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Europäisches Patentamt  
European Patent Office  
Office européen des brevets

(11) Publication number:

**0 283 012**  
**A2**

(12)

# EUROPEAN PATENT APPLICATION

(21) Application number: 88104258.4

(51) Int. Cl. 4: H01B 9/00

(22) Date of filing: 17.03.88

(30) Priority: 18.03.87 JP 63559/87

(43) Date of publication of application:  
21.09.88 Bulletin 88/38(84) Designated Contracting States:  
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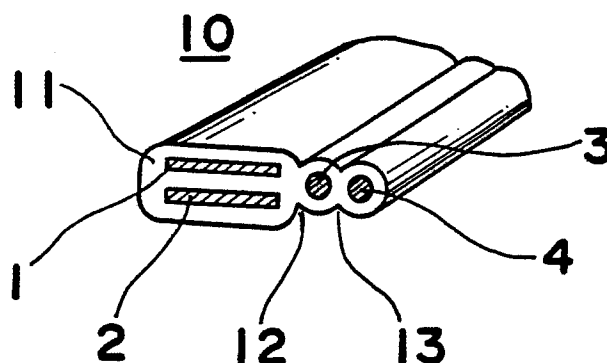
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(54) Cable arrangement for use in a multiplex transmission system.

(57) A cable unit (10) comprises a pair of power supply conductors (1,2) of an elongated strip shape extending parallelly, being opposed each other. The two conductors (1,2) are separated as close as possible with a possible distance for assuring a desired withstand voltage. A pair of signal conductors (3,4) are disposed one side of the power conductors (1,2) at positions corresponding to the center between the two power supply conductors (1,2) and extending parallelly along the power supply conductors (1,2). The respective conductors (1-4) are covered with suitable insulation layers (11).

*Fig. 3*



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## CABLE ARRANGEMENT FOR USE IN A MULTIPLEX TRANSMISSION SYSTEM

### Background of the Invention

#### a) Field of the Invention

The present invention relates to a cable arrangement in which a pair of power conductors for transmitting power and a pair of signal conductors for transmitting various signals are integrally formed in one cable structure.

#### b) Description of the Prior Art

Fig. 1 shows an example of a multiplex transmission system. In Fig. 1, 101 and 102 denote power transmission lines for supplying power to terminals 105 and 106. 103 and 104 denote data transmission lines for transmitting data information to the terminals 105 and 106. In the example shown, the respective terminals 105 and 106 are provided with actuators 107 and 108 such as an electric motor or display lamp which are activated by the data information in addition to various switches 109 and 110 for inputting the data information.

In the prior art, the power lines 101 and 102 and data transmission lines 103 and 104 are connected to the respective terminals 105 and 106 by means of one or more separate conventional connecting wires or twisted pair wires through external connectors 121 and 122 as shown in Fig. 2. In Fig. 2, the connecting lines generally shown by an arrow mark A show the lines to be connected with a front stage terminal and the lines generally shown by an arrow mark B show the lines to be connected to a back stage terminal.

However, in the prior art, since the respective lines are connected to the multiplex transmission terminal through one or more external connectors 121 and 122, in order to connect each line with the multiplex transmission terminal, it is necessary to provide a cable of a suitable length corresponding to the position of the multiplex transmission terminal, having a suitable connector tip attached to the end of conductor of the cable.

Moreover, since the respective lines 101 and 102 are independently laid, it is necessary to consider cable lay out so as to prevent noise caused by the power lines from being induced on the signal lines.

### Summary of the Invention

An essential object of the present invention is to provide a multiplex transmission cable arrangement which is capable of eliminating the problems as mentioned above.

Another object of the present invention is to provide a multiplex transmission cable arrangement which is easy to connect to one or more multiplex transmission terminals.

A further object of the present invention is to provide a multiple transmission cable arrangement which can prevent noise from power lines.

In order to accomplish the objects mentioned above, according to the present invention, there is provided a cable arrangement comprising:

a pair of power conductors which are electrically separated but closely opposed each other;

a pair of signal conductors disposed at one side of said power conductors with the center of the respective signal conductors positioned corresponding to substantially a center between said pair of power conductors and to extend parallelly with the power conductors; and

insulation layers for insulating said power conductors and signal conductors respectively.

### Brief Description of the Drawings

Fig. 1 is a circuit diagram showing an example of multiplex transmission terminal,

Fig. 2 is a perspective view of an example of a wire connection in the conventional multiplex transmission terminal,

Fig. 3 is a perspective view showing an example of a multiplex transmission cable according to the present invention,

Fig. 4 is a perspective view showing a specific feature of the use of the multiplex transmission cable according to the present invention,

Fig. 5 is a front view of the multiplex transmission terminal shown in Fig. 4 with the case halves opened, and

Fig. 6 is a perspective view of the multiplex transmission terminal attached to the multiplex transmission cable according to the present invention.

### Detailed Description of the Preferred Embodiment

Referring to Fig. 3, there is shown a multiplex transmission cable unit 10 used for the multiplex transmission terminal. The cable unit 10 comprises

a pair of power supply conductors 1 and 2 of an elongated strip shape extending parallelly, being opposed each other. The two conductors 1 and 2 are separated as close as possible with a possible distance for assuring a desired withstand voltage. To dispose both conductors 1 and 2 as close as possible enables to increase a capacitance between them, thereby to provide low impedance power supply lines. A pair of signal conductors 3 and 4 are disposed one side of the power conductors 1 and 2, at positions corresponding to the center between the two power supply conductors 1 and 2 and extending parallelly along the power supply conductors 1 and 2. The respective distances between the signal conductor 3 and both of the power supply conductors 1 and 2 are made equal so as to prevent electrostatic induction from the power supply conductors 1 and 2. The respective distances between the signal conductor 4 and both of the power supply conductors 1 and 2 are also equal.

The respective conductors 1 to 4 are covered with insulation material 11 (referred to as insulation layer hereinafter) as shown in Fig. 3. Although the conductors 1 to 4 are covered with insulation layer 11 over the whole length of the conductors, a multiplex transmission terminal can be connected to the respective conductors 1 to 4 anywhere desired on the multiplex cable unit as mentioned below. There are formed grooves 12 and 13 on the surface of the insulation layer 11 corresponding to interface portions between the power conductors 1 or 2 and the signal conductor 3 and between the two signal conductors 3 and 4.

Referring to Figs. 4, 5 and 6, a terminal case 30 of a multiplex transmission terminal is composed of a top case half 30a and bottom case half 30b made of resin material. Both of the case halves 30a and 30b are rotatably coupled by one or more hinges 19 so that both of the case halves 30a and 30b can be opened and closed around the hinge 19. A lock mechanism 20 is provided at the right hand portion of the outside of the terminal case 30. A printed circuit board 25 is accommodated in the top case half 30a and possible circuit arrangement including such as integrated circuit chip 23 or other necessary components for use in the multiplex transmission terminal is provided on the printed circuit board 25. Such circuit arrangement including the integrated circuit 23 and other components are respectively connected to the conductor patterns 24 formed on the printed circuit board 25 so as to provide a desired terminal circuit.

Three pressing connector pins 15, 17 and 18 are downwardly projected from the printed circuit board 25 toward a recess 26f and one pressing type connector pin 16 is upwardly projected from the bottom case half 30b toward the recess 26f.

The connector pin 15 is connected to the printed circuit patterns 24 and the connector pin 15 is also connected to other printed circuit pattern 24 through a flexible wire 27. The connector pins 15 and 16 are so projected that when the top case half 30a and bottom case half 30b are closed, the respective connector ends of the connector pins 15 and 16 are opposed in the recesses 26 and the connector pin 15 is coupled to the power supply conductor 1 and the connector pin 16 is coupled to the power supply conductor 2. The connector pins 17 and 18 are connected to the other printed circuit patterns.

The terminal 30 is mounted to the cable unit 10 in such a manner that the power conductor portion 10f is laid in the generally flat shaped recess 26f and signal conductor portions 10r are laid in the round recesses 26r. Then the terminal 30 is closed as shown in Fig. 4 and Fig. 6 with the top case half 30a and bottom case half 30b locked in a closed manner by locking member 20, the ends of the connector pins 15, 16, 17 and 18 penetrate the insulation layer 11 and the connector pins 15 and 16 contact to the power supply conductors 1 and 2 respectively and the connector pins 17 and 18 clamp and contact the signal conductors 3 and 4 by their fork shaped ends as shown in Fig. 6. In case the terminal 30 is correctly mounted to the cable unit 10, the respective projections 14 are fitted in the grooves 12 and 13. In other words, the grooves 12 and 13 can serve to position the connector pins 17 and 18 with respect to the conductors 3 and 4.

As described above, an advantage of the present invention is in that the multiplex transmission terminal 30 can be mounted at anywhere desired on the cable unit 10 without any works to the cable such as cable cutting and end treatment.

Another advantage of the present invention is in that since the power conductors are closely opposed, it is possible to decrease the power source impedance independent of length of the cable unit.

A still further advantage of the present invention is in that the cable unit has such structure that cross talk between the power conductors and signal conductors is small, whereby noise on the signal conductors caused by the power conductors can be effectively avoided.

## Claims

1. A cable arrangement (10) comprising:

a pair of power conductors (1,2) which are electrically separated but closely opposed each other;

a pair of signal conductors (3,4) disposed at

one side of said power conductors (1,2) with the center of the respective signal conductors (3,4) positioned corresponding to substantially a center between said pair of power conductors (1,2) and to extend parallelly with the power conductors (1,2); and

insulation layers (11) for insulating said power conductors (1,2) and signal conductors (3,4) respectively.

2. The cable arrangement (10) according to claim 1, wherein said power conductors (1,2) have respectively generally flat plate shape.

3. The cable arrangement (10) according to claim 1, wherein said insulation layers (11) have grooves corresponding to intermediate portions between said power conductor (1,2) and one of said signal conductors (3,4) and between two adjacent signal conductors (3,4).

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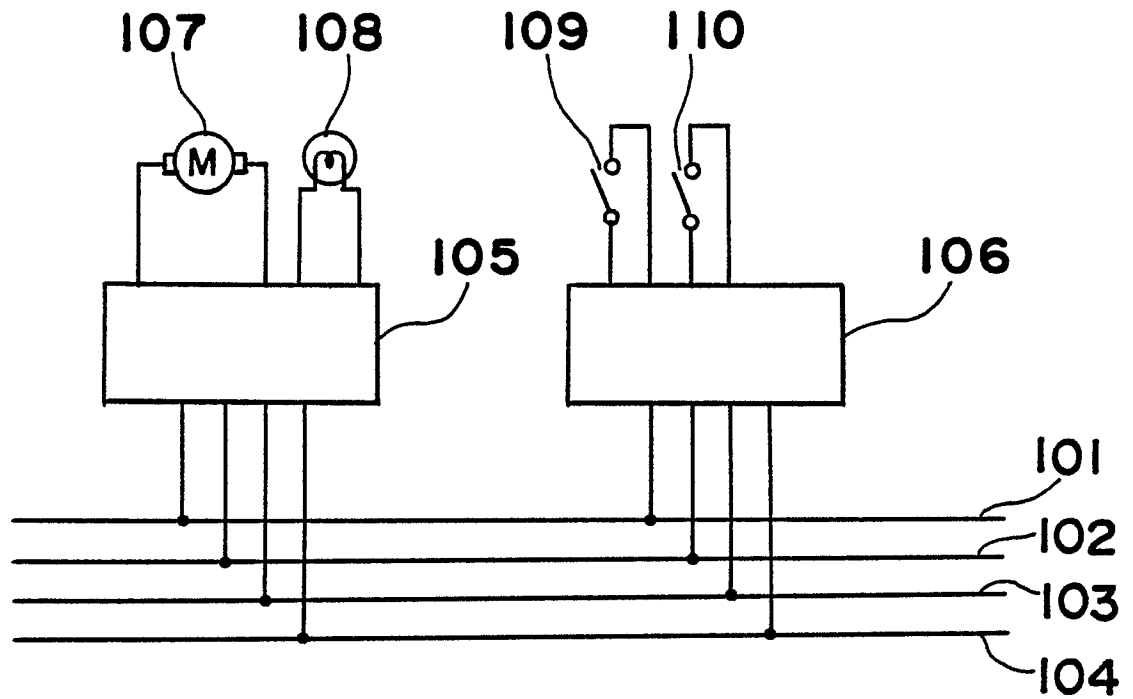
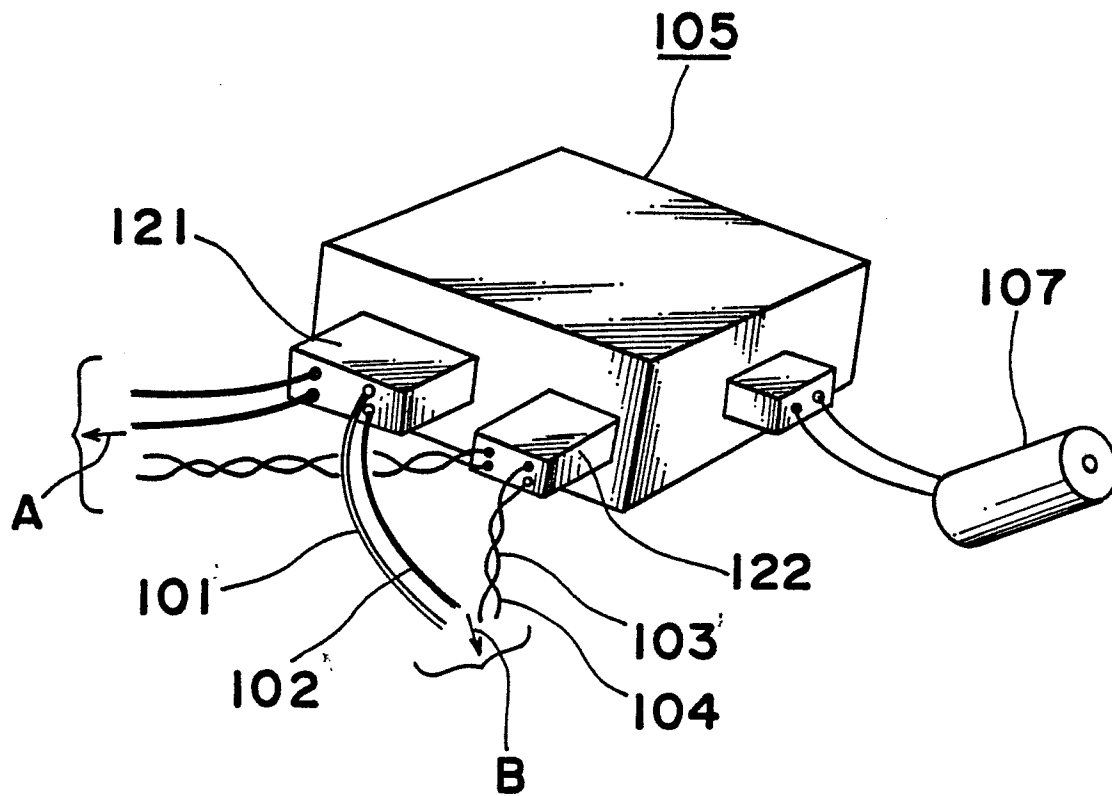
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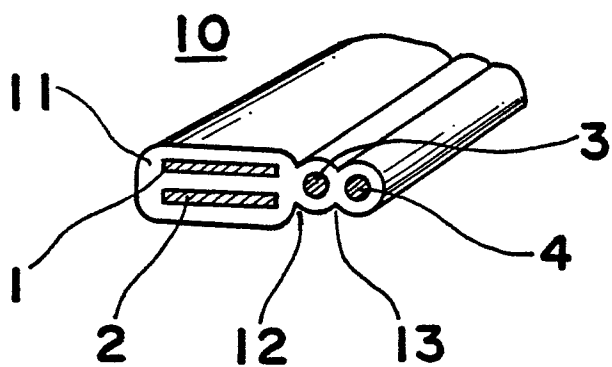
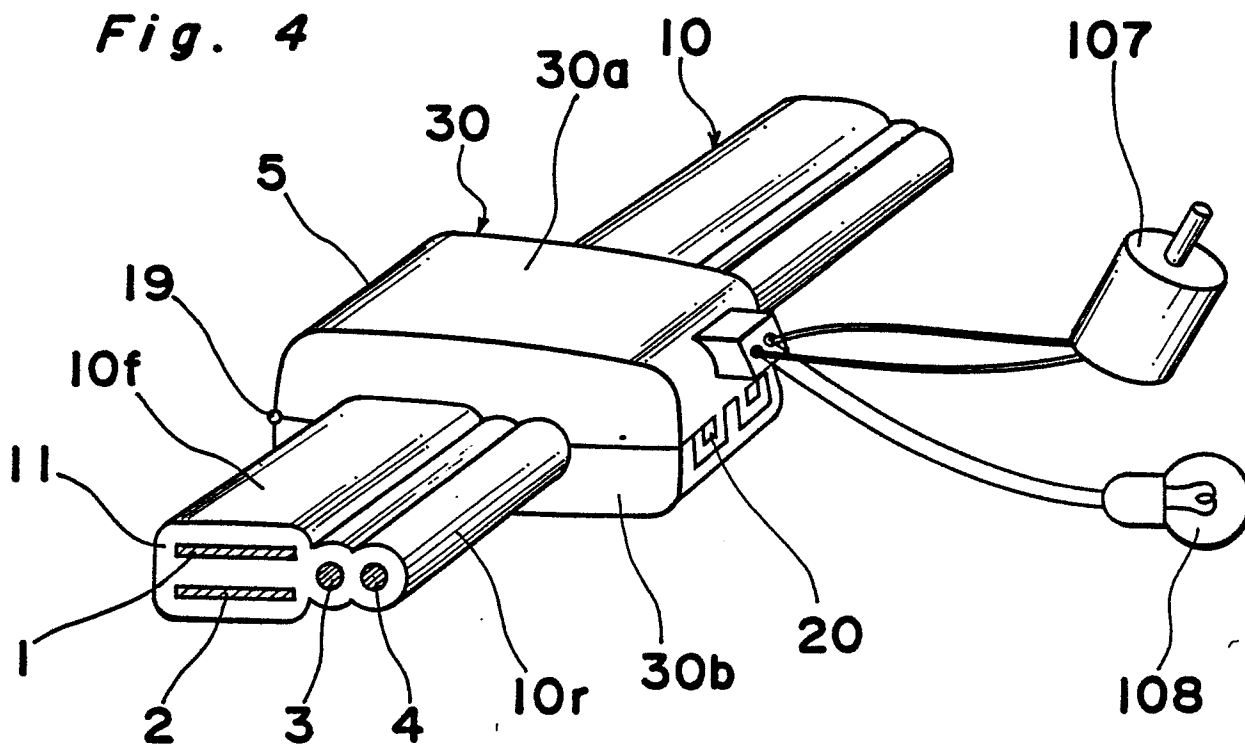
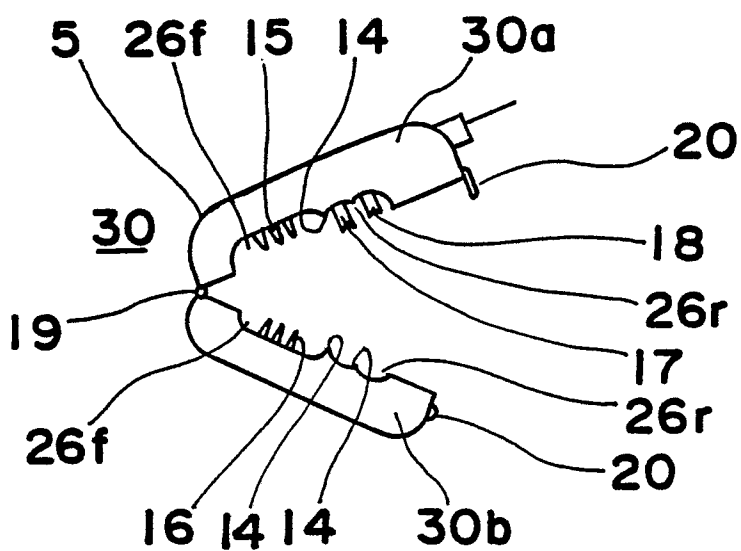
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*Fig. 1**Fig. 2*

*Fig. 3**Fig. 4**Fig. 5*

*Fig. 6*