(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 March 2016 (17.03.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/037596 A1

(51) International Patent Classification:
H01H 9/14 (2006.01) *H01R 9/26* (2006.01)
H01H 50/02 (2006.01) *H01R 13/66* (2006.01)
H01H 71/04 (2006.01) *H01T 4/04* (2006.01)
H01R 9/24 (2006.01) *H01T 4/06* (2006.01)

(21) International Application Number:
PCT/CZ2015/050004

(22) International Filing Date:
4 September 2015 (04.09.2015)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2014-611 8 September 2014 (08.09.2014) CZ

(71) Applicant: **SALTEK S.R.O.** [CZ/CZ]; Drazdanska 561/85, 40007 Usti nad Labem (CZ).

(72) Inventor: **SUCHY, Jaromir**; Obloukova 298, 40340 Usti nad Labem - Skorotice (CZ).

(74) Agents: **KRATOCHVIL, Vaclav** et al.; P.O. Box 26, 29501 Mnichovo Hradiste (CZ).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

WO 2016/037596 A1

(54) Title: OVERVOLTAGE PROTECTION IN MODULAR DESIGN

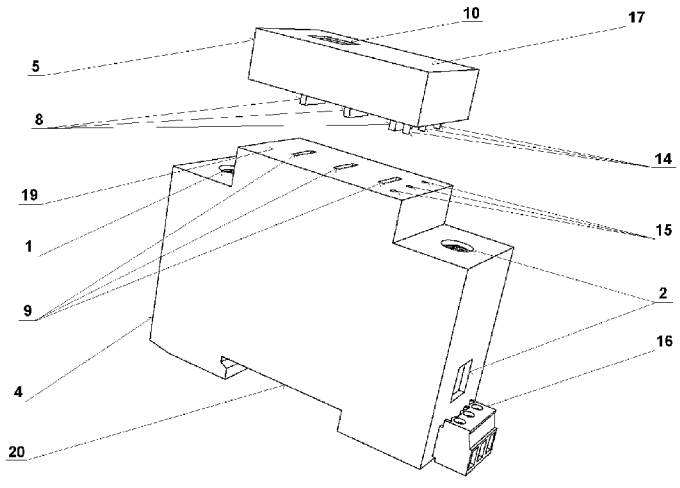

Fig. 2

(57) Abstract: This overvoltage protection in a modular design features an electromechanical arrangement containing a base (4) with at least one protection element (3), at least one removable module (5) with an ignition circuit (6) and at least one main connecting system (7) of the ignition circuit (6), consisting of a multi-pole set of contacts (8) and the corresponding opposite contacts (9) of the ignition circuit (6), whereas the contacts (8), with the advantage being in the three-pole metallic arrangement, are situated on the bottom surface (18) of the removable module (5), whereas the corresponding opposite contacts (9), with the advantage being in the three-pole metallic design, are situated on the upper part (19) of the base (4), and at the same time, each protection element (3) is from its one pole connected to at least one first terminal clamp (1) associated with it, situated on one side of the base (4), and from its second pole it is connected to at least one second terminal clamp (2) associated with it, situated on the opposite side of the base (4).

Overvoltage protection in modular design

Technical Field

The invention relates to overvoltage protection in a modular design, being a part of the area of electrical protection devices with at least one protection element which requires an ignition circuit for its correct performance, and specified for the personal protection of people, apparatus, machinery and metal structures against dangerous contact voltage, overvoltage or effects of stray electrical currents.

Current state of technology

Currently known overvoltage protection designs mostly feature a first terminal clamp, second terminal clamp, and a protection element - usually a spark gap and ignition circuit that are connected in one construction unit. This is a compact and unreplaceable design considering the individual circuit components. The disadvantage is that if the ignition circuit is damaged, the whole product has to be replaced. Another disadvantage is that the product is difficult to inspect - the overvoltage protection must be disconnected. Such design is, for example, presented in the documents WO2007065997 “DEVICE FOR PROTECTION AGAINST OVERVOLTAGES HAVING IMPROVED SAFETY AND CORRESPONDING METHOD OF MANUFACTURE” and DE102007012760 “Surge arrester, with rotational symmetric, insulated dischargers arranged within series installation housing in stack design, and electrical terminal clamps connected to dischargers over wire“.

The above-stated deficiencies are partially solved in another known design, in which the first terminal clamp and second terminal clamp are located in the base, whereas the protection element, ignition circuit and signalling of the operating state of the ignition circuit are located in a removable module connected to the base via a connecting system. In such design, inspections are easy to do by removing the removable module. However, the expensive protection element has to be replaced together with the damaged ignition circuit, so the disadvantage remains. Another technical disadvantage are strict requirements for the connecting system between the base and removable module, which must transfer great stress from *the* pulse currents. Examples of such an arrangement are shown in the documents EP1900072 “PLUGGABLE SURGE ARRESTER COMPRISING ONE OR SEVERAL OVERVOLTAGE ELEMENTS” and DE202004006227 "Überspannungsschutzgerät“.

Another example of a modular concept of overvoltage protection is shown in document DE102008031200 @Surge protection device for single- or multi-core signal circuit, with a base

part fastened to a mounting rail, and two plugging parts, each comprising two terminal clamps for the respective electrical conductors". The construction is designed to easily increase the number of protected communication channels or lines. The base features part fastening to the bottom of the profiled bar, the upper part of the base is modified for the connection of removable modules that contain overvoltage protection and other connecting parts. This allows more removable modules to be connected above each other, whereas the last top removable module contains optical signalling of the operating state of the overvoltage protection devices, including the possibility of remote signalling of the operating state of the overvoltage protection devices. This solution is primarily specified for overvoltage protection of communication channels or lines, hence it does not use a power protection element of the spark gap type, which would require an ignition circuit for it to function.

An example of products containing more than one protection element with the relevant ignition circuit is given in the documents DE10058977 "Mehrpoliger stossstromfester Überspannungsableiter" and DE10125941 "Multipole electrical surge-proof arrester with arrester capsule". The basic problem, i.e., that the ignition circuit cannot be separated from the relevant protection element, also remains unresolved in these arrangements, so the replacement of the damaged ignition circuit cannot be carried out without simultaneous replacement of the undamaged protection element.

Summary of Invention

The aforesaid disadvantages are eliminated to a large extent by overvoltage protection in a modular design according to this invention, created by an electromechanical arrangement that features a base with at least one protection element and at least one removable module with an ignition circuit and, finally, at least one main connecting system of the ignition circuit, consisting of a multi-pole set of contacts and corresponding opposite contacts of the ignition circuit, whereas the contacts, with the advantage of being in a three-pole metallic design, are situated on the bottom surface of the removable module, whereas the corresponding opposite contacts, with the advantage of being in a three-pole metallic design, are situated on the upper part of the base, and simultaneously, each protection element is connected by one of its poles to at least one assigned first terminal clamp situated on one side of the base and its second pole is connected to at least one assigned second terminal clamp, situated on the opposite side of the base.

The advantage of such arrangement is that should the ignition circuit be damaged by overvoltage, the function of the overvoltage protection can be restored by replacing the removable module with the ignition circuit, without the need to replace the protection element,

situated in the base. The base can generally contain more than one protection element and it allows the connection of more than one removable module to the ignition circuit.

This overvoltage protection in a modular design in this advantageous design is provided with an optical status indicator of the ignition circuit operating state, located on the removable module, with the advantage on its upper surface.

The optical status indicator of the ignition circuit operating state is used for visual inspection and quick identification of the removable module with the non-functional ignition circuit or ignition circuit damaged by overvoltage.

This overvoltage protection in a modular design in this advantageous design features at least one connecting system signalling the operating state, on the side of the removable module linked to the primary part of the signalling of the operating state of the ignition circuit, on the side of the base linking to the secondary part of the operating state signalling, connected to the connecting point of the operating state signalling, with the advantage being in a two-pole or three-pole design, situated on one of the base sides, whereas the connecting system of the operating state signalling is provided with contact elements of the operating state signalling, with the advantage being in the two-pole or three-pole design, situated on the bottom surface of the removable module and the corresponding opposite contact elements of the operating state signalling, with the advantage being in the two-pole or three-pole design, situated on the upper part of the base.

Such arrangement deals with the remote operating state signalling of the ignition circuit and enables the removable module with a non-functional ignition circuit or the ignition circuit damaged by overvoltage to be located without any operating staff attending the place where the overvoltage protection is installed in the modular design. If the base is provided with more than one protection element and modified to the connection of more than one removable module with the ignition circuit, remote signalling of the operating state of the ignition circuit can be provided for every removable module, or just for some of them.

The advantageous design of this overvoltage protection in a modular design comprises such arrangement, i.e., the contacts of the ignition circuit and/or contact elements of the operating state signalling feature fixed or spring-loaded pins and the opposite contacts of the ignition circuit and/or opposite contact elements of the operating state signalling are created by plugs or contact surfaces.

In this arrangement, the alternative design of the contacts and opposite contacts of the ignition circuit and/or contact elements and opposite contact elements of the operating state signalling are

provided in such a manner that ensures reliable functionality of the main connecting system of the ignition circuit and/or connecting system of the operating state signalling.

This overvoltage protection in a modular design is arranged in such a manner that the protection element advantageously features a spark gap with symmetrically or asymmetrically arranged electrodes, or a multiple spark gap comprising at least two spark gaps connected in series, or from at least two gas discharge tubes arranged in series.

Such arrangement represents an alternative to the protection element situated in the base.

This overvoltage protection in a modular design is arranged in such a manner that the fastening of the base to the profiled bottom part is provided by an inversely profiled fastening part situated on the bottom side of the base, or fastening of the base to the flat surface is provided via a plate with openings, or the base is accommodated to the installation in a holder, the shape, dimensions and load capacity of which match the base.

This base installation in the advantageous design is provided to allow fastening of the base to a profiled or flat bottom surface, or the base is installed in a holder with minimum mounting requirements.

The removable module of this overvoltage protection in a modular design is fixed to the base in the connected condition with a demountable connection or fastening system, or a mechanical lock.

Such arrangement deals with the situation in which the spring-loaded pins and contact surfaces form the main connecting system of the ignition circuit and/or connecting system of the operating state signalling.

Brief Description of Drawings

The invention will be explained in detail using drawings, in which Figure 1 shows a block diagram of the electromechanical system of this overvoltage protection in a modular design with operating state signalling.

Fig. 2 shows this overvoltage protection in a modular design with the disconnected and remote removable module, the main connecting system of the ignition circuit, comprising three pairs of contacts and opposite contacts of the ignition circuit and the connecting system of the operating state signalling, comprising three pairs of contact elements of the signalling and opposite contact elements of the operating state signalling.

Fig. 3 shows the overvoltage protection base in a modular design with the main connecting system of the ignition circuit, comprising three opposite contacts of the ignition circuit, without the connecting system of the operating state signalling system.

Fig. 4 shows this overvoltage protection in a modular design with a connected removable module in a position to the side of the first terminal clamp.

Fig. 5 shows the overvoltage protection in a modular design with the connected removable module on the side of the second terminal clamp.

Fig. 6 shows the overvoltage protection in a modular design with a disconnected and separated removable module, the main connecting system of the ignition circuit comprising three pairs of contacts and opposite contacts of the ignition circuit and the connecting signalling system of the operating state, comprising the contact element of the signalling, linked to the opposite contact element of the operating state signalling via a mechanical bond.

Fig. 7 shows the removable module of the overvoltage protection in a modular design connected to the base, with the main connecting system of the ignition circuit comprising three contacts of the ignition circuit, without the connecting system of the operating state signalling.

Fig. 8 shows the removable module of the overvoltage protection in a modular design with its bottom surface facing upwards, featuring the main connecting system of the ignition circuit, comprising three contacts of the ignition circuit, without the connecting system of the operating state signalling.

Fig. 9 shows the removable module of the overvoltage protection in a modular design with its bottom surface facing upwards, featuring the main connecting system of the ignition circuit, comprising three contacts of the ignition circuit, with the connecting system of the operating state signalling, comprising three contact elements of the operating state signalling.

Examples of the technical invention´s implementation

The overvoltage protection in a modular design according to Fig. 1 and 2 comprises an electromechanical arrangement containing the base 4 with the protection element 3, the removable module 5 with the ignition circuit 6 and the main connecting system 7 of the ignition circuit 6, consisting of the multi-pole set of contacts 8 and the associated opposite contacts 9 of the ignition circuit 6, whereas the contacts 8, with the advantage being in a three-pole metallic design, are situated on the bottom surface 18 of the removable module 5, whereas the

corresponding opposite contacts 9, with the advantage being in a three-pole metallic design, are situated on the upper part 19 of the base 4, and at the same time, the protection element 3 is with its one pole connected to at least one first terminal clamp 1 situated on one side of the base 4 and by its second pole it is connected to at least one second terminal clamp 2, situated on the opposite side of the base 4.

The three-pole design of the contacts 8 and opposite contacts 9 corresponds to the situation when the protection element 3 is represented by a spark gap with three symmetrically or asymmetrically arranged electrodes. The base 4 can be equipped with a higher number of first terminal clamps 1 and second terminal clamps 2 to make the connection of conductors easy.

The base 4 can be provided with the advantage of more protection elements 3 and first terminal clamps 1 associated with each of them, and second terminal clamps 2. One main connecting system 7 of the ignition circuit 6 and one removable module 5 with the ignition circuit 6 are then associated with each protection element 3.

The overvoltage protection in a modular design according to Fig. 1, 2, 4, 5, 6, 7 in the advantageous design is provided with an optical status indicator 10 of the operating state of the ignition circuit 6, located on the removable module 5, with the advantage being on its upper surface 17.

The optical status indicator 10 is used to evaluate the operating state of the ignition circuit 6 and to alert the operating staff of the need to replace the removable module 5 if it is not functional or damaged by overvoltage.

The overvoltage protection in a modular design according to Fig. 1 and 2 in the advantageous design is equipped with a connecting system 13 of the operating state signalling, which links to the primary part 11 on the side of the removable module 5 of the operating state signalling of the ignition circuit 6, on the side of the base 4 linking to the secondary part 12 of the operating state signalling, connected to the connecting point 16 of the operating state signalling, with the advantage being in the two-pole or three-pole design, situated on one side of the base 4, whereas the connecting system 13 of the operating state signalling is equipped with contact elements 14 of the operating state signalling, with the advantage being in the two-pole or three-pole design, situated on the bottom surface 18 of the removable module 5 and the corresponding opposite contact elements 15 of the operating state signalling, with the advantage being in the two-pole or three-pole design, situated on the upper part 19 of the base 4.

The connecting system 13 of the operating state signalling is used to transfer information on the operating state of the ignition circuit 6 from the removable module 5 to the connection point 16 of the operating state signalling on the base 4. It can be provided with contact elements 14 and opposite contact elements 15 of the operating state signalling in a metallic design according to Fig. 2, or in a mechanical design according to Fig. 6.

The connecting system 13 of the operating state signalling subject to Fig. 1 can be generally implemented also as contact-less or wireless, with use of the information transfer through a short radius electromagnetic field. The primary part 11 of the operating state signalling works as a transmitter and/or receiver of the carrier frequency, the contact element 14 works as a transmitting and/or receiving antenna, the secondary part 12 of the operating state signalling works as a receiver and/or transmitter of the carrier frequency, and the opposite contact element 15 works as a receiving and/or transmitting antenna. Radio chips with a short radius based on RFID technology can also be considered, or so-called "Radio Frequency Identification", or NFC, "Near field communication", or transfer technologies using the optical or infrared part of the electromagnetic spectrum. Thanks to RFID and NFC technology the chips can be made in both an active design comprising its own source of supply and a passive design without its own supply, i.e., suitable for installation into the removable module 5. Both stated technologies make at least one-way communication possible between the end equipment, which is sufficient for the specific purpose.

The two-pole design of the metallic contact elements 14 and opposite contact elements 15 enables only signalling of basic operating information on the state of the ignition circuit 6 if connected galvanically, i.e., whether it is in operating or failure/defective condition; it works similarly in the mechanical design. Multi-condition transfer of information can be used in the three-pole design of the metallic contact elements 14 and opposite contact elements 15 in their galvanic connection, or in the use of radio chip technology.

If the base 4 is provided with more protection elements 3 and modified for connecting the required number of removable modules 5 with ignition circuits 6, all removable modules 5 or just some of them can be equipped with the primary parts 11 of the operating state signalling of the ignition circuit 6 and the connecting systems 13 of the operating state signalling linked to them. On the side of the base 4 each connecting system 13 of the operating state signalling can be connected to its own secondary part 12 of the operating state signalling on the side of the base (4), or one common secondary part 12 of the operating state signalling for all connecting systems 13 of the operating state signalling can be installed. In relation to the used design, the connection

point 16 of the operating state signalling can be provided as individual, i.e., dedicated to the specific removable module 5, or common for the whole group of removable modules 5.

The overvoltage protection in a modular design according to Fig. 1 and 2, 3, 7, 8, 9 in the advantageous design, comprising the contacts 8 of the ignition circuit 6 and/or contact elements 14 of the operating state signalling represented by fixed or flexible spring-loaded pins and the opposite contacts 9 of the ignition circuit 6 and/or the opposite contact elements 15 of the operating state signalling feature plugs or contact surfaces.

The main connecting system 7 of the ignition circuit 6 and/or connecting system 13 of the operating state signalling can either comprise fixed pins and associated plugs as shown in Fig. 2, 3, 7, 8, 9 and/or spring-loaded pins and the surface contacts associated with them.

The overvoltage protection in a modular design according to Fig. 1, in the design comprising the protection element 3 which is advantageously created by a spark gap with symmetrically or asymmetrically arranged electrodes, or a multi-spark gap comprising at least two spark gaps connected in series, or at least two gas discharge tubes in series.

The protection element 3 comprises one or more electronic elements, characterised by the ignition circuit 6 which is necessary for correct functioning.

The overvoltage protection in a modular design according to Fig. 2 to 6, shows the base 4 fastened to the profiled surface using an inversely profiled fastening part 20 situated on the bottom side of the base 4, or the fastening of the base 4 on a flat surface using a plate with openings, or the base 4 is accommodated to installation in a holder, whose shape, dimensions and load capacity correspond to the base 4.

In the basic design, the overvoltage protection is installed by slipping the base 4 onto an appropriately shaped profile, usually a mounting bar. If the bottom surface is flat, the base 4 is fixed to it using demountable connections, e.g., screws or bolts inserted into the openings in the plate situated on the bottom side of the base 4. The bottom side of the base 4 can be provided with blades, specified for inserting into the blade-shaped bottom part. The holder can also be provided in a "U" shape, whose flexible arms embrace the sides of the base 4 and fix it in the locked condition using interlocks.

The overvoltage protection in a modular design in the advantageous design comprising the fixing of the removable module 5 to the base 4 in the connected condition features a dismountable connection, or fastening system, or mechanical lock.

Fixing the removable module 5 to the base 4 in the connected condition is necessary especially in situations when the main connecting system 7 of the ignition circuit 6 and, at the same time, the connecting system 13 of the operating state signalling feature spring-loaded pins and the corresponding surface contacts. In this instance, the removable module 5 is pushed away from the base 4. A similar situation occurs if the spring-loaded pins are provided in one of the connecting systems and the second is provided with fixed pins. The flexible pins push the removable module 5 away from the base 4, which can lead to mechanical damage, or bending of the fixed pins.

Fixing the removable module 5 to the base 4 in the connected condition features in the simplest design a demountable connection comprising at least one screw driven through the removable module 5 and screwed into the base 4. Another option is the use of fastening of the system, e.g., by a flexible clamp, metallic with the advantage. Finally, fixing of the removable module 5 to the base 4 in the connected condition can be provided with the help of a mechanical lock, featuring for example interlocks.

Industrial Applicability

The overvoltage protection in a modular design according to this invention is a product that can be used where it is necessary to ensure the protection of people, equipment, machinery and metallic constructions against dangerous contact voltage, overvoltage, and protection from the effects of electrical stray currents. In comparison with known products it allows the replacement of a damaged or non-functional ignition circuit without having to replace the protection element at the same time.

List of symbols:

1. first terminal clamp
2. second terminal clamp
3. protection element
4. base
5. removable module
6. ignition circuit
7. main connecting system
8. contact
9. opposite contact
10. optical status indicator
11. primary part of the signalling
12. secondary part of the signalling
13. connecting system of the signalling
14. contact element of the signalling
15. opposite contact element of the signalling
16. connecting point of the signalling
17. upper surface
18. bottom surface
19. upper part
20. fastening part

PATENT CLAIMS

1. An overvoltage protection in a modular design, **comprising** an electromechanical arrangement containing the base (4) with at least one protection element (3), at least one removable module (5) with the ignition circuit (6) and at least one main connecting system (7) of the ignition circuit (6), consisting of a multi-pole set of contacts (8) and the corresponding opposite contacts (9) of the ignition circuit (6), whereas the contacts (8), with the advantage being in three-pole metallic design, are situated on the bottom surface (18) of the removable module (5), whereas the corresponding opposite contacts (9), with the advantage being in the three-pole metallic design, are located on the upper part (19) of the base (4), and simultaneously, each protection element (3) is from its one pole connected to at least one associated terminal clamp (1) situated on one side of the base (4) and from its second pole connected to at least one associated second terminal clamp (2), situated on the opposite side of the base (4).

2. The overvoltage protection in a modular design subject to Claim 1, **comprising** an optical status indicator (10) of the operating state of the ignition circuit (6), located on the removable module (5), with the advantage being on its upper surface (17).

3. The overvoltage protection in a modular design according to Claim 1 or 2, **comprising** at least one connecting system (13) of the operating state signalling, on the side of the removable module (5) linking to the primary part (11) of the operating state signalling ignition circuit (6), on the side of the base (4) linking to the secondary part (12) of the operating state signalling, connected to the connecting point (16) of the operating state signalling, with the advantage being in the two-pole or three-pole design, situated on one side of the base (4), whereas the connecting system (13) of the operating state signalling is provided with contact elements (14) of the operating state signalling, with the advantage being in the two-pole or three-pole design, situated on the bottom surface (18) of the removable module (5) and the corresponding opposite contact elements (15) of the operating state signalling, with the advantage being in the two-pole or three-pole design, situated on the upper part (19) of the base (4).

4. The overvoltage protection in a modular design according to Claims 1 to 3, **comprising** contacts (8) of the ignition circuit (6) and/or contact elements (14) of the operating state signalling are represented by fixed or spring-loaded pins, and the opposite contacts (9) of the ignition circuit (6) and/or opposite contact elements (15) of the operating state signalling are represented by plugs or contact surfaces.

5. The overvoltage protection in a modular design according to Claims 1 to 4, **comprising** a protection element (3) is with the advantage created by the spark gap with symmetrically or asymmetrically arranged electrodes, or a multi-spark gap comprising at least two spark gaps connected in series or at least two gas discharge tubes in series.

6. The overvoltage protection in a modular design according to Claims 1 to 5, **comprising** fastening of the base (4) to the profiled surface bar features an inversely profiled fastening part (20) situated on the bottom side of the base (4), or fastening of the base (4) to the flat surface using a plate with openings, or the base (4) is accommodated for the installation into a holder whose shape, dimensions and capacity match those of the base (4).

7. The overvoltage protection in a modular design according to Claims 1 to 6, **comprising** fixing of the removable module (5) to the base (4) in the connected status, features a demountable connection, or fastening system, or mechanical lock.

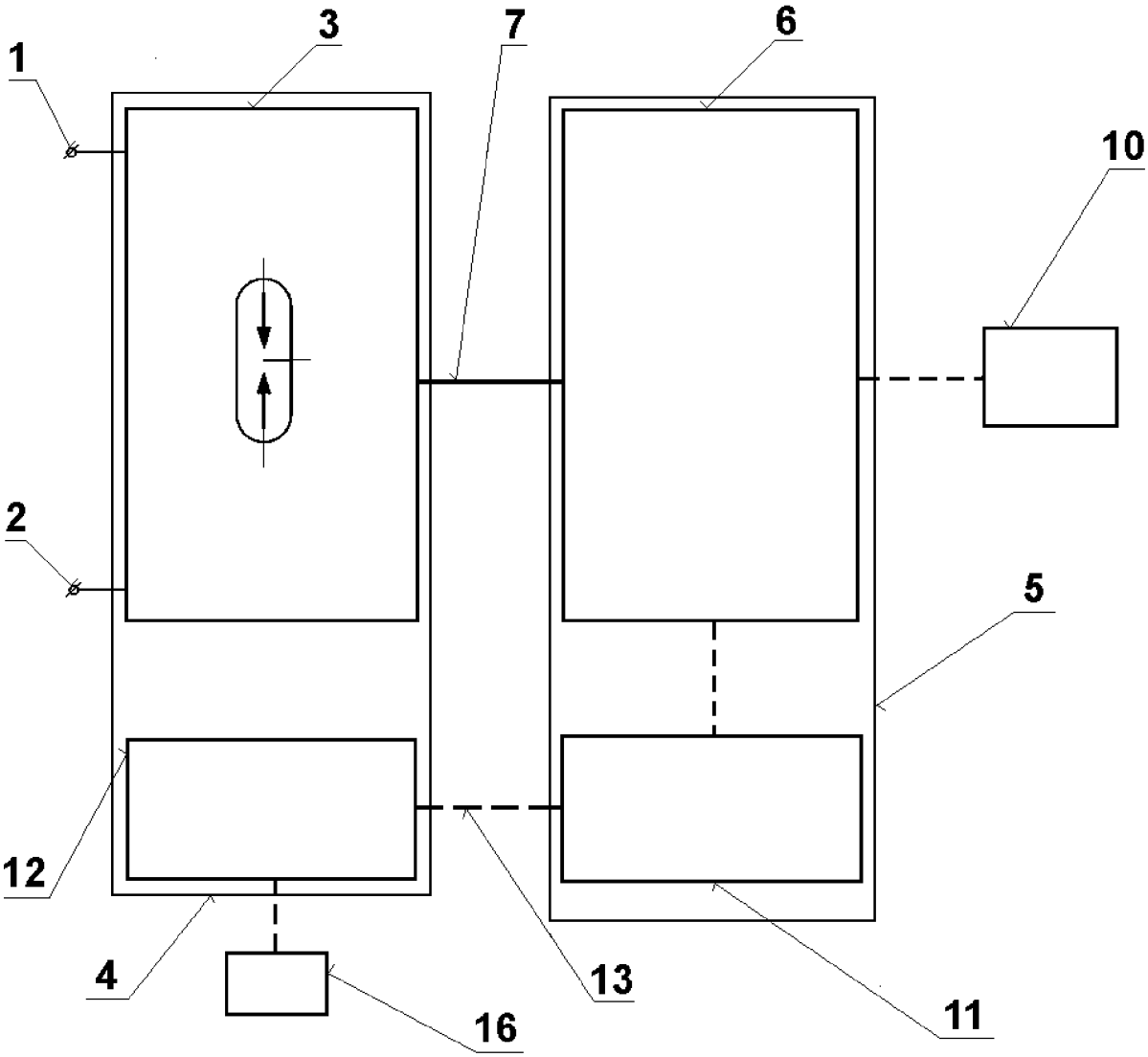

Fig. 1

5

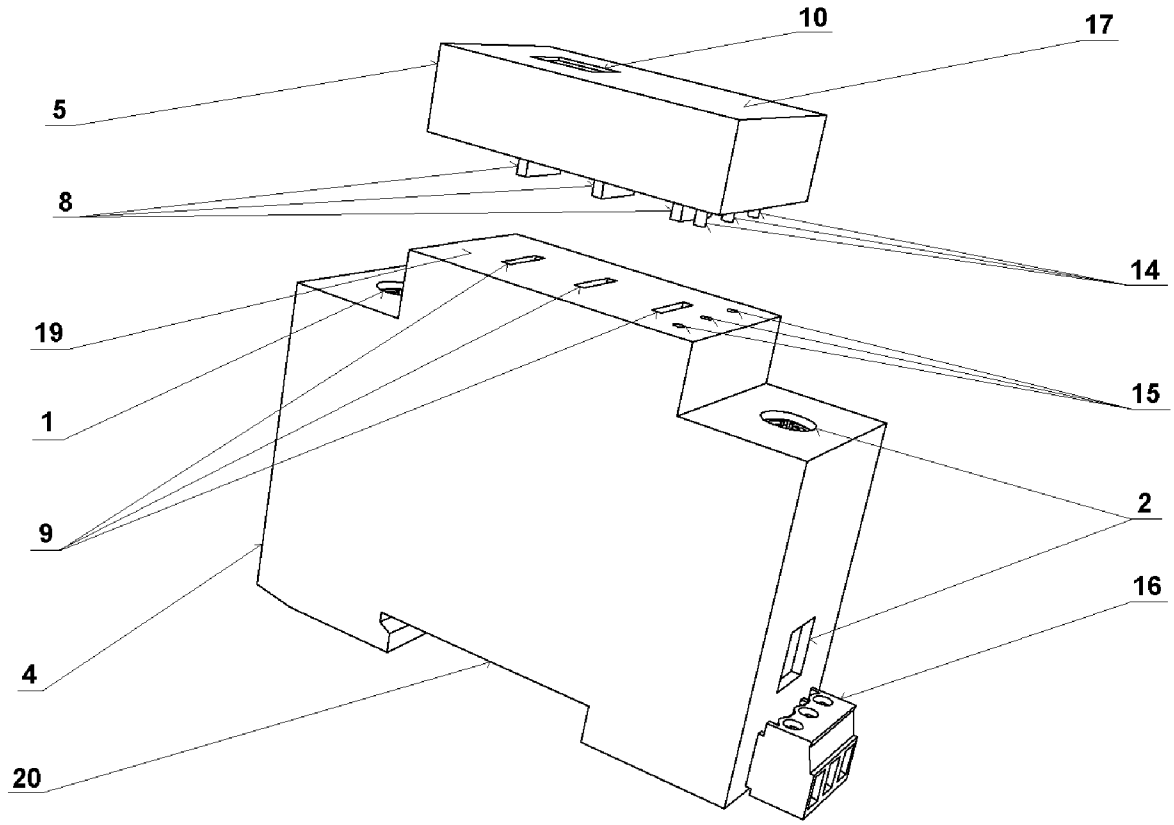

Fig. 2

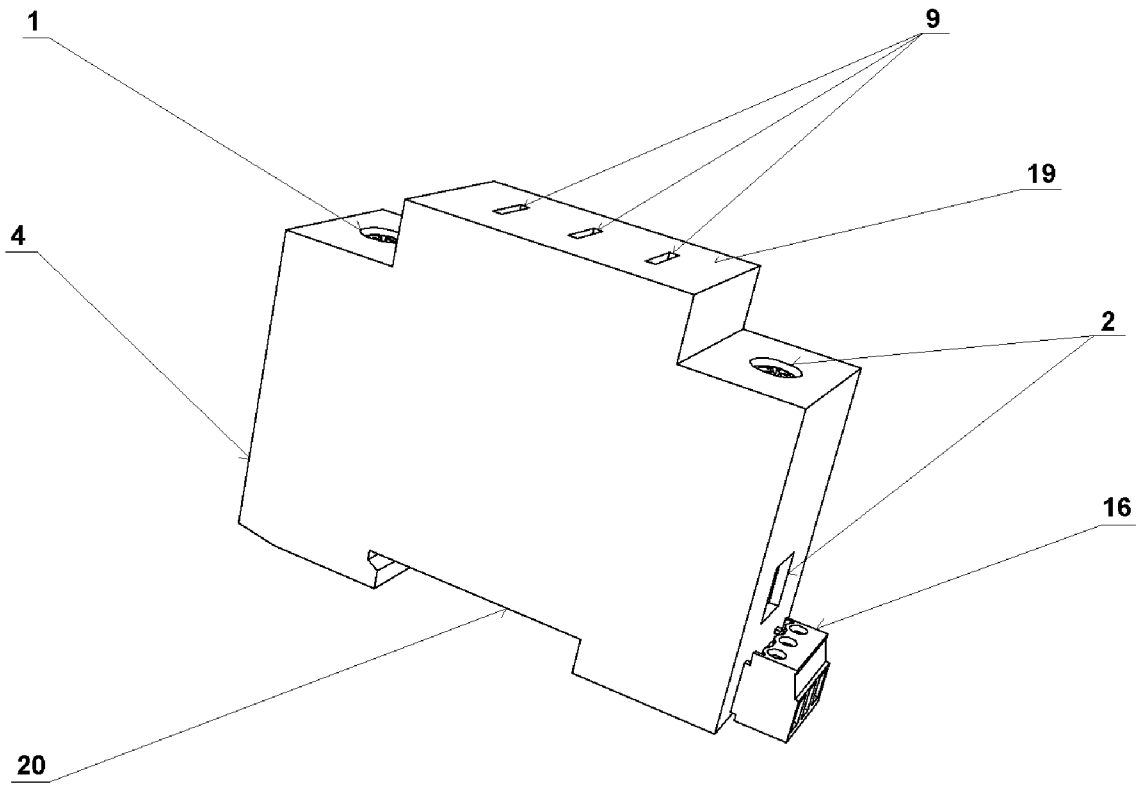

Fig. 3

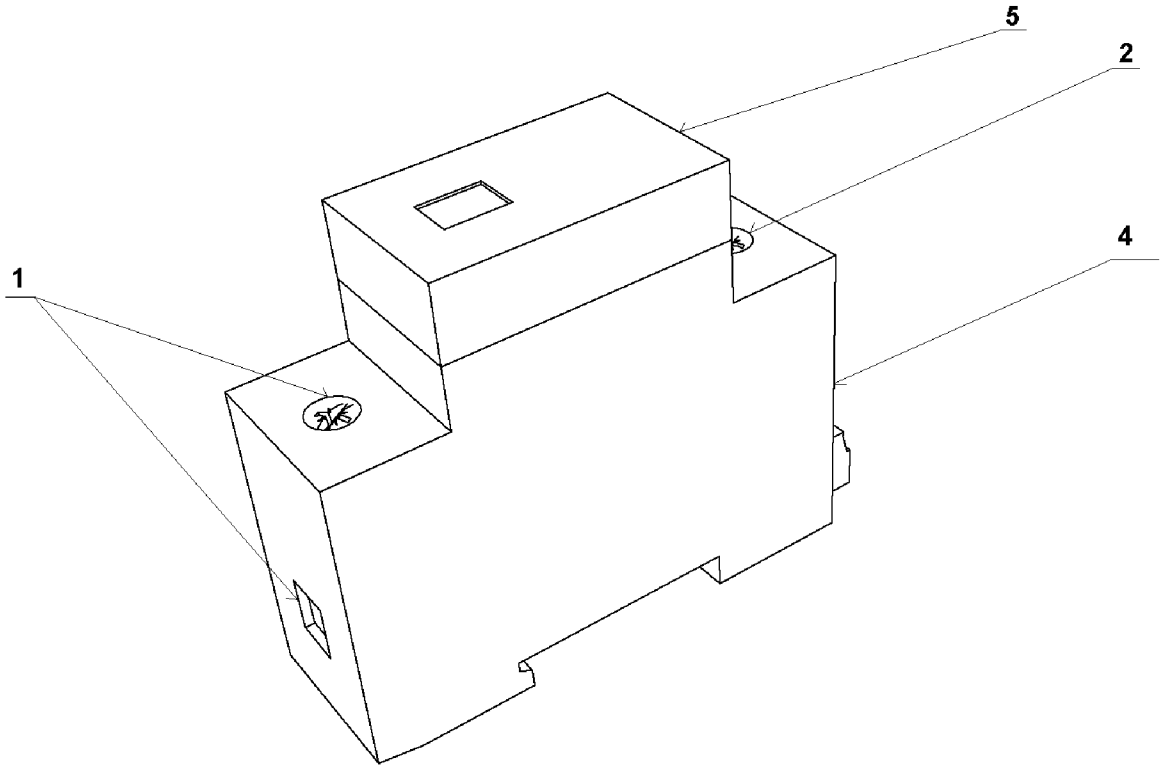

Fig. 4

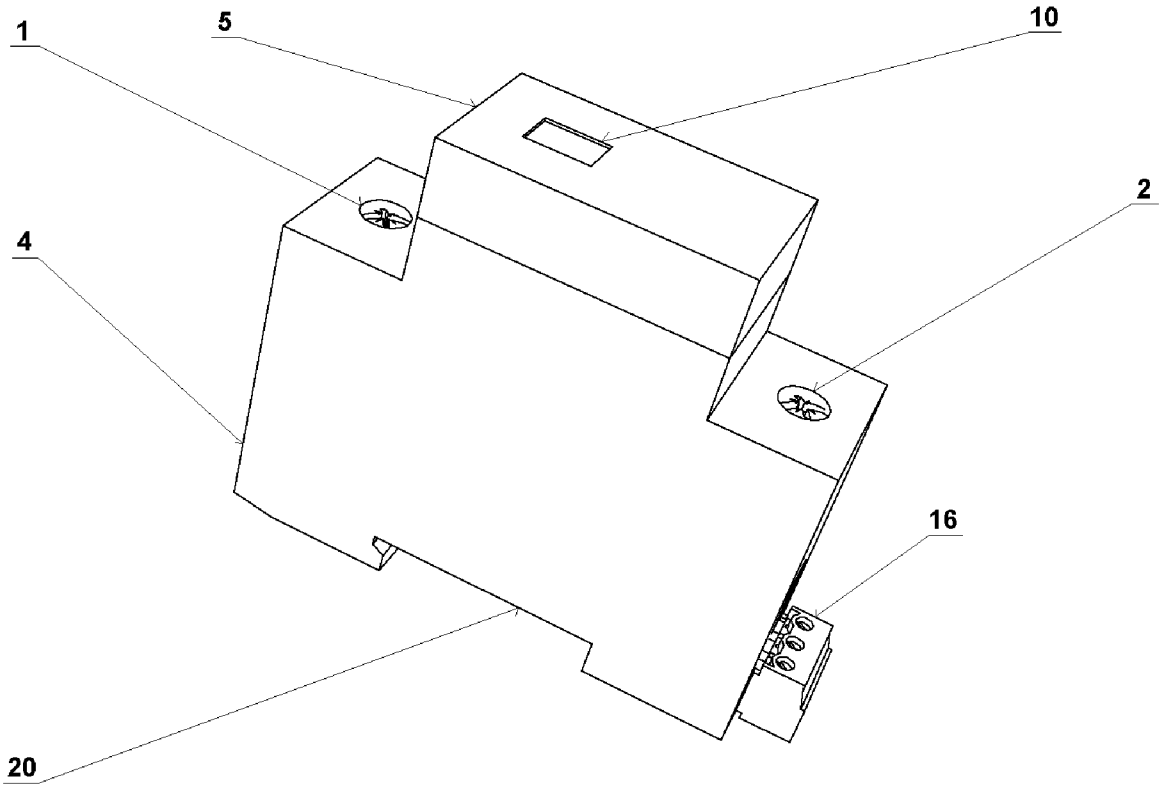

Fig. 5

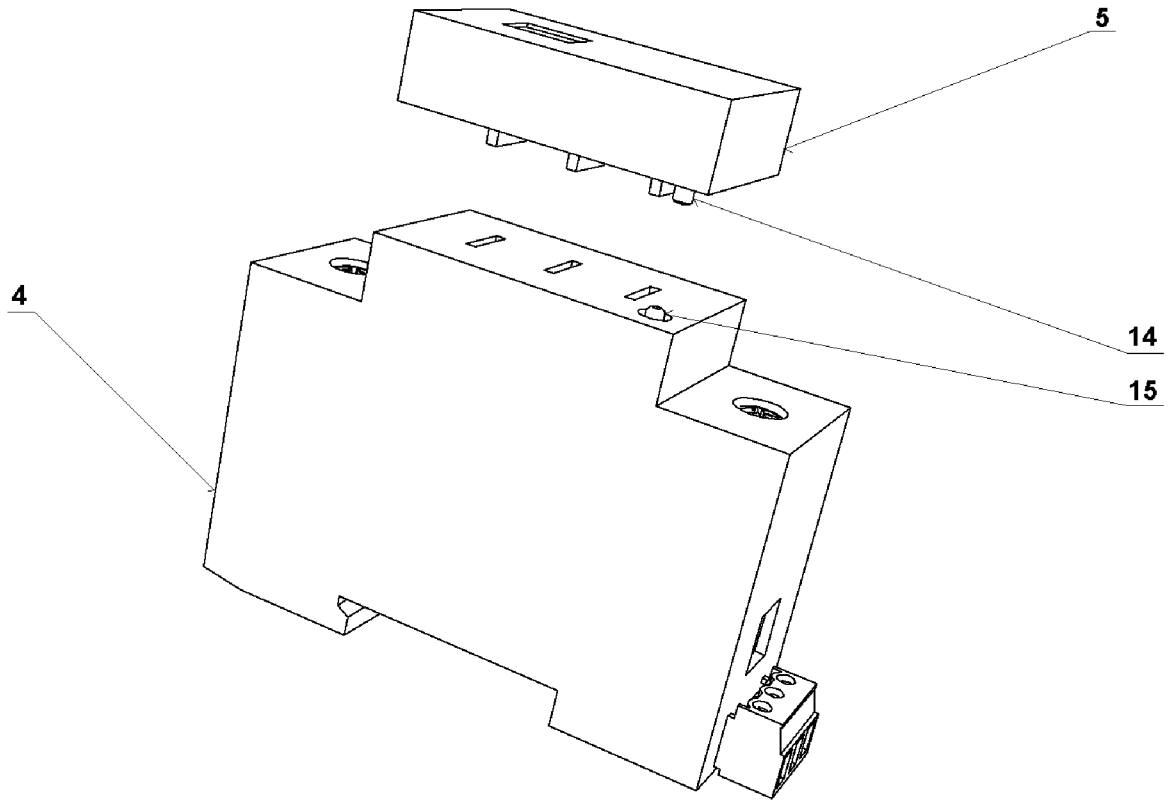

Fig. 6

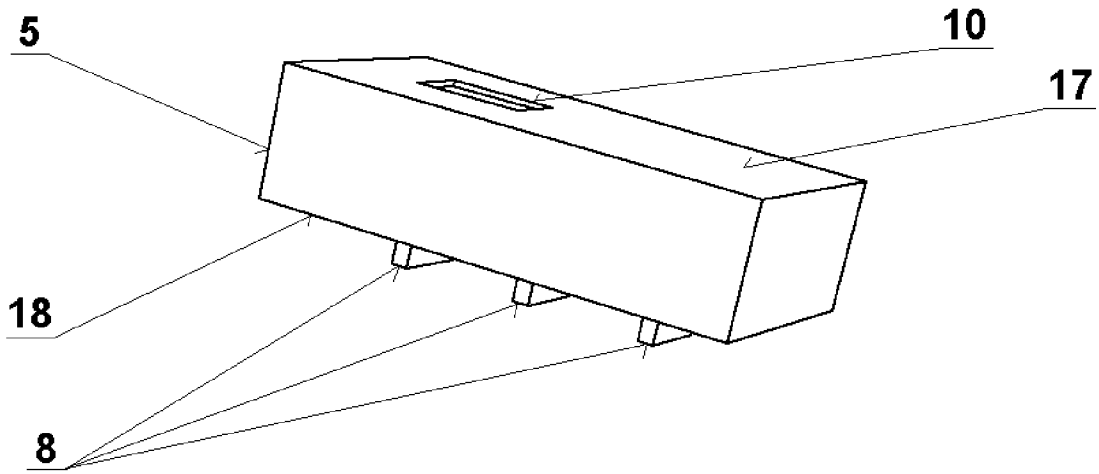

Fig. 7

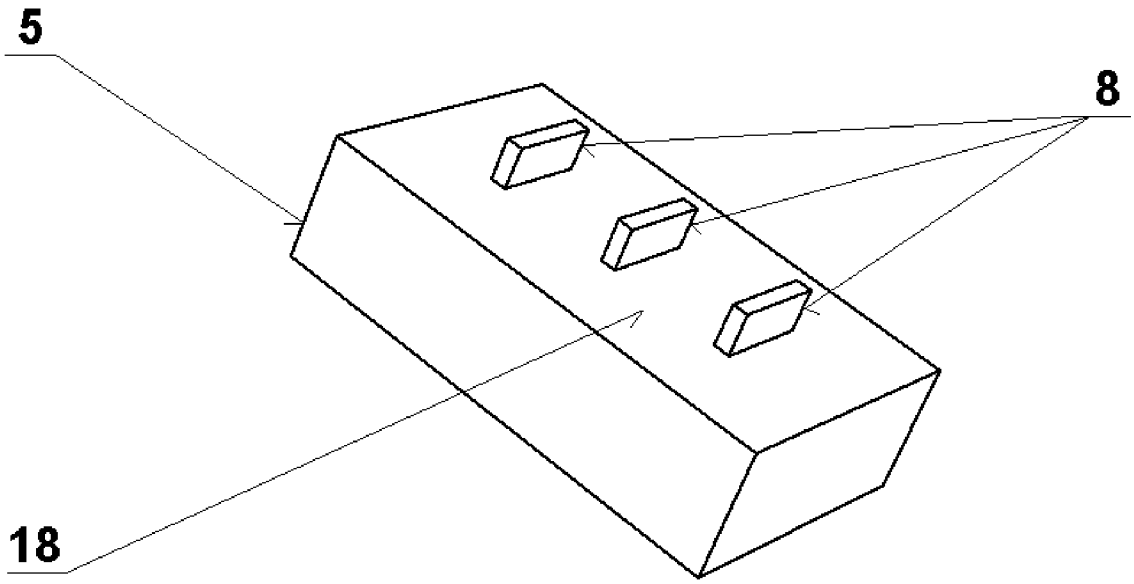

Fig. 8

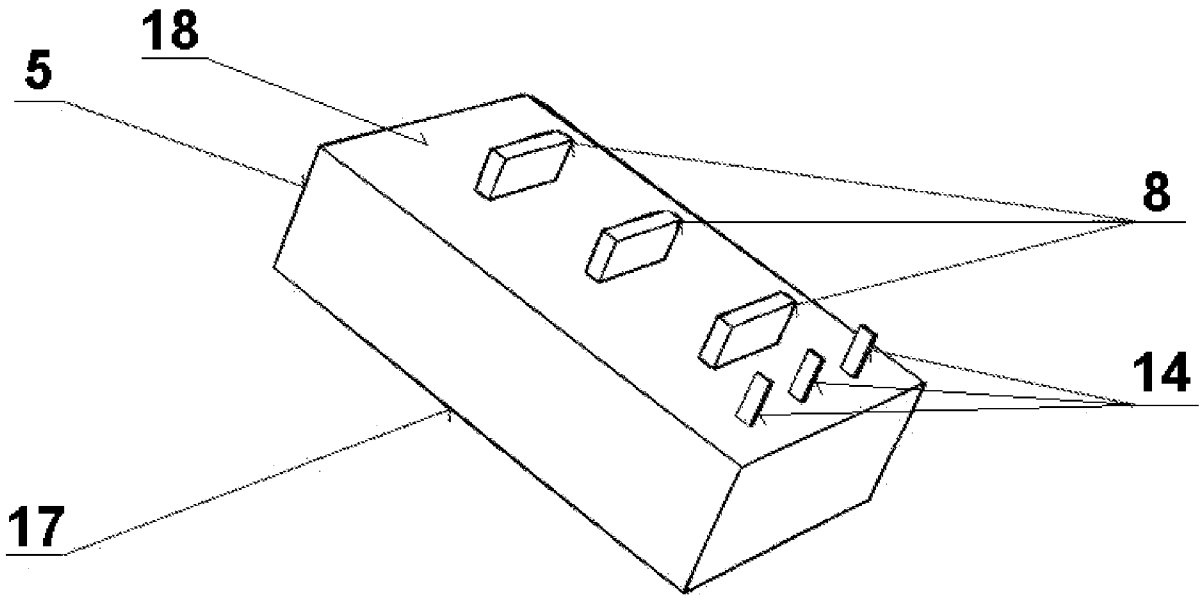

Fig. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/CZ2015/050004

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01H9/14 H01H50/02 H01H71/04 H01R9/24 H01R9/26
H01R13/66 H01T4/04 H01T4/06
ADD.
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)
H01H H01R H01T

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)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 103 04 492 A1 (PHOENIX CONTACT GMBH & CO [DE]) 19 August 2004 (2004-08-19)	1,4-7
Y	paragraphs [0008] - [0012]; figure 1	2,3
Y	US 2004/087215 A1 (POHL RANDY [US] ET AL) 6 May 2004 (2004-05-06) paragraphs [0047], [0059] - [0061]; figures 5,6	2,3
A	DE 10 2010 012684 A1 (PHOENIX CONTACT GMBH & CO [DE]) 29 September 2011 (2011-09-29) abstract; figure 2	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 December 2015	21/12/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Findeli, Luc

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/CZ2015/050004

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 10304492 A1	19-08-2004	NONE	
US 2004087215 A1	06-05-2004	DE 102004045889 A1	02-06-2005
		US 2004087215 A1	06-05-2004
DE 102010012684 A1	29-09-2011	CN 102812603 A	05-12-2012
		DE 102010012684 A1	29-09-2011
		EP 2550712 A1	30-01-2013
		ES 2552165 T3	26-11-2015
		US 2013010395 A1	10-01-2013
		WO 2011116960 A1	29-09-2011