(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 954 065 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
03.11.1999 Bulletin 1999/44

(51) Int Cl.[6]: **H01R 23/02**, H01R 13/64

(21) Application number: **99302824.0**

(22) Date of filing: **12.04.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **27.04.1998 JP 11703798**

(71) Applicant: **ALPS ELECTRIC CO., LTD.**
Ota-ku Tokyo 145 (JP)

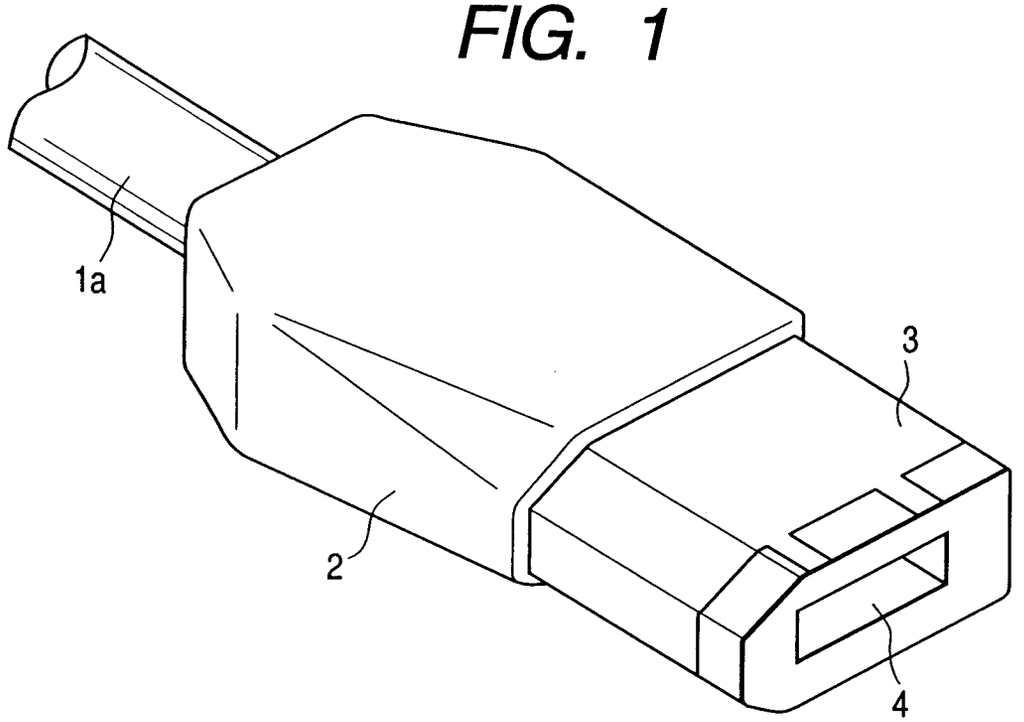
(72) Inventors:
- **Saito, Kyozo**
  Iwate-gun, Iwate-ken (JP)
- **Wagatsuma, Toru**
  Miyagi-ken (JP)
- **Ninomiya, Nobuyuki**
  Furukawa-shi, Miyagi-ken (JP)

(74) Representative: **Kensett, John Hinton**
Saunders & Dolleymore,
9 Rickmansworth Road
Watford, Hertfordshire WD1 7HE (GB)

(54) Connector device and data transfer apparatus

(57) A connector device by which problems such as confusion between signal cables of different kinds are avoided is disclosed. The device comprises a receptacle (6) provided on a device side, a plug (2) which is connected at an end of a signal cable and inserted into the receptacle, and cable discriminating means (10) which is provided on the device side and discriminates the kind of the signal cable to be connected.

FIG. 1



EP 0 954 065 A2

Description

[0001] The present invention relates to a connector device with a cable and a data transfer apparatus such as an electronic device which is connected by the connector device.

Related Art

[0002] As shown in Fig. 14, a first data transfer apparatus 100 and a second data transfer apparatus 101 or other data transfer apparatuses (not shown) to be connected are connected via a signal cable 104 with plugs 103 which are inserted into receptacles 102 of respective apparatuses, and data is transferred via the signal cable 104.

[0003] In such a data transfer system, when there is a specification change such as improvement in data transfer speed, it is necessary to change not only the data transfer apparatuses but also the signal cable to those adapted to the data transfer speed.

[0004] Japanese Unexamined Patent Application Numbers 8-202474, 8-102349, 8-22863 and the like disclose related conventional techniques.

[0005] In case of the above-mentioned technique, generally, plugs are changed as well in order to avoid confusion with an old signal cable and the following problems are therefore brought about.

(1) The number of kinds of signal cables increases and the end user is confused.
(2) A signal cable with plugs of an old type becomes useless.
(3) By changing the signal cable with plugs, the cost increases.
(4) Even if there is a need of data transfer at a speed adapted to the signal cable of an old type, the signal cable cannot be used since the plugs are not adapted.
(5) In case of changing devices of a part of the system to those having a faster data transfer speed, they cannot be connected or an adapter is necessary.

[0006] The invention has been achieved in consideration of the circumstances and its first object is to provide a connector device which can dissolve the harmful effects as mentioned above.

[0007] Further, it is a second object of the invention to provide a data transfer apparatus which can efficiently perform data transfer.

[0008] According to the invention, the first object is achieved by a connector device comprising: a receptacle provided on a device (for example, a data transfer apparatus which will be described hereinlater) side; a plug which is connected at an end of a signal cable and inserted into the receptacle; and cable discriminating means (such as a switch group which will be described hereinlater) which is provided on the device side and discriminates the kind of the signal cable to be connected (such as maximum data transfer speed which will be described hereinlater).

[0009] According to the invention, the second object is achieved by a data transfer apparatus comprising: a first data processing system (for example, a first data transfer apparatus which will be described hereinlater); a second data processing system (for example, a second data transfer apparatus which will be described hereinlater); a signal cable connecting the first and second data processing systems, through which data is transferred between the data processing systems; comparing means (for example, a CPU which will be described hereinlater) for comparing maximum data transfer speed information (A) of the first data processing system, maximum data transfer speed information (B) of the second data processing system, and maximum data transfer speed information (C) of the signal cable to be used; and transfer speed setting means (comprised of a CPU, a data transfer speed adjusting unit, and the like which will be described hereinlater) for selecting the lowest data transfer speed among the speed information (A), (B), and (C) as a comparison result and setting the lowest data transfer speed as an execution transfer speed, wherein data transfer is executed between the first data processing system and the second data processing system via the signal cable on the basis of the set execution transfer speed.

[0010] The first invention has a construction as described above. Since the kind of the connected signal cable can be automatically known by the cable discriminating means, the device side can correspond to the kind. Consequently, the trouble such as confusion with the signal cables is dissolved and the quality, performance, and function of the whole system can be improved.

[0011] The second invention has also a construction as described above. Since a reasonable execution transfer speed can be set from the maximum data transfer speed information of the data processing systems to be connected and the signal cable used for connection, data transfer is efficiently performed and the quality, performance, and function of the whole system can be improved.

[0012] Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which;

[0013] Fig. 1 is a perspective view of a plug of cable type 1 according to an embodiment of the invention.

[0014] Fig. 2 is a perspective view of a plug of cable type 2 according to an embodiment of the invention.
[0015] Fig. 3 is a perspective view of a plug of cable type 3 according to an embodiment of the invention.
[0016] Fig. 4 is a perspective view of a plug of cable type 4 according to an embodiment of the invention.
[0017] Fig. 5 is a perspective view of a plug of cable type 5 according to an embodiment of the invention.
[0018] Fig. 6 is a perspective view of a receptacle according to a first embodiment of the invention.
[0019] Fig. 7 is a partly enlarged cross section showing a state in which a plug is inserted into a receptacle.
[0020] Fig. 8 is a functional block diagram of a data transfer apparatus according to an embodiment of the invention.
[0021] Fig. 9 is a flowchart showing a data transfer processing routine according to an embodiment of the invention.
[0022] Fig. 10 is an exploded perspective view of a receptacle and a switch according to a second embodiment of the invention.
[0023] Fig. 11 is a perspective view of a plug and a receptacle for explaining a third embodiment of the invention.
[0024] Fig. 12 is a perspective view of a plug and a receptacle for explaining a fourth embodiment of the invention.
[0025] Fig. 13 is a perspective view of a plug and a receptacle for explaining a fifth embodiment of the invention.
[0026] Fig. 14 is an explanatory diagram showing an example of a connection state of data transfer apparatuses.
[0027] Embodiments of the invention will be described with reference to the drawings. Figs. 1 to 5 are perspective views of various plugs according to embodiments of the invention. Fig. 6 is a perspective view of a receptacle according to a first embodiment to which each of the plugs can be inserted. Fig. 7 is a partly enlarged cross section showing a state where the plug is inserted into the receptacle.
[0028] As shown in Figs. 1 to 5, a plug 2 is connected to a signal cable 1 (la to le) and an insertion engagement part 3 made by a resin molding is provided at an end of the plug 2. The insertion engagement part 3 has a shape which is asymmetrical laterally or vertically to prevent erroneous insertion. An opening 4 is formed in the center of the insertion engagement part 3 and a contact point (not shown) is provided in the opening 4.
[0029] In the embodiments, five kinds of signal cables la to le are shown. Fig. 1 shows a cable in which no recessed part 5 is formed in the insertion engagement part 3. Fig. 2 shows a cable in which one recessed part 5 is formed in the insertion engagement part 3. Fig. 3 shows a cable in which two recessed parts 5 are formed. Fig. 4 shows a cable in which three recessed parts 5 are formed. Fig. 5 shows a cable in which four recessed parts 5 are formed. Each of the recessed parts 5 is opened to the insertion end face of the plug 2. The signal cables la to le are classified as shown in Table 1 according to, for example, the maximum data transfer speed and have wire diameters adapted to the respective maximum data transfer speeds.

[Table 1]

Number of recessed part(s) 5	cable type	maximum data transfer speed
0	1	400 Mbps
1	2	800 Mbps
2	3	1600 Mbps
3	4	3200 Mbps
4	5	6400 Mbps

[0030] In the example, the maximum data transfer speeds become higher in accordance with the order of the cable types 1, 2, 3, and 4.
[0031] As shown in Fig. 6, six armatures 8 which come into contact with the contact point of the plug 2 are provided in a housing 7 of a receptacle 6. A lead 9 is connected to each armature 8. The inside of the housing 7 has a shape which is asymmetrical laterally or vertically so as to be adapted to the outer shape of the plug 2. Two each of push-on type (or push-off type) switches 10 (10a to 10d) are provided on the upper and lower sides of the armature group 8. The switches 10a to 10d are disposed in the positions facing the recessed parts 5a to 5d of the plug 2, respectively.
[0032] In the case where the plug 2 has the recessed part 5 as shown in Fig. 7, when the plug 2 is inserted into the receptacle 6, the end of the switch 10 is just housed in the recessed part 5 and the switch 10 is not pressed. When there is no recessed part 5 in the plug 2, however, the switch 10 is pressed and an ON signal is outputted. The ON/OFF states of the switches 10 of respective cable types are as shown in Table 2.

[Table 2]

	SW10a	SW10b	SW10c	SW10d
Cable type 1	ON	ON	ON	ON

[Table 2] (continued)

	SW10a	SW10b	SW10c	SW10d
Cable type 2	OFF	ON	ON	ON
Cable type 3	OFF	OFF	ON	ON
Cable type 4	OFF	OFF	OFF	ON
Cable type 5	OFF	OFF	OFF	OFF

[0033] Therefore, based on the combination information of the ON signals, the kind of the signal cable, that is, the maximum data transfer speed at which data can be transferred can be automatically discriminated in the embodiment.

[0034] The data transfer process will now be described. Fig. 8 is a functional block diagram of a data transfer apparatus. Fig. 9 is a flowchart showing a data transfer processing routine.

[0035] As shown in Fig. 8, a data transfer apparatus comprises: the receptacle 6 having therein the switches 10a to 10d; a decoder 11 for extracting a combination of the ON signals of the switches 10a to 10d as information; a CPU 12 for taking in various information, determining, processing, and the like; a storage unit 13 for storing decoding information of the switch 10 and a series of control programs, temporarily storing data, or the like; a signal processing unit 14 for processing signals which are inputted via the receptacle 6 so as to be easily dealt at the post stage and outputting the processed signals via the receptacle 6; a data processing unit 15 for processing information; a data transfer speed adjusting unit 16 for receiving a command of the CPU 12 and adjusting data transfer speeds of respective units; a bias voltage detecting unit 17 for detecting a bias voltage applied from the partner data transfer apparatus to be connected. The components have the connecting relation as shown in the diagram.

[0036] The data transfer processing routine will be described with reference to Fig. 9. The example shows the routine from connection of an electronic device A serving as a first data transfer apparatus and an electronic device B serving as a second data transfer apparatus via a signal cable until starting of the transfer of signals.

[0037] In step (hereinbelow, abbreviated as "S") 1, each of the electronic devices A and B acquires the maximum data transfer speed of itself during initializing process after turn-on of the power.

[0038] In S2, whether the electronic devices A and B are connected via the signal cable or not is determined. Whether the devices are connected or not is determined by detecting the bias voltage added to signals by the bias voltage detecting unit 17.

[0039] In S3, communication is performed between the devices at a predetermined lowest data transfer speed. The maximum data transfer speeds are exchanged and temporarily stored in the respective storage units 13. The predetermined lowest data transfer speed is a speed (for example, 100 Mbps) which is used in the present version and it is determined that all of the electronic devices can perform communication at this speed at the lowest.

[0040] In S4, the key shape of the plug 2 inserted into the receptacle of the device, that is, the presence or absence of the recessed part 5 and the position of the recessed part 5 is decoded by the decoder 11. The maximum data transfer speed of the signal cable 1 used for connection is calculated and temporarily stored in the storage unit 13. The maximum data transfer speed from the key shape of the plug 2 is calculated by referring to a preliminarily stored table in the storage unit 13.

[0041] In S5, the maximum data transfer speeds of the self device, the partner device, and the signal cable 1 to be used are read from the storage unit 13 and compared by the CPU 12. The smallest value among them is found and set as an execution transfer speed to be used. For example, when it is assumed that the maximum data transfer speed (A) of the self device (electronic device A) is 3200 Mbps, the maximum data transfer speed (B) of the partner device (electronic device B) is 800 Mbps, and the maximum data transfer speed (C) of the signal cable is 1600 Mbps, the execution transfer speed to be used is set to the smallest value of 800 Mbps. The execution transfer speed is set by the CPU 12 and adjustment of the data transfer speeds of the respective units in association with the setting is carried out by the data transfer speed adjusting unit 16.

[0042] In S6, the data transfer speed to be used is confirmed with the partner device. In S7, whether the confirmation is made or not is determined. If YES, the program determines the state as normal and enters a usual data transfer routine. If NO, the program enters an error processing routine.

[0043] Fig. 10 is a perspective view of a receptacle and a switch group for explaining a second embodiment of the invention. Although the cable discriminating means (for example, switch) for discriminating the kind of a signal cable is provided integrally with the receptacle as shown in Fig. 6 in the first embodiment, in the second embodiment, the receptacle 6 and the switch group 10 are separately provided. The switches 10 are inserted into four insertion holes 18 (only two of them are shown in the diagram) formed in the receptacle 6, and the switches 10 and the receptacle 6 become integral.

[0044] In place of the recessed part 5 of the first embodiment, a through hole or a projected part can be used. The

number of the recessed parts, through holes, or projected parts indicative of the kind of the signal cable can be arbitrarily selected according to the number of kinds.

[0045] Fig. 11 is a perspective view of a plug and a receptacle for explaining a third embodiment of the invention. In the embodiment, magnets 20 are attached to the front end face of the insertion engagement part 3 of the plug 2 by proper means such as adhesion or embedding in accordance with the kind of the signal cable. On the other hand, magnetic induction switches 21 such as Hall devices or reed switches are attached to the receptacle 6 side. The arranging state of the magnets 20 is detected by the magnetic induction switches 21 to thereby discriminate the kind of the signal cable connected to the plugs 2.

[0046] Fig. 12 is a perspective view of a plug and a receptacle for explaining a fourth embodiment of the invention. In the embodiment, notches 22 are formed on the front end face of the insertion engagement part 3 of the plug 2 in accordance with the kind of the signal cable. On the other hand, optical sensors 23 each consisting of a light emitting device 23a and a light receiving device 23b are attached to the receptacle 6 side.

[0047] In the case where there is no notch 22 at a predetermined position, the front end face of the insertion engagement part 3 comes close to the optical sensor 23 when the plug 2 is inserted into the receptacle 6. Light emitted from the light emitting device 23a is reflected by the front end face of the insertion engagement part 3 and a large amount of reflection light is received by the light receiving device 23b. On the other hand, in the case where the notch 22 is formed, the bottom face 24 of the notch 22 is away from the optical sensor 23 when the plug 2 is inserted into the receptacle 6. Although the reflection light of light emitted from the light emitting device 23a is received by the light receiving device 23b, the reflection light amount is small, so that the detection output of the light receiving device 23b is weak. Thus, the kind of the signal cable connected to the plug 2 is determined in accordance with the reflection light amount (detection output).

[0048] Fig. 13 is a perspective view of a plug and a receptacle for explaining a fifth embodiment of the invention. In the embodiment, short bars 25 such as metal thin plates are provided on the front end face of the insertion engagement part 3 of the plug 2 in accordance with the kind of the signal cable. On the other hand, a pair of electrodes 26 are attached at predetermined intervals to the receptacle 6 side.

[0049] In the case where there is no short bar 25 at a predetermined position, the pair of electrodes 26 come into contact with the electrically insulating plug 2 when the plug 2 is inserted into the receptacle 6, so that the electrodes 26 are not made conductive. On the other hand, in the case where the short bar 25 is provided, the pair of electrodes 26 come into contact with the short bar 25 and is electrically short-circuited when the plug 2 is inserted into the receptacle 6. Consequently, the kind of the signal cable connected to the plug 2 can be discriminated whether the electrodes 26 are short-circuited or not. Although the surface of the electrode 26 may be flat, by providing a projecting part on the surface of the electrode 26, the contact with the short bar 25 can be more secured.

[0050] The invention is not limited to the foregoing embodiments. Besides the above, for example, a bar code part, a different color part, an electromagnetic induction coil, or the like is provided on the plug side and optically or electromagnetically detected, thereby enabling the kind of the signal cable to be discriminated.

[0051] As data transfer modes, there are an electrical method, an electromagnetic method via an electromagnetic induction coil, an optical method via an optical connector, and the like which are properly selected.

[0052] According to the invention, the construction as mentioned above is provided and the kind of the connected signal cable can be automatically known by the cable discriminating means, so that the device side can correspond to the kind. Consequently, the trouble such as confusion with the signal cables is solved and the quality, performance, and function of the whole system can be improved.

[0053] According to the invention, since there is no projecting part on the plug side, it is convenient that compatibility with an existing receptacle can be provided.

[0054] According to the invention, the detector can be moved when the plug is inserted. In case of an existing plug, it is inserted by pushing all of detectors. Consequently, the detectors do not become hindrance and it is convenient that there is compatibility with an existing plug.

[0055] According to the invention, by also using erroneous insertion preventing means, the kind of the signal cable can be accurately discriminated so that the reliability can be improved.

[0056] According to the invention, since a reasonable execution transfer speed can be set from the maximum data transfer speed information of the data processing systems to be connected and the signal cable to be used for connection, the data transfer can be efficiently performed as a result. Thus, the quality, performance, and function of the whole system can be improved.

Claims

1. A connector device comprising:

a receptacle provided on a device;
a plug which is connected at an end of a signal cable and inserted into the receptacle; and
cable discriminating means which is provided at the device
and discriminates the kind of the signal cable to be connected.

2. A connector device according to claim 1, wherein the kinds of the signal cables are classified according to maximum data transfer speed information.

3. A connector device according to claim 1, wherein the kind of the signal cable is discriminated according to the presence or absence of a recessed part or a through hole in the plug and the position of the recessed part or the through hole.

4. A connector device according to claim 1, wherein the receptacle has a housing for inserting the plug and a detector for discriminating the kind of the signal cable is provided so as to face the inside of the housing.

5. A connector device according to claim 1, wherein the detector for discriminating the kind of the signal cable is a switch.

6. A connector device according to Claim 5, wherein the switch is a push type switch, a magnetic induction switch or an optical switch.

7. A connector device according to Claim 5, wherein the switch comprises a short bar provided at the plug and a pair of electrodes which are provided at the receptacle and electrically short-circuited by the short bar.

8. A connector device according to Claim 5, wherein the switch is integrally provided with a housing at the receptacle.

9. A connector device according to Claim 5, wherein the switch is provided separately from a housing at the receptacle.

10. A connector device according to Claim 1, wherein the receptacle and the plug are provided with erroneous insertion preventing means.

11. A data transfer apparatus comprising:

a first data processing system;

a second data processing system;

a signal cable connecting the first and second data processing systems, through which data is transferred between the data processing systems;

comparing means for comparing maximum data transfer speed information (A) of the first data processing system, maximum data transfer speed information (B) of the second data processing system, and maximum data transfer speed information (C) of the signal cable to be used; and

transfer speed setting means for selecting the lowest data transfer speed among the speed information (A), (B), and (C) as a comparison result and setting the lowest data transfer speed as an execution transfer speed,

wherein the data transfer is executed between the first data processing system and the second data processing system via the signal cable on the basis of the set execution transfer speed.

12. A data transfer apparatus according to Claim 11, wherein an index part indicative of the maximum data transfer speed information (C) of the signal cable is provided at the signal cable side and discriminating means for discriminating the maximum data transfer speed information (C) shown in the index part is provided at the data processing system side which is to be connected to the signal cable.

13. A data transfer apparatus according to Claim 12, wherein the index part is provided for the plug and the discriminating means is provided for the receptacle.

14. A data transfer apparatus according to Claim 13, wherein the discriminating means is a switch.

15. A data transfer apparatus according to Claim 15, wherein the switch is a push type switch, a magnetic induction switch or an optical switch.

16. A data transfer apparatus according to Claim 13, wherein the index part is a short bar and the discriminating means is a pair of electrodes electrically short-circuited by the short bar.

FIG. 1

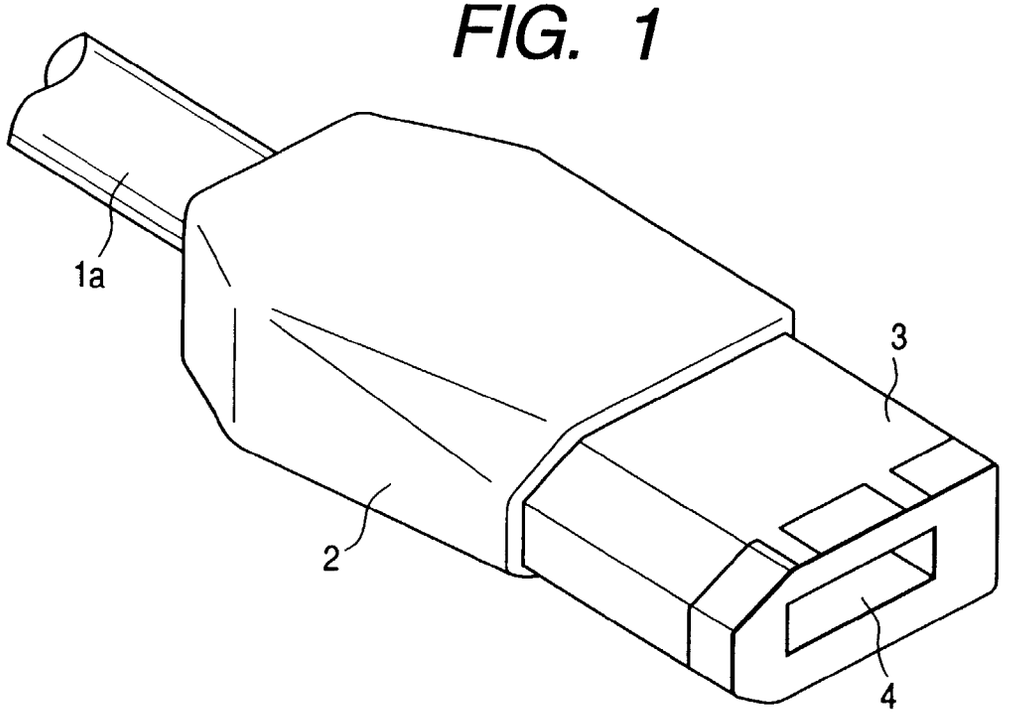


FIG. 2

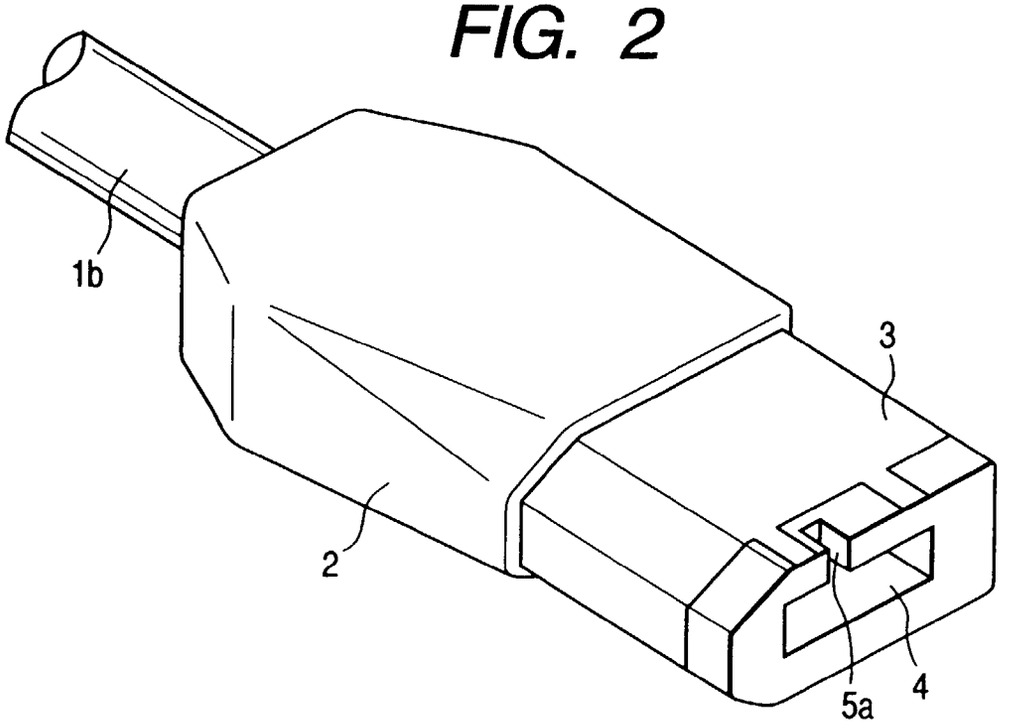


FIG. 3

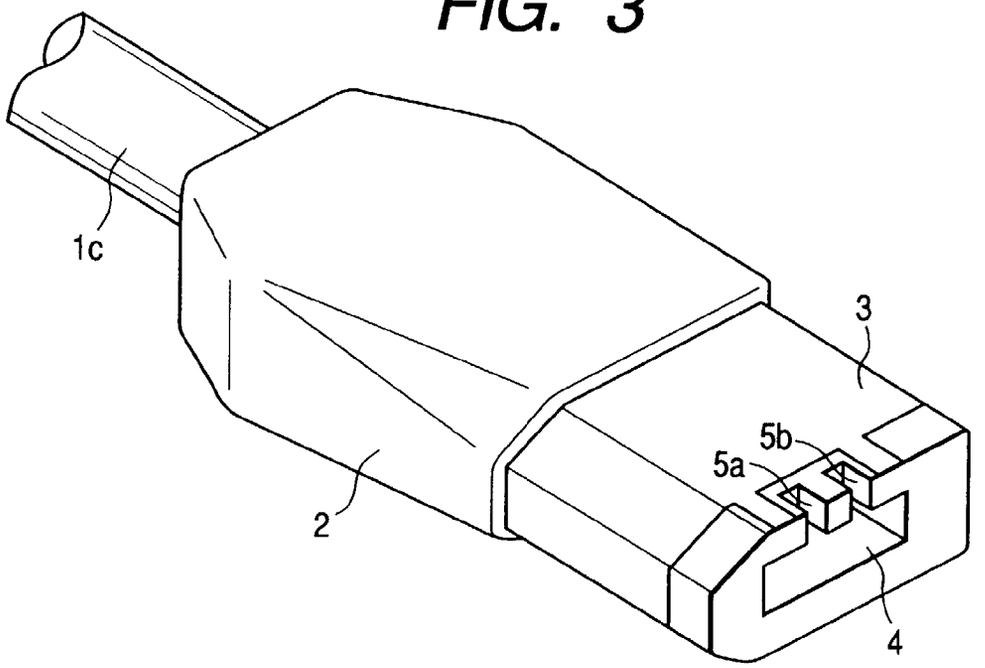


FIG. 4

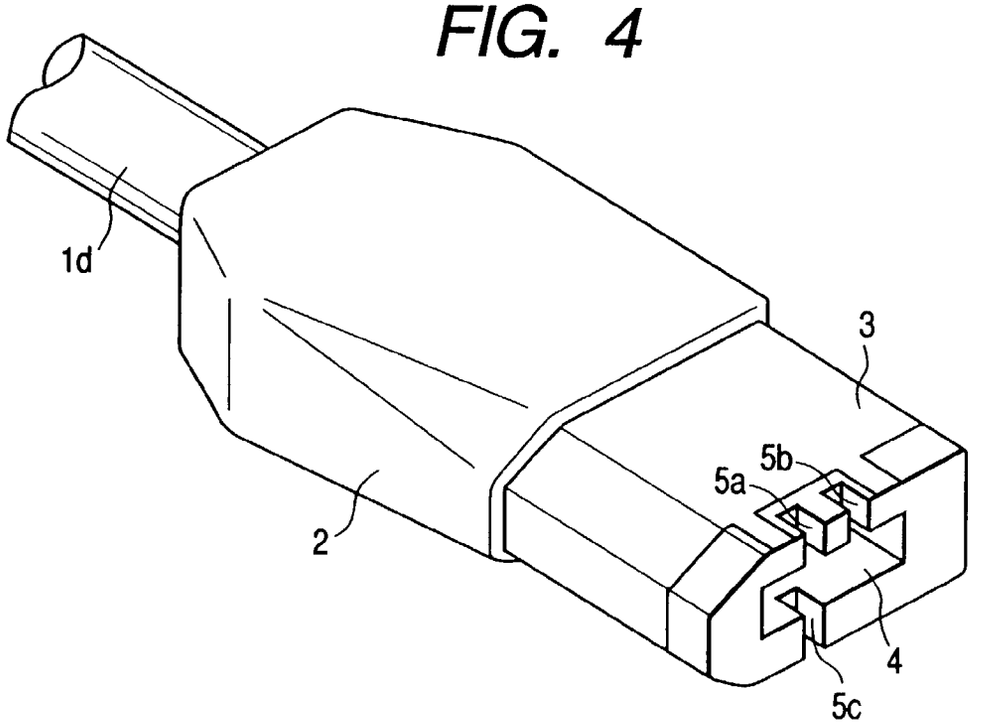


FIG. 5

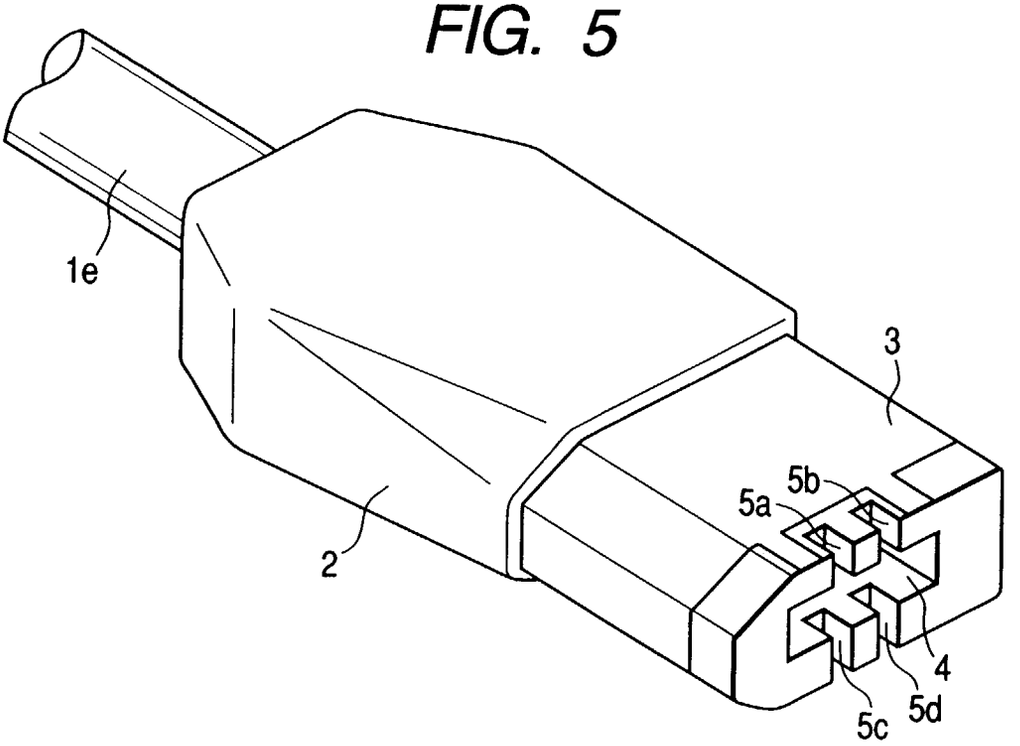


FIG. 6

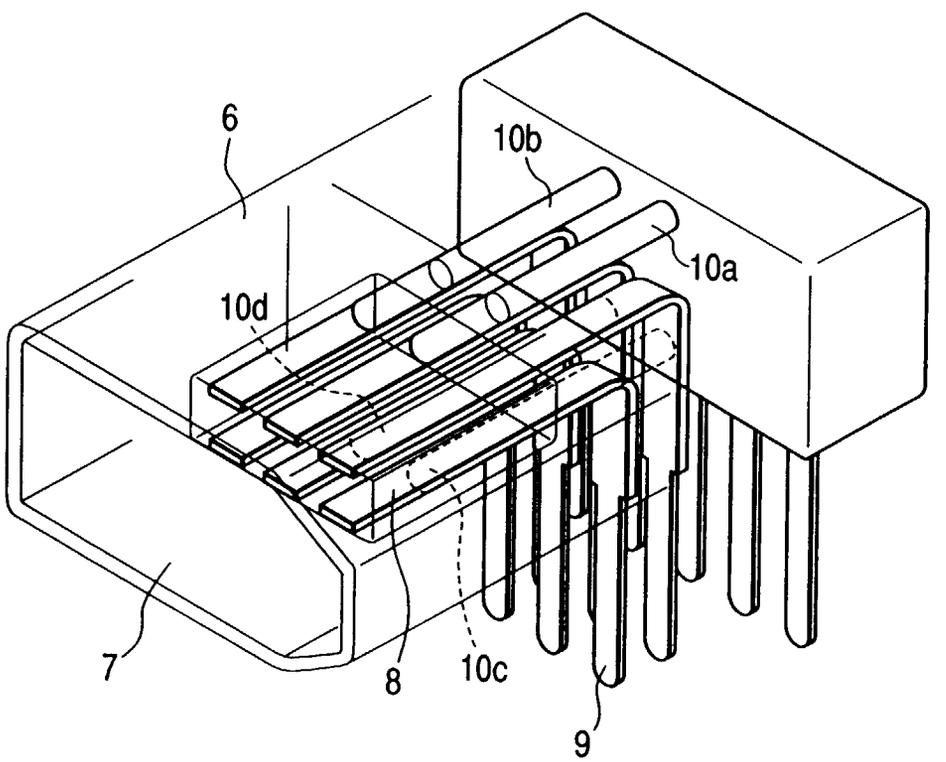


FIG. 7

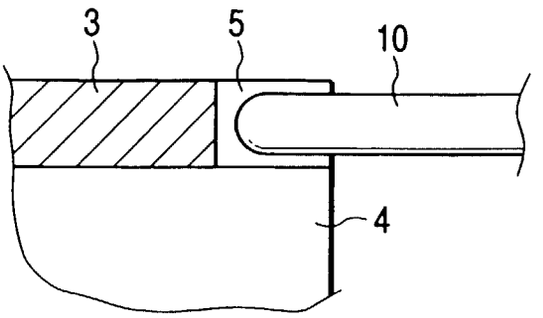

3
5
10
4

FIG. 8

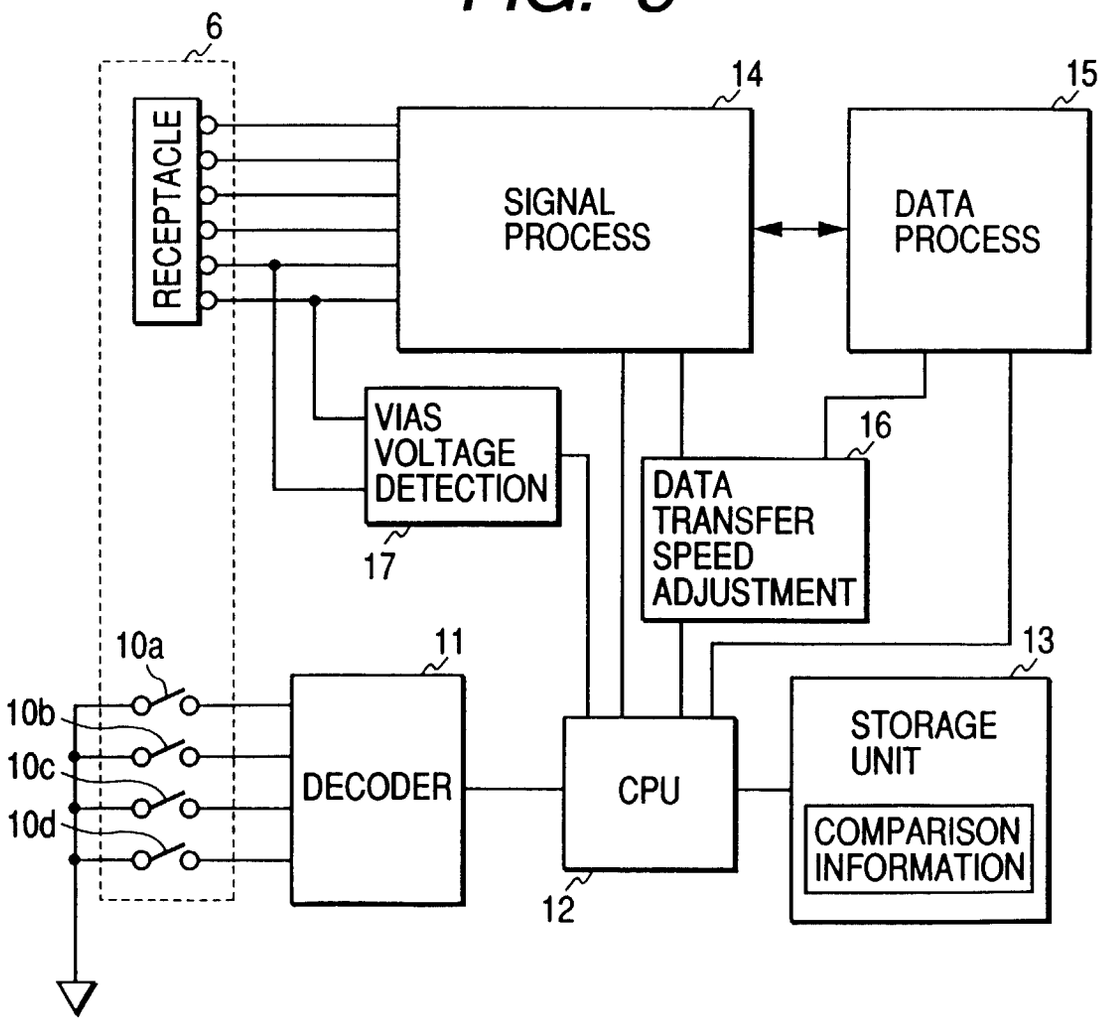

6
RECEPTACLE
14
SIGNAL PROCESS
15
DATA PROCESS
VIAS VOLTAGE DETECTION
17
16
DATA TRANSFER SPEED ADJUSTMENT
10a
10b
10c
10d
11
DECODER
CPU
12
13
STORAGE UNIT
COMPARISON INFORMATION

FIG. 9

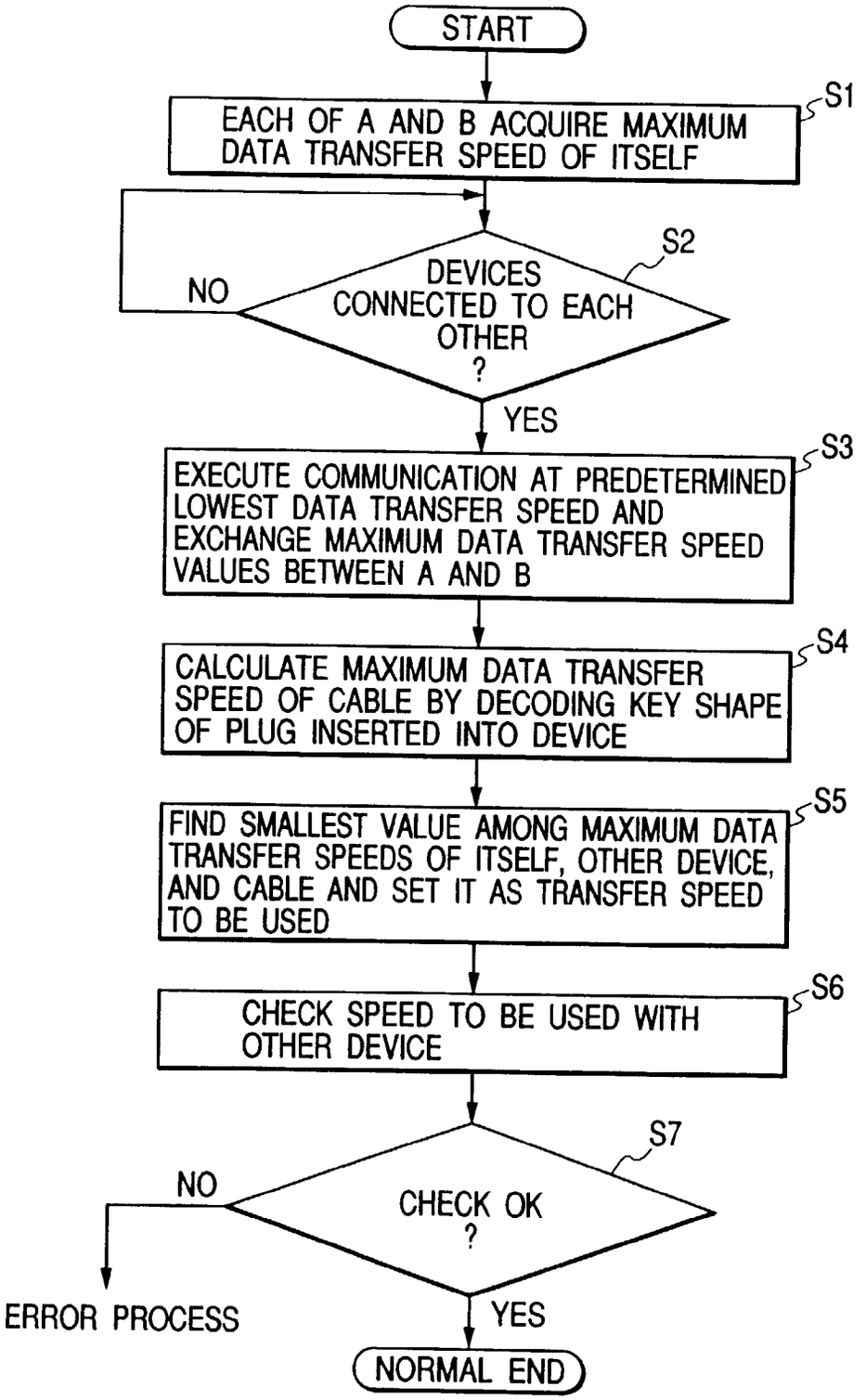

START
EACH OF A AND B ACQUIRE MAXIMUM DATA TRANSFER SPEED OF ITSELF
S1
DEVICES CONNECTED TO EACH OTHER ?
S2
NO
YES
EXECUTE COMMUNICATION AT PREDETERMINED LOWEST DATA TRANSFER SPEED AND EXCHANGE MAXIMUM DATA TRANSFER SPEED VALUES BETWEEN A AND B
S3
CALCULATE MAXIMUM DATA TRANSFER SPEED OF CABLE BY DECODING KEY SHAPE OF PLUG INSERTED INTO DEVICE
S4
FIND SMALLEST VALUE AMONG MAXIMUM DATA TRANSFER SPEEDS OF ITSELF, OTHER DEVICE, AND CABLE AND SET IT AS TRANSFER SPEED TO BE USED
S5
CHECK SPEED TO BE USED WITH OTHER DEVICE
S6
CHECK OK ?
S7
NO
YES
ERROR PROCESS
NORMAL END

FIG. 10

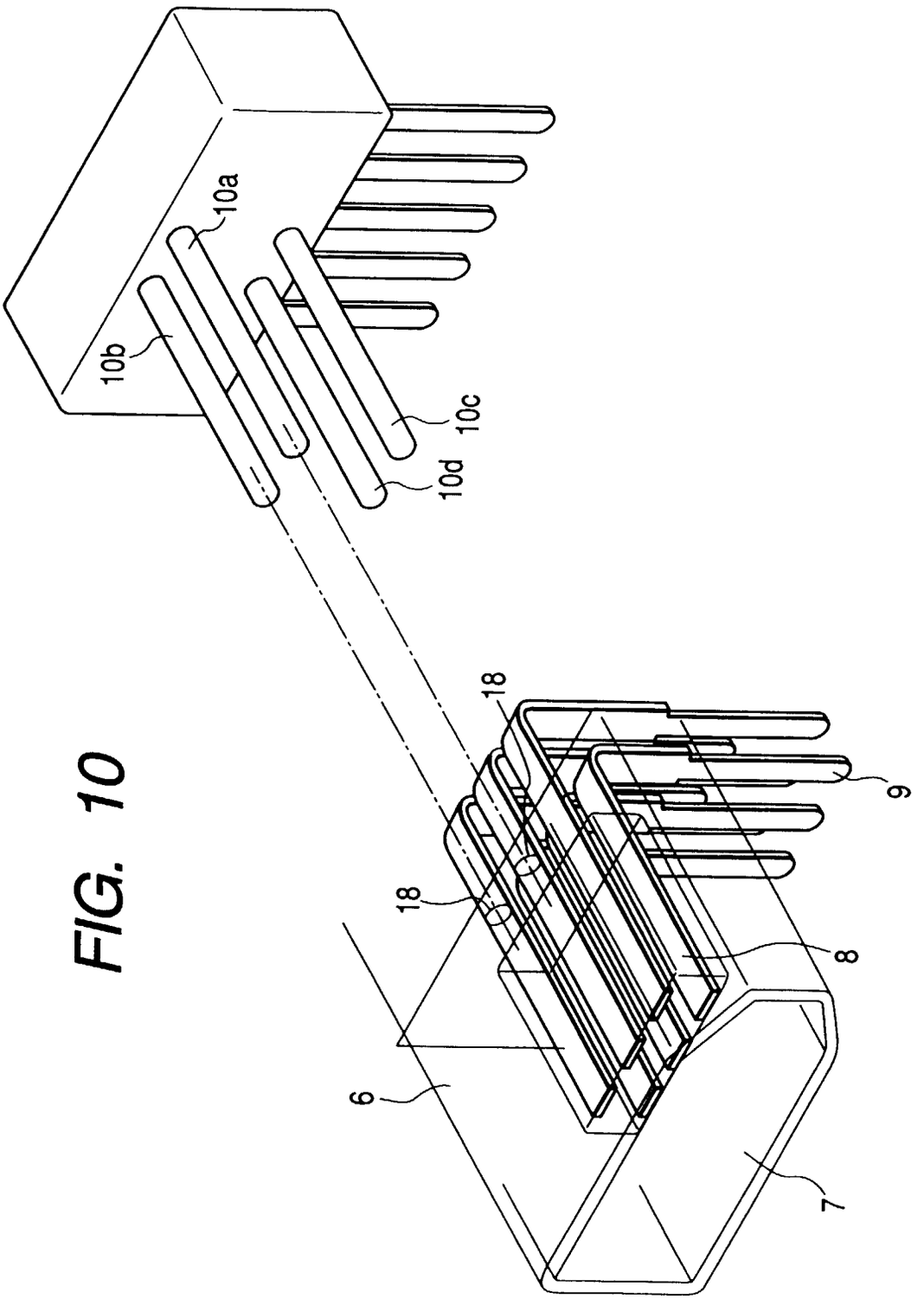


FIG. 11

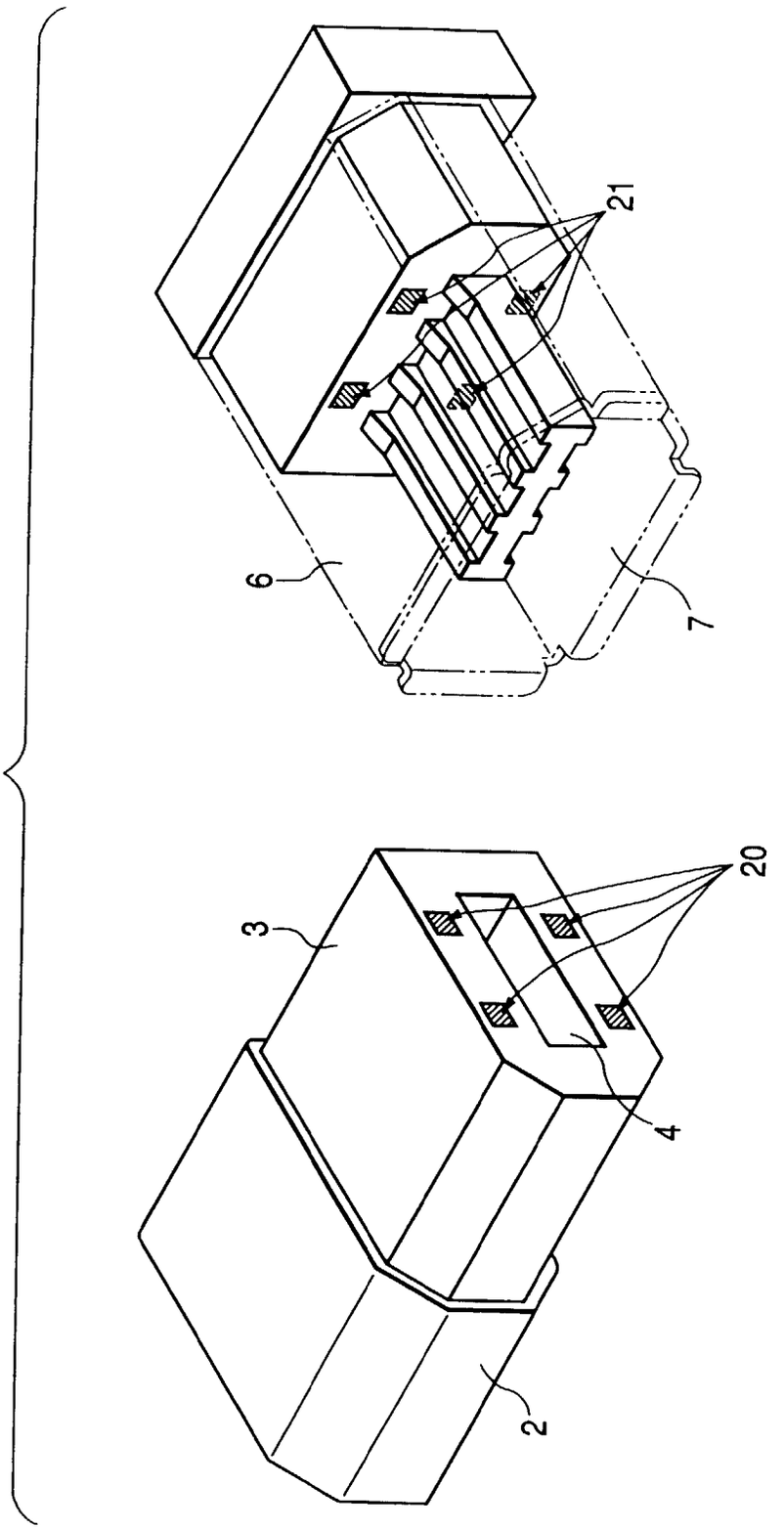


FIG. 12

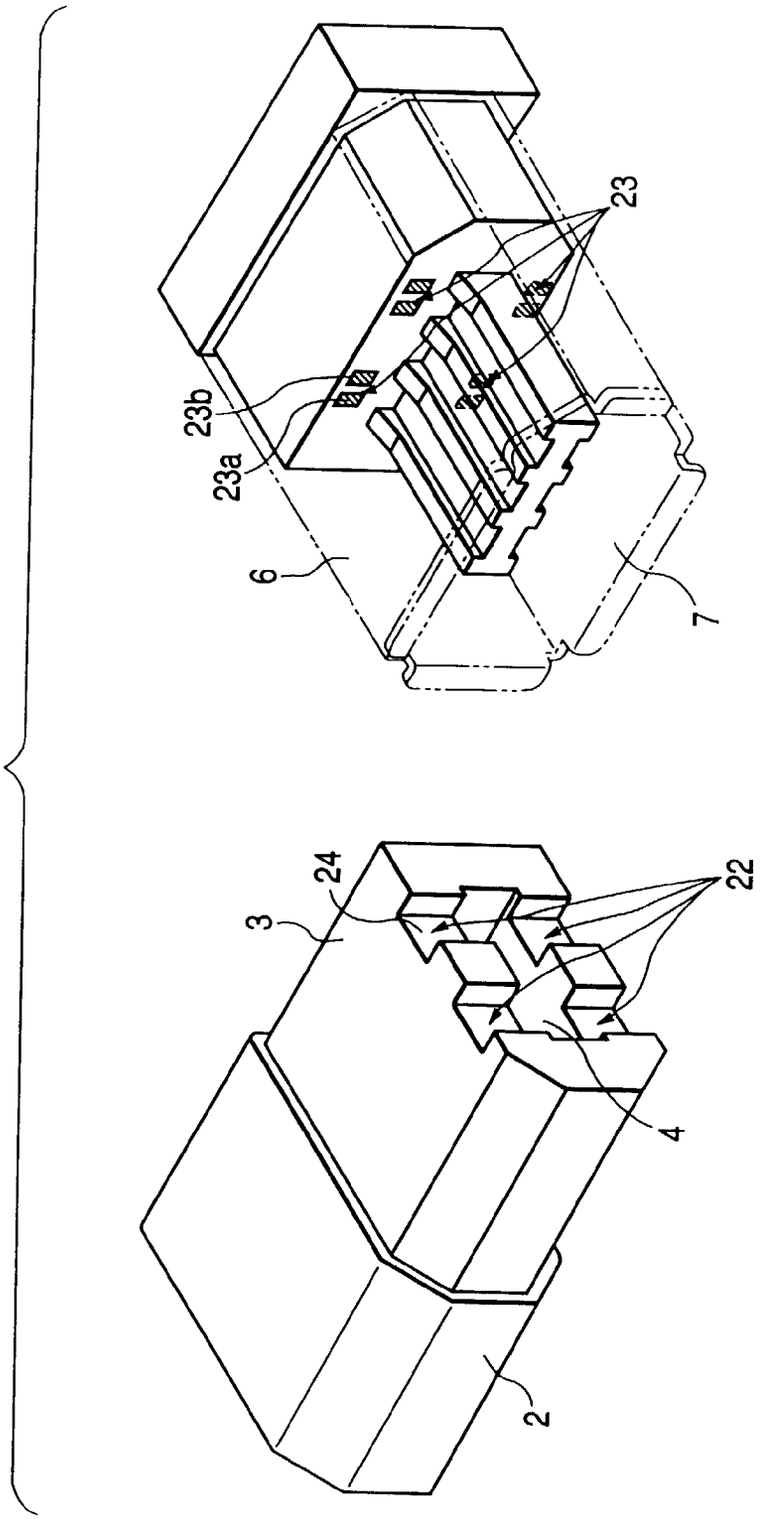


FIG. 13

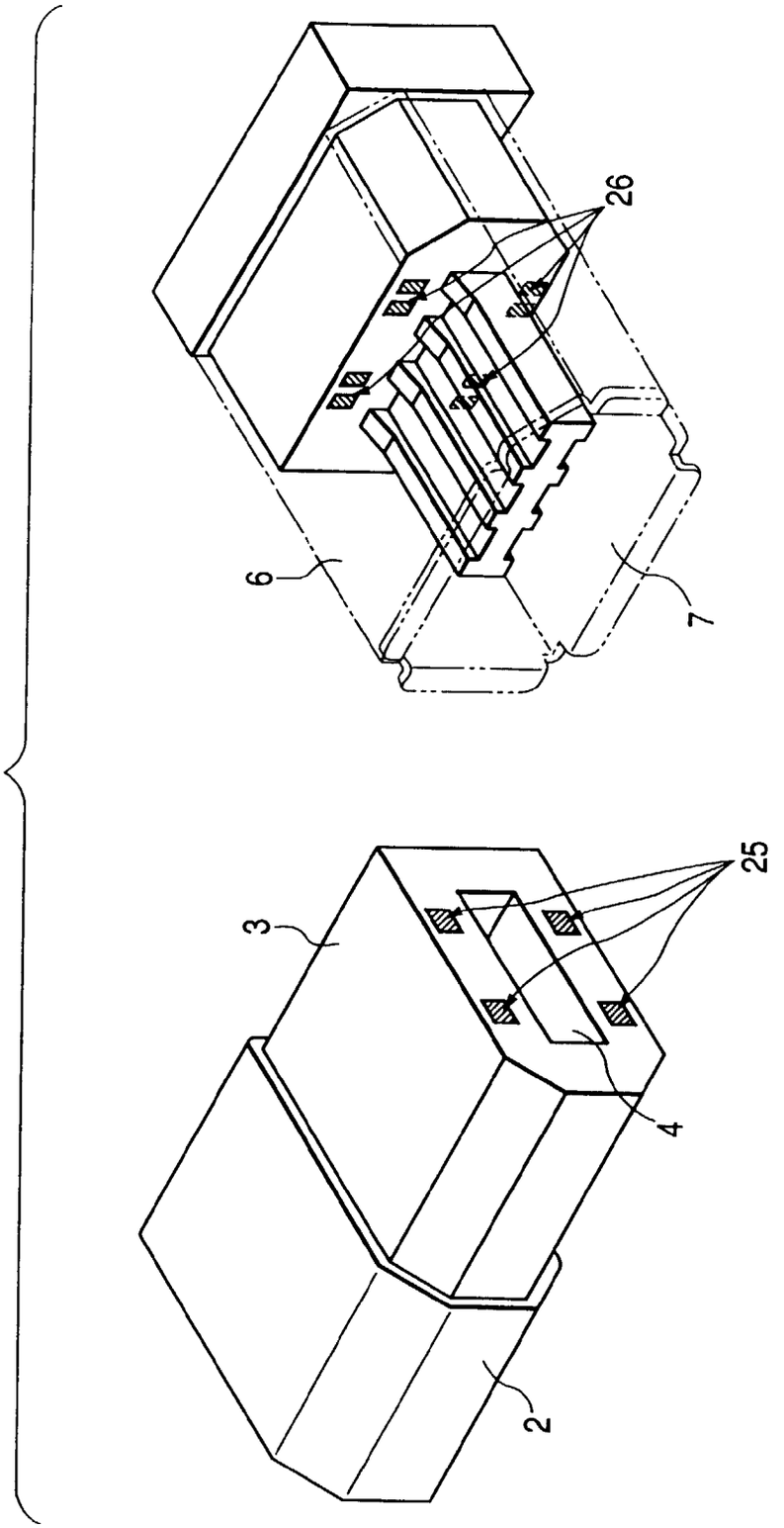


FIG. 14
PRIOR ART