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(71) Applicant: **VYSOKÁ ŠKOLA BÁŇSKÁ - TECHNICKÁ UNIVERZITA OSTRAVA** [CZ/CZ]; 17. Listopadu 15, CZ-70833 Ostrava Poruba (CZ).(72) Inventors: **SLIVA, Aleš**; Soukromá 533, CZ-73935 Václavovice (CZ). **BRÁZDA, Robert**; Gen. Sochora 1763/24, CZ-70800 Ostrava (CZ). **GÜNTHER, Petr**; Družstevní 171, CZ-74719 Bohuslavice (CZ). **PROCHÁZKA, Aleš**; Jugoslávská 61, CZ-70030 Ostrava (CZ). **BORA, Tomáš**; Tomicova 1008/3, CZ-71600 Ostrava (CZ). **KAŠNÝ, Rostislav**; Topolná 445, CZ-68711Topolná (CZ). **ZAHRAĐNIK, Aleš**; Erbenova 805, CZ-73961 Třinec (CZ). **ŽILKA, František**; Horní Štěpánov 272, CZ-79847 Horní Štěpánov (CZ).(74) Agent: **KENDEREŠKI, Dušan**; Lidická 51, CZ-60200 Brno (CZ).

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(54) Title: DEVICE FOR SENSING MECHANICAL-PHYSICAL AND OPTICAL PROPERTIES OF BULK SOLIDS

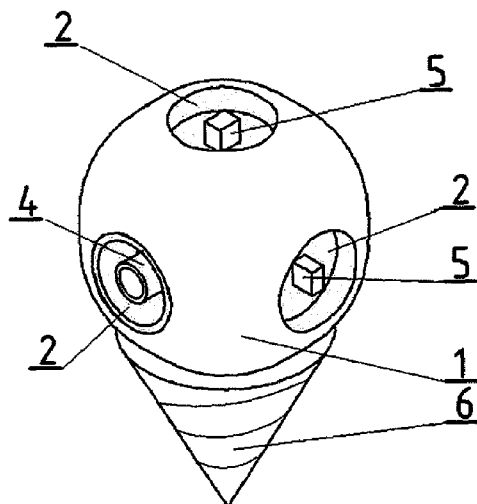


Fig. 1

(57) Abstract: A device for sensing mechanical-physical and optical properties of bulk solids and examination and localization of life-threatening places, comprising a basic body (1), where in the outer part at least one recess covered by a transparent head (2) is arranged and in the inner part a combined unit (3) with a source (31) and a recording storage (32) are arranged, and it further comprises sensor (4) of optical properties and detector (5) of physical properties, wherein the detector (5) of physical properties is arranged in at least one recess, which is characterized in that a sinking medium comprising a worm screw (6), which is equipped with a propulsion (7), and means for attachment to the basic body (1) constitutes the integral part of the device, wherein a position sensor (8) including the signal transmitter (81) is further arranged in the basic body (1).



LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, **Published:**

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GW, KM, ML, MR, NE, SN, TD, TG).

DEVICE FOR SENSING MECHANICAL-PHYSICAL AND OPTICAL PROPERTIES OF BULK SOLIDS

Field of the Invention

The invention relates to a device for sensing mechanical-physical and optical properties of bulk solids and exploration and localization of life-threatening places, comprising the basic body equipped with heads, source and recording storage, wherein the body further comprises an optical properties sensor and physical properties detectors.

State of the Art

In a certain sense, the field of bulk solids is unexplored and it is necessary to approach the identification of properties of bulk solids in this regard. The problem arises with the identification of dangerous bulk solids-rocks, sands, which are prone to land-slide (shifting sand). Any solution in this field is a progress, because it secures the signal transmission from the incriminated place to the secure place of the examiner, where there is no threat of land-slide or any other danger.

There is a known device for identification and sensing of bulk solids properties. The device is designed to measure properties by sinking into the bulk solids and to identify it or to sense bulk solids behaviour "in vitro" in various transport, operating or storing systems respectively. CZ patent no. 303700 discloses a capsule-type sensor of physical and optical properties of bulk solids. It consists of the basic body, where in the outside part there is installed at least one transparent head, whereas in the inside part are arranged a combined unit of the source and recording storage, optical properties sensor and physical properties detector, wherein at least one transparent head comprises a detector of physical properties on the inside. Measuring physical and optical properties of bulk solids is realized using capsule-type sensor which is placed into the initial position on the surface of bulk solids so as the y axis of the capsule-type sensor is identical with the y axis of the bulk solids feeder, afterwards the feeder outlet is opened and the capsule-type sensor is sunk into the bulk solids. When passing of the capsule-type sensor through the bulk solids the optical properties are sensed by sensor of optical properties and physical properties are sensed by detector of physical properties and the surface of bulk solids in the feeder is being constantly refilled to the upper level during measurement.

A certain drawback of this design is an impossibility of use at such places, where the fixation onto the examined surface or the penetration into the examined surface is necessary.

Summary of the Invention

The present invention concerns the device for recording the condition of properties of bulk solids in wireless transmission mode which is usable particularly at life threatening places, for instance at shifting masses, shifting sands and the like. The invention is complemented by a unit for automatic sinking after dropping this unit at the incriminated place, where the shifting of bulk solids occurs.

The above mentioned drawbacks are eliminated thanks to the device for sensing mechanical-physical and optical properties of bulk solids and examination and localization of life-threatening places, comprising a basic body, where in the outer part at least one recess covered by a transparent head is arranged and in the inner part a combined unit with a source and a recording storage are arranged, and it further comprises sensor of optical properties and detector of physical properties, wherein the detector of physical properties is arranged in at least one recess, which is characterized in that a sinking medium comprising a worm screw, which is equipped with a propulsion, and means for attachment to the basic body constitutes the integral part of the device, wherein a position sensor including the signal transmitter is further arranged in the basic body.

In contrast to the current state of the art, the essential difference is that the present invention extends the use of the present embodiment in the life-threatening places or hard to reach areas, from which it is necessary to obtain data.

An advantage is also the possibility to transport the device to the place using various means of transport, for instance, it can be dropped at the incriminated place from a helicopter.

To navigate the device for recording the condition of properties of bulk solids in wireless transmission mode to the surface of the impact it is necessary for the centre of gravity of the device to be placed on the axis of the device in such point (place) so as to navigate the worm screw to the intended impact surface. One thing emerging from this condition is that material from which the sinking medium is made has to have higher density than that the density of the basic body.

The sinking medium for sinking the device comprises the worm screw furnished with automatic propulsion, comprising an electric motor and a control unit including an activation sensor for dropping from the means of transport. The device can be set up so as to “self-sink” itself at the hard to reach places.

Brief Description of the Drawings

The present invention will be further described with reference to the drawings, where the fig. 1 illustrates the sinking medium in perspective view, fig. 2 illustrates the sinking medium from the fig.1 in perpendicular views, fig. 3 illustrates A-A section from the fig. 2, fig. 4 illustrates B-B section from the fig. 2, and fig. 5 illustrates the transport of the device by the means of transport to the place of destination.

Description of the Preferred Embodiments

The invention will be further clarified in the following description of the preferred embodiments of the device with reference to the respective figures.

The said device in the exemplary use in bulk solids with position sensing via GPS and sensing of the condition of bulk solids properties, where dropping from a helicopter is chosen as the means of transport of the device at the incriminated place – the dangerous place is shown in the figs. 1 to 5.

As is apparent from the fig. 1, fig. 2, fig. 3, and fig. 4, the device for sensing of bulk solids and examining and localization of life threatening places comprises the main body 1, where in its outer part there are arranged three recesses covered by transparent heads 2. Optical properties sensors 4 are arranged in the recesses, wherein at least in one recess there is a physical properties detector 5. It is apparent from the fig. 3 which illustrates the A-A section that inside the main body 1 there is arranged combined unit 3 comprising a source 31 and recording storage 32 of data. Combined unit 3 is placed in the recess in the way so as to enable the recording of recording into the recording storage 32 via the transparent head 2. It results from the fig. 4 illustrating the B-B section that the sinking medium 11, comprising a worm screw 6 and propulsion 7, is attached to the main body 1 via attachment means. The propulsion 7 comprises electric motor, control unit 71 and means 72 for activation of the device (activation sensor after landing). Furthermore, in the inner part of the main body 1 there is arranged a position sensor 8 including the signal transmitter 81. Position sensor 8

records the actual position of the basic body 1 and current data from the position sensor 8 (e.g. GPS position sensor) are sent to a signal receiver 9 of the device's position which is placed in the mobile medium 10 in a safe distance from the critical place of impact.

The function of the device is as follows. The device is activated while being dropped from the helicopter 10 or from any other means of transport, wherein the sinking medium 11 is activated when in contact with the surface of the examined place and the worm screw 6 will "sink" into the bulk solids, for example shifting sand, via the propulsion 7. Eventually the device position data are recorded and transmitted via the optical properties sensor 4 and physical properties sensor 5, wherein the position of the basic body 1 is being constantly recorded using the GPS position sensor 8 including the signal transmitter for signal receiver 9 of the position of the device, which is placed in the safe place distant from the incriminated place.

Another variation is using the device for identification of the conditions in the snow and for searching for persons, for instance under the avalanche (the device is again dropped from a helicopter – dangerous place)

The device consists of the basic body 1, in its outer part there is arranged at least one recess covered by the transparent head 2. In the inner part of the basic body 1 there are arranged the combined unit 3 with the source 31 and the recording storage 32, optical properties sensor 4, and physical properties detector 5.

The device is activated while being dropped from a helicopter or any other means of transport 10, as is shown in the fig. 5. The sinking medium 11 is activated when in contact with the surface and the propulsion 7 is activated via the control unit 71, subsequently the worm screw 6 "sinks" into a certain area. Eventually the optical properties sensor 4 and physical properties detector 5 are activated, wherein the position of the basic body 1 is being constantly recorded using the GPS position sensor 8 including the signal transmitter 81. These signals are received by the signal receiver 9 of the position, which is placed in the safe place distant from the incriminated place.

Another variation is using the device for localization of minefields or dangerous objects, wherein the device is dropped from a helicopter to a designated location. The incriminated place is indicated using several devices.

The device consists of the basic body 1 comprising heads 2, combined unit 3 with the source 31 and the recording storage 32 and it further comprises optical properties sensor 4 and physical properties detector 5. The device is activated while being dropped from the helicopter 10 or from any other means of transport as shown in the fig. 5. The sinking medium 11 is activated when in contact with the surface as described above. The device is fixed onto the intended place, where the occurrence of mines, etc. is expected, and subsequent activation of optical properties sensor 4 and physical properties detector 5 takes place, wherein the position of the basic body 1 is being constantly monitored via the GPS position sensor 8 including the signal transmitter 81. These signals are received by signal receiver 9 of the position, which is placed in the safe place distant from the incriminated place.

Industrial Applicability

The function of the said device is to sense mechanical-physical and optical properties of bulk solids and it functions on the principle of wireless communication with the operating system. Its applicability can be multifunctional; it can be used in the search for mines in wide surroundings, in search for people under the snow, for detection of the objects, and for measuring the properties of the environment in which it is currently placed.

List of reference signs

- 1 basic body
- 2 transparent head
- 3 combined unit of the source and recording storage
- 31 source
- 32 recording storage of data
- 4 optical properties sensor
- 5 physical properties detector
- 6 worm screw
- 7 propulsion
- 71 control unit
- 72 means for propulsion activation
- 73 electric motor
- 8 position sensor
- 81 signal transmitter
- 9 signal receiver of the device position
- 10 mobile medium
- 11 sinking medium

CLAIMS

1. A device for sensing bulk solids and exploration and localization of life-threatening places, comprising a basic body (1), where in its outer part at least one recess covered by a transparent head (2) is arranged, and in the inner part a combined unit (3) with a source (31) and a recording storage (32) are arranged, further it comprises an optical properties sensor (4) and a physical properties detector (5), wherein the physical properties detector (5) is arranged in at least one recess, **characterized in that** a sinking medium (11) comprising a worm screw (6), a propulsion (7) and means for attachment to the basic body (1) constitutes its integral part, wherein a position sensor (8) including a signal transmitter (81) is further arranged in the basic body (1).
2. The device for sensing bulk solids and exploration and localization of life-threatening places according to claim 1, **characterized in that** the sinking medium (11) is made from material with higher density in comparison with the density of the material of the basic body (1) in order to navigate the basic body (1) towards the surface.
3. The device for sensing bulk solids and exploration and localization of life-threatening places according to claim 1 or 2, **characterized in that** the propulsion (7) comprises an electric motor (12) with a control unit (71) and activation means (72) of the device.

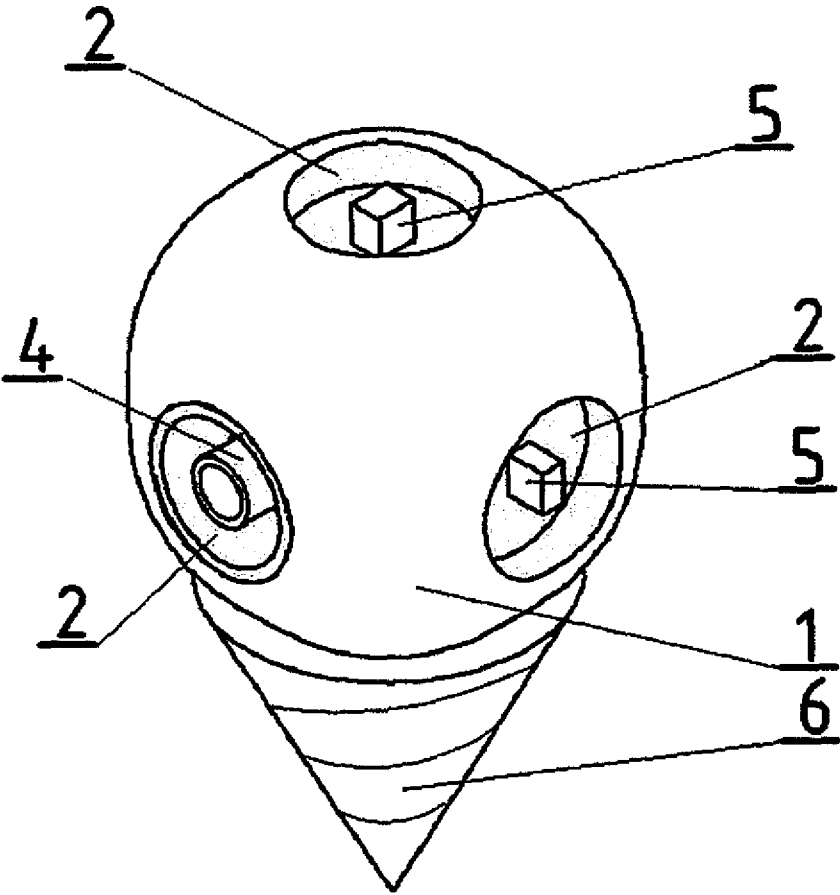


Fig. 1

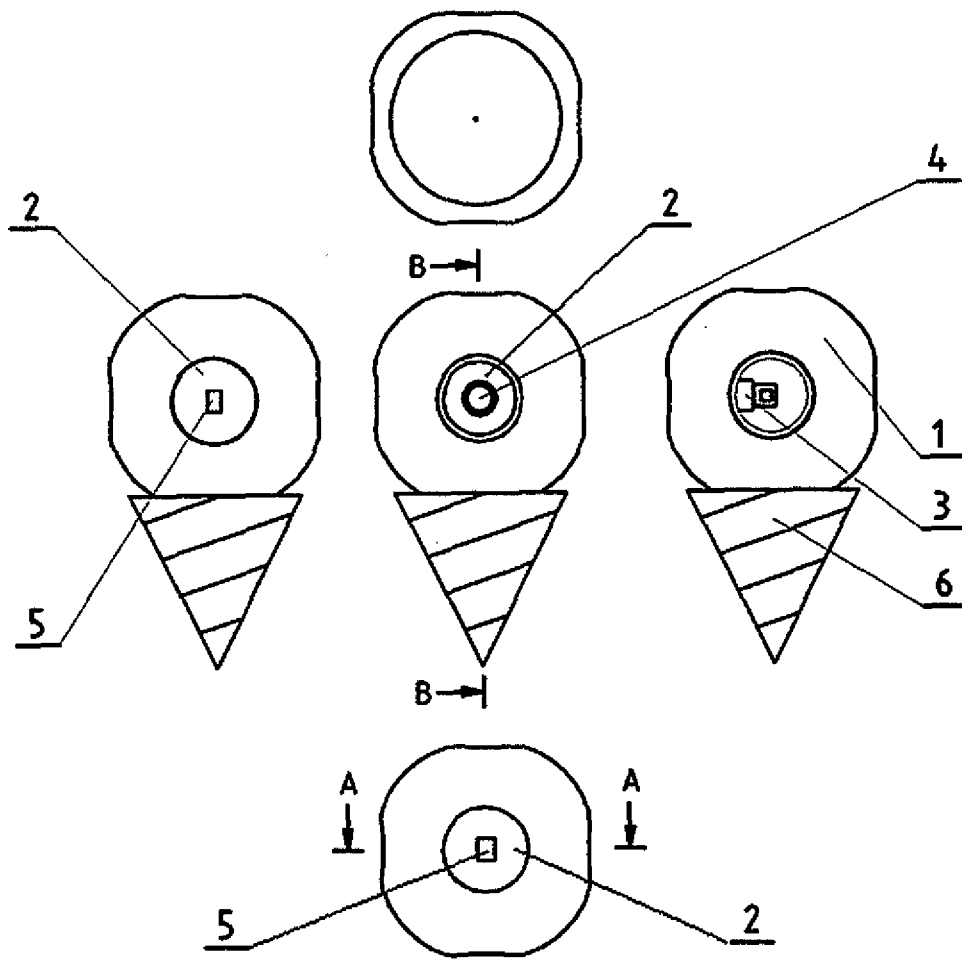


Fig. 2

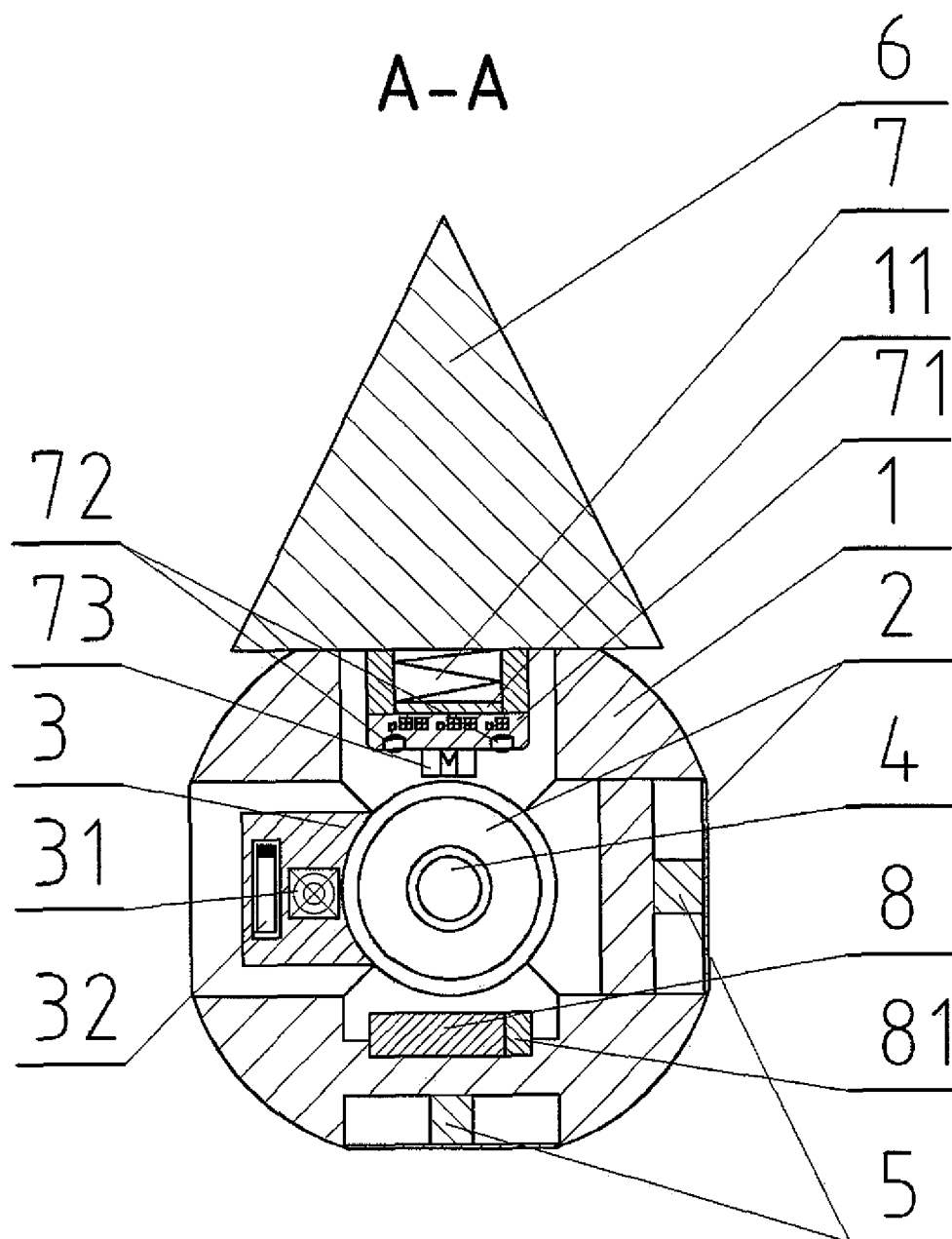


Fig. 3

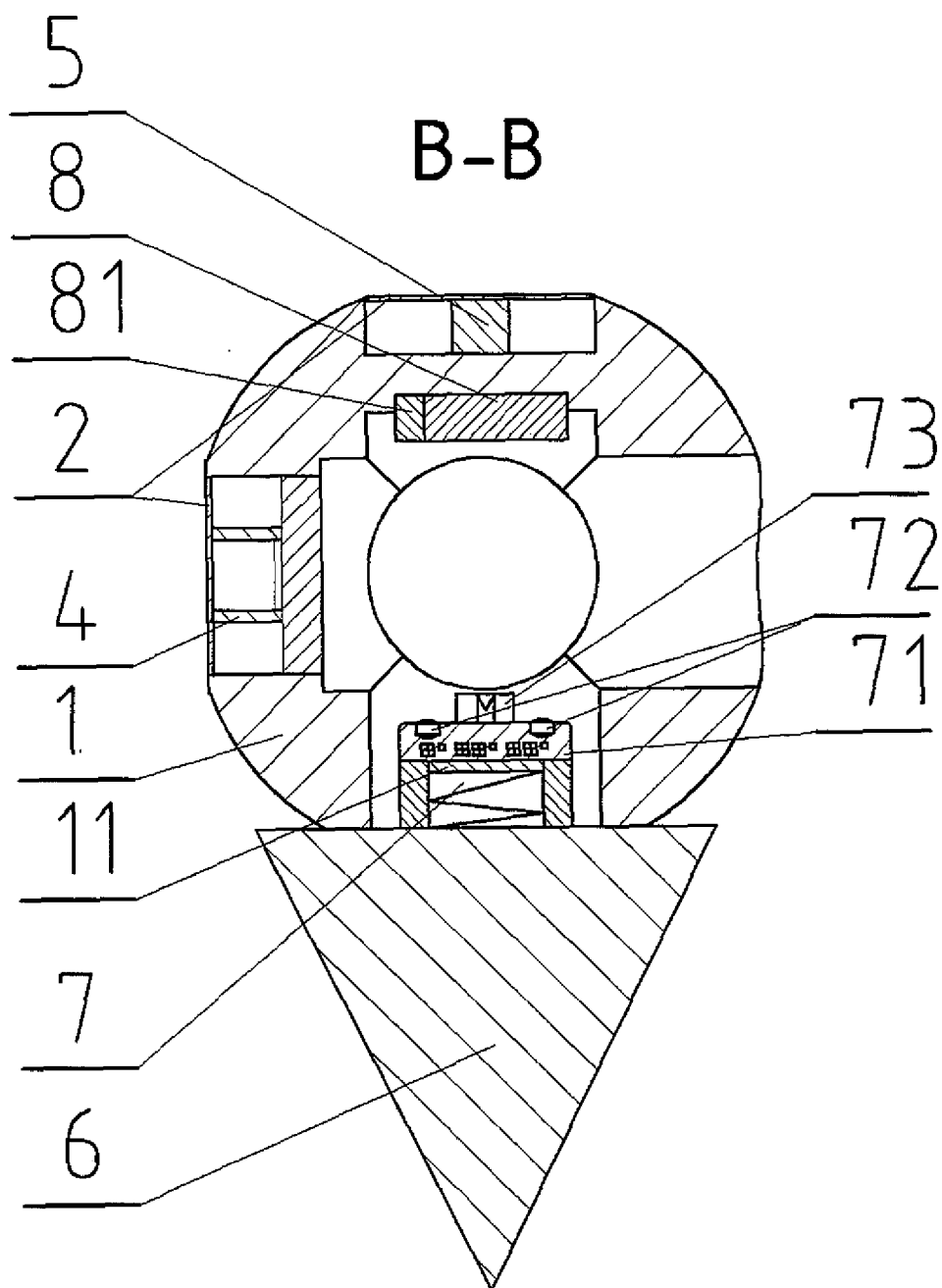


Fig. 4

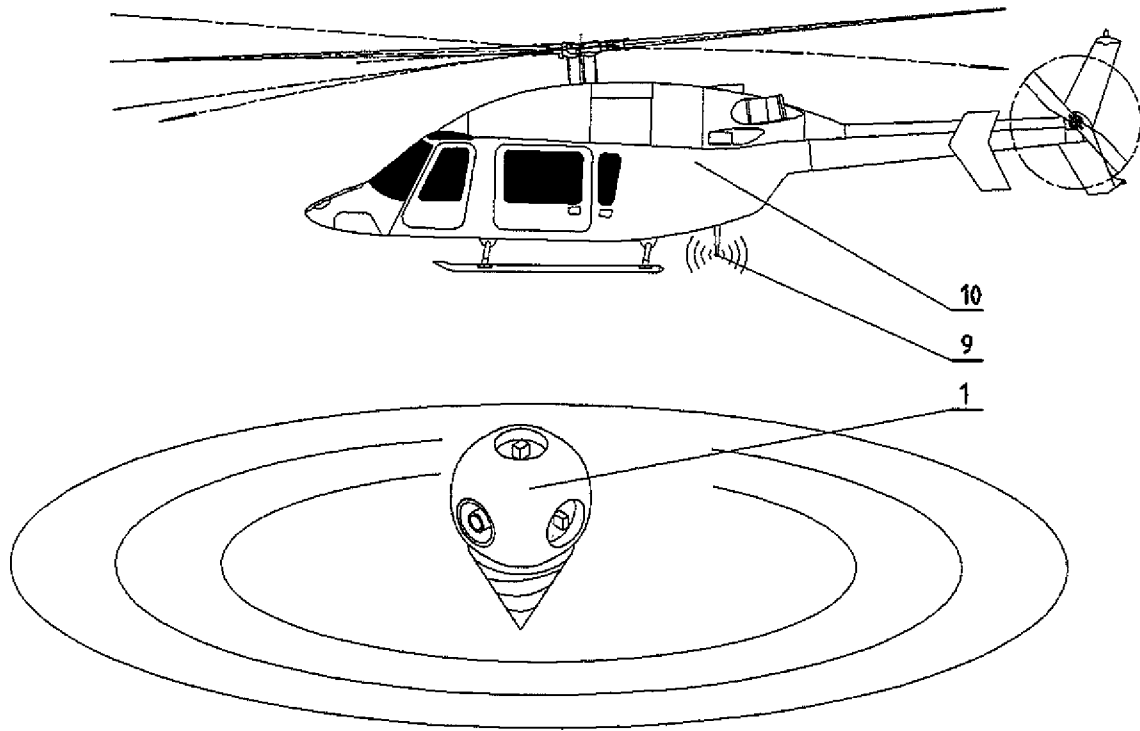


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/CZ2014/000118

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01D11/24
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)
G01D

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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| Y | CZ 303 700 B6 (VS BANSKA TECHNICKA UNIVERZITA OSTRAVA [CZ]) 20 March 2013 (2013-03-20) abstract; figure 1 page 2, lines 40-49 ----- | 1-3 |
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Thomas, Judith

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/CZ2014/000118

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