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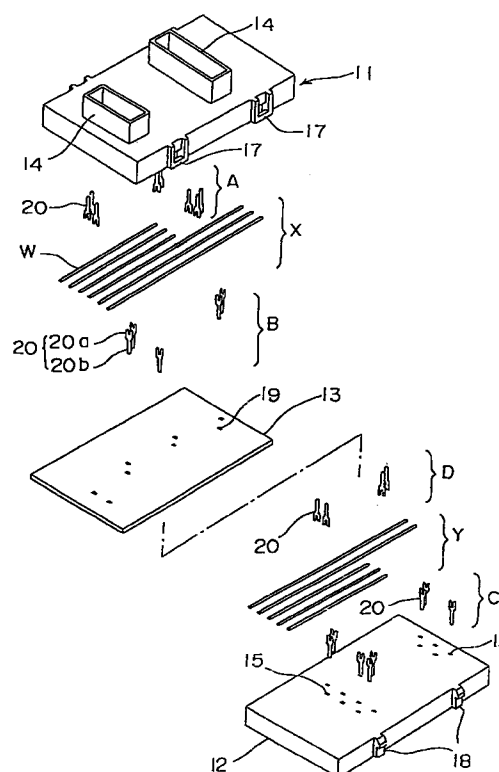
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(54) Electrical connection box

(57) In order to provide a small size electrical connection box in which wires can be arranged with an improved degree of freedom and which can sufficiently cope with a complicated wiring, wires *W* are arranged at two vertical stages in a space defined by an upper casing 11 and a lower casing 12, and are electrically connected with cramping terminals 20 pressed and secured in the casings 11 and 12.

FIG. 1



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Description

The present invention relates to an electrical connection box used e.g. for a wiring in an automotive vehicle.

A known electrical connection box used for a wiring in an automotive vehicle, e.g. for electrically connecting wires extending from a variety of equipments such as a battery and an audio equipment is comprised of an upper casing 1, a lower casing 2 and an insulating plate 3 mounted between the casings 1 and 2 as shown in FIG. 6 (see; for example, Japanese Unexamined Utility Model Publication No. 3-120627).

In this electrical connection box, the upper and the lower casings 1 and 2 are formed with connector receptacles 4 (those on the lower casing 2 are not shown) and terminal holes 5 in communication with the interior of the connector receptacles 4. A cramping terminal 6 is pressed into each terminal hole 5. A wire W is electrically connected with a contact portion 6a formed at one end of each cramping terminal 6, and an input/output terminal portion 6b formed at the other end projects into the corresponding connector receptacle 4 of the lower casing 2 through the terminal hole 5. Alternatively, the input/output terminal portion 6b may project into the corresponding connector receptacle 4 of the upper casing 1 through a through hole 3a formed in the insulating plate 3 and the terminal hole 5.

However, in the prior art electrical connection box, the wires W are arranged in parallel one adjacent to the other between the insulating plate 3 and the lower casing 2. Accordingly, this electrical connection box is allowed to have only limited wire arrangement patterns and cannot cope with a complicated wiring.

In view of the above problem, an object of the invention is to provide an electrical connection box in which wires can be arranged with a large degree of freedom, in particular for coping with a complicated wiring without enlarging the size thereof.

This object is solved according to the invention by an electrical connection box according to claim 1. Preferred embodiments of the invention are subject of the dependent claims.

According to the invention, there is provided an electrical connection box, comprising:

- a main body provided with one or more connector receptacles, a first wire group including wires arranged on a first wire plane inside the main body,

- a second wire group including wires arranged on a second wire plane inside the main body,

- wherein cramping terminals are electrically connected with corresponding wires of the first wire group and/or corresponding wires of the second wire group and project into the corresponding connector receptacle.

According to a preferred embodiment of the invention, the wire planes are spaced apart, in particular parallel to one another.

Preferably, the cramping terminals project into the connector receptacle through corresponding terminal

holes formed in the main body and are preferably mounted in corresponding cramping terminal mount portions.

Further preferably, a first terminal group includes the cramping terminals being electrically connected with the corresponding wires of the first wire group and projecting into the connector receptacle as a first connector receptacle, and/or a second terminal group includes the cramping terminals being electrically connected with the corresponding wires of the first wire group and projecting into a second connector receptacle, and/or a third terminal group includes the cramping terminals being electrically connected with the corresponding wires of the second wire group and projecting into the second connector receptacle, and/or a fourth terminal group includes the cramping terminals being electrically connected with the corresponding wires of the second wire group and projecting into the first connector receptacle.

Further preferably, the cramping terminals comprise a projecting portion, wherein the projecting portions of cramping terminals of two different terminal groups may have a different length.

According to a further preferred embodiment of the invention, the main body comprises an upper casing and a lower casing, at least one of the casings being provided with at least one connector receptacle, wherein one of the connector receptacles preferably is provided on the upper casing and the other connector receptacle preferably is provided on the lower casing.

According to a further preferred embodiment, at least one further wire group is arranged on at least one further wire plane inside the main body, wherein further cramping terminals are electrically connected with corresponding wires of the further wire group.

Preferably, there is arranged at least one insulating plate between two adjacent wire planes, wherein preferably a part of the cramping terminals project through corresponding through holes formed in the insulating plate.

Further preferably, the main body comprises at least one support wall for supporting the electrical connection box from inside.

Preferably, the electrical connection box comprises: upper and lower casings each provided with a connector receptacle on its outer surface, terminal holes being formed in the connector receptacle, and cramping terminal mount portions,

- an insulating plate disposed in a space defined by the upper and the lower casings and formed with through holes through which input/output terminal portions of cramping terminals are inserted,

- a first wire group including wires arranged between the upper casing and the insulating plate,

- a second wire group including wires arranged between the lower casing and the insulating plate,

- a first terminal group including cramping terminals each having at one end an input/output terminal portion which projects into the connector receptacle through the corresponding terminal hole of the upper casing and having at the other end a contact portion which is elec-

trically connected with the corresponding wire of the first wire group and mounted in the corresponding cramping terminal mount portion,

a second terminal group including cramping terminals each having at one end a contact portion which is electrically connected with the corresponding wire of the first wire group and having at the other end an input/output terminal portion which projects into the connector receptacle through the corresponding through hole of the insulating plate and the corresponding terminal hole of the lower casing,

a third terminal group including cramping terminal each having at one end an input/output terminal portion which projects from the corresponding terminal hole of the lower casing and having at the other end a contact portion which is electrically connected with the corresponding wire of the second wire group and mounted in the corresponding cramping terminal mount portion, and

a fourth terminal group including cramping terminals each having at one end a contact portion which is electrically connected with the corresponding wire of the second wire group and having at the other end an input/output terminal portion which projects from the corresponding terminal hole of the connector receptacle of the upper casing through the corresponding through hole of the insulating plate,

wherein the input/output terminal portions of the cramping terminals connected with the wires of the first and second wire groups arranged at two vertical stages in the space defined by the upper and the lower casings project into the connector receptacles formed on the outer surfaces of the upper and the lower casings.

Accordingly, the wires of the first and the second wire groups arranged along the upper and the lower casings on the opposite vertical sides of the insulating plate, respectively, are electrically connected with the respective cramping terminals secured on the upper or lower casing. The input/output terminal portions of the respective cramping terminals project from the terminal holes of the connector receptacle of the upper or lower casing to be electrically connected with an external electrical device.

As is clear from the above description, the wires of the first and the second wire groups are arranged along the upper casing and the lower casing with the insulating plate therebetween, respectively. Accordingly, the wire can be arranged with an enhanced degree of freedom, with the result that a complicated wiring can be made in a compact manner and the dimensions of the electrical connection box itself can be made smaller.

Further preferably, the electrical connection box comprises:

upper and lower casings each provided with a connector receptacle on its outer surface, terminal holes being formed in the connector receptacle, and cramping terminal mount portions,

a first terminal group including cramping terminals each having a short input/output terminal portion which projects into the connector receptacle through the

corresponding terminal hole of the upper casing,

a fourth terminal group including cramping terminals each having a long input/output terminal portion which projects into the connector receptacle through the corresponding terminal hole of the upper casing,

a third terminal group including cramping terminals each having a short input/output terminal portion which projects into the connector receptacle through the corresponding terminal hole of the lower casing,

a second terminal group including cramping terminals each having a long input/output terminal portion which projects into the connector receptacle through the corresponding terminal hole of the lower casing,

a first wire group including wires which are arranged along the upper casing while being connected with the cramping terminals of the first terminal group mounted in the cramping terminal mount portions of the upper casing, and are electrically connected with the cramping terminals of the second terminal group after being arranged, and

a second wire group including wires which are arranged along the lower casing while being connected with the cramping terminals of the third terminal group mounted in the cramping terminal mount portions of the lower casing, and are electrically connected with the cramping terminals of the fourth terminal group after being arranged,

wherein the input/output terminal portions of the cramping terminals connected with the wires of the wire groups arranged at two vertical stages in the space defined by the upper and the lower casings without the insulating plate project into the connector receptacles formed on the outer surfaces of the upper and the lower casings.

Accordingly, after the short cramping terminals of the first and the third terminal groups are mounted in the mount portions of the upper and the lower casings, the wires of the first and the second wire groups are electrically connected with the contact portions of the respective cramping terminals. Subsequently, the long cramping terminals of the second and the fourth terminal groups are electrically connected with the wires of the first and the second wire groups.

The input/output terminal portions of the cramping terminals of the first to the fourth terminal groups project from the terminal holes of the connector receptacle of the upper or lower casing to be electrically connected with an external electrical device.

The above electrical connection box does not include the insulating plate. Accordingly, the number of parts can be reduced, thereby making the electrical connection box smaller and simpler.

Preferably, one of the upper and the lower casings is formed with a support wall for supporting the other casing from inside.

Accordingly, upon assembling the upper and the lower casings, the support wall projecting from one of the casings comes into contact with the opposing inner sur-

face of the other casing. Therefore, the rigidity of the casing can be enhanced.

In the above electrical connection box, one casing is supported from inside by the support wall formed with the other casing. Accordingly, the strength of the casing can be reinforced and the assembled electrical connection box has a sufficient rigidity even without the insulating plate.

These and other objects, features and advantages of the present invention will become more apparent upon a reading of the following detailed description and accompanying drawings in which:

FIG. 1 is an exploded perspective view of an electrical connection box as a first embodiment of the invention,

FIG. 2 is a side view in section of the first embodiment of FIG. 1,

FIG. 3 is an enlarged perspective view partially showing cramping terminal mount portions of FIG. 1, FIG. 4 is a side view in section of an electrical connection box as a second embodiment,

FIG. 5 is a side view in section of a modification of the second embodiment, and

FIG. 6 is an exploded perspective view of a prior art electrical connection box.

Hereafter, embodiments of the invention are described with reference to the accompanying drawings.

As shown in FIGS. 1 and 2, an electrical connection box according to a first embodiment is roughly comprised of an upper casing 11, a lower casing 12, and an insulating plate 13 mounted in a space defined by the upper and the lower casings 11 and 12.

The upper casing 11 has a box-like shape which is open at its bottom. Two connector receptacles 14 project from the upper surface of the upper casing 11. The connector receptacles 14 have a rectangular cylindrical shape, and terminal holes are formed in the bottom wall of the connector receptacles 14 (upper wall of the upper casing 11). Cramping terminal mount portions 16 project from the ceiling of the upper casing 11 in positions where respective cramping terminals 20 in a first group to be described later are inserted and in positions corresponding to respective cramping terminals 20 in a second group B.

Each mount portion 16 is, as shown in FIG. 3, formed by two plate members 16a which are spaced apart in parallel by a specified distance such that a contact portion 20a of the cramping terminal 20 can be pressed and fixed therebetween. The two plate members 16a are formed with a slot 16b in which the wire W is inserted. Further, U-shaped projections are formed in two positions at the opposite sides of the opposite side surfaces of the upper casing 11, and a portion of each-projection near the opening edge of the upper casing 11 is in communication with the interior of the upper casing 11 and acts as an engaging portion 17.

The lower casing 12 is a plate-like member, and connector receptacles 14 similar to those formed on the upper casing 11 projects from the lower surface of the lower casing 12. A plurality of terminal holes 15 are formed in the lower casing 12, and cramping terminal mount portions 16 similar to those formed on the upper casing 11 project from the upper surface of the lower casing 12 in positions where respective cramping terminals 20 in a third group C are inserted and in positions corresponding to respective cramping terminals 20 in a fourth group D. Locking portions 18 project from opposite side surfaces of the lower casing 12.

The insulating plate 13 is a plate member of such dimensions that it can be in particular closely accommodated in the interior of the upper casing 11. The insulating plate 13 is formed with a plurality of through holes 19 opening in the upper and the lower surfaces thereof.

The cramping terminals 20 are inserted into the terminal holes 15 of the upper and the lower casings 11 and 12. Each cramping terminal 20 is of a conductive material and has a substantially U-shaped contact portion 20a at one end thereof and an input/output terminal portion 20b at the other end thereof. The wires W are pressed into the slots of the contact portions 20a. The edges of the slots penetrate insulating sheaths of the wires W while the wires W are pressed into the slots, thereby establishing an electrical connection between the cramping terminals 20 and cores of the wires W. The contact portions 20a are pressed and fixed in the respective mount portions 16 of the upper and the lower casings 11 and 12. The input/output terminal portions 20b are inserted into the terminal holes 15 directly or through the through holes 19 of the insulating plate 13 so as to project into the connector receptacles 14 of the upper or the lower casings 11 or 12.

The electrical connection box is assembled as follows.

The input/output terminal portions 20b of the cramping terminals 20 (first terminal group A) are inserted into the terminal holes 15 of the upper casing 11 so as to project into the connector receptacles 14. At this stage, the contact portions 20a are pressed into the mount portions 16, with the result that the cramping terminals 20 are fixed. Subsequently, a plurality of wires W (first wire group X) are so arranged as to establish an electrical connection with the contact portions 20a of the cramping terminals 20. Further, the arranged wires W of the first wire group X are pressed into the slots of the contact portions 20a of the cramping terminals 20 (second terminal group B), and are pressed and secured into the mount portions 16 of the upper casing 11. Likewise, the cramping terminals 20 (third terminal group C) are inserted into the terminal holes 15 of the lower casing 12, pressed and secured in the mount portions 16. Thereafter, a plurality of wires W (second wire group Y) are so arranged as to establish an electrical connection with the contact portions 20a. Further, the respective wires W are electrically connected with the contact portions 20a of the cramping terminals 20 (fourth terminal

group D), pressed and secured in the mount portions 16 of the lower casing 12.

Subsequently, the upper and the lower casings 11 and 12 are assembled such that the insulating plate 13 is located therebetween. At this stage, the input/output terminal portions 20b of the cramping terminals 20 of the group B secured in the upper casing 11 project into the respective connector receptacles 14 formed on the lower casing 12 through the through holes 19 of the insulating plate 13 and the terminal holes 15 of the lower casing 12. On the other hand, the input/output terminal portions 20b of the cramping terminals 20 of the group D secured in the lower casing 12 project into the respective connector receptacles 14 formed on the upper casing 11 through the through holes 19 of the insulating plate 13 and the terminal holes 15 of the upper casing 11. The upper and the lower casings 11 and 12 are assembled by the engagement of the locking portion 18 and the engaging portion 17.

In the electrical connection box thus assembled, since the wires W can be arranged along the upper casing 11 and the lower casing 12 with the insulating plate 13 therebetween, the wire arrangement in the respective casings 11 and 12 can be simplified. Further, this electrical connection box can sufficiently cope with a complicated wiring without enlarging the size thereof.

FIG. 4 shows an electrical connection box as a second embodiment which does not need the insulating plate 13 of the electrical connection box of the first embodiment.

Similar to the first embodiment, an upper casing 11 is formed with a connector receptacle 14, terminal holes 15, cramping terminal mount portions 16 (see FIG. 3) and an engaging portion 17 which acts to lock the engagement of the upper casing 11 with a lower casing 12. Similarly, the lower casing 12 is formed with a connector receptacle 14, terminal holes 15, cramping terminal mount portions 16 and a locking portion 18 engageable with the engaging portion 17 of the upper casing 11.

Cramping terminals 20 of a first terminal group A' having shorter input/output terminal portions 20b and cramping terminals 20 of a fourth terminal group D' are inserted into the terminal holes 15 of the upper casing 11.

Likewise, cramping terminals 20 of a third terminal group C' having shorter input/output terminal portions 20b and cramping terminals 20 of a second terminal group B' are inserted into the terminal holes 15 of the lower casing 12.

Wires W1 and W2 of a first wire group which are arranged along the upper casing 11 are connected with the cramping terminals 20 of the first and the second terminal groups A' and B'. Further, wires W3 and W4 of a second wire group which are arranged along the lower casing 12 are connected with the cramping terminals 20 of the third and the fourth terminal groups C' and D'.

In the assembled electrical connection box, the wires W1 and W2 of the first wire group and the wires

W3 and W4 of the second wire group are arranged on the same planes, respectively. Further, the first and the second wire groups are arranged at two vertical stages.

The above electrical connection box is assembled as follows.

First, the input/output terminal portions 20b of the cramping terminals 20 of the first terminal group A' are inserted into the terminal holes 15 of the upper casing 11 so as to project into the connector receptacle 14 of the upper casing 11. At this stage, the contact portions 20a of the cramping terminals 20 of the first terminal group A' are pressed and secured in the mount portions 16 of the upper casing 11.

Further, the input/output terminal portions 20b of the cramping terminals 20 of the third terminal group C' are inserted into the terminal holes 15 of the lower casing 12 so as to project into the connector receptacle 14 of the lower casing 11. At this stage, the contact portions 20a of the cramping terminals 20 of the third terminal group C' are pressed and secured in the mount portions 16 of the lower casing 11.

Subsequently, the wires W1 and W2 of the first wire group are arranged along the upper casing 11, and the wire W1 is electrically connected with the contact portions 20a of the cramping terminals 20 of the first terminal group A'. Likewise, the wires W3 and W4 of the second wire group are arranged along the lower casing 12, and the wire W3 is electrically connected with the contact portions 20a of the cramping terminals 20 of the third cramping terminals group C'.

Thereafter, the contact portions 20a of the cramping terminals 20 of the second terminal group B' are electrically connected with the wire W2 of the first wire group, and the long input/output terminal portions 20b thereof are inserted through the terminal holes 15 of the lower casing 12 so as to project into the connector receptacle 14 of the lower casing 12. Likewise, the contact portions 20a of the cramping terminals 20 of the fourth terminal group D' are electrically connected with the wire W4 of the second wire group, and the long input/output terminal portions 20b thereof are inserted through the terminal holes 15 of the upper casing 12 so as to project into the connector receptacle 14 of the upper casing 12.

In the assembled electrical connection box, as described above, the wires W1 and W2 of the first wire group and the wires W3 and W4 of the second wire group are arranged on the same planes, respectively, and the first and the second wire groups are arranged at two vertical stages, in particular on vertically spaced planes.

Similar to the first embodiment, the wire groups can be arranged at two stages in the space defined by the upper and the lower casing 11 and 12 in the electrical connection box thus constructed. Accordingly, the wire arrangement in the respective casings 11 and 12 can be simplified and this electrical connection box can sufficiently cope with even a complicated wiring without enlarging the size thereof.

Further, since the insulating plate 13 is not required, the number of parts can be reduced compared to the

electrical connection box of the first embodiment and assembling operability can be improved.

FIG. 5 shows a modification of the electrical connection box of the second embodiment.

In this electrical connection box, a support wall 12a 5 for supporting the upper wall of the upper casing 11 projects from the bottom surface of the lower casing 12 in a specified position.

In the electrical connection box having the lower casing 12 formed with the support wall 12a, the strength of the upper casing 11 is reinforced by the support wall 12a. 10

LIST OF REFERENCE NUMERALS

11	Upper Casing	15
12	Lower Casing	
13	Insulating Plate	
20	Cramping Terminal	
A	First Terminal Group	
B	Second Terminal Group	20
C	Third Terminal Group	
D	Fourth Terminal Group	
W	Wire	
X	First Wire Group	
Y	Second Wire Group	25

Claims

1. An electrical connection box, comprising:
 - a main body (11, 12) provided with one or more connector receptacles (14),
 - a first wire group (X) including wires (W; W1, W2) arranged on a first wire plane inside the main body (11, 12),
 - a second wire group (Y) including wires (W3, W4) arranged on a second wire plane inside the main body (11, 12),
 - wherein cramping terminals (20) are electrically connected with corresponding wires (W1, W2) of the first wire group (X) and/or corresponding wires (W3, W4) of the second wire group (Y) and project into the corresponding connector receptacle (14).
2. An electrical connection box according to claim 1, wherein the wire planes are spaced apart, in particular parallel to one another. 45
3. An electrical connection box according to claim 1 or 2, wherein the cramping terminals (20) project into the connector receptacle (14) through corresponding terminal holes (15) formed in the main body (11, 12) and are preferably mounted in corresponding cramping terminal mount portions (16). 50
4. An electrical connection box according to one of the preceding claims, wherein
 - a first terminal group (A; A') includes the cramping terminals (20) being electrically connected with the corresponding wires (W; W1, W2) of

the first wire group (X) and projecting into the connector receptacle (14) as a first connector receptacle, and/or

a second terminal group (B; B') includes the cramping terminals (20) being electrically connected with the corresponding wires of the first wire group (X) and projecting into a second connector receptacle (14), and/or

a third terminal group (C; C') includes the cramping terminals (20) being electrically connected with the corresponding wires of the second wire group (Y) and projecting into the second connector receptacle (14), and/or

a fourth terminal group (D; D') includes the cramping terminals (20) being electrically connected with the corresponding wires (W4) of the second wire group (Y) and projecting into the first connector receptacle (14).

5. An electrical connection box according to claim 4, wherein the cramping terminals (20) comprise a projecting portion (20b), and wherein the projecting portions (20b) of cramping terminals (20) of two different terminal groups (A, B, C, D; A', B', C', D') may have a different length.
6. An electrical connection box according to one of the preceding claims, wherein the main body (11, 12) comprises an upper casing (11) and a lower casing (12), at least one of the casings (11, 12) being provided with at least one connector receptacle (14).
7. An electrical connection box according to claim 6 and claim 4 or 5, wherein one of the connector receptacles (14) is provided on the upper casing (11) and the other connector receptacle (14) is provided on the lower casing (12).
8. An electrical connection box according to one of the preceding claims, wherein at least one further wire group is arranged on at least one further wire plane inside the main body (11, 12), and wherein further cramping terminals (20) are electrically connected with corresponding wires of the further wire group.
9. An electrical connection box according to one of the preceding claims, wherein there is arranged at least one insulating plate (13) between two adjacent wire planes, and wherein preferably a part of the cramping terminals (20) project through corresponding through holes (19) formed in the insulating plate (13).
10. An electrical connection box according to one of the preceding claims, wherein the main body (11, 12) comprises at least one support wall (12a) for supporting the electrical connection box from inside.

FIG. 1

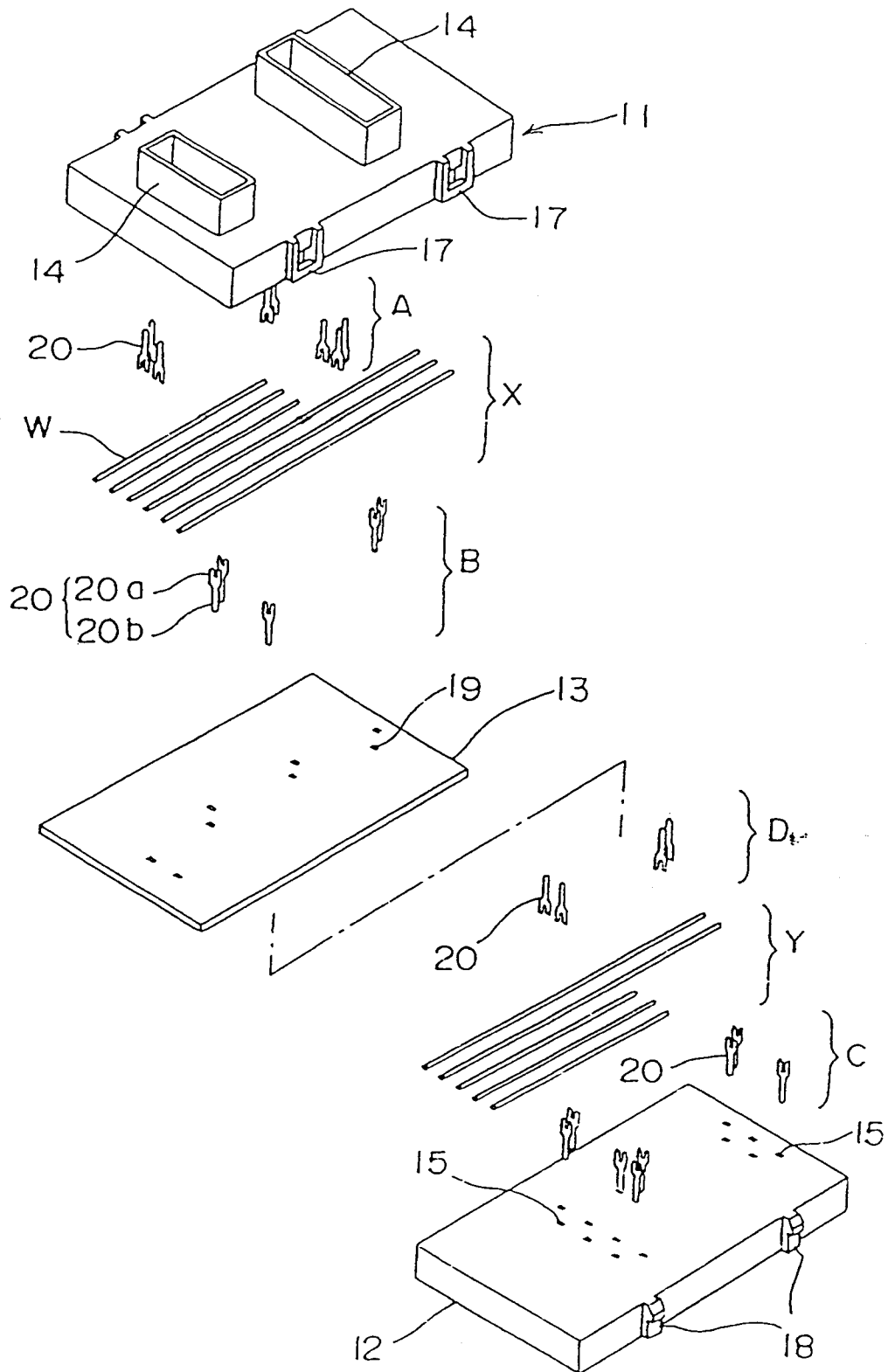


FIG. 2

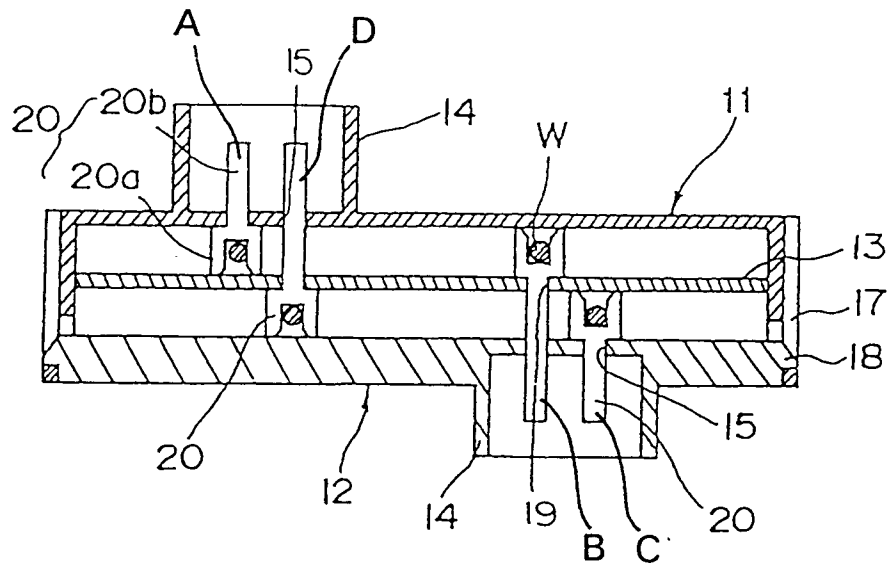


FIG. 3

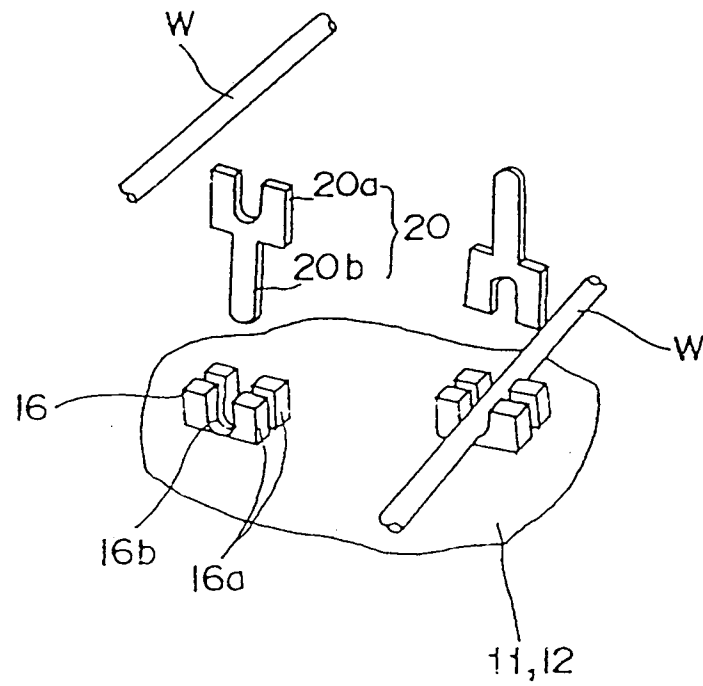


FIG. 4

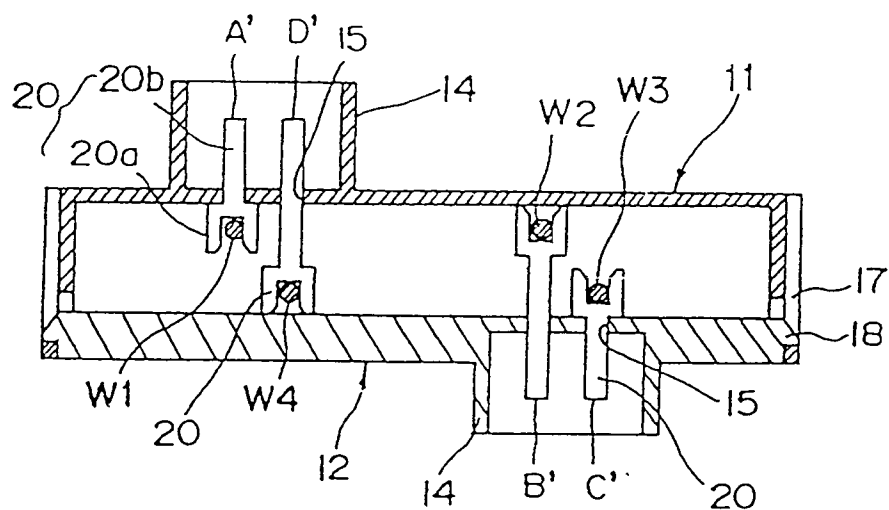


FIG. 5

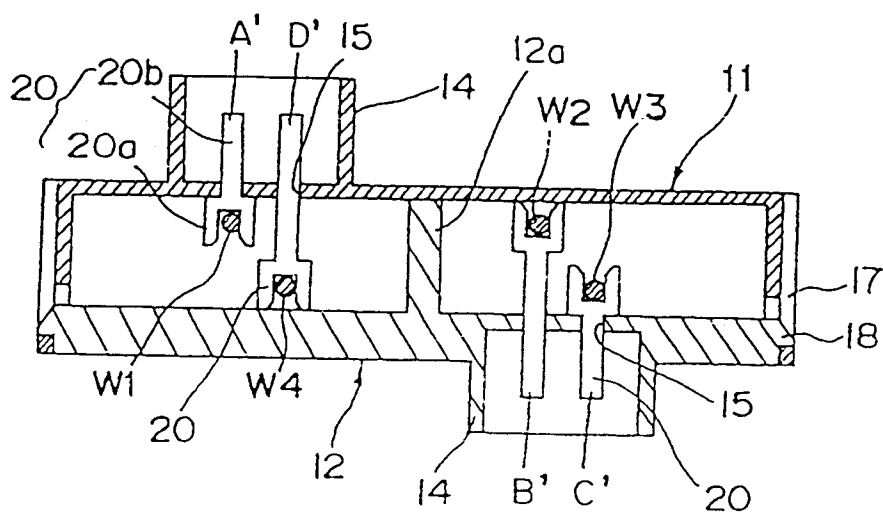


FIG. 6
PRIOR ART

