B). The plurality of temperature sensor elements (40) include a first temperature sensor element (40A) which detects a temperature of the first conductive pin (10A) and a second temperature sensor element (40B) which detects a temperature of the second conductive pin (10B). The first conductive pin (10A) and the second conductive pin (10B) have longitudinal directions parallel to a first direction, and are spaced apart from one another in a second direction orthogonal to the first direction. The fuse holder (50) is spaced apart from the first conductive pin (10A) and the second conductive pin (10B) in a third direction orthogonal to the first direction and the second direction. The first temperature sensor element (40A) is located closer to the first conductive pin (10A) than to the fuse holder (50), and not between the fuse holder (50) and the first conductive pin (10A). The second temperature sensor element (40B) is located closer to the second conductive pin (10B) than to the fuse holder (50), and not between the fuse holder (50) and the second conductive pin (10B).

[0067] The plug according to the second aspect enables accurate detection of heat generated by the first and

second conductive pins (10A and 10B) and reduces the possibility of causing confusion of heat generated by the fuse (70) with heat generated by the first and second conductive pins (10A and 10B).

[0068] A plug according to a third aspect of the present invention can be achieved by a combination with the second aspect. According to the third aspect, the first temperature sensor element (40A) is located on the opposite side of the first conductive pin (10A) from the fuse holder (50). The second temperature sensor element (40B) is located on the opposite side of the second conductive pin (10B) from the fuse holder (50).

[0069] The plug according to the third aspect enables further accurate detection of heat generated by the first and second conductive pins (10A and 10B). Moreover, the plug according to the third aspect further reduces the possibility of causing confusion of heat generated by the fuse (70) with heat generated by the first and second conductive pins (10A and 10B).

[0070] A plug according to a fourth aspect of the present invention can be achieved by a combination with the second or third aspect. According to the fourth aspect, each of the first conductive pin (10A) and the second conductive pin (10B) has a rectangular bar shape. The first conductive pin (10A) and the second conductive pin (10B) have thickness directions parallel to the third direction. Each of the first temperature sensor element (40A) and the second temperature sensor element (40B) has a temperature sensing surface (44) which is flat. The temperature sensing surface (44) of the first temperature sensor element (40A) faces the first conductive pin (10A) in the third direction. The temperature sensing surface (44) of the second temperature sensor element (40B) faces the second conductive pin (10B) in the third direction.

[0071] With the plug according to the fourth aspect, it is possible to increase the amount of heat conducted from the conductive pins (10A and 10B) to the temperature sensor elements (40A and 40B). This thus enables further accurate detection of heat generated by the first and second conductive pins (10A and 10B).

[0072] A plug according to a fifth aspect of the present invention can be achieved by a combination with any one of the second to fourth aspects. According to the fifth aspect, the plug further includes a first wall (317A) and a second wall (317B) which are electrically insulating. The first wall (317A) is located between the first conductive pin (10A) and the first temperature sensor element (40A). The second wall (317B) is located between the second conductive pin (10B) and the second temperature sensor element (40B).

[0073] With the plug according to the fifth aspect, the conductive pins (10A and 10B) and the temperature sensor elements (40A and 40B) can be electrically insulated with reliability. Moreover, since the walls (317A and 317B) facilitate heat conduction from the conductive pins (10A and 10B) to the temperature sensor elements (40A and 40B), the accuracy of detection of heat generated

by the conductive pins (10A and 10B) increases.

[0074] A plug according to a sixth aspect of the present invention can be achieved by a combination with any one of the second to fifth aspects. According to the sixth aspect, the plug further includes a plug body (30) which houses the fuse holder (50), the first temperature sensor element (40A), and the second temperature sensor element (40B). The plug body (30) has a first surface (311) and a second surface (331) in the first direction. The first conductive pin (10A) and the second conductive pin (10B) are attached to the plug body (30) such that a tip of the first conductive pin (10A) and a tip of the second conductive pin (10B) protrude from the first surface (311) of the plug body (30). The first temperature sensor element (40A) and the second temperature sensor element (40B) are located closer to the first surface (311) than to the second surface (331).

[0075] With the plug according to the sixth aspect, the temperature sensor elements (40A and 40B) can be located further closer to the tips of the conductive pins (10A and 10B). In general, heat generation by the conductive pins (10A and 10B) occurs at the tip side. Thus, the accuracy of detection of heat generated by the conductive pins (10A and 10B) increases.

[0076] A plug according to a seventh aspect of the present invention can be achieved by a combination with any one of the second to sixth aspects. According to the seventh aspect, the fuse holder (50) includes: a first terminal (51) which holds a first end (71) of the fuse (70); and a second terminal (52) which holds a second end (72) of the fuse (70). The first terminal (51) is spaced apart from the first conductive pin (10A) in the third direction. The second terminal (52) is spaced apart from the second conductive pin (10B) in the third direction.

[0077] The plug according to the seventh aspect enables accurate detection of heat generated by the first and second conductive pins (10A and 10B). Moreover, the plug according to the seventh aspect reduces the possibility of causing confusion of heat generated by the fuse (70) with heat generated by the first and second conductive pins (10A and 10B).

[0078] A plug according to an eighth aspect of the present invention can be achieved by a combination with the seventh aspect. According to the eighth aspect, the specific conductive pin (10) is the first conductive pin (10A). The first terminal (51) is electrically connected to the first conductive pin (10A). The second terminal (52) has a portion (522) for electrically connecting to a line corresponding to the first conductive pin (10A).

[0079] The plug according to the eighth aspect enables overcurrent protection with a simple structure.

[0080] Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of example only and is not to be taken by way of limitation, the scope of the present invention being limited only by the terms of the appended claims.

[Reference Signs List]

[0081]

10	conductive pin	5
10A	first conductive pin	
10B	second conductive pin	
30	plug body	
311	first surface	
317A	first wall	10
317B	second wall	
331	second surface	
40	temperature sensor element	
40A	first temperature sensor element	
40B	second temperature sensor element	15
44	temperature sensing surface	
50	fuse holder	
51	first terminal	
52	second terminal	
522	line connecting portion (portion)	20
70	fuse	
71	first end	
72	second end	

Claims**1.** A plug comprising:

a plurality of conductive pins having longitudinal directions parallel to one another;
a plurality of temperature sensor elements which are spaced apart from the plurality of conductive pins and detect temperatures of the plurality of conductive pins; and
a fuse holder which holds a fuse that blows when overcurrent flows through a specific conductive pin among the plurality of conductive pins, wherein each of the plurality of temperature sensor elements is located closer to a corresponding conductive pin among the plurality of conductive pins than to the fuse holder, and not between the fuse holder and the corresponding conductive pin.

2. The plug according to claim 1, wherein the plurality of conductive pins include a first conductive pin and a second conductive pin, the plurality of temperature sensor elements include a first temperature sensor element which detects a temperature of the first conductive pin and a second temperature sensor element which detects a temperature of the second conductive pin, the first conductive pin and the second conductive pin have longitudinal directions parallel to a first direction, and are spaced apart from one another in a second direction orthogonal to the first direction, the fuse holder is spaced apart from the first conduc-

tive pin and the second conductive pin in a third direction orthogonal to the first direction and the second direction,
the first temperature sensor element is located closer to the first conductive pin than to the fuse holder, and not between the fuse holder and the first conductive pin, and
the second temperature sensor element is located closer to the second conductive pin than to the fuse holder, and not between the fuse holder and the second conductive pin.

3. The plug according to claim 2, wherein the first temperature sensor element is located on an opposite side of the first conductive pin from the fuse holder, and the second temperature sensor element is located on an opposite side of the second conductive pin from the fuse holder.

4. The plug according to claim 2 or 3, wherein each of the first conductive pin and the second conductive pin has a rectangular bar shape, the first conductive pin and the second conductive pin have thickness directions parallel to the third direction,
each of the first temperature sensor element and the second temperature sensor element has a temperature sensing surface which is flat,
the temperature sensing surface of the first temperature sensor element faces the first conductive pin in the third direction, and
the temperature sensing surface of the second temperature sensor element faces the second conductive pin in the third direction.

5. The plug according to any one of claims 2 to 4, further comprising
a first wall and a second wall which are electrically insulating,
wherein the first wall is located between the first conductive pin and the first temperature sensor element, and
the second wall is located between the second conductive pin and the second temperature sensor element.

6. The plug according to any one of claims 2 to 5, further comprising
a plug body which houses the fuse holder, the first temperature sensor element, and the second temperature sensor element,
wherein the plug body has a first surface and a second surface in the first direction,
the first conductive pin and the second conductive pin are attached to the plug body such that a tip of the first conductive pin and a tip of the second conductive pin protrude from the first surface of the plug

body, and
the first temperature sensor element and the second
temperature sensor element are located closer to
the first surface than to the second surface.

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7. The plug according to any one of claims 2 to 6,
wherein the fuse holder includes:

a first terminal which holds a first end of the fuse;
and
a second terminal which holds a second end of
the fuse,

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the first terminal is spaced apart from the first con-
ductive pin in the third direction, and
the second terminal is spaced apart from the second
conductive pin in the third direction.

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8. The plug according to claim 7,
wherein the specific conductive pin is the first con-
ductive pin,
the first terminal is electrically connected to the first
conductive pin, and
the second terminal has a portion for electrically con-
necting to a line corresponding to the first conductive
pin.

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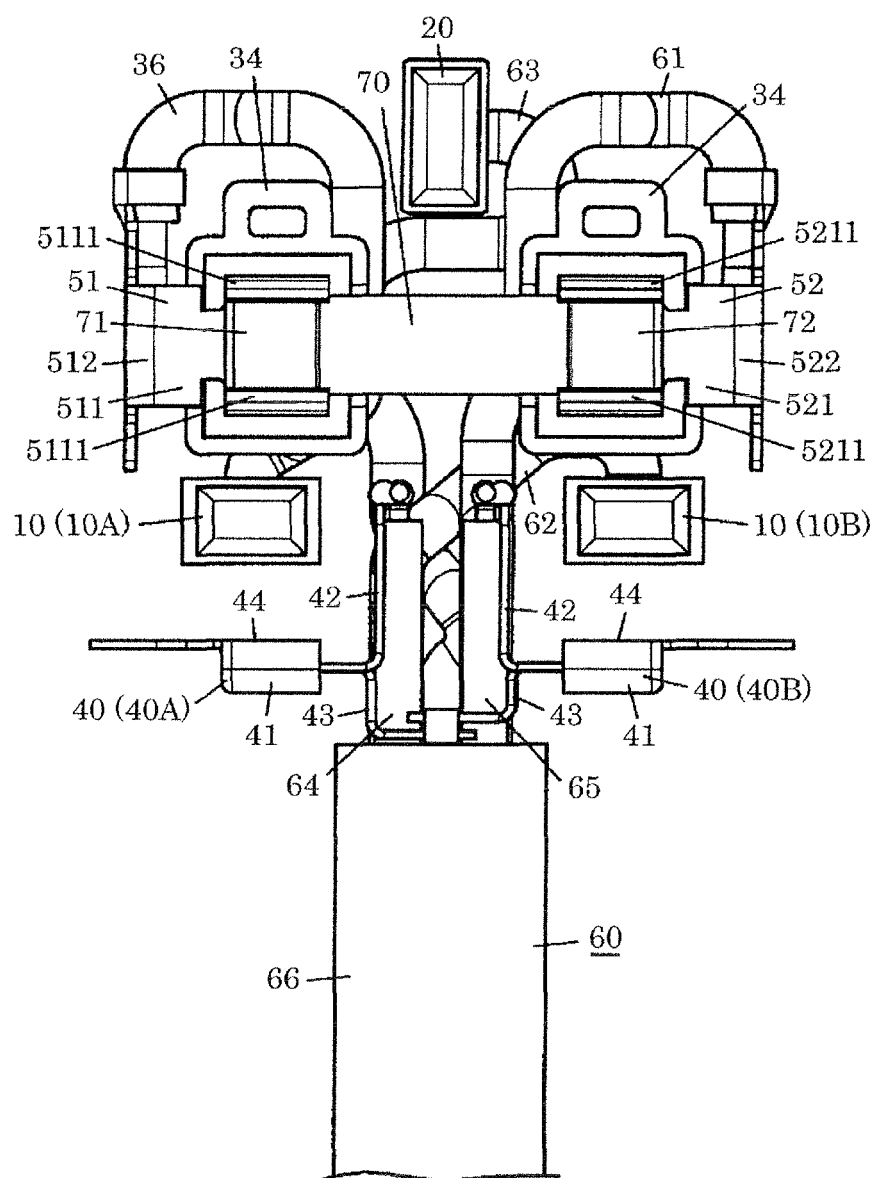
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FIG. 1



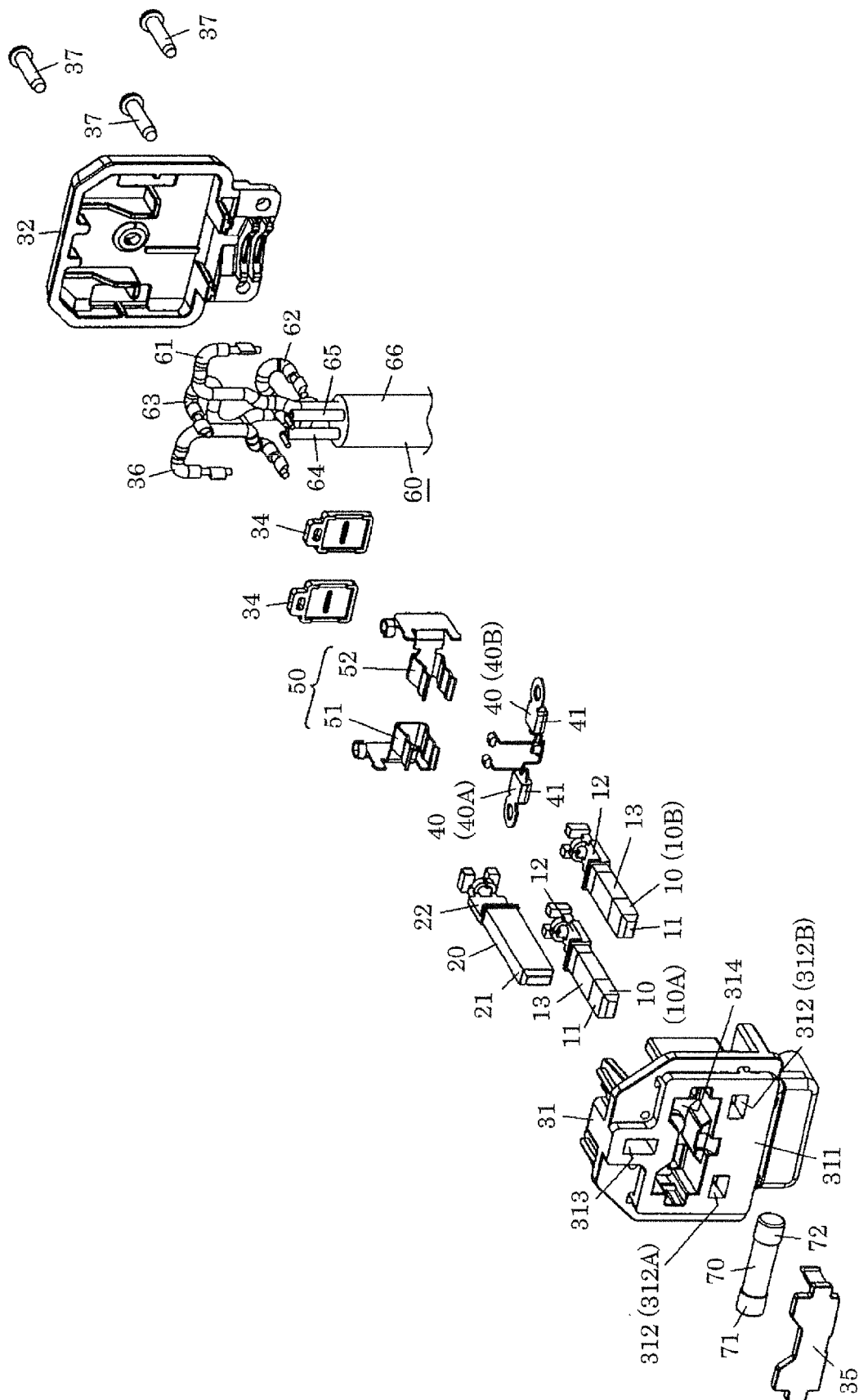


FIG. 2

FIG. 3

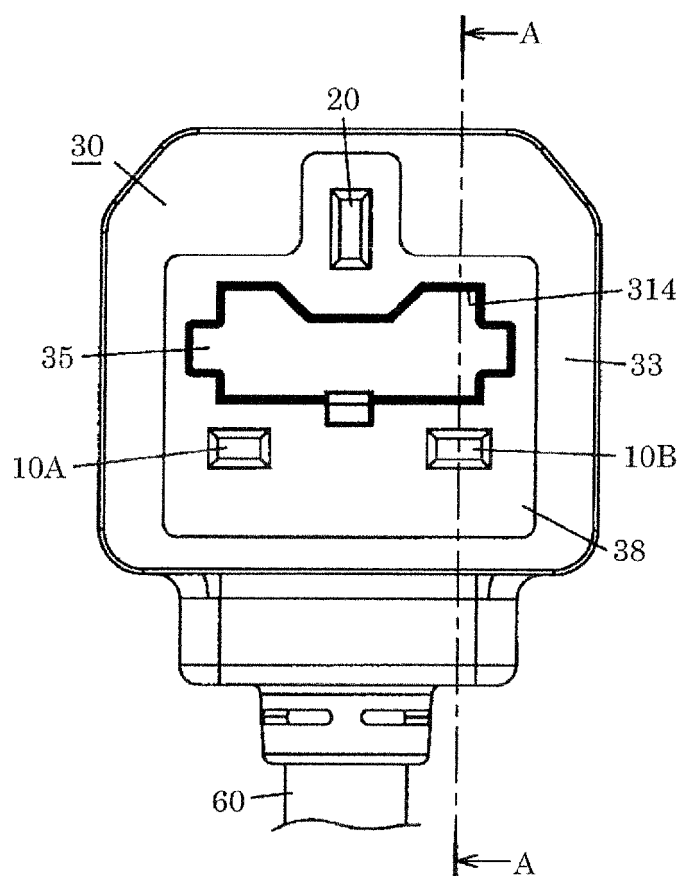


FIG. 4

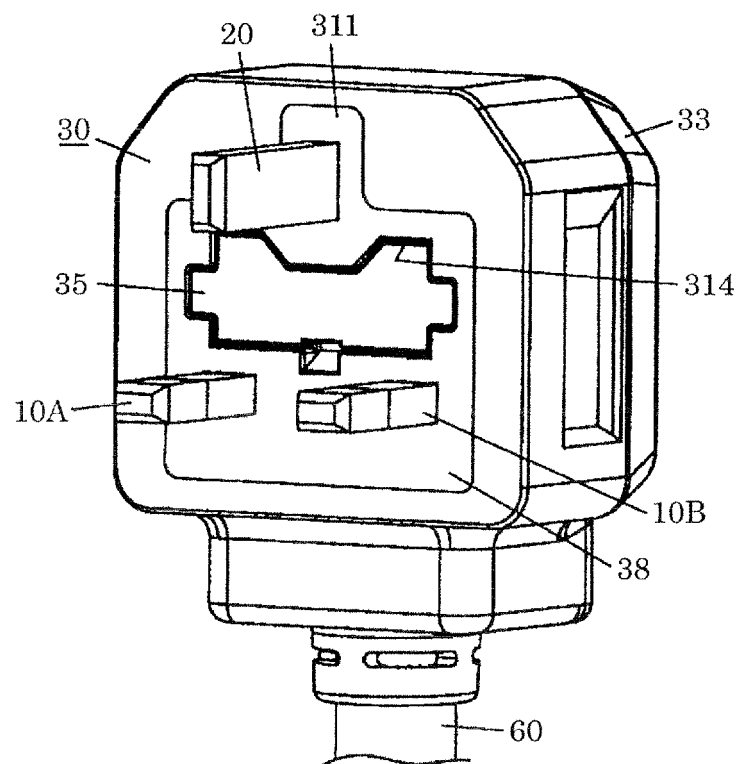


FIG. 5

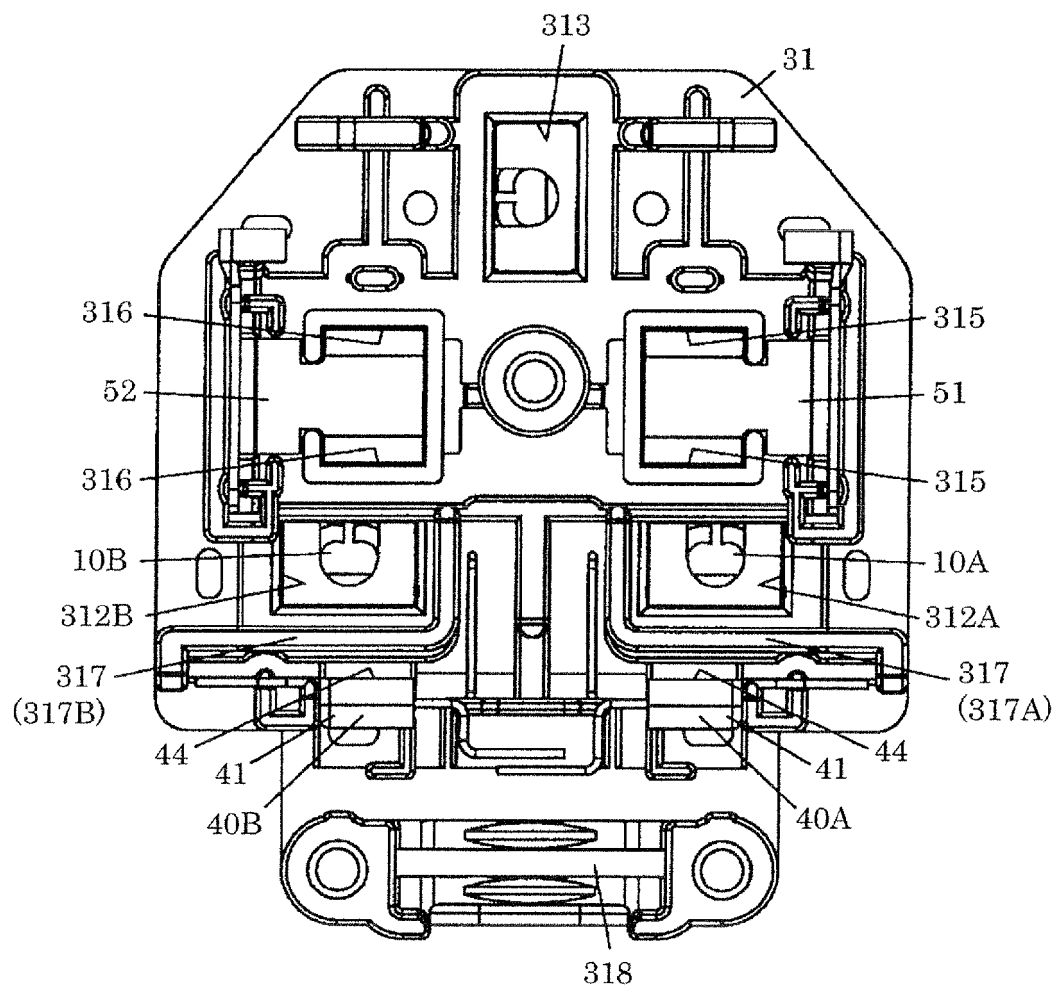
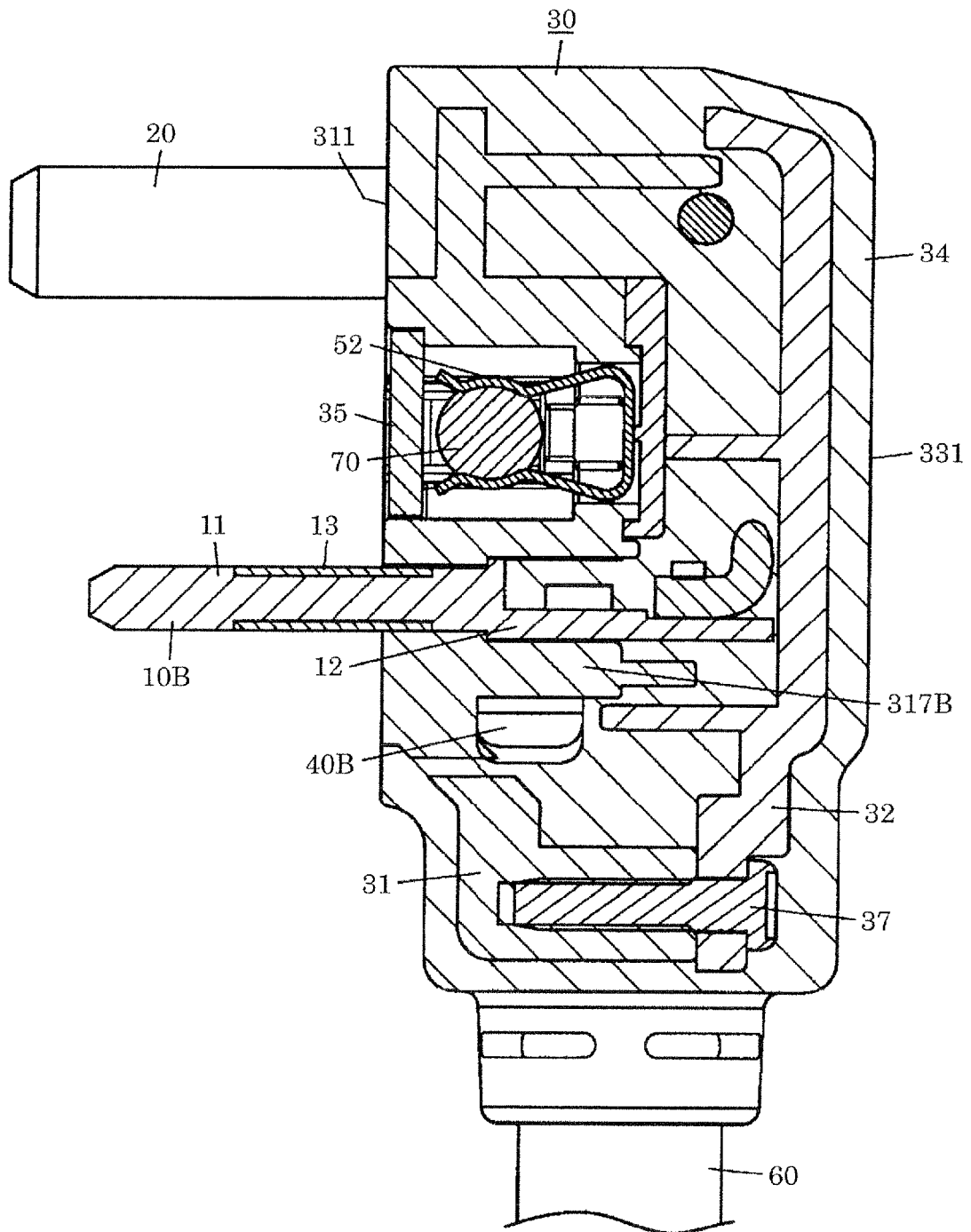


FIG. 6





EUROPEAN SEARCH REPORT

Application Number
EP 16 16 0663

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			TECHNICAL FIELDS SEARCHED (IPC)
			H01R
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 16 August 2016	Examiner Hugueny, Bertrand
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16-08-2016

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