



(11) **EP 3 439 113 A1**

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

(43) Date of publication:
06.02.2019 Bulletin 2019/06

(51) Int Cl.:
H01R 9/00 (2006.01) H01R 4/48 (2006.01)

(21) Application number: **17896554.7**

(86) International application number:
PCT/JP2017/045957

(22) Date of filing: **21.12.2017**

(87) International publication number:
WO 2018/150727 (23.08.2018 Gazette 2018/34)

(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 TN

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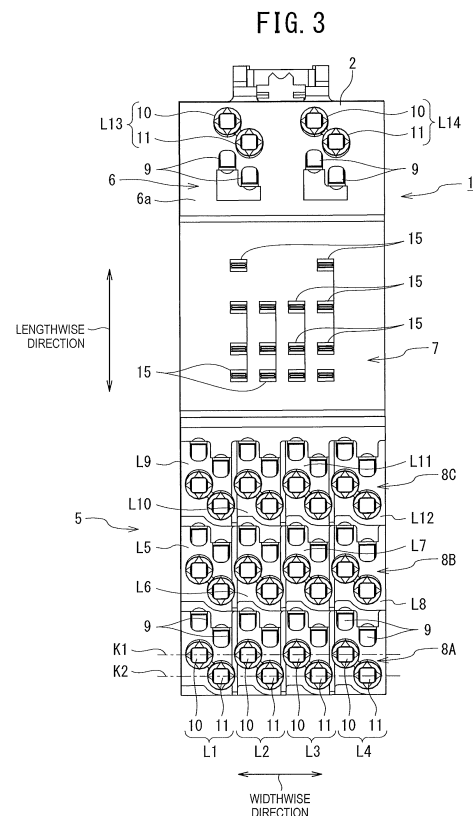
(30) Priority: **16.02.2017 JP 2017026723**

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(54) **LEAD WIRE TERMINAL BLOCK AND ELECTRIC APPARATUS CONNECTION SOCKET PROVIDED WITH SAME**

(57) A lead wire terminal block includes: a plurality of lead wire insertion holes L1 to L12 formed in terminal surfaces (8A to 8C) of a case (2); and a plurality of lead wire connection portions (H1 to H12) that is provided in the case and electrically connects cores (35, 36) of lead wires inserted into the lead wire insertion holes to contact points. The plurality of lead wire insertion holes is arranged in zigzag.



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Description

Technical Field

[0001] The present invention relates to a lead wire terminal block to which a large number of lead wires are connected and an electric device connection socket including the lead wire terminal block.

Background Art

[0002] For example, a device disclosed in PTL 1 is known as an electric device connection socket.

[0003] The electric device connection socket disclosed in PTL 1 is a device that connects an electric device, such as a relay or a timer, to an external circuit through lead wires and includes an electric device terminal block and a lead wire terminal block.

[0004] In the electric device terminal block, a terminal surface is formed in a surface of a case and plug-in terminal insertion holes are formed in the terminal surface. Connection portions connected to plug-in terminals inserted into the plug-in terminal insertion holes are provided in the case.

[0005] In the lead wire terminal block, terminal surfaces are formed in the surface of the case in a plurality of stages and lead wire insertion holes are formed in the terminal surface in each stage. Connection portions connected to cores of lead wires inserted into the lead wire insertion holes are provided in the case.

[0006] In addition, relay conductive plates for electrically connecting the connection portions of the electric device terminal block and the connection portions of the lead wire terminal block are provided in the case.

[0007] However, for example, in an electric device connection socket including a relay with 4-pole contact points, since a large number of plug-in terminals (14 plug-in terminals in a relay with 4-pole contact points) protrude, a large number of plug-in terminal insertion holes and a large number of connection portions are provided in a relay terminal block (electric device terminal block) and lead wire insertion holes and connection portions corresponding to the number of relay terminal portions need to be provided in a lead wire terminal block.

[0008] In general, each of the lead wire insertion holes provided in the lead wire terminal block includes a set of two lead wire insertion holes, that is, a hole into which a signal lead wire is inserted and a hole into which a distribution lead wire (for a contact point with a different pole in the same socket and for a crossover wire) is inserted.

Citation List

Patent Literature

[0009] PTL 1: JP 2002-298943 A

Summary of Invention

Technical Problem

[0010] In the lead wire terminal block of the electric device connection socket including a relay with multi-pole contact points (for example, a relay with 4-pole contact points), a large number of lead wires, such as signal lines and distribution lines, are connected while being closely spaced, as described above. Therefore, it is difficult to easily check the display of symbols or characters on mark tubes attached to the ends of the lead wires.

[0011] Accordingly, an object of the invention is to provide a lead wire terminal block that enables a user to easily check the display of a mark tube attached to the end of each lead wire even in a case in which a large number of lead wires are connected and an electric device connection socket including the lead wire terminal block.

Solution to Problem

[0012] In order to achieve the object, a lead wire terminal block according to an aspect of the invention includes a plurality of lead wire insertion holes formed in a terminal surface of a case; and a plurality of lead wire connection portions provided in the case, the plurality of lead wire connection portions electrically connecting cores of lead wires inserted into the lead wire insertion holes to contact points. The plurality of lead wire insertion holes is arranged in zigzag.

[0013] In particular, the plurality of lead wire insertion holes is formed on two reference lines extending in parallel along the terminal surface. The lead wire insertion holes formed on one of the two reference lines and the lead wire insertion holes formed on the other of the two reference lines are arranged in zigzag not to be aligned in a direction perpendicular to the reference lines.

[0014] An electric device connection socket including the lead wire terminal block according to the aspect of the invention includes an electric device terminal block having an electric device connection portion configured to electrically connect an electric device such as a relay or a timer, the lead wire terminal block, and a relay conductive member configured to electrically connect the electric device connection portion and the lead wire connection portion.

Advantageous Effects of Invention

[0015] The lead wire terminal block and the electric device connection socket including the lead wire terminal block according to the invention enable the user to easily check the display of a mark tube attached to the end of each lead wire even in a case in which a large number of lead wires are connected.

Brief Description of Drawings

[0016]

FIG. 1 is a perspective view illustrating the front of an electric device connection socket according to a first embodiment of the invention;

FIG. 2 is a perspective view illustrating the side and back of the electric device connection socket according to the first embodiment of the invention;

FIG. 3 is a plan view illustrating the electric device connection socket according to the first embodiment of the invention;

FIG. 4 is a diagram illustrating the inside of the electric device connection socket according to the first embodiment of the invention;

FIG. 5 is a perspective view illustrating a lead connection portion provided in the electric device connection socket according to the first embodiment of the invention;

FIG. 6 is a perspective view illustrating a conductive metal part forming the lead connection portion illustrated in FIG. 6;

FIG. 7 is a perspective view illustrating a spring member forming the lead connection portion illustrated in FIG. 6;

FIG. 8 is a diagram illustrating the opening position of a lead wire insertion hole and a tool insertion hole with respect to the lead wire connection portion; and FIG. 9A is a diagram illustrating a plurality of lead wire insertion holes according to the invention which is arranged in zigzag and FIG. 9B is a diagram illustrating a device according to the related art in which a plurality of lead wire insertion holes is arranged in a straight line.

Description of Embodiments

[0017] Hereinafter, a first embodiment of the invention will be described with reference to the drawings. In the following description of the drawings, the same or similar portions are denoted by the same or similar numerical numbers. However, it is noted that the drawings are schematic and, for example, the relationship between a thickness and planar dimensions and the ratio of the thicknesses of layers are different from the actual ones. Therefore, specific thicknesses or dimensions need to be determined in consideration of the following description. In addition, the drawings may include portions that have different dimensional relationships and ratios.

[0018] The first embodiment which will be described below illustrates a device or a method for embodying the technical idea of the invention. The technical idea of the invention does not limit, for example, the materials, shapes, structures, and arrangements of components to the following. The technical idea of the invention can be modified in various ways within the technical scope defined by the claims.

[0019] FIG. 1 is a perspective view illustrating the front of an electric device connection socket (hereinafter, referred to as a socket) 1 according to the first embodiment which is formed in a rectangular parallelepiped shape in appearance. FIG. 2 is a perspective view illustrating the side and back of the socket 1. FIG. 3 is a plan view illustrating the socket 1. In FIGS. 1 to 3 and other drawing, a longitudinal direction of socket is referred to as a lengthwise direction and a direction perpendicular to the lengthwise direction is referred to as a widthwise direction.

[0020] The socket 1 includes a case 2 made of a synthetic resin and a base 3.

[0021] Rail attachment portions 4a and 4b are provided in the base 3. The rail attachment portions 4a and 4b are members that are used to attach the socket 1 to rails provided on a distribution board (not illustrated) so as to be detachable.

[0022] A first lead wire terminal block 5 is formed at one end of the socket 1 in the longitudinal direction. A second lead wire terminal block 6 is formed at the other end of the socket 1 in the longitudinal direction. A relay terminal block 7 is provided at the bottom of a concave portion that is formed between the first lead wire terminal block 5 and the second lead wire terminal block 6.

[0023] The first lead wire terminal block 5 has first to third terminal surfaces 8A, 8B, and 8C which are formed in a surface of the case 2 in a plurality of stages with different heights.

[0024] In this embodiment, the socket includes a plurality of lead wire insertion holes that are formed in a terminal surface of the case and a plurality of lead wire connection portions that are provided in the case and electrically connect cores of the lead wires inserted into the lead wire insertion holes to contact points. The plurality of lead wire insertion holes are arranged in zigzag.

[0025] As illustrated in FIGS. 1 and 3, four first to fourth lead wire insertion holes L1 to L4 are formed in the first terminal surface 8A which is the lowest terminal surface among the first to third terminal surfaces 8A, 8B, and 8C so as to be arranged in a line in the widthwise direction. In addition, a plurality of tool insertion holes 9 corresponding to the first to fourth lead wire insertion holes L1 to L4 are formed in the first terminal surface 8A at positions that are closer to the second terminal surface 8B than the first to fourth lead wire insertion holes L1 to L4 so as to be arranged in a line in the widthwise direction.

[0026] The first lead wire insertion hole L1 includes two holes, that is, a signal line insertion hole 10 and a distribution line insertion hole 11. Similarly, each of the second to fourth lead wire insertion holes L2 to L4 includes two holes, that is, the signal line insertion hole 10 and the distribution line insertion hole 11. In this embodiment, the insertion hole 10 is a signal line insertion hole and the insertion hole 11 is a distribution line insertion hole. However, the insertion hole 10 may be the distribution line insertion hole and the insertion hole 11 may be the signal line insertion hole.

[0027] As illustrated in FIG. 3, the first to fourth signal

line insertion holes 10 of the first to fourth lead wire insertion holes L1 to L4 are formed on a first reference line K1 that extends in the widthwise direction at regular intervals. The first to fourth distribution line insertion holes 11 of the first to fourth lead wire insertion holes are formed

on a second reference line K2 that is parallel to the first reference line K1 in the lengthwise direction and extends in the widthwise direction at regular intervals.
[0028] The first to fourth distribution line insertion holes 11 on the second reference line K2 are formed at positions that deviate from the first to fourth signal line insertion holes 10 on the first reference line K1 in the widthwise direction. Therefore, the first to fourth distribution line insertion holes 10 and the first to fourth distribution line insertion holes 11 forming the first to fourth lead wire insertion holes L1 to L4 are formed so as to be arranged in zigzag in the widthwise direction.

[0029] Eight tool insertion holes 9 are formed at positions that are separated from the first to fourth distribution line insertion 10 and the first to fourth distribution line insertion holes 11 in the lengthwise direction and are matched with the insertion holes in the widthwise direction so as to be arranged in zigzag in the widthwise direction.

[0030] The second terminal surface 8B and the third terminal surface 8C have the same structure as the first terminal surface 8A.

[0031] That is, four fifth to eighth lead wire insertion holes L5 to L8 are formed in the second terminal surface 8B so as to be arranged in a line in the widthwise direction. A plurality of tool insertion holes 9 corresponding to the fifth to eighth lead wire insertion holes L5 to L8 are formed in the second terminal surface 8B at positions that are closer to the third terminal surface 8C than the fifth to eighth lead wire insertion holes L5 to L8 so as to be arranged in a line in the widthwise direction.

[0032] Each of the four fifth to eighth lead wire insertion holes L5 to L8 formed in the second terminal surface 8B includes two holes, that is, the signal line insertion hole 10 and the distribution line insertion hole 11. The signal line insertion holes 10 and the distribution line insertion holes 11 are formed so as to be arranged in zigzag in the widthwise direction.

[0033] Eight tool insertion holes 9 corresponding to the fifth to eighth lead wire insertion holes L5 to L8 are formed at positions that are separated from the fifth to eighth distribution line insertion 10 and the eighth to eighth distribution line insertion holes 11 in the lengthwise direction and are matched with the insertion holes in the widthwise direction so as to be arranged in zigzag in the widthwise direction.

[0034] In addition, four ninth to twelfth lead wire insertion holes L9 to L12 are formed in the third terminal surface 8C so as to be arranged in a line in the widthwise direction. A plurality of tool insertion holes 9 corresponding to the ninth to twelfth lead wire insertion holes L9 to L12 are formed in the third terminal surface 8C at positions that are closer to the relay terminal block 7 than the

ninth to twelfth lead wire insertion holes L9 to L12 so as to be arranged in a line in the widthwise direction.

[0035] Each of the four ninth to twelfth lead wire insertion holes L9 to L12 formed in the second terminal surface 8B includes two holes, that is, the signal line insertion hole 10 and the distribution line insertion hole 11. The signal line insertion holes 10 and the distribution line insertion holes 11 are formed so as to be arranged in zigzag in the widthwise direction.

[0036] Eight tool insertion holes 9 corresponding to the ninth to twelfth lead wire insertion holes L9 to L12 are formed at positions that are separated from the ninth to twelfth distribution line insertion 10 and the ninth to twelfth distribution line insertion holes 11 in the lengthwise direction and are matched with the insertion holes in the widthwise direction so as to be arranged in zigzag in the widthwise direction.

[0037] In a terminal surface 6a of the second lead wire terminal block 6 formed at the other end of the socket 1 in the longitudinal direction, a thirteenth lead wire insertion hole L13 and a fourteenth lead wire insertion hole L14 are formed and the tool insertion holes 9 are formed at positions that are closer to the relay terminal block 7 than the thirteenth and fourteenth lead wire insertion holes L13 and L14 so as to be arranged in a line in the widthwise direction.

[0038] Each of the thirteenth lead wire insertion hole L13 and the fourteenth lead wire insertion hole L14 includes two holes, that is, the signal line insertion hole 10 and the distribution line insertion hole 11, similarly to, for example, the first lead wire insertion holes L1 formed in the first terminal surface 8A.

[0039] The tool insertion holes 9 are formed at positions that are separated from the signal line insertion holes 10 and the distribution line insertion holes 11 of the thirteenth lead wire insertion hole L13 and the fourteenth lead wire insertion hole L14 in the lengthwise direction and are matched with the insertion holes in the widthwise direction.

[0040] An electric device terminal block that electrically connects an electric device, such as a relay or a timer, is formed between the first lead wire terminal block 5 and the second lead wire terminal block 6. In this embodiment, the relay terminal block 7 is formed as the electric device terminal block. Fourteen plug-in terminal insertion holes 15 are formed in a terminal surface 7a of the relay terminal block 7.

[0041] Next, FIG. 4 illustrates the internal structure of the socket 1 from which the case 2 has been detached. A lead wire connection portion according to this embodiment includes a conductive metal part in which a contact point is provided and a spring member biasing a core of a lead wire to the conductive metal part.

[0042] First to twelfth lead wire connection portions H1 to H12 forming the first lead wire terminal block 5, thirteenth and fourteenth lead wire connection portions H13 and H14 forming the second lead wire terminal block 6, fourteen plug-in terminal connection portions 16 forming

the relay terminal block 7, and a plurality of relay conductive plates 18a, 18b, and 18c electrically connecting the first to fourteenth lead wire connection portions H1 to H14 and the fourteen plug-in terminal connection portions 16 are provided on the base 3.

[0043] As illustrated in FIG. 5, the first lead wire connection portion H1 includes a conductive metal part 21 that is fixed to the base 3 and a spring member 22 that is integrally attached to the conductive metal part 21.

[0044] As illustrated in FIG. 6, the conductive metal part 21 is a member formed by bending a metal flat plate in a substantially cylindrical shape and includes a spring member surface contact portion 23, a relay plate connection portion 24, a pair of spring member locking pieces 25, a first extension portion 26, a first fixed contact point 27 which is a first contact point, a second extension portion 28, a second fixed contact point 29 which is a second contact point, and a spring support piece 30.

[0045] That is, the relay plate connection portion 24 extends from a lower part of the spring member surface contact portion 23 with a flat plate shape and the spring support piece 30 extends from an upper part of the spring member surface contact portion 23.

[0046] The first extension portion 26 is bent from one side edge of the spring member surface contact portion 23 at a right angle and extends. The second extension portion 28 is bent from the other side edge of the spring member surface contact portion 23 at a right angle so as to be parallel to the first extension portion 26 and extends so as to be longer than the first extension portion 26.

[0047] The pair of spring member locking pieces 25 bent in the direction in which the spring member locking pieces 25 become closer to each other are formed in the lower parts of the first extension portion 26 and the second extension portion 28 which are close to the spring member surface contact portion 23.

[0048] The first fixed contact point 27 that is bent so as to be parallel to the spring member surface contact portion 23 is formed at the leading end of the first extension portion 26. The second fixed contact point 29 that is bent so as to be parallel to the first fixed contact point 27 is formed at the leading end of the second extension portion 28.

[0049] As illustrated in FIG. 7, the spring member 22 is a member formed by bending a conductive metal plate and includes a conductive metal part surface contact portion 31 with a flat plate shape, a conductive metal part locking concave portion 32 that is formed in a lower part of the conductive metal part surface contact portion 31, and first and second elastic portions 33 and 34 that extend from an upper part of the conductive metal part surface contact portion 31 in a strip shape and are bent substantially in the same direction.

[0050] The first elastic portion 33 includes a protruding portion 33a that protrudes to one surface 31a of the conductive metal part surface contact portion 31, a bent portion 33b that is bent from the protruding portion 33a at an interior angle less than 90°, and a first movable contact

33c that linearly extends from the bent portion 33b.

[0051] The second elastic portion 34 includes a straight extension portion 34a that linearly extends from the upper part of the conductive metal part surface contact portion 31, a bent portion 34b that is bent from the straight extension portion 34a at an interior angle less than 90°, and a second movable contact 34c that linearly extends from the bent portion 34b.

[0052] In order to integrally attach the spring member 22 to the conductive metal part 21, the conductive metal part surface contact portion 31 of the spring member 22 is inserted into a cylindrical space of the conductive metal part 21 and the pair of spring member locking pieces 25 of the conductive metal part 21 are locked to the conductive metal part locking concave portions of the spring member 22 while being elastically deformed, with the conductive metal part surface contact portion 31 coming into surface contact with the spring member surface contact portion 23 of the conductive metal part 21. In a state in which the spring member 22 is integrally attached to the conductive metal part 21, the leading end of the first movable contact 33c of the first elastic portion 33 as a first movable contact point 33d comes into contact with the first fixed contact point 27 and the leading end of the second movable contact 34c of the second elastic portion 34 as a second movable contact point 34d comes into contact with the second fixed contact point 29.

[0053] The second to fourteenth lead wire connection portions H2 to 14 have the same structure as the first lead wire connection portion H1.

[0054] FIG. 8 illustrates the opening positions of the first to fourth lead wire insertion holes L1 to L4 and the tool insertion holes 9 formed in the first terminal surface 8A of the case 2 with respect to the first to fourth lead wire connection portions H1 to H4 forming the first lead wire terminal block 5 in the socket 1.

[0055] The signal line insertion hole 10 of the first lead wire insertion hole L1 is open in the vicinity of the first movable contact point 33d of the first lead wire connection portion H1 and the distribution line insertion hole 11 of the first lead wire insertion hole L1 is open in the vicinity of the second movable contact point 34d of the first lead wire connection portion H1. One of two tool insertion holes 9 is open on the base end side of the first movable contact 33c and the other tool insertion hole 9 is open on the base end side of the second movable contact 34c.

[0056] The opening positions of the second to fourth lead wire insertion holes L2 to L4 and the tool insertion holes 9 with respect to the second to fourth lead wire connection portions H1 have the same structure as the opening positions of the first lead wire insertion hole L1 and the tool insertion hole 9 with respect to the first lead wire connection portion H1.

[0057] In addition, the opening positions of the fifth to twelfth lead wire insertion holes L5 to L12 and the tool insertion holes 9 formed in the second and third terminal surfaces 8B and 8C of the case 2 with respect to the fifth to twelfth lead wire connection portions H5 to H12 forming

the first lead wire terminal block 5 have the same structure as the opening positions of the first to fourth lead wire insertion holes L1 to L4 and the tool insertion holes 9 with respect to the first to fourth lead wire connection portions H1 to H4 illustrated in FIG. 8, which is not illustrated in the drawings.

[0058] In the first lead wire terminal block 5 having the above-mentioned structure, signal lines are connected to the first to twelfth lead wire connection portions H1 to H12 as follows. A tool is inserted into the tool insertion hole 9 which is open on the base end side of the first movable contact 33c in the case 2 to elastically deform the first elastic portion 33 such that the first movable contact point 33d of the first movable contact 33c does not come into contact with the first fixed contact point 27. Then, after the signal line is inserted into the signal line insertion hole 10, the elastic deformation of the first elastic portion 33 is released and the core of the signal line is interposed between the first fixed contact point 27 and the first movable contact point 33d of the elastically restored first movable contact 33c. In this way, the signal line is connected.

[0059] In a case in which distribution lines are connected to the first to twelfth lead wire connection portions H1 to H12, a tool is inserted into the tool insertion hole 9 which is open on the base end side of the second movable contact 34c in the case 2 to elastically deform the second elastic portion 34 such that the second movable contact point 34d does not come into contact with the second fixed contact point 29. Then, after the distribution line is inserted into the distribution line insertion hole 11, the elastic deformation of the second elastic portion 34 is released and the core of the distribution line is interposed between the second fixed contact point 29 and the second movable contact point 34d of the elastically restored second movable contact 34c. In this way, the distribution line is connected.

[0060] A lead wire terminal block according to the invention corresponds to the first lead wire terminal block 5. An electric device terminal block according to the invention corresponds to the relay terminal block 7. Two reference lines according to the invention correspond to the first reference line K1 and the second reference line K2.

[0061] FIG. 9A is a diagram schematically illustrating the first terminal surface 8A in a case in which signal lines 35 and distribution lines 36 are connected to the first to fourth lead wire connection portions H1 to H4 of the first lead wire terminal block 5.

[0062] Four signal line insertion holes 10 are formed on the first reference line K1 at regular intervals and four distribution line insertion holes 11 are formed on the second reference line K1 at regular intervals. The eight signal line insertion holes 10 and distribution line insertion holes 11 are formed so as to be arranged in zigzag. Therefore, a distance between the signal line insertion hole 10 and the distribution line insertion hole 11 which are adjacent to each other can be set to D1.

[0063] FIG. 9B illustrates a lead wire terminal block according to the related art in which a plurality of signal line insertion holes S1 and distribution line insertion holes S2 are formed in a straight line on a reference line K3. A distance D2 between the signal line insertion hole S1 and the distribution line insertion hole S2 which are adjacent to each other is less than the distance D1 between the signal line insertion hole 10 and the distribution line insertion hole 11 which are adjacent to each other illustrated in FIG. 9A.

[0064] In many cases, mark tubes on which symbols or characters for identifying the type of each line are displayed are attached to the ends of the signal line 35 and the distribution line 36. In a case in which the distance between the signal line insertion hole 10 and the distribution line insertion hole 11 which are adjacent to each other is the distance D1 as illustrated in FIG. 9B, the signal line 35 and the distribution line 36 to which the mark tubes are attached are connected while being closely spaced. Therefore, it is difficult to easily check the symbol or display of the mark tube.

[0065] In contrast, in the first embodiment illustrated in FIG. 9A, a plurality of signal line insertion holes 10 and distribution line insertion holes 11 are arranged in zigzag and the distance (distance D1) between the signal line insertion hole 10 and the distribution line insertion hole 11 which are adjacent to each other is sufficiently ensured. Therefore, even in a case in which the mark tubes are attached to all of the signal lines 35 and the distribution lines 36 connected to the first lead wire terminal block 5, it is possible to easily check the symbols or display of the mark tubes since the signal lines 35 and the distribution lines 36 are not connected while being closely spaced.

[0066] In a case in which the signal lines 35 and the distribution lines 36 are connected to the fifth to twelfth lead wire connection portions H5 to H12 forming the first lead wire terminal block 5, it is possible to obtain the same effect as that in the case in which the signal lines 35 and the distribution lines 36 are connected to the first to fourth lead wire connection portions H1 to H4.

[0067] In a case in which the signal lines 35 and the distribution lines 36 are connected to or disconnected from the lead wire connection portions H1 to H12, the spring member 22 is elastically deformed by the tool inserted into the tool insertion hole 9 provided in the vicinity of the signal line insertion hole 10 and the distribution line insertion hole 11 to temporarily release the biasing of the spring member 22 such that the first and second movable contact points 33d and 34d can be separated from the first and second fixed contact points 27 and 29.

[0068] In a case in which the signal lines 35 and the distribution lines 36 are connected to the lead wire connection portions H1 to H12, after the signal line 35 and the distribution line 36 are inserted into the signal line insertion hole 10 and the distribution line insertion hole 11, the spring member 22 is elastically restored such that the core of the signal line 35 is interposed between the

first movable contact point 33d and the first fixed contact point 27 and the core of the distribution line is interposed between the second movable contact point 34d and the second fixed contact point 29. In this way, the signal line 35 and the distribution line 36 can be connected. As such, it is possible to facilitate an operation of connecting the signal line 35 and the distribution line 36.

[0069] In each of the lead wire connection portions H1 to H12, the spring member 22 is integrally attached to the conductive metal part 21. Each of the lead wire connection portions H1 to H12 includes the first fixed contact point 27 and the first movable contact point 33d for connecting the signal line 35 and the second fixed contact point 29 and the second movable contact point 34d for connecting the distribution line 36. Therefore, it is possible to reduce the number of components and the cost of the device.

Industrial Applicability

[0070] As described above, the lead wire terminal block and the electric device connection socket including the lead wire terminal block according to the invention make it possible to easily check the display of the mark tube attached to the end of each lead wire even in a case in which a large number of lead wires are connected.

Reference Signs List

[0071]

- 1: socket
- 2: case
- 3: base
- 4a, 4b: rail attachment portion
- 5: first lead wire terminal block
- 6: second lead wire terminal block
- 6a: terminal surface
- 7: relay terminal block
- 7a: terminal surface
- 8A: first terminal surface
- 8B: second terminal surface
- 8C: third terminal surface
- 9: tool insertion hole
- 10: signal line insertion hole
- 11: distribution line insertion hole
- 15: plug-in terminal insertion hole
- 16: plug-in terminal connection portion
- 18a, 18b, 18c: relay conductive plate
- 21: conductive metal part
- 22: spring member
- 23: spring member surface contact portion
- 24: relay plate connection portion
- 25: spring member locking piece
- 26: first extension portion
- 27: first fixed contact point
- 28: second extension portion
- 29: second fixed contact point

- 30: spring support piece
- 31: conductive metal part surface contact portion
- 32: conductive metal part locking concave portion
- 33: first elastic portion
- 33a: protruding portion
- 33b: bent portion
- 33c: first movable contact
- 33d: first movable contact point
- 34: second elastic portion
- 34a: straight extension portion
- 34b: bent portion
- 34c: second movable contact
- 34d: second movable contact point
- 35: signal line
- 36: distribution line
- H1 to H14: first to fourteenth lead wire connection portions
- K1: first reference line
- K2: second reference line
- L1 to L14: first to fourteenth lead wire insertion holes

Claims

1. A lead wire terminal block comprising:
 - a plurality of lead wire insertion holes formed in a terminal surface of a case; and
 - a plurality of lead wire connection portions provided in the case, the plurality of lead wire connection portions electrically connecting cores of lead wires inserted into the lead wire insertion holes to contact points,
- wherein the plurality of lead wire insertion holes is arranged in zigzag.
2. The lead wire terminal block according to claim 1, wherein
 - the plurality of lead wire insertion holes is formed on two reference lines extending in parallel along the terminal surface, and
 - the lead wire insertion holes formed on one of the two reference lines and the lead wire insertion holes formed on the other of the two reference lines are arranged in zigzag not to be aligned in a direction perpendicular to the reference lines.
3. The lead wire terminal block according to claim 1 or 2, wherein
 - each of the plurality of lead wire connection portions includes a conductive metal part in which the contact point is provided and a spring member biasing the core of the lead wire to the conductive metal part.
4. The lead wire terminal block according to claim 3, wherein
 - a plurality of tool insertion holes corresponding to

the plurality of lead wire insertion holes respectively is formed in the terminal surface of the case, and the spring member is configured to be deformed by a tool inserted into the tool insertion hole to temporarily release the biasing of the spring member. 5

5. The lead wire terminal block according to any one of claims 1 to 4, wherein the lead wire connection portion includes a first contact point and a second contact point deviating from each other, and one of two adjacent lead wire insertion holes among the plurality of lead wire insertion holes arranged in zigzag faces the first contact point and the other lead wire insertion hole faces the second contact point. 10 15

6. An electric device connection socket comprising:

an electric device terminal block including an electric device connection portion configured to electrically connect an electric device including a relay or a timer; 20 the lead wire terminal block according to any one of claims 1 to 5; and 25 a relay conductive member configured to electrically connect the electric device connection portion and the lead wire connection portion.

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FIG. 1

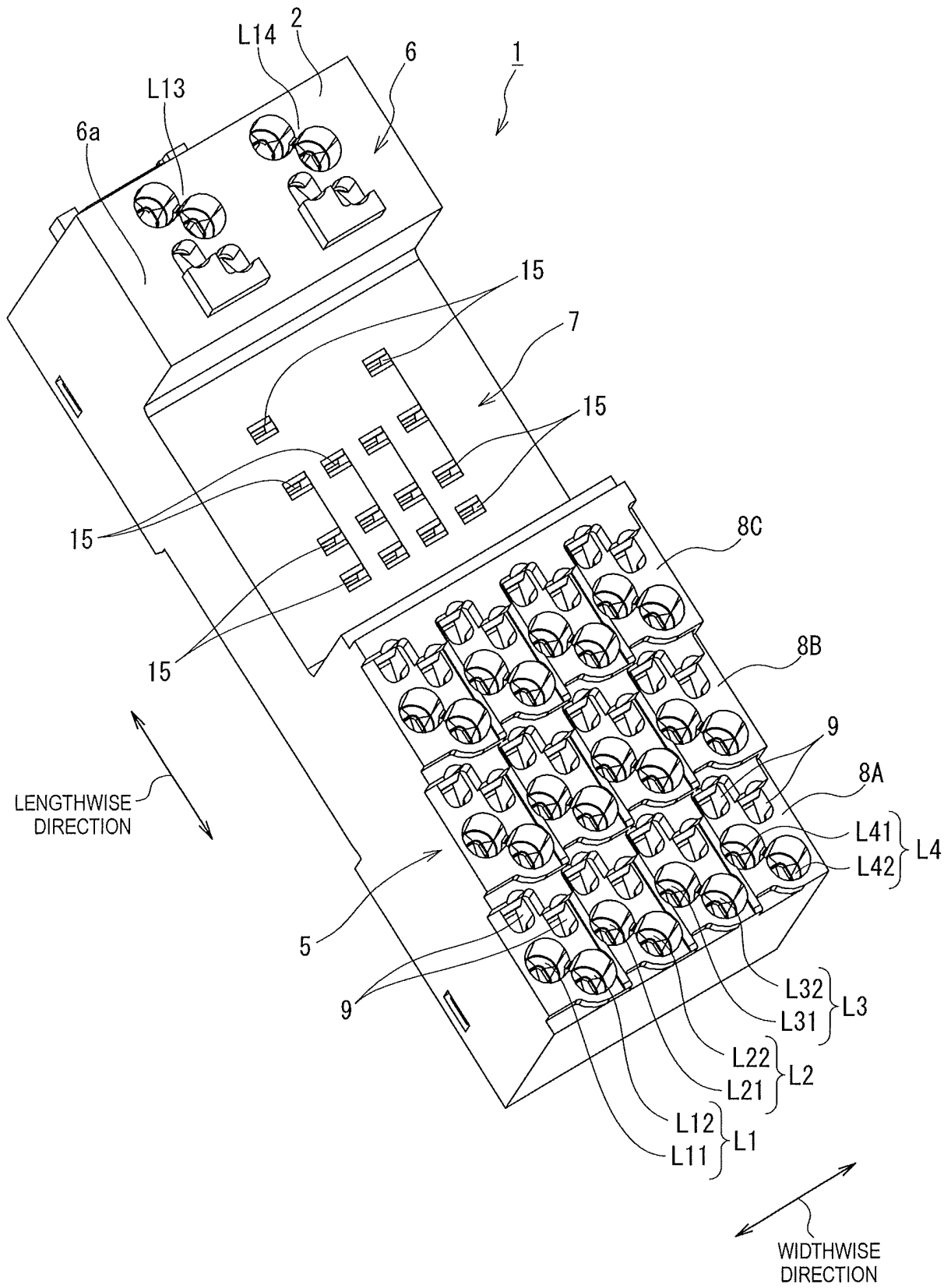


FIG. 2

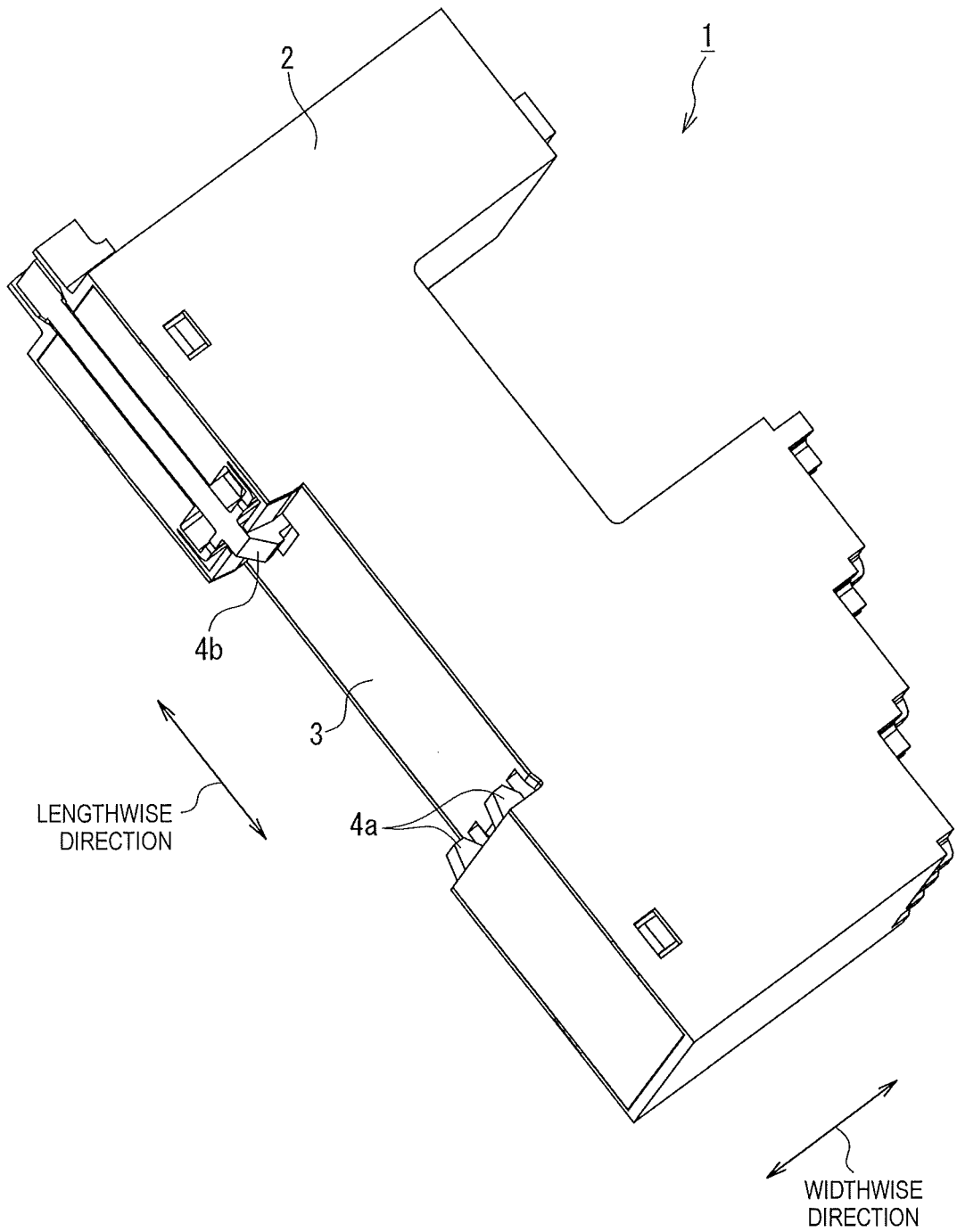


FIG. 3

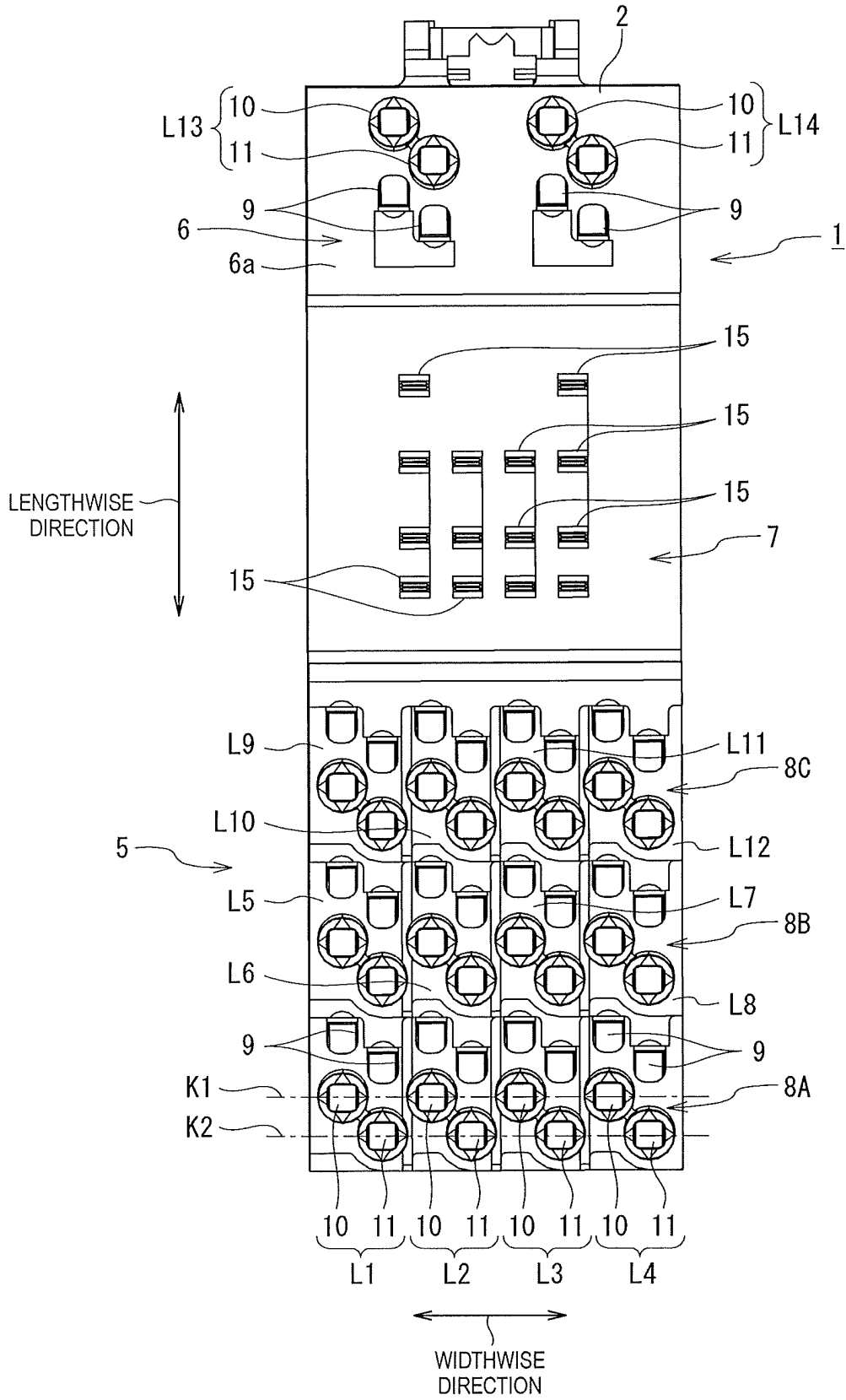


FIG. 4

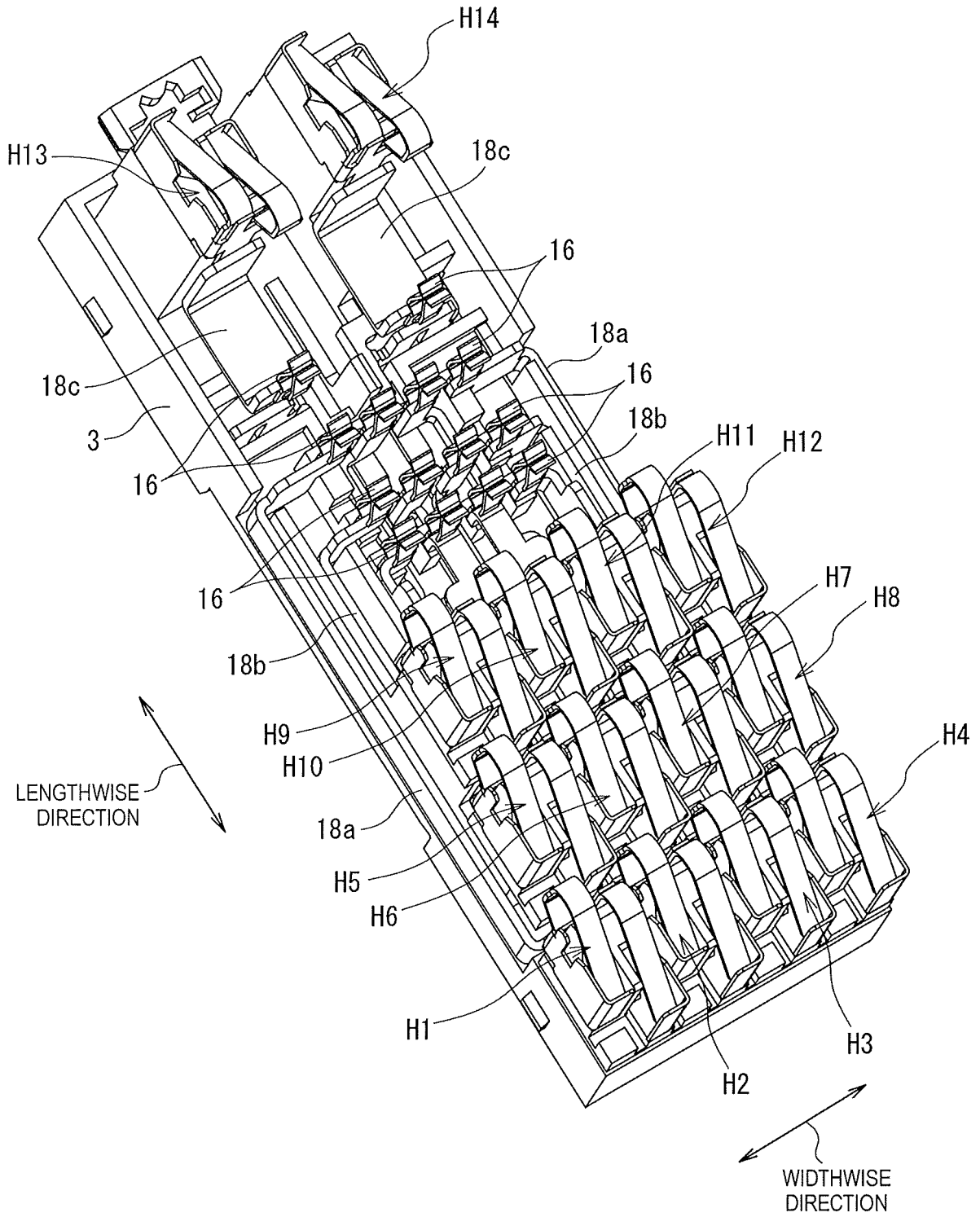


FIG. 5

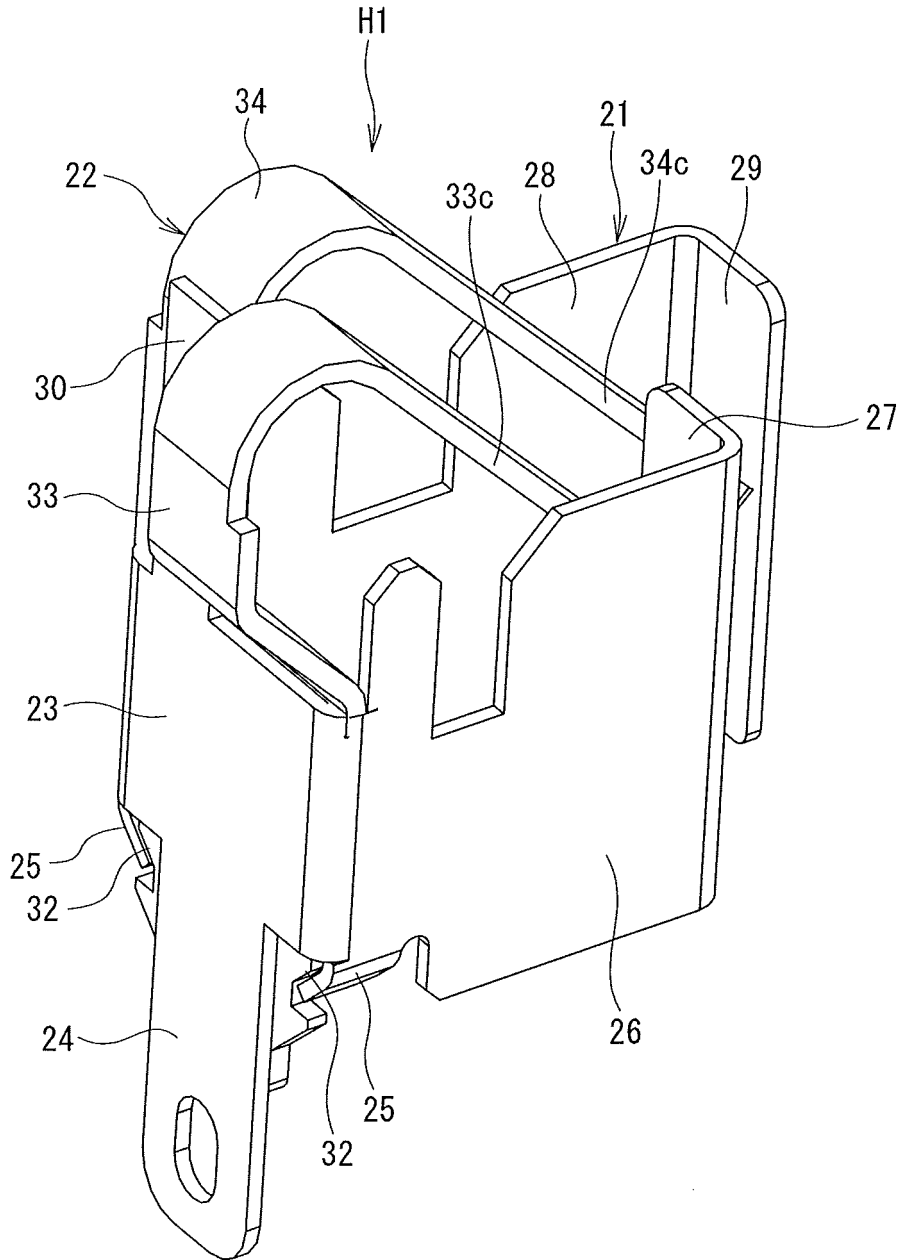


FIG. 6

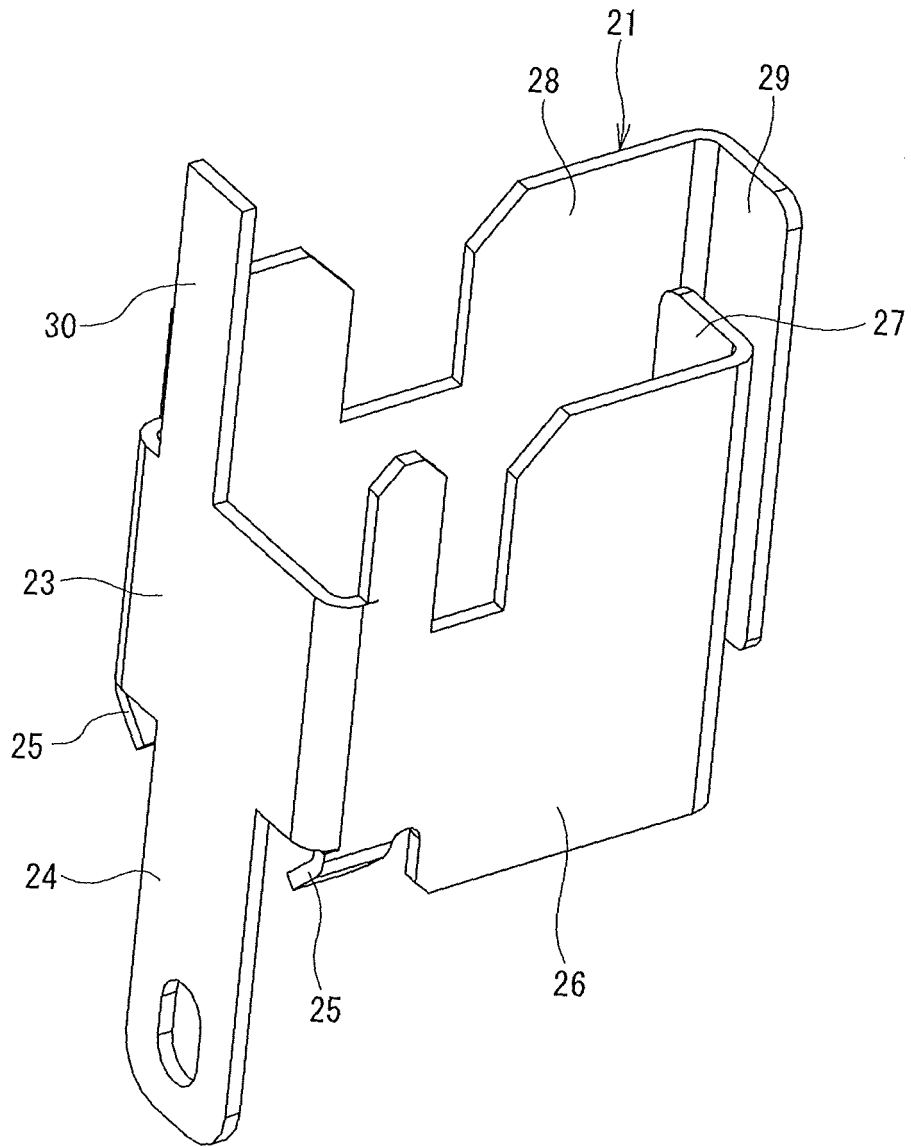


FIG. 7

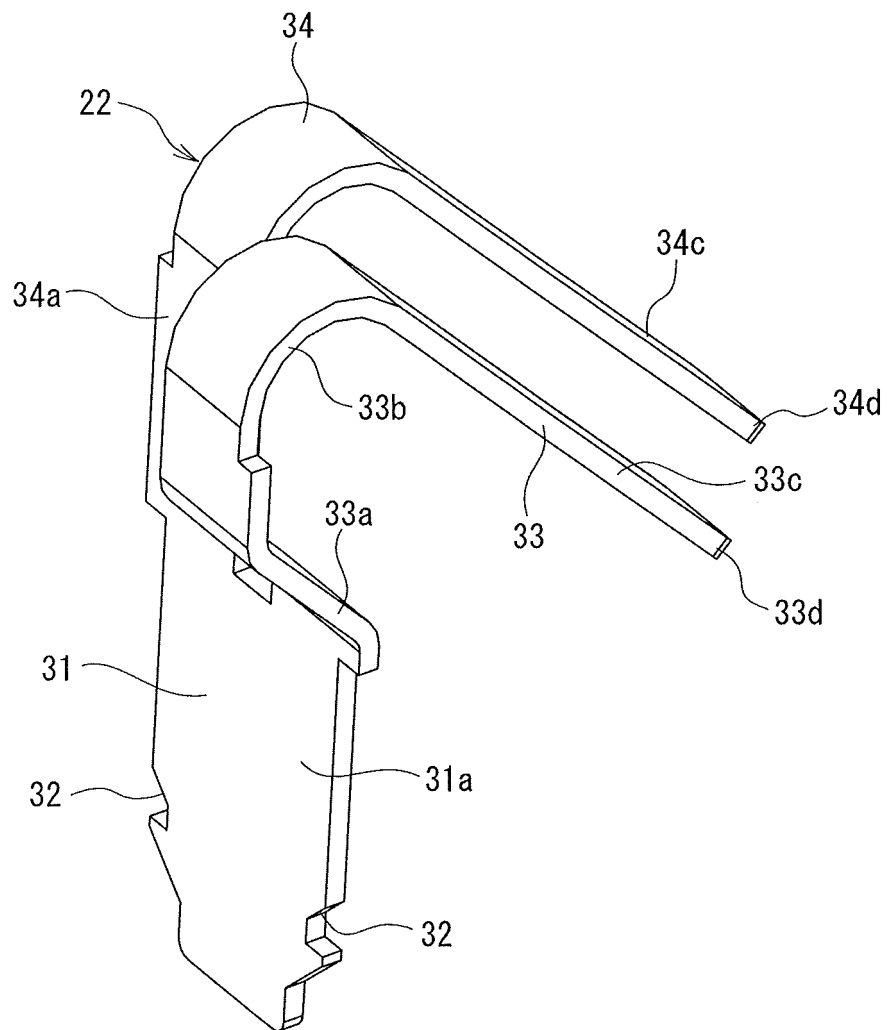


FIG. 8

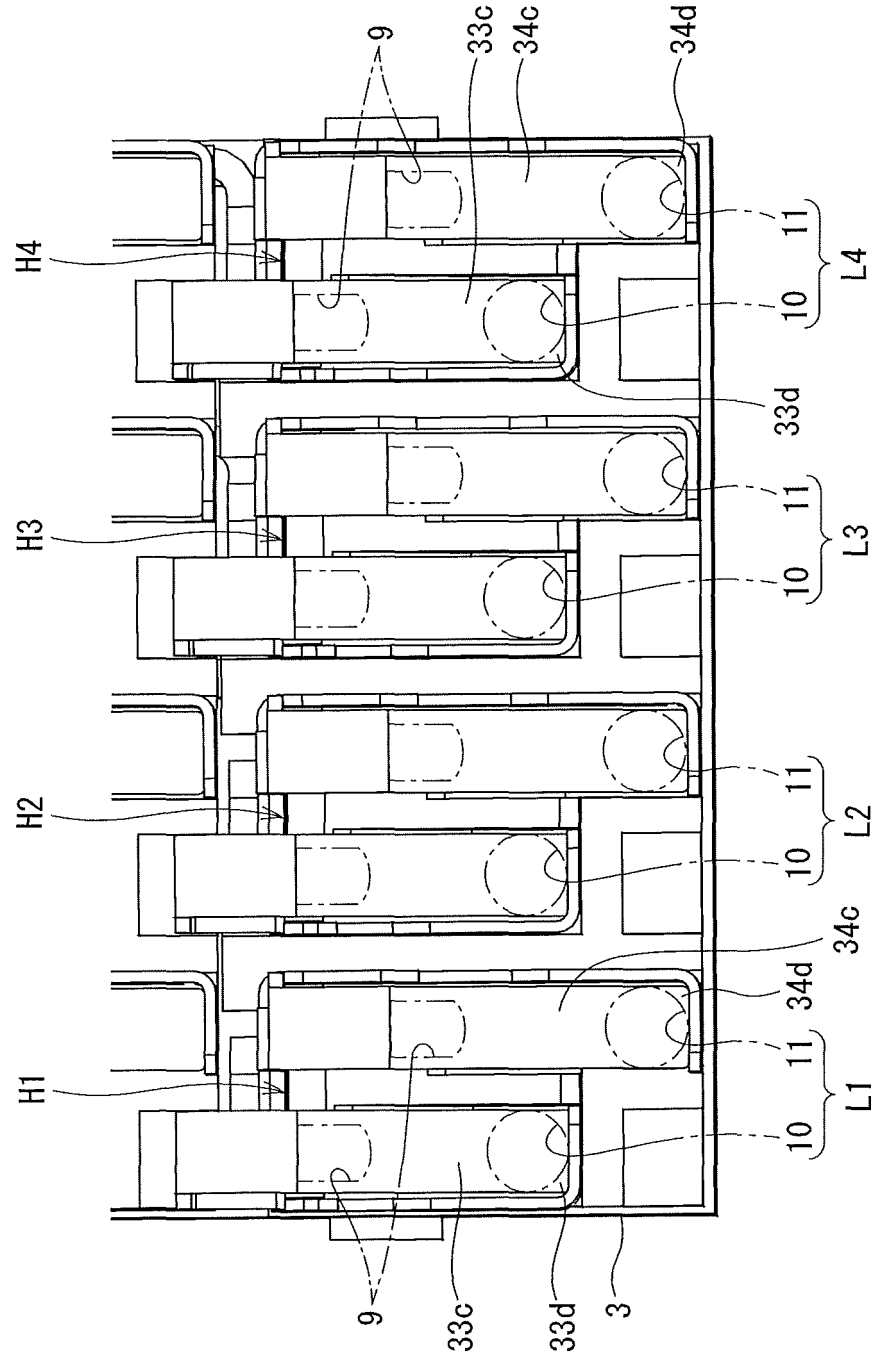


FIG. 9A

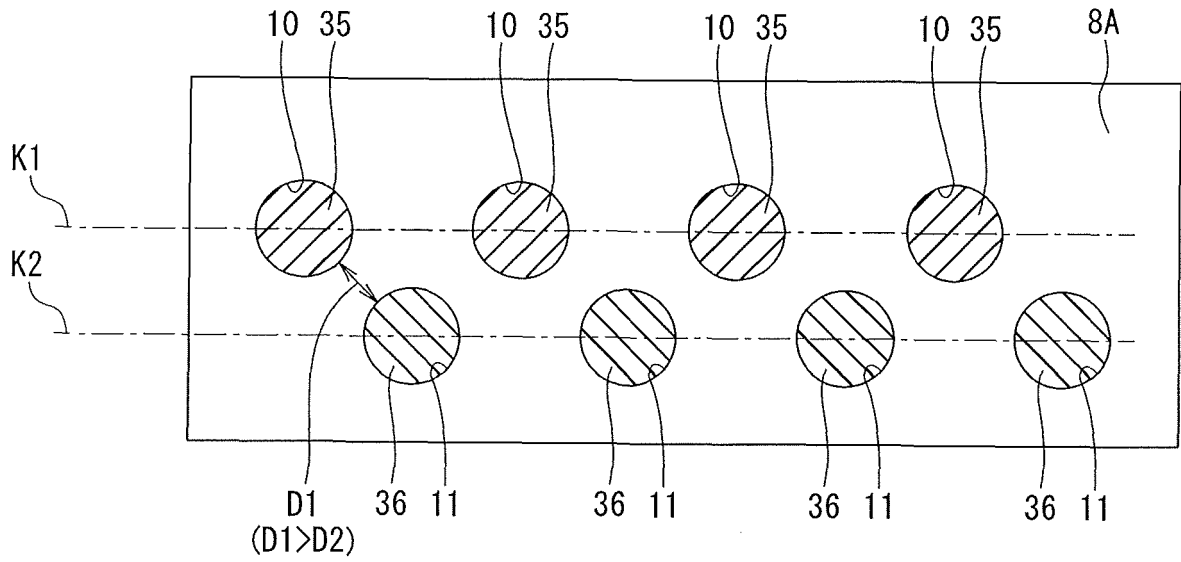
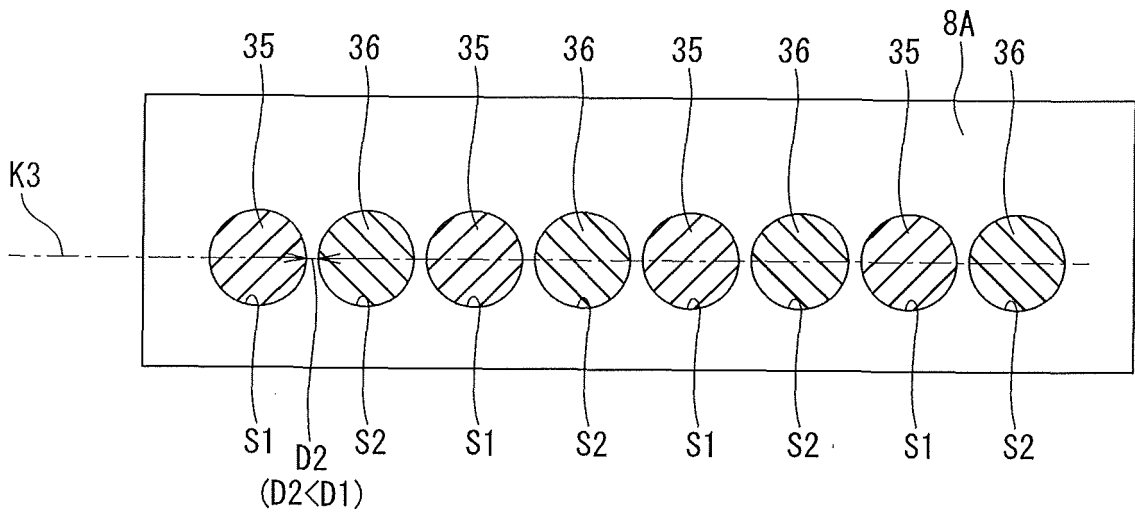


FIG. 9B



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2017/045957

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A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. H01R9/00 (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. H01R9/00, 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.
X Y	JP 2006-66183 A (MATSUSHITA ELECTRIC WORKS, LTD.) 09 March 2006, paragraphs [0006]-[0017], fig. 1-6 (Family: none)	1-3, 5 4, 6
Y	JP 2002-298943 A (OMRON CORP.) 11 October 2002, fig. 1, 2 & US 2002/0142671 A1 (fig. 1, 2) & DE 10213854 A & CN 1379507 A	4, 6
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
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"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 22 January 2018 (22.01.2018)	Date of mailing of the international search report 06 February 2018 (06.02.2018)	
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.	

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Patent documents cited in the description

- JP 2002298943 A [0009]