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(54) **MODULAR BUILDING BLOCK AND ELECTRONIC BUILDING BLOCK SYSTEM**

(57) A modular block, comprising a circuit board (1), a functional circuit (2) disposed on the circuit board (1), an input connector (3) and an output connector (4). The input connector (3) and the output connector (4) are both provided with a plurality of conductive terminals (5) connected to the circuit board (1). The plurality of conductive terminals (5) are a positive power conductive terminal, a negative power conductive terminal and a data signal conductive terminal respectively. At least one of the input

connector (3) and the output connector (4) is provided with a plurality of the data signal conductive terminals. Also provided is an electronic block system. The input connector (3) and the output connector (4) of the modular block can be provided with one or more data signal conductive terminals according to actual needs, data signal lines can be expanded for use, and the modular block has more functions and applications.

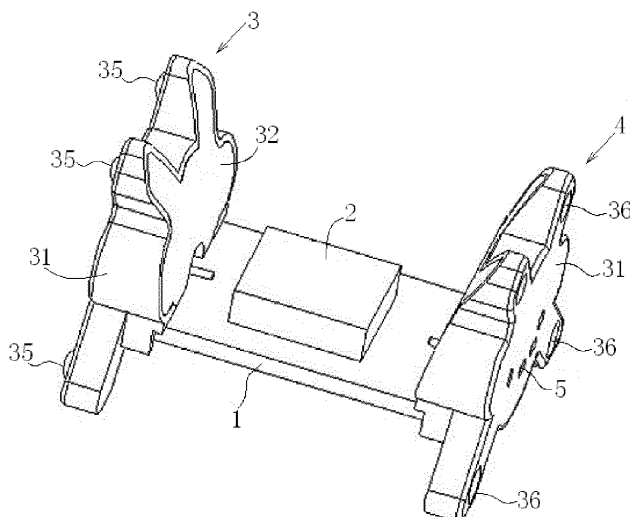


Fig. 1

Description

TECHNICAL FIELD

[0001] The present invention relates to an electronic block, and more particularly to a modular block and an electronic block system applied to teaching of experiments and electronic block toys.

BACKGROUND

[0002] It is known that a traditional electronic block system for teaching of experiments or electronic block toys usually includes a complete circuit board and various functional devices. Designated lines and installation holes are provided on the circuit board. In use, the required functional devices are installed on the circuit board to achieve specific functions. However, a common circuit board or functional device is an undetachable integrity. Such a product is limited to a few single functions and thus has poor flexibility. For a user who likes to manually detach or splice a toy, he/she cannot learn the structures and functions of various functional modules in this product and thus it is of a low interesting.

[0003] Chinese patent CN203108212U discloses a magnetically attractive electronic block system, which includes a plurality of connected electronic block modules. Each electronic block module includes a circuit board, a plug connector and a socket connector. The circuit board is provided with three groups of signal lines, i.e., a positive power line, a data signal line and a negative power line. The plug connector and the socket connector include an insulating body and three conductive terminals. The insulating body is provided with a plurality of accommodating grooves where a permanent magnet is installed. The three conductive terminals are respectively connected to corresponding signal lines on the circuit board. One of the plurality of electronic block modules includes a power and signal generation module for providing a power source and a signal source. The other plurality of electronic block modules cascade with the power and signal generation module successively.

[0004] However, this disclosed technique has the following problems during practical application.

1. It is limited to three groups of lines on the circuit board and the connector, which limits the expansive usage of the data signal lines and also the development of more functions of the electronic block system.

2. Arrangement of the magnet has an applicability problem. First, the multi-magnet design has high requirements on the placement of the pole thereof, which is not beneficial for the reduction of manufacture costs; it directly occupies a large portion of the coupling surface of the insulating body and thus is not beneficial for the expansion of more conductive

connectors. It is more important that the magnet is directly exposed on the coupling surface, which hampers the protection to the magnet. The magnet will be easily oxidized after long-time hand contact and collision and will produce magnet power debris due to the exposure. In the meantime, the magnet will gradually lose efficacy and the magnet attraction force will be reduced due to magnet debris, and even the magnet will be damaged.

3. It limits that the placement of the conductive connectors has to be "arranged on the insulating body side by side". This limitation can achieve relevant functions but its "side by side arrangement" will cause high requirements on space and thus the expansion of more conductive connectors is restricted seriously. It is also not easy to be processed during manufacturing and the costs are high.

SUMMARY

[0005] An object of the present invention is to provide a modular block and an electronic block system to solve one or more of the above problems.

[0006] In order to achieve the above object, according to an aspect of the present invention, a modular block is provided which comprises a circuit board, a functional circuit disposed on the circuit board, an input connector and an output connector. The input connector and the output connector are both provided with a plurality of conductive terminals connected to the circuit board. The plurality of conductive terminals are a positive power conductive terminal, a negative power conductive terminal and a data signal conductive terminal respectively. At least one of the input connector and the output connector is provided with a plurality of the data signal conductive terminals. In this way, on the modular block, a data signal may be input via one wire and output via a plurality of wires and it may also be input via a plurality of wires and output via one wire. On the modular block, a data signal may also be input via a plurality of wires and output via a plurality of wires. The input connector and the output connector of the modular block can be provided with one or more data signal conductive terminals according to actual needs. Thus, data signal lines can be expanded for use and the modular block will have more functions and applications.

[0007] In some embodiments, the conductive terminals are probes and conductive elements matching the probes. One of the probes and the conductive elements is provided at the input connector and the other is provided at the output connector. In this way, a plurality of modular blocks may achieve conductive connections through the matching of the probes and the conductive elements.

[0008] In some embodiments, the input connector and the output connector both include a main body and a rear cover which are both made of an insulating material. The

rear cover is detachably mounted on the main body. The main body or the rear cover has a cavity and an attraction element is provided in the cavity. In this way, the attraction elements of the main body and the rear cover are provided inside the input connector or the output connector, which protects the attraction elements and prolongs the service life of the attraction elements. The attraction element can be a magnet or a magnetically attractive metal.

[0009] In some embodiments, the cavity is provided in the middle of the main body or the rear cover. A plurality of the conductive terminals are arranged at the outer circumference of the cavity in a way of not side by side. In this way, the input connector or the output connector is merely provided with one magnet or one magnetically attractive metal. Thus, the placement requirements on the magnet's pole are lowered and the space is saved. The plurality of conductive terminals are provided in a stagger way, which lowers the requirements to the space.

[0010] In some embodiments, the modular block further includes a fool-proofing bump and a fool-proofing notch. One of the fool-proofing bump and the fool-proofing notch is provided at the connector and the other is provided at the output connector and the shape and size of the fool-proofing bump and the fool-proofing notch are mating with each other. In this way, the provision of the fool-proofing structure ensures a precise and stable coupling of the input connectors and the output connectors of two modular blocks.

[0011] Accordingly, the present invention also provides an electronic block system including the above modular block. This electronic block system further includes a power and signal generation module block cascading with the modular block. The functional circuit of the modular block includes a function execution device. The power and signal generation module block is provided with a power circuit and a signal source circuit. The power circuit and the signal source circuit are electrically connected to the input connector of the modular block. In this way, the electronic block system facilitates expansive use of data signal lines and the development of more functions.

[0012] In some embodiments, there are a plurality of modular blocks and the functional circuit of at least one of the plurality of modular blocks includes a relay connection unit. In this way, the connection of modular blocks has a changeover function, which can achieve the splicing of a plurality of modular blocks.

[0013] The beneficial effects of the present invention are as follows.

1. The modular block in the present invention is provided with one or more data signal conductive terminals, which expands usage of data signal lines and improves the development of more functions of the electronic block system.

2. The input connector or the output connector of the

modular block is provided with one magnet or a magnetically attractive metal, which greatly lowers the placement requirements to the pole of the magnets to facilitate the reduction of manufacture costs. It will not occupy the coupling surface of the insulating main body, which facilitates the expansion of more conductive terminals and protects the magnet well. Moreover, such placement of the conductive terminals may also make full use of the space and facilitate the expansion of more conductive terminals.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Fig. 1 is a structure diagram of a modular block according to embodiment 1 of the present invention;

Fig. 2 is a structure diagram of an input connector of the modular block shown in Fig. 1;

Fig. 3 is an explosion diagram of the input connector shown in Fig. 2;

Fig. 4 is a structure diagram of an output connector of the modular block shown in Fig. 1;

Fig. 5 is an explosion diagram of the output connector shown in Fig. 4;

Fig. 6 is a structure diagram of an electronic block system according to embodiment 3 of the present invention; and

Fig. 7 is a structure diagram of an electronic block system according to embodiment 4 of the present invention.

DETAILED DESCRIPTION

[0015] Hereinafter, the present invention will be further described in detail in reference to the drawings.

Embodiment 1

[0016] As shown in Fig. 1, the modular block in this embodiment comprises a circuit board 1 and a functional circuit 2 disposed on the circuit board 1. An input connector 3 and an output connector 4 are connected to the circuit board 1. The input connector 3 and the output connector 4 are both provided with a plurality of conductive terminals 5 connected to the circuit board 1. The plurality of conductive terminals 5 are a positive power conductive terminal, a negative power conductive terminal and a data signal conductive terminal, respectively.

[0017] As shown in Figs. 2 to 5, the input connector 3 and the output connector 4 both comprise a main body 31 and a rear cover 32. The rear cover 32 is detachably

mounted on the main body 31. The main body 31 and the rear cover 32 are both made of an insulating material, in particular, a plastic material. The main body 31 or the rear cover 32 has a cavity 33. An attraction element 34 is provided in the cavity 33. The attraction element 34 is a magnet or a magnetically attractive metal.

[0018] It should be noted that the attraction elements 34 of the input connector 3 and the output connector 4 may all be magnets or the attraction element 34 of one of the two connectors is a magnetically attractive metal. If the attraction element 34 of one of the input connector 3 and the output connector 4 is a magnetically attractive metal, the attraction element 34 of the other connector is a magnet. In this way, the input connector 3 and the output connector 4 can achieve coupling to each other.

[0019] There is one cavity 33 and it is provided in the middle of the main body 31 or the rear cover 32. The plurality of conductive terminals 5 are arranged at the outer circumference of the cavity 33 in a way of not side by side but around the cavity 33. In this embodiment, the cavity 33 is provided in the middle of the main body 31.

[0020] The modular block further includes a fool-proofing bump 35 and a fool-proofing notch 36 provided on the main body 31. The shape and size of the fool-proofing bump 35 and the fool-proofing notch 36 are matching with each other. In this embodiment, the fool-proofing bump 35 is provided at the input connector 3 and the fool-proofing notch 36 is provided at the output connector 4.

[0021] The conductive terminals 5 are probes and conductive elements matching the probes. The probes can be inserted into the conductive elements with the shapes thereof matching each other. End portions 51 of the probes and the conductive terminals extend to the circuit board 1 and are electrically connected to the wires of the circuit board 1. The probes are spring probes. In this embodiment, the probes are provided in the input connector 3. The conductive elements are provided in the output connector 4. The conductive terminals 5 are supported by the main body 31.

[0022] One of the input connector 3 and the output connector 4 has one data signal conductive terminal and the other has a plurality of the data signal conductive terminals. The input connector 3 and the output connector 4 can all have a plurality of data signal conductive terminals. In this embodiment, the input connector 3 has one data signal conductive terminal and the output connector 4 have two data signal conductive terminals.

[0023] When in use, the data signal conductive terminals of the input connector 3 and the output connector 4 may be set as required. For example, in some cases, only one data signal conductive terminal is needed on the input connector 3 of some modular blocks and a plurality of data signal lines branch out from the output thereof, which makes the output connector 4 have a plurality of data signal conductive terminals.

[0024] When several modular blocks are spliced together, the attraction elements of the input connector 3

and the output connector 4 attract each other, the fool-proofing structures thereof match with each other, and the conductive terminals 5 thereof are connected to each other. In this way, modular blocks can be conductively connected and attractively connected.

Embodiment 2

[0025] The modular block in this embodiment is substantially the same as that in embodiment 1. Their differences lie in that the circuit board 1 of the modular block in this embodiment is connected to one input connector 3 and a plurality of output connectors 4 and the functional circuit 2 has the function of power source and signal conduction.

Embodiment 3

[0026] As shown in Fig. 6, the electronic block system in this embodiment comprises a power and signal generation module block and a plurality of the modular blocks. The plurality of modular blocks cascade with the power and signal generation module block.

[0027] In the present invention, cascading means that the modular blocks are electrically connected to the power and signal generation module block for current delivery and signal transmission.

[0028] The power and signal generation module block has a power circuit and a signal source circuit which are electrically connected to the input connector 3 of the modular block.

[0029] The functional circuit 2 of the modular block is a function execution device. The modular block in embodiment 1 may be adopted. The function execution device can be selected according to user's demand, such as LED light, beeper, loudspeaker, vibrator, motor, switch, display screen, etc. The input connector 3 and the output connector 4 of the modular block can be provided with one or more data signal conductive terminals according to actual needs.

[0030] The positive power wire connectors, the negative power conductive terminals and one data signal conductive terminal of a plurality of modular blocks are fixed at the input connector 3 and the output connector 4 so that the common conductive terminals 5 can be connected one by one correspondingly when one modular block is spliced with another modular block.

Embodiment 4

[0031] As shown in Fig. 7, the electronic block system in this embodiment is added with a modular block having a plurality of output connectors 4, as compared to the embodiment 3. The functional circuit 2 of this modular block includes a relay connection unit which has functions of power source and signal conduction. The input connector 3 and the plurality of output connectors 4 of the modular block can be provided with one or more data

signal conductive terminals according to actual needs.

[0032] The foregoing described is merely some embodiments of the present invention. For a person skilled in the art, variations and modifications may be made without departing from the inventive concept of the present invention, which all fall into the protection scope of the present invention.

Claims

1. A modular block, wherein it comprises a circuit board (1), a functional circuit (2) disposed on the circuit board (1), an input connector (3) and an output connector (4), the input connector (3) and the output connector (4) being both provided with a plurality of conductive terminals (5) connected to the circuit board (1), the plurality of conductive terminals (5) being a positive power conductive terminal, a negative power conductive terminal and a data signal conductive terminal respectively, and at least one of the input connector (3) and the output connector (4) being provided with a plurality of the data signal conductive terminals. 5
2. The modular block according to claim 1, wherein the conductive terminals (5) are probes and conductive elements matching the probes, one of the probes and the conductive elements being provided at the input connector (3) and the other being provided at the output connector (4). 10
3. The modular block according to claim 1, wherein the input connector (3) and the output connector (4) both comprise a main body (31) and a rear cover (32), the main body (31) and the rear cover (32) both being made of an insulating material, the rear cover (32) being detachably mounted on the main body (31), the main body (31) or the rear cover (32) having a cavity (33), and an attraction element (34) being provided in the cavity (33). 15
4. The modular block according to claim 3, wherein the cavity (33) is provided in the middle of the main body (31) or the rear cover (32) and the plurality of conductive terminals (5) are arranged at the outer circumference of the cavity (33) in a way of not side by side. 20
5. The modular block according to claim 3, wherein it further comprises a fool-proofing bump (35) and a fool-proofing notch (36), with one of them being provided at the connector (3) and the other being provided at the output connector (4), the shape and size of the fool-proofing bump (35) and the fool-proofing notch (36) being matching with each other. 25
6. An electronic block system comprising a modular block according to any one of claims 1 to 5, wherein it further comprises a power and signal generation module block cascading with the modular block, the functional circuit (2) of the modular block including a function execution device, the power and signal generation module block being provided with a power circuit and a signal source circuit, both of the power circuit and the signal source circuit being electrically connected to the input connector (3) of the modular block. 30
7. The electronic block system according to claim 6, wherein it comprises a plurality of the modular blocks and the functional circuit (2) of at least one of the modular blocks comprises a relay connection unit. 35

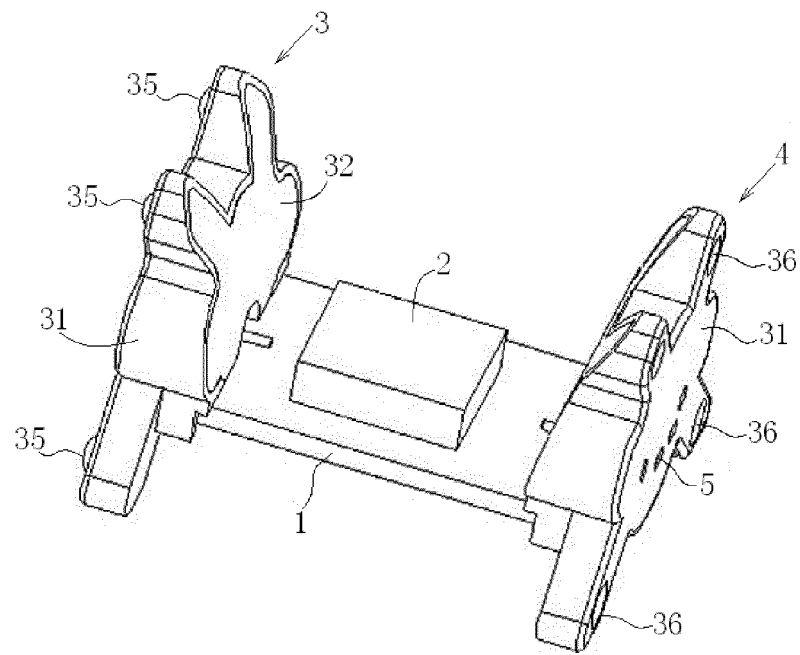


Fig. 1

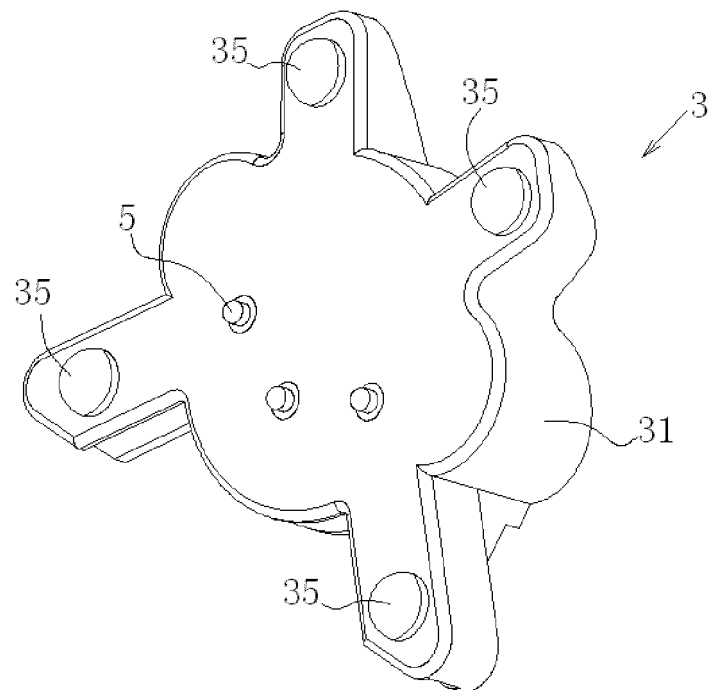


Fig. 2

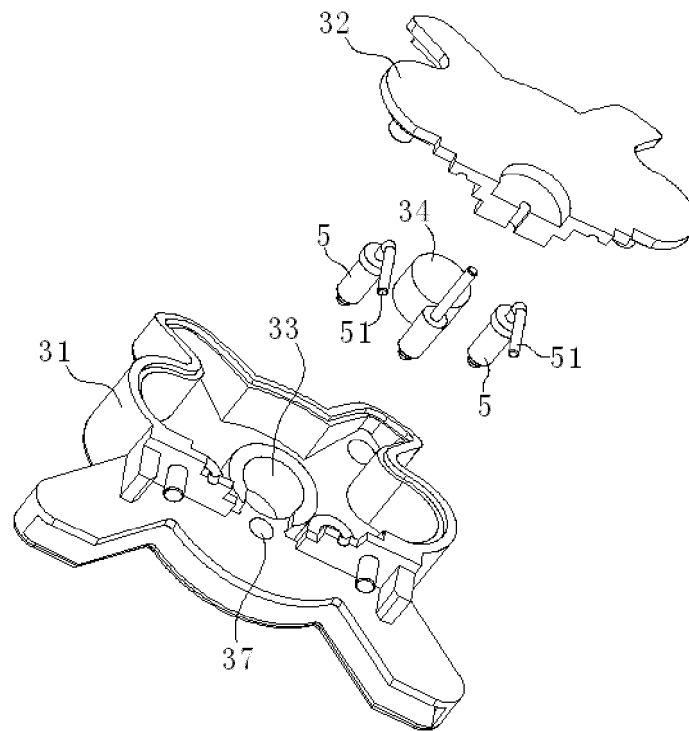


Fig. 3

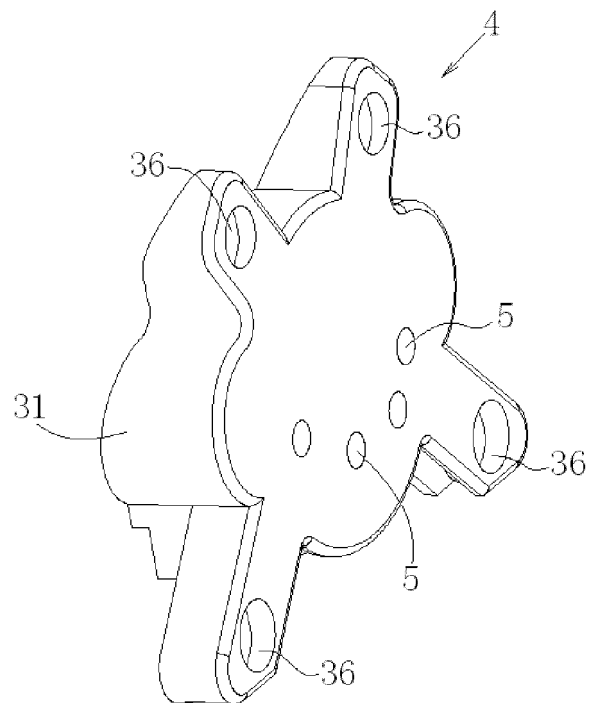


Fig. 4

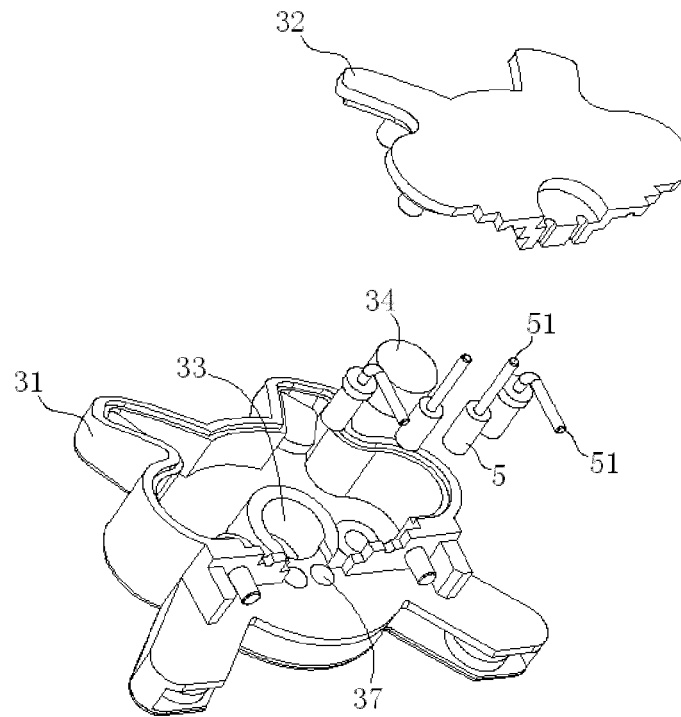


Fig. 5

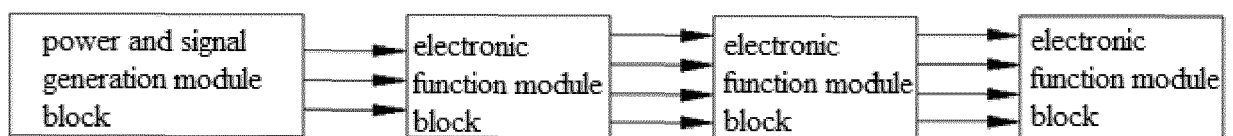


Fig. 6

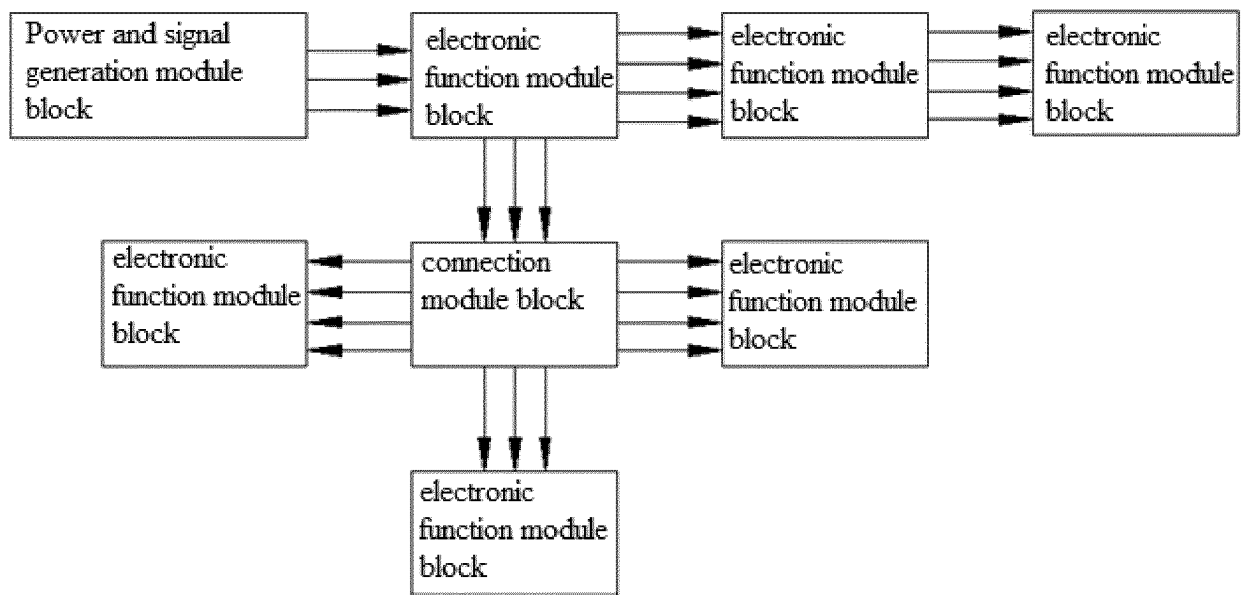


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/076452

A. CLASSIFICATION OF SUBJECT MATTER

A63H 33/10 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A63H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

VEN, WPI, EPODOC, CNABS, CNAPT, CNTXT, CNKI: WEI Zhenpeng, input? Output?, electric, probe, magnetism, signal, hole,
groove, module, building block, circuit board, connector, conduction terminals, spring probe electrode, terminal, absorb

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 203118309 U (HANGZHOU SUZE ELECTRONIC TECHNOLOGY CO., LTD.) 07 August 2013 (07.08.2013) description, paragraphs [0023], [0025]-[0027], and figures 1-6	1-7
Y	CN 201918609 U (TYCO ELTECTONICS HOLDINGS (BERMUDA) LIMITED) 03 August 2011 (03.08.2011) description, paragraph [0017], and figures 1 and 2	1-7
PX	CN 203944177 U (WEI, Zhengpeng) 19 November 2014 (19.11.2014) description, paragraphs [0010]-[0013], and figures 1-4	1-7
PX	CN 203911076 U (WEI, Zhengpeng) 29 October 2014 (29.10.2014) description, paragraphs [0020]-[0029], and figures 1-4	1-7
PX	CN 104043252 U (WEI, Zhengpeng) 17 September 2014 (17.09.2014) description, paragraphs [0010]-[0016], and figures 1-4	1-7
PX	CN 203944132 U (WEI, Zhengpeng) 19 November 2014 (19.11.2014) description, paragraphs [0027]-[0032], and figures 1-4	1-7

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
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Date of the actual completion of the international search 10 June 2015	Date of mailing of the international search report 17 June 2015
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer LIU, Jing Telephone No. (86-10) 92245358

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/076452

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 203944132 U	07 August 2013	None	
CN 201918609 U	03 August 2011	None	
CN 203944177 U	19 November 2014	None	
CN 203911076 U	29 October 2014	None	
CN 104043252 U	17 September 2014	None	
CN 203118309 U	19 November 2014	None	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 203108212 U [0003]