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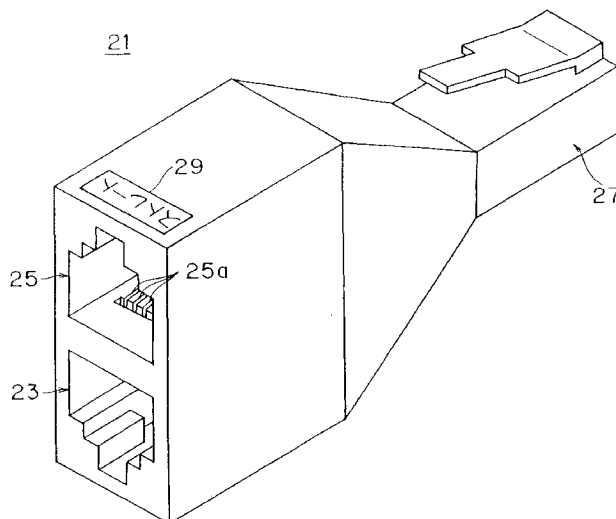
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(54) **Devices for interchanging connection modes**

(57) A device (21) includes a first alternative port (23) for making crossover connection, a second alternative port (25) for making straight connection and a plug portion (27) for connecting with a hub unit (9). Each of the first alternative port, the second alternative port and the plug portion includes terminal connectors (23a, 25a, 27a). The terminal connectors of the first alternative port (23) and those of the plug portion (27) are wired, such that a pair of transmission connectors (23a) of the first alternative port (23) is connected to a pair of reception connectors (27a) of the plug portion (27), thereby interchanging the connection mode. Alternatively, the terminal connectors (25) of the second alter-

native port (25) and those of the plug portion (27) are wired, such that a pair of transmission connectors (25a) of the second alternative port (25) is connected to a pair of transmission connectors (27a) of the plug portion (27), thereby maintaining the connection mode. A cable (5) has either straight or crossover connection mode and is provided with a cable plug (6) at end portions thereof. By connecting the cable plug (6) either to the first alternative port (23) or to the second alternative port (25) of the device (21), connection mode of the cable (5) can be interchanged between crossover connection and straight connection. The connection mode can thus be modified without replacing the cable plug (6).

Fig.6



Description

[0001] The present invention relates to communications networks such as local area network (LAN), and in particular modular jacks set up in communications pathways of such networks. The modular jack of the present invention is designed for switching over from straight connection to crossover connection, or vice versa.

[0002] In recent years, communications technologies have progressed into such fields as computer networks. Especially, the construction of the network so-called 'LAN' has increased considerably. A network LAN allows connecting the terminal apparatuses of computers and peripherals thereof to one another in rooms or buildings. A LAN has two types : one is 'peer-to-peer' type, shown in Fig. 1, in which a plurality of terminal apparatuses 1 exchange data therebetween on the same ranking basis. The other is 'client/server' type, shown in Fig. 2, in which a plurality of terminal apparatuses (client apparatuses) are connected to a central server 3 that controls the client apparatuses.

[0003] As shown in Figs. 3 and 4, a connecting cable 5 belonging to, for example, category 5 includes eight signal lines. Both ends of cable 5 are provided, respectively, with a first cable plug 6 (left side in the figures) and a second cable plug 6 (right side in the figures). Both cable plugs 6 may be an RJ-45 plug which is commonly used. Both the first cable plug 6 and the second cable plug 6 include, respectively, eight pin connectors 6a numbered from 1 to 8, corresponding to the eight signal lines. Pins 1 and 2 of pin connectors 6a of the first cable plug 6 include a positive electrode and a negative electrode respectively, and form a pair of transmission connectors. Likewise, pins 1 and 2 of pin connectors 6a of the second cable connector 6 include a positive electrode and a negative electrode respectively, and form a pair of transmission connectors. On the other hand, pins 3 and 6 of respective pin connectors 6a of the first and the second cable plugs 6 form a pair of reception connectors in the same way.

[0004] Fig. 3 shows a straight connection cable 5a according to standards 'EIA/TIA', in which pins 1 and 2 of pin connectors 6a of the first cable plug 6 are correspondingly connected to pins 1 and 2 of pin connectors 6a of the second cable plug 6. Alternatively, Fig. 4 shows a crossover connection cable 5b according to the same standards, in which pins 1 and 2 of pin connectors 6a of the first cable plug 6 are connected to pins 3 and 6 of pin connectors 6a of the second cable plug 6; as compared to straight connection cable 5a, connection to pin connectors 6a of the second cable plug 6 is thus interchanged from the pair of transmission connectors 1 and 2 to the pair of reception connectors 3 and 6.

[0005] When such a connecting cable 5a or 5b is used as in the case of prior art, a suitable cable must first be selected between two kinds of connection, prior to use, depending upon circumstances.

[0006] As shown in Figs. 1 and 2, a plurality of connecting cables 5 are jointed at branch junctions 7. Fig. 5 shows a hub unit 9 used for assembling such connecting cables 5. Hub unit 9 includes a plurality of hub ports 11, e.g. 8 hub ports. Cable plug 6 at the end portion of connecting cable 5 is engaged into one of hub ports 11.

[0007] Among hub ports 11 (1 to n) provided in hub unit 9, a port 11a, for example, is linked to connecting cable 5A which is bound to the main line (upstream in branching direction). The other hub ports 11b are then linked to respective connecting cables 5B which are bound to branched lines (downstream in branching direction). Connecting cables 5 are thus connected in serial order via hub unit 9, and communications pathways may be arranged either in star-type branching or for further extension, where necessary.

[0008] In such a hub unit 9, hub port 11a may or may not include a cascade mechanism. As is mentioned above, connecting cable 5A is connected to hub port 11a, and a plurality of connecting cables 5B are connected to the other corresponding hub ports 11b. Connecting cable 5A is then linked to the plurality of connecting cables 5B via straight connection or crossover connection. In the cascade mechanism, connection mode (straight or crossover) is interchanged by using a switch (not shown in figures) provided in hub unit 9. In hub unit 9 having no such mechanism, hub port 11a and a plurality of hub ports 11b are always linked via straight connection.

[0009] In terminal apparatuses 1 and 3 shown in Fig. 2, the transmission and the reception of communications data may be performed in two directions. To this end, a connection port (not shown in figures) of cable 5 mounted on one (first apparatus) of terminal apparatuses 1 and 3 must include two transmission connectors, which include a positive electrode and a negative electrode respectively and thus form a pair. The output signals exiting from the pair of transmission connectors of the first apparatus thus enter the reception connectors, which also form a pair on the same positive and negative electrodes basis in a connection port of the other (second apparatus) of terminal apparatuses 1 and 3. Conversely, the output signals exiting from the pair of transmission connectors included in the connection port of the second apparatus must enter the pair of reception connectors included in the connection port of the first apparatus. Therefore, at some points in a communications pathway, the pair of transmission connectors and the pair of reception connectors must be interchanged and connected.

[0010] Usually, the pair of transmission connectors and the pair of reception connectors are interchanged by using hub unit 9 including cascade-type ports, and by switching over the connection mode in the cascade-type ports : in such a case, connecting cable 5 used is basically straight connection cable 5a. However, in some cases, the switching-over between the pair of transmission connectors and the pair of reception con-

nectors is carried out by inserting a crossover connection cable in a communications pathway.

[0011] When terminal apparatuses 1 and 3 in a LAN are to be connected according to the above-mentioned prior art, straight connection cables and hub units 9 including cascade-type ports must be stored in advance in sufficient numbers. However, problems often arise when there lacks hub unit 9 having cascade-type ports, or only hub units 9 having no cascade-type ports are available. It may also happen that only straight connection cables are available, whenever crossover connection cables are needed, or vice versa. When such cases arise, the straight connection cable 5, or conversely the crossover connection cable 5, is cut off at the end portion thereof, and removed from the cable plugs 6 already connected thereto. Then, a pair of signal lines for transmission and a pair of signal lines for reception, contained in connecting cable 5, are interchanged, and connected to a new cable plug 6, so that the connection mode (straight or crossover) of connection cable 5 is reversed.

[0012] However, replacement of cable plug 6, and the ensuing modification of the connection mode of connecting cable 5, is a cumbersome and complicated work. Consequently, when it is executed by poorly experienced workers, there often arise connection misses or poor electrical contacts. This also results in repeated replacement works. A number of cable plugs 6 are thus damaged and cost is increased.

[0013] In view of the above problems, an object of the present invention is to provide modular jacks, which are capable of easily switching over the connection modes of connecting cables between straight connection and crossover connection, without replacing the cable plugs of connecting cables.

[0014] To this end, there is provided a device for connecting a cable having first and second end portions used in a communications network and adapted to interchange the connection modes of the cable between straight connection and crossover connection. The cable is mounted with a first cable plug at the first end portion, and with a second cable plug at the second end portion. The first cable plug and the second cable plug at least include a pair of transmission connectors and a pair of reception connectors respectively, whereby, when the pair of transmission connectors of the first cable plug is engaged with the pair of transmission connectors of the second cable plug, the straight connection is formed, and when the pair of transmission connectors of the first cable plug is engaged with the pair of reception connectors of the second cable plug, the crossover connection is formed. The device includes a first and a second alternative port for receiving the cable, and a plug portion for connecting a hub unit. The first alternative port, the second alternative port and the plug portion at least include a pair of transmission connectors and a pair of reception connectors respectively, and have the same configuration as that of the first or second cable

plug. The first alternative port and the plug portion are wired such that, when the first cable plug is engaged with the first alternative port, the pair of transmission connectors of the first cable plug is connected to the pair of reception connectors of the plug portion, thereby interchanging the connection mode, and the second alternative port and the plug portion is wired such that, when the first cable plug is engaged with the second alternative port, the pair of transmission connectors of the first cable plug is connected to the pair of transmission connectors of the plug portion, thereby maintaining the connection mode.

[0015] The device may be defined by a frame having a first end portion, and a second end portion distal thereto, and the first and second alternative ports may be provided at the first end portion and the plug portion may be provided at the second end portion.

[0016] Further, the frame may include a first surface near the first alternative port for crossover connection and a second surface near the second alternative port for straight connection. The first surface is then provided with an indication for the crossover connection, and the second surface is provided with an indication for said straight connection, respectively.

[0017] The above and other objects, features and advantages of the present invention will be made apparent from the following description of the preferred embodiments, given as non-limiting examples, with reference to the accompanying drawings, in which :

Fig. 1 shows a 'peer-to-peer' type wiring system commonly used in a LAN;

Fig. 2 shows a client /server' type wiring system commonly used in a LAN;

Fig. 3 shows an electrical circuit for making straight connection used in a connecting cable;

Fig. 4 shows an electrical circuit for making crossover connection used in a connecting cable ;

Fig. 5 is a perspective view of a commonly used hub unit;

Fig. 6 is a perspective view of the modular jack for making crossover or straight connection according to the invention;

Fig. 7 is a top plan view of the plug portion included in the modular jack of Fig. 6;

Fig. 8 shows the electrical circuits connecting the first and second alternative ports to the plug portion included in the modular jack of Fig. 6.

[0018] Fig. 6 shows a perspective view of the modular jack 21 for switching over between straight and crossover connections, according to a first embodiment of the present invention. modular jack 21 has two end portions. The first end portion includes a first alternative port 23 for crossover connection and a second alternative port 25 for straight connection. The second end portion of modular jack 21 includes a plug portion 27.

[0019] Each of first alternative ports 23, second alter-

native port 25 and plug portion 27 has substantially the same structure as hub ports 11 included in hub unit 9 and the connection plugs of terminal apparatuses 1 and 3, as well as cable plug 6 (RJ-45 plug) connected to the end portion of connecting cable 5.

[0020] The first and second alternative ports 23 and 25 respectively include a plurality of terminal connectors 23a and 25a (Fig. 8) which are connected to a plurality of terminal connectors 6a provided in cable plug 6A of connecting cable 5. When cable plug 6A is inserted into first alternative port 23 or second alternative port 25, each of terminal connectors 6a of cable plug 6A is connected to the corresponding terminal connectors 23a of first alternative port 23 or the corresponding terminal connectors 25a of second alternative port 25.

[0021] The plug portion 27 of modular jack 21, shown in Fig. 7, includes the same number of terminal connectors 27a as the terminal connectors 23a of first alternative port 23 or the terminal connectors 25a of second alternative port 25. When plug portion 27 is inserted into a predetermined hub port 11 of hub unit 9, each of the terminal connectors 27a of plug portion 27 is connected to each of the terminal connectors provided in a hub port 11.

[0022] The modular jack 21 is defined by a frame which contains the above-mentioned first and second alternative ports 23 and 25 and plug portion 27. A label 29 may be stuck onto the frame, which indicates the connection feature 'crossover' and 'straight' on the outer surface of the corresponding first alternative port 23 and second alternative port 25 (Fig. 6). Etching or carving the frame may also be used, instead of labeling, to show the same indication.

[0023] The terminal connectors 23a of first alternative port 23 and the terminal connectors 27a of plug portion 27 are wired, such that, when linking connecting cable 5 to first alternative port 23, a pair of transmission connectors and a pair of reception connectors of connection cable 5 are interchanged. Conversely, the terminal connectors 25a of second alternative port 25 and the terminal connectors 27a of plug portion 27 are wired, such that, when linking connecting cable 5 to second alternative port 25, a pair of transmission connectors and a pair of reception connectors of connection cable 5 are not interchanged.

[0024] Fig. 8 represents the inner circuit of modular jack 21 which shows how the terminal connectors 27a of plug portion 27 are connected to the terminal connectors 23a of first alternative port 23 and to the terminal connectors 25a of second alternative port 25.

[0025] In Fig. 8, terminal connectors 23a, 25a and 27a of, respectively, first alternative port 23, second alternative port 25 and plug portion 27 are differentiated by assigning the connector number 1 to 8, as in the case of terminal connectors 6a of cable plug 6A shown in Figs. 3 and 4. Then, terminal connectors 6a of cable plug 6A are connected to terminal connectors 23a of first alternative port 23, or to terminal connectors 25a of second

alternative port 25, via the same connector number.

[0026] In Fig. 8, connector numbers 1 and 2 of terminal connectors 23a, 25a and 27a form a pair of transmission connectors respectively, and connector numbers 3 and 6 of terminal connectors 23a, 25a and 27a form a pair of reception connectors respectively. In the crossover connection, terminal connectors 23a of first alternative port 23 and terminal connectors 27a of plug portion 27 are wired, such that the pair of transmission connectors and the pair of reception connectors are interchanged. Conversely, in the straight connection, terminal connectors 25a of second alternative port 25 and terminal connectors 27a of plug portion 27 are wired, such that the pair of transmission connectors and the pair of reception connectors are not interchanged.

[0027] In the system including modular jack 21, when connecting cable 5 is linked to second alternative port 25 of modular jack 21, the connection mode of connecting cable 5 is not switched. Alternatively, when connecting cable 5 is connected to first alternative port 23, the connection mode of connecting cable 5 is switched.

[0028] The plug portion 27 of modular jack 21 has a similar structure to an ordinary RJ-45 plug. Accordingly, connecting cable 5 can first be connected to modular jack 21 via terminal connectors 23a or 25a, and then, via modular jack 21, to a desired hub port 11.

[0029] According to the first embodiment of the present invention, by means of inserting cable plug 6A mounted to the end portion of connecting cable 5 into first alternative port 23, the connection mode of connecting cable 5 can easily be interchanged from straight connection to crossover connection, or vice versa. In this manner, complicated handling work for replacing cable plug 6A can be suppressed.

[0030] When connecting terminal apparatuses 1 and 3 to each other, it may occur that there lacks either connecting cables 5 having straight connection or crossover connection. This kind of problem may be completely solved by adopting the means of the present invention, according to which the connection mode of connecting cable 5 can be switched over via modular jack 21.

[0031] In order to assess whether connecting cable 5 used as a communications pathway satisfies the criteria for category 5, a cable tester is commonly used. Normally, the cable tester is designed to connect only to the straight connection cable 5a. In such cases, if modular jack 21 of the invention is connected to the connection port of the cable tester, the cable tester may also allow testing the crossover connection cable 5b.

[0032] As described above, modular jack 21 includes a first alternative port 23 (crossover connection) and a second alternative port 25 (straight connection). Further, modular jack 21 can be connected in advance to one of hub ports 11 provided in any junction point of the communications pathway. Accordingly, when it is needed to switch the connection mode of connecting cable 5, connecting cable 5 may be linked to first alternative port 23. On the contrary, when there is no need to switch,

connecting cable 5 may be linked to second alternative port 25. The switching-over in this way renders the handling more flexible.

[0033] In addition, as mentioned above, first alternative port 23 and second alternative port 25 may be stuck with labels 29 indicating respectively 'crossover connection' or 'straight connection', so that the alternative port to be connected with connecting cable 5 can be identified easily.

[0034] Instead of labeling, other identification means such as coloring, signs, marking, etc. may also be applied.

[0035] According to the present invention, when change of the connection mode (straight or crossover) of a connecting cable is desired, it suffices to connect the modular jack for switching the connection mode to a cable plug which is mounted at the end portion of a connecting cable. The complicated work of replacing the cable plug is thus no longer required.

[0036] Further, the modular jack according to the invention includes a first alternative port making the crossover connection and a second alternative port making the straight connection. The modular jack may be allowed to stand linked to a connection port set up at a junction point of the communications pathway. Then, when the connection mode of the connecting cable must be changed, the connecting cable is linked to the first alternative port. When there is no need to change the connection mode, the connecting cable is connected to the second alternative port. In this way, flexible handling of the cables is secured.

[0037] Furthermore, labels may be stuck onto the first and the second alternative ports of the modular jack, which indicate connection modes such as 'crossover' or 'straight'. These labels allow the connecting cable to be branched, swiftly and easily, with a desired connection port.

Claims

1. A device (21) for connecting a cable (5) having first and second end portions used in a communications network and adapted to interchange the connection modes of said cable between straight connection (5a) and crossover connection (5b), said cable (5) being mounted with a first cable plug (6) at said first end portion, and with a second cable plug (6) at said second end portion, said first cable plug (6) and said second cable plug (6) at least including a pair of transmission connectors (6a) and a pair of reception connectors (6a) respectively, whereby, when said pair of transmission connectors (6a) of said first cable plug (6) is engaged with said pair of transmission connectors (6a) of said second cable plug (6), said straight connection is formed, and when said pair of transmission connectors (6a) of said first cable plug (6) is engaged with said pair of reception connectors (6a) of said second cable plug (6), said crossover connection is formed, characterised in that said device (21) includes a first and a second alternative port (23, 25) for receiving said cable (5), and a plug portion (27) for connecting a hub unit (9), said first alternative port (23), said second alternative port (25) and said plug portion (27) at least including a pair of transmission connectors (23a, 25a, 27a) and a pair of reception connectors (23a, 25a, 27a) respectively, and having the same configuration as that (6a) of said first or second cable plug (6), said first alternative port (23) and said plug portion (27) being wired such that, when said first cable plug (6) is engaged with said first alternative port (23), said pair of transmission connectors (6a) of said first cable plug (6) is connected to said pair of reception connectors (27a) of said plug portion (27), thereby interchanging said connection mode, and said second alternative port (25) and said plug portion (27) being wired such that, when said first cable plug (6) is engaged with said second alternative port (25), said pair of transmission connectors (6a) of said first cable plug (6) is connected to said pair of transmission connectors (27a) of said plug portion (27), thereby maintaining said connection mode.
2. The device (21) according to claim 1, wherein said device (21) is defined by a frame having a first end portion, and a second end portion distal thereto, and said first and second alternative ports (23, 25) are provided at said first end portion and said plug portion (27) is provided at said second end portion.
3. The device (21) according to claim 2, wherein said frame includes a first surface near said first alternative port (23) for crossover connection and a second surface near said second alternative port (25) for straight connection and wherein said first surface is provided with an indication (29) for said crossover connection, and said second surface is provided with an indication (29) for said straight connection, respectively.

Fig.1

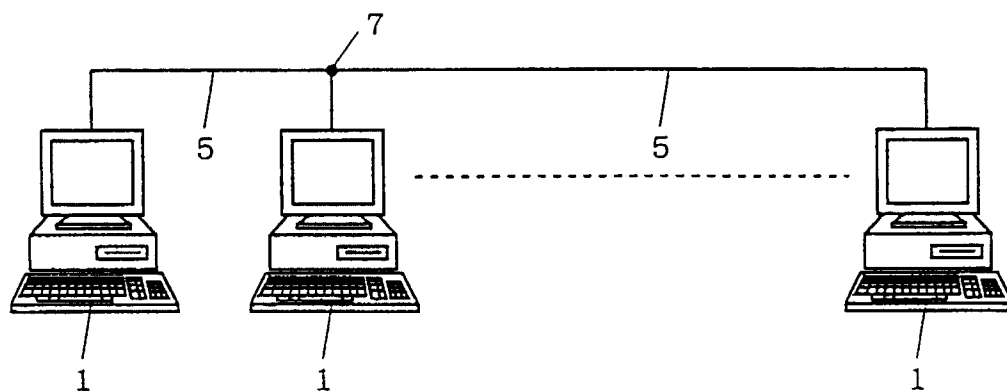


Fig.2

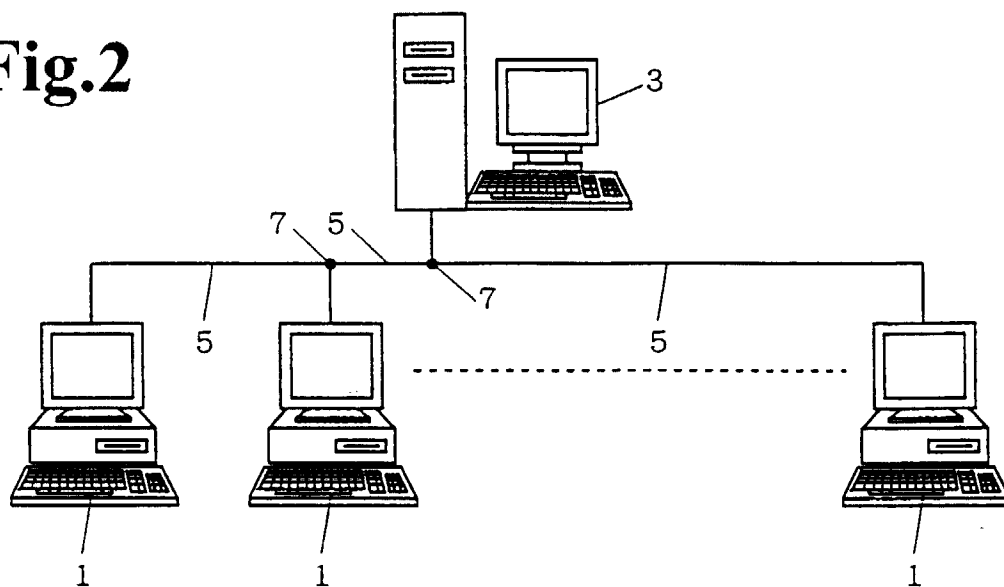


Fig.3

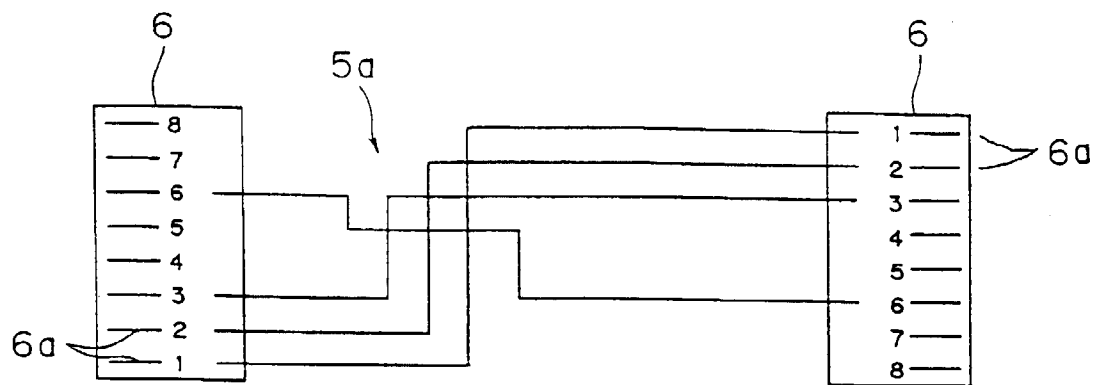


Fig.4

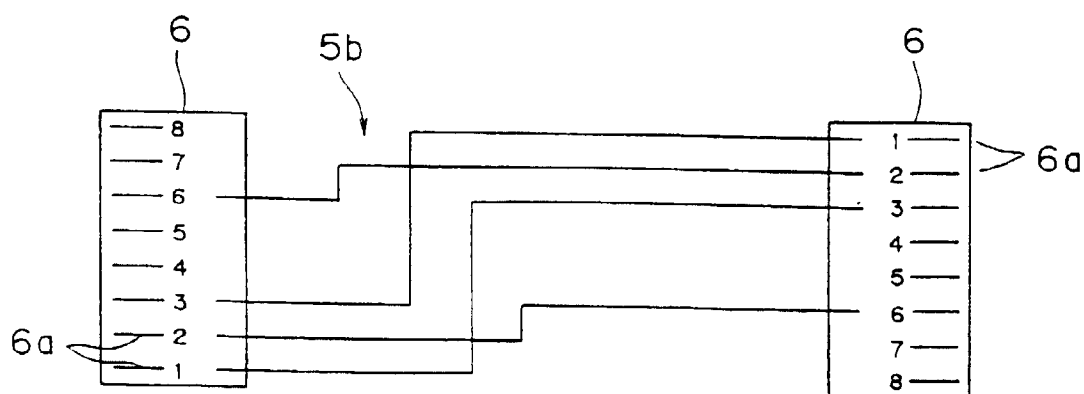


Fig.5

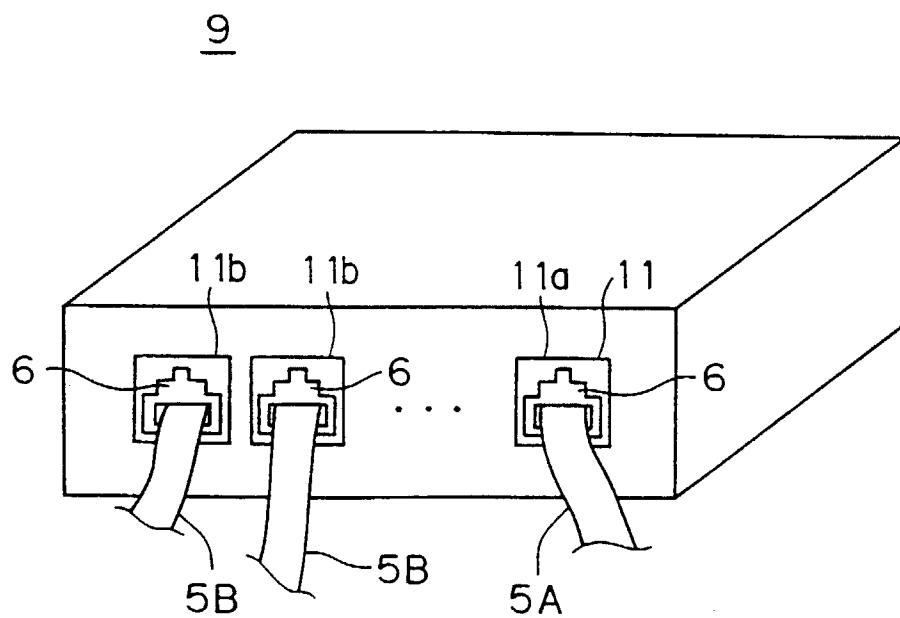


Fig.6

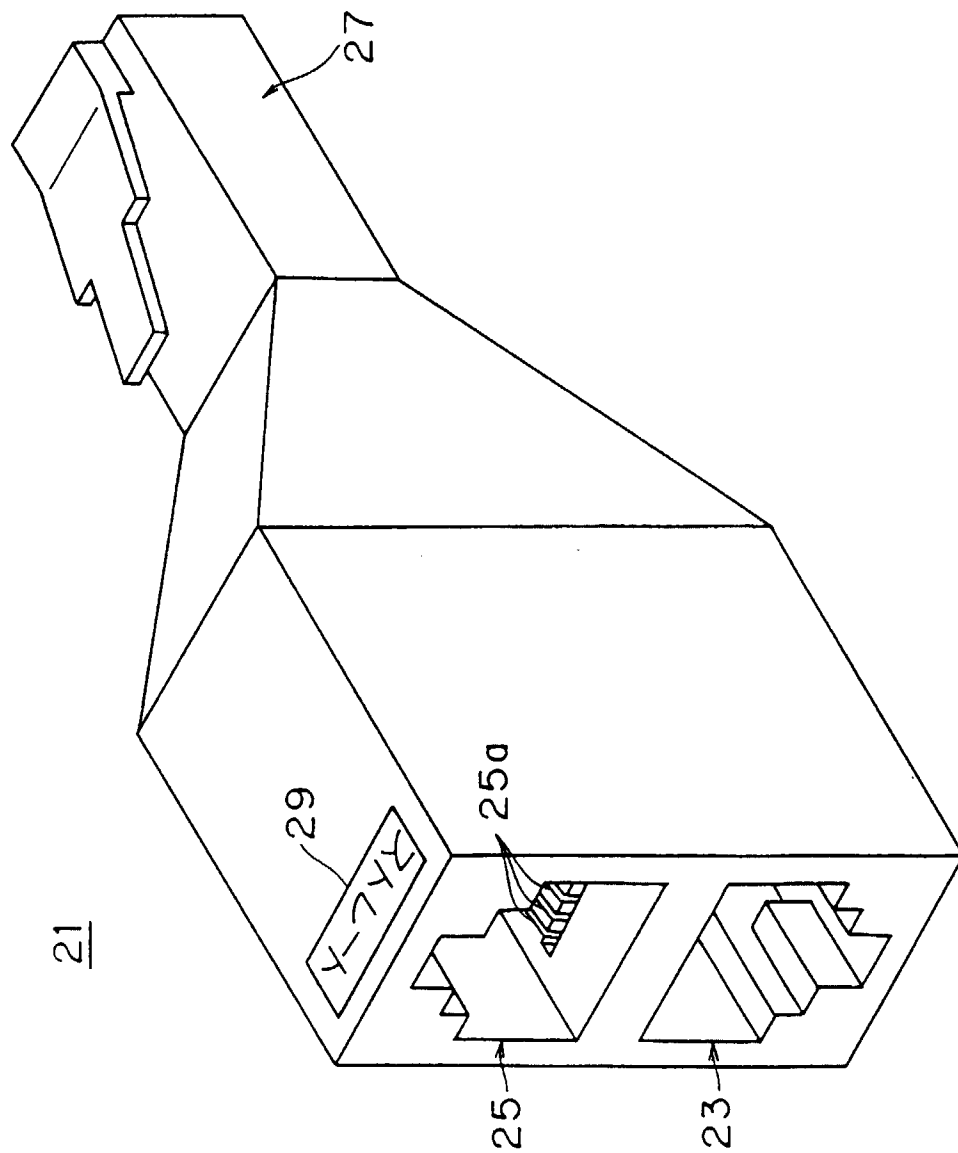


Fig.7

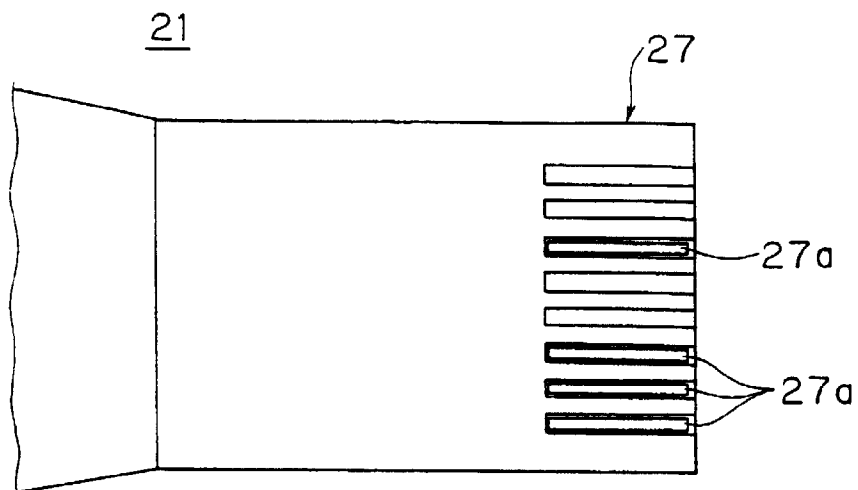
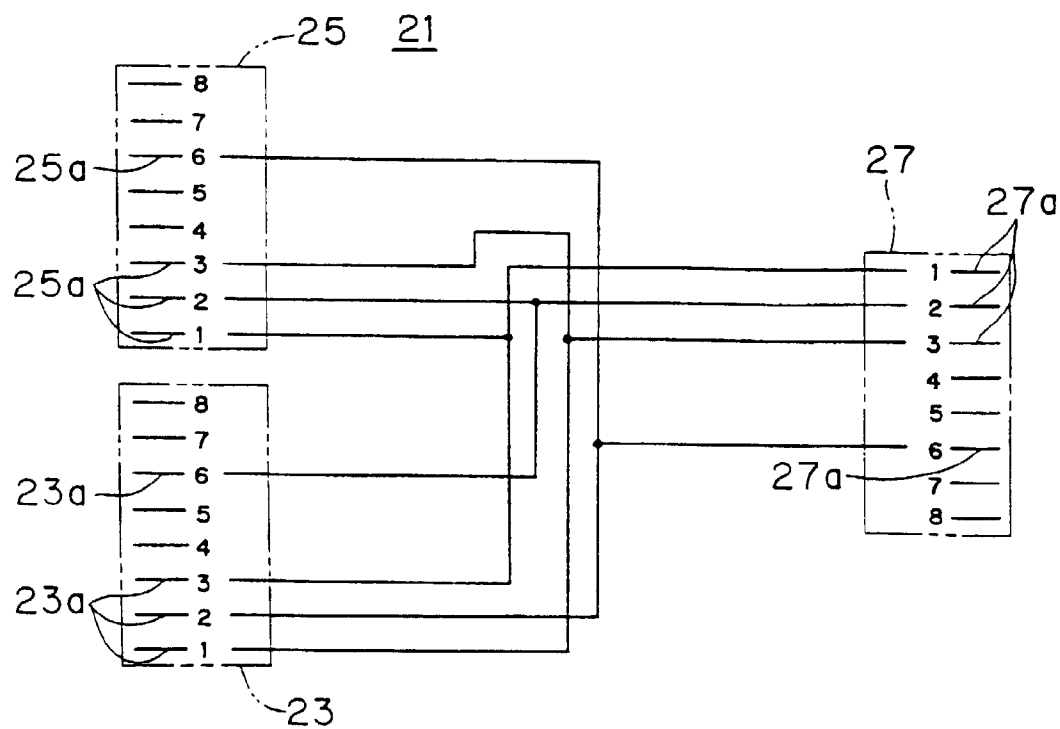


Fig.8





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EUROPEAN SEARCH REPORT

Application Number
EP 99 40 0011

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Place of search THE HAGUE		Date of completion of the search 8 April 1999	Examiner Demol, S
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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