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(54) Benævnelse: **SENSOR SYSTEM WITH OPTOELECTRONIC DISTANCE SENSORS**

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**DE-A1-102015 216 659**
**DE-B3-102017 105 999**

# Sensor system with optoelectronic distance sensors

The present invention relates to a sensor system comprising distance sensors.

DE 10 2015 112 656 A1 discloses a plurality of optoelectronic distance sensors at a movable machine part.

Tasks are resulting more and more in today's production environment in which people have to work hand in hand with robots in close spaces. Protection of a person from the robot is in this respect not possible by mechanical protective devices such as fences or barriers, but must rather be transposed into the direct environment of the robot.

To make this kind of collaboration possible in principle, robot manufacturers have developed robots having a performance and force limitation. The maximum force a robot can exert before the movement is automatically stopped can be set here such that a force effect cannot produce serious injury in the event of a collision of the robot with a person. The motor control and the rotary encoder which carry out a positional determination of the robot arm are safety components with corresponding certification.

In addition, when designing the mechanical robot components, care is deliberately taken to provide edge-free, round or soft external contours so that a possible collision force is distributed over as large a surface as possible and so that no danger of lacerations or the like can occur.

An increasing prevalence of safe small robots having safe movement controls and force-limited drives reduces the sources of danger to the tool attachment at the end of the robot arm. A problem which has not yet been solved satisfactorily in this respect is the securing of the tool and/or of the workpiece at the robot per se. The

tool itself frequently comprises sharp or pointed parts, parts which rotate or which are hot, etc. in order to be able to carry out its function at all. Examples include drills, screwdrivers, cutters, blades, grippers having sharp edges for filigree parts, welding guns, soldering tips, etc.

There is thus an increased risk of injury at the tool, even with a safe force limitation of the robot due to the movement of the tool or of parts having sharp edges. Even blunt tools or workpieces can represent a danger with a sharp-edged working area or environmental area. A tool attachment typically has small dimensions and is well localized. At the same time, the great variety of possible tool geometries, the fast movement in a number of degrees of freedom and the demand for fast fitting and changing geometries of the tool attachment represent new demands on a securing solution which existing safety sensors cannot satisfy or can only meet unsatisfactorily.

Robots are not finished machines since they are delivered without tools. Inherently safe HRC robots also do not receive a CE mark for this reason. Safety sensors marked as ESPE can be used to secure a robot including a tool and a workpiece. These sensors have to be fastened to the robot.

DE 102015216659 A1 discloses an adapter that permits an object to be pulled into a chamber formed by an outer cover after gripping by a gripper module having a drive. The outer cover is here adapted to at least partly cover the object and to be sufficiently large to screen the object. The adapter can be understood as a base gripper system at which the gripper module is adapted. The drive pulls the total gripper module together with the object into the base gripper system. The adapter represents a safety gripper system having an object housing for a safe human-robot interaction. The outer cover protects the person from sharp-edged objects gripped by the gripper module that could otherwise result in injuries to the persons present in the working space. Sharp-edged or pointed objects can therefore also be safely

transported by the robot due to the adapter. The apparatus can, for example, be used to link gripper modules to industrial robots, for example delta robots or articulated arm robots.

D2 DE102017105999B3 relates to a sensor system for a multi-member robot comprising a plurality of sensors that are arranged distributed at the robot and that are communicatively connected to a master unit that is connected to a control device for forwarding measurement data collected by the sensors, wherein the master unit is positioned, adapted to the shape of the robot, at a tool unit of the robot and is connected to the control device via a cable.

D3 WO2017036732A1 provides a safety gripper system having an object housing for safe human-robot interaction. For this purpose, the adapter has two protective covers that at least partly cover a gripped object and that are large enough to screen the object. The associated grippe module is fixedly installed in the adapter in a first embodiment and is flexibly replaceable by means of a gripper change mount element in a second embodiment. In the closed position, the protective covers protect the persons from sharp-edged objects that were grasped by the gripper module and could otherwise result in injuries to the persons present in the working space. Sharp-edged or pointed objects can thus also be safely transported by the robot due to the apparatus. The projective cover furthermore provides the advantage that objects that are not securely held by the gripper module and slip out of it while the robot is, for example, moving due to centrifugal forces can be caught.

It is an object of the invention to provide an improved sensor system comprising distance sensors.

The object is satisfied in accordance with claim 1 by a sensor system comprising distance sensors for monitoring a hazard zone at a movable machine part having at least one protected zone, wherein a tool and/or a workpiece is/are arranged at the

movable machine part, wherein the distance sensors are arranged at a holder at the movable machine part, wherein a plurality of distance sensors are arranged, wherein the detection beams of the distance sensors form a protected field, wherein the holder has mounts for the distance sensors, wherein a first fastening adapter for fastening the holder to the movable machine part is arranged at the holder and a second fastening adapter for fastening the tool to the holder is arranged at the holder and the holder has a disk-shaped housing between the fastening adapters, and wherein the disk-shaped housing has round surfaces and has no corners at the outer surfaces.

This is a fastening concept for ESPE sensors that represents a flexible solution for application-specific demands. An adapter function for different robot flanges and end effectors is in particular provided by the fastening adapters here. In addition, the sensor system having the disk-shaped housing with the fastening structure is inherently safe in form and material and is mechanically stable to prevent manipulations of the safety devices, on the one hand, and to forward forces to an optionally power and force limited robot, on the other hand.

Due to the round surface of the disk-shaped housing, a possible collision surface is present at every point and actually no edge and/or corner, whereby a risk of injury is minimized. The outer contours of the disk-shaped housing are here optionally rounded, also circular or arcuate.

The design the machine operator is exposed to may not have any sharp edges. An organic shape is rather provided that has the effect of small surface pressure on contact. The design the machine operator is exposed to does not have any gaps in which the fingers or clothing of the machine operator could catch.
The holder that receives the distance sensors can be monolithic or modular.

The holder and the mount for the distance sensors are fixedly connected to the fastening adapters so that they do not release from the fastening adapters on a blow between the person and the holder. Forces can thus be forwarded to the robot. The mechanical design is designed as so stable that forces can be forwarded to the robot and to its power and force limitation.

The sensor system serves for the safe monitoring of the hazard zone or of a monitored zone of the movable machine part.

Safety in accordance with the present invention is safety in the sense of machine safety. The standard EN/IEC 61496, for example, regulates the demands on a safe sensor or on electro-sensitive protective equipment (ESPE) for securing hazardous zones. Machine safety is regulated in the standard EN 13849. Safety is, for example, ensured by a single-channel design with testing, a two-channel design or a design diverse in two channels of an evaluation unit for error localization and for a functional test. The distance measuring sensor or distance sensor in accordance with the present invention is designed, for example, as intrinsically safe and recognizes internal errors. An error signal is generated, for example, on discovery of an error. The sensor or distance sensor furthermore optionally has a sensor testing.

The evaluation unit recognizes protected field infringements and can output a safety directed switch-off signal to stop a dangerous movement of the part or to brake the part. This can e.g. be implemented via safe switching signals, e.g. OSSD signals (output safety switching device signals) or safe distance data, spacing data or safe spatial data of the intrusion event. The evaluation unit has a two-channel design, for example.

The plurality of distance sensors are connected to an evaluation unit for evaluating the distance sensors.

The distance sensors are optionally arranged spaced apart from one another along a ring, with the sensors forming an areal protected field that extends, for example, cylindrically or frustoconically.

The distance sensors optionally have uniform spacings. An almost uniform resolution within the protected field is achieved by the uniform spacings of the sensors and a respective identical angular orientation of the detection beams.

The sensors are contactlessly acting distance measuring distance sensors, with the sensors having a detection beam for detecting objects in the monitored zone. The distance sensors are preferably optoelectronic distance sensors.

The distance sensors can each have a linear or areal protected field. The areal protected field is formed in fan shape with a specific opening angle of, for example, 2° to 20°.

The monitoring takes place using a plurality of simple distance measurement sensors sensing in one dimension.

The distance sensors are time of flight sensors, for example. A time of flight sensor or distance sensor or light scanner in accordance with the time of flight principle has at least one light transmitter which transmits consecutive light pulses into a measured zone and has at least one light receiver which receives the light pulses reflected at an object in the measured zone or monitored zone and supplies them in the form of received electrical signals to a control and evaluation unit which determines a distance signal representative of the distance of the object from the light sensor while taking account of the speed of light from the time between transmission and reception of the light pulse.

In addition to the distance sensors, a plurality of other sensor technologies can also be considered as electrosensitive protective equipment, namely cameras, for example 2D cameras or 3D cameras of color or monochrome operation.

Radar sensors, ultrasound sensors, inductive sensors, capacitive sensors, or similar sensors are furthermore optionally provided.

The sensor system comprising the fastening concept can comprise further sensors that are used for gesture control.

The fastening concept with the holder and the fastening adapters can be manufactured with the aid of rapid prototyping methods and can be adapted to individual customer demands. Methods of additive production are possible here.

A modular design of the holder is likewise provided. A submodule of the holder here only includes a limited number of distance sensors. Any designed securing contours can thus be produced by a combination of different submodules.

An adaptation of the number of sensors is provided to generate a more or less closed protective jacket or protected field from the distance sensors: The number of sensors can be changed, for example. The more distance sensors are arranged, the closer the optoelectronic axes of the distance sensors are next to one another, whereby the protected field has a higher resolution.

The wavelength of the transmitted light of the distance sensors is preferably a wavelength invisible to the human eye, for example infrared light. A direct intrusion into possible protection gaps is thereby made more difficult since they are not visible.

In a further development of the invention, the mounts of the holder for the distance sensors have at least one mechanical fastening for the distance sensors at which the distance sensors can be mounted in at least one predefined position.

The holder or the mount is implemented such that all the distance sensors have a fixed relative position with respect to one another that is compatible with the securing concept.

The distance sensors are optionally installed by means of poka-yoke, according to which the sensors automatically have to necessarily be installed in the correct position.

The mount is optionally implemented such that a plurality of orientations of the individual ESPE are possible that are each compatible with the securing concept.

The position and alignment of the individual ESPE sensors can no longer be recognized by the machine operator in the finally installed state so that a manipulation is thereby made more difficult. The disk-shaped housing can be opened here without releasing the holder from the first fastening adapter or from the second fastening adapter. The disk-shaped housing can in particular be opened to install the distance sensors. The disk-shaped housing is then closed again so that the distance sensors are no longer recognizable for the machine operator.

In a further development of the invention, the holder has mounts for circuit boards, electronic assemblies and/or cable connections.

The holder can simultaneously serve as a mount for further electronic assemblies such as cable collector boards, logic units for the first data processing and/or further sensors.

The cable guidance is designed here such that the user or machine operator cannot get entangled in the cables.

The holder provides a strain relief for the cables of the ESPE sensors.

In a further development of the invention, the disk-shaped housing has a safety closure to open and close the disk-shaped housing.

The disk-shaped housing or a closure screw is closed or opened by one or a few safety mechanisms so that the position of the distance sensors in the interior of the holder cannot be manipulated.

The disk-shaped housing and the holder protect the distance sensors from contamination or front screen contamination as much as possible.

In a further development of the invention, the disk-shaped housing is resilient so that the housing surface is deformable on exertions of force onto the surface of the housing. The deformation can be temporary or permanent in this respect. The disk-shaped housing is made, for example, from a foamed plastic or from another deformable material having a low density.

The outer skin is, for example, resilient with a spring mechanism and can comprise soft materials having a cushioning effect so that a cushioned disk-shaped housing is formed.

In a further development of the invention, the holder has means for looping through or guiding around a plurality of electrical, pneumatic and/or hydraulic connectors.

The holder allows the looping through or guiding around of a plurality of electrical or pneumatic connectors of the end effectors. In this process, the cables for controlling

the end effector do not influence the sensor function here, for example by avoiding a masking.

In a further development of the invention, the holder has a color signal display, with the signal display colors being, for example, at least green, yellow, and red.

The fastening concept comprises the signal or status display that serves as an interface between the machine operator and the securing solution.

The signal or status display serves as a collaboration interface between the machine operator and the robot and provides information on the status of the total securing or of the individually installed distance sensors.

The status display has at least three colors similar to a traffic light principle. The color green indicates "Everything OK". The color yellow shows a warning due to a specific distance or the reduction of robot speed taking place as a result. The color red shows a falling below of a safety distance, with the robot being stopped.

Further colors for e.g. servicing or system failures are optionally provided. The status display can have a ring-shaped design. The signal or status display can optionally also illuminate parts of the protected zone.

The signal or status display can optionally visualize the protective jacket or protective volume implemented by the distance sensors, e.g. as a light ring on the working area.

Different further flashing modes are optionally provided in addition to the traffic light function. Green flashing at the start of the robot, for example, signals that the robot will start to move.

On an automatic restart after a stop, the green flashing likewise signals that the robot will start to move again soon. Flashing modes are also conceivable for the other embodiments of the status display.

In a further development of the invention, the signal display indicates a direction of a movement of the holder. Which direction the robot will move in is thereby visible to the user or machine operator. A risk of injury for the user is thereby minimized.

The invention will also be explained in the following with respect to further advantages and features with reference to the enclosed drawing and to embodiments. The Figures of the drawing show in:

Figure 1 and Figure 2 respectively a sensor system comprising optoelectronic distance sensors at a robot arm in a schematic representation;

Figure 3 a sensor system in a schematic exploded view;

Figure 4 a sensor system in a schematic sectional view;

Figure 5 a sensor system having the second fastening adapter in a schematic representation from the lower side or from the sensor side;

Figure 6 a sensor system having the first fastening adapter in a schematic representation from the upper side;

Figure 7 a sensor system having the second fastening adapter in a schematic representation with a cable connection;

Figure 8 a sensor system having the first fastening adapter in a schematic representation from the upper side with a cable connection;

Figure 9 a sensor system in a schematic sectional view;

Figure 10 a sensor system in a schematic exploded view;

Figure 11 respectively sensor systems having different heights of the disk-shaped housing;

Figure 12 and Figure 13 respectively different spatial arrangements of distance sensors in a holder.

In the following Figures, identical parts are provided with identical reference numerals.

Figure 1 and Figure 2 respectively show a sensor system 1 having distance sensors 2 for monitoring a hazard zone 3 at a movable machine part 4 having at least one protected zone 5, wherein a tool 6 and/or a workpiece is/are arranged at the movable machine part, wherein the distance sensors 2 are arranged at a holder 7 at the movable machine part 4, wherein a plurality of distance sensors 2 are arranged, wherein the detection beams 9 of the distance sensors 2 form a protected field 10, wherein the holder 7 has mounts for the distance sensors 2, wherein a first fastening adapter 12 for fastening the holder 7 to the movable machine part 4 is arranged at the holder 7 and a second fastening adapter 13 for fastening the tool 6 to the holder 7 is arranged at the holder and the holder 7 has a disk-shaped housing 14 between the fastening adapters 12 and 13, and wherein the disk-shaped housing 14 has a round surface 15 and has no corners at the outer surfaces or at the side surfaces.

The distance sensors can be optoelectronic distance sensors.

An adapter function for different robot flanges and end effectors is in particular provided by the fastening adapters 12 and 13 here. In addition, the sensor system 1 having the disk-shaped housing 14 with the fastening structure is inherently safe in form and material and is mechanically stable to prevent manipulations of the sensor system or of the safety devices, on the one hand, and to forward forces to an optionally power and force limited robot, on the other hand.

In accordance with Figure 2, due to the round surface 15 of the disk-shaped housing 14, a possible collision surface is present at every point and actually no edge or corner, whereby a risk of injury is minimized. The outer contours of the disk-shaped housing 14 are here optionally rounded, also circular or arcuate.

In accordance with Figure 2, an organic shape is provided that has the effect of small surface pressure on contact. The design the machine operator is exposed to does not have any gaps in which the fingers or clothing of the machine operator could catch.

The holder 7 that receives the distance sensors 2 can be monolithic or modular.

The holder 7 and the mount for the distance sensors 2 are fixedly connected to the fastening adapters 12 and 13 so that they do not release from the fastening adapters 12 and 13 on a blow between the person and the holder 7. Forces can thus be forwarded to the robot. The mechanical design is designed as so stable that forces can be forwarded to the robot and to its power and force limitation.

The sensor system 1 serves for the safe monitoring of the hazard zone 3 or of a monitored zone of the movable machine part by means of the protected field 10.

The evaluation unit recognizes protected field infringements and can output a safety directed switch-off signal the robot to stop a dangerous movement of the movable

machine part 4 or to brake the machine part 4 or the robot. This can e.g. be implemented via safe switching signals, e.g. OSSD signals (output safety switching device signals) or safe distance data, spacing data or safe spatial data of the intrusion event.

The plurality of distance sensors 2 are connected to an evaluation unit for evaluating the distance sensors 2.

The distance sensors 2 are arranged spaced apart from one another along a ring in accordance with Figure 3, with the detection beams of the distance sensor 2 forming an areal or spatial protected field that extends, for example, cylindrically in accordance with Figures 1 or 2 or, for example, frustoconically.

The sensors 2 are contactlessly acting distance measuring distance sensors 2, with the sensors in accordance with Figure 1 and Figure 2 having a detection beam 9 for detecting objects in the monitored zone.

The monitoring takes place, for example, using a plurality of simple distance measurement sensors 2 sensing in one dimension.

In accordance with Figure 3, the distance sensors 2 are time of flight sensors.

In accordance with Figure 3, a modular design of the holder 7 is provided. A submodule of the holder 7 here only includes a limited number of distance sensors 2. Any designed securing contours can thus be produced by a combination of different submodules.

In accordance with Figure 1 and Figure 2, an adaptation of the number of sensors is provided to generate a more or less closed protective jacket or protected field 10 from the distance sensors 2: The number of sensors can be changed, for example.

The more distance sensors 2 are arranged, the closer the optoelectronic axes 8 of the distance sensors 2 are next to one another, whereby the protected field 10 has a higher resolution.

In accordance with Figure 3, the mounts 11 of the holder 7 for the distance sensors 2 have at least one mechanical fastening for the distance sensors 2 at which the distance sensors 2 can be mounted in at least one predefined position.

The holder 7 or the mount is implemented such that all the distance sensors 2 have a fixed relative position with respect to one another that is compatible with the securing concept.

The distance sensors 2 are installed in accordance with Figure 3 by means of poka-yoke guidelines, according to which the sensors 2 automatically have to necessarily installed in the correct position.

In accordance with Figure 3, the holder 7 has means for looping through or guiding around a plurality of electrical, pneumatic and/or hydraulic connectors. Figure 3 shows a cable connection 18 by way of example..

The holder 7 allows the looping through or guiding around of a plurality of electrical or pneumatic connectors of the end effectors. In this process, the cables or the cable connection 18 for controlling the end effector do/does not influence the sensor function, for example by avoiding a masking of the distance.

In accordance with Figure 4, the disk-shaped housing 14 is resilient so that the housing surface is deformable on exertions of force onto the surface 15 of the housing 14.

The outer skin is resilient with a spring mechanism and can comprise soft materials having a cushioning effect.

In accordance with Figure 5, the distance sensors 2 have uniform spacings. An almost uniform resolution within the protected field is achieved by the uniform spacings of the sensors 2 and a respective identical angular orientation of the detection beams.

In accordance with Figure 6, the holder has a color signal display 19, with the signal display colors being at least green, yellow, and red.

The fastening concept comprises the signal or status display 19 serving as an interface between the machine operator and the securing solution.

The signal or status display 19 serves as a collaboration interface between the machine operator and the robot and provides information on the status of the total securing or of the individually installed distance sensors 2.

The signal or status display 19 has at least three colors similar to a traffic light principle. The color green indicates "Everything OK". The color yellow shows a warning due to a specific distance or the reduction of robot speed taking place as a result. The color red shows a falling below of a safety distance, with the robot being stopped.

Further colors for e.g. servicing or system failures are optionally provided. The signal or status display 19 can have an annular design in accordance with Figure 6. The signal display 19 or status display can optionally also illuminate parts of the protected zone.

The signal or status display 19 can optionally visualize the protective jacket or protective volume implemented by the distance sensors 2, e.g. as a light ring on the working area.

Different further flashing modes are optionally provided in addition to the traffic light function. Green flashing at the start of the robot, for example, signals that the robot will start to move.

On an automatic restart after a stop, the green flashing likewise signals that the robot will start to move again soon. Flashing modes are also conceivable for the other embodiments of the signal or status display 19.

In accordance with Figure 6 of the invention, the signal display 19 indicates a direction of a movement of the holder. Which direction the robot will move in is thereby visible to the user or machine operator. A risk of injury for the user is thereby minimized.

In accordance with Figure 7 and Figure 8,, the disk-shaped housing 14 has a safety closure 20 to open or close the disk-shaped housing.

The disk-shaped housing 14 or a closure hood is closed or opened by one or a few safety mechanisms so that the position of the distance sensors 2 in the interior of the holder cannot be manipulated.

The disk-shaped housing 14 and the holder protect the distance sensors 2 from contamination or front screen contamination as much as possible.

The position and alignment of the individual distance sensors 2 can no longer be recognized by the machine operator in the finally installed state so that a manipulation is thereby made more difficult.

In accordance with Figures 9 and 10, the holder 7 has mounts for circuit boards, electronic assemblies and/or cable connections.

The holder 7 can simultaneously serve as a mount for further electronic assemblies such as cable collector boards, logic units for the first data processing and/or further sensors.

The cable guidance is designed here such that the user or machine operator cannot get entangled in the cables.

The holder 7 provides a strain relief for the cables of the distance sensors.

In accordance with Figure 11, sensor systems 1 having different heights or different dimensions are shown schematically that can be used in dependence on the space requirements of the application. Heights of 50 mm, 40 mm, 30 mm, and 20 mm are, for example, shown from top to bottom.

The mount is implemented in accordance with Figures 12 and 13 such that a plurality of orientations of the individual distance sensors are possible that are each compatible with the securing concept.

Reference numerals:

| | |
|---|---|
| 1 | sensor system |
| 2 | optoelectronic distance sensors |
| 3 | hazard zone |
| 4 | movable machine part |
| 5 | protected zone |
| 6 | tool |
| 7 | holder |
| 8 | optoelectronic axes |
| 9 | detection beams |
| 10 | protected field |
| 11 | mounts |
| 12 | first fastening adapter |
| 13 | second fastening adapter |
| 14 | disk-shaped housing |
| 15 | round surface |
| 16 | circuit board |
| 17 | electronic assembly |
| 18 | cable connection |
| 19 | signal display |

# SENSORSYSTEM MED OPTOELEKTRONISKE DISTANCESENSORER

Patentkrav

1. Sensorsystem (1) omfattende en holder (7) og distancesensorer (2) til overvågning af et fareområde (3) på en bevægelig maskindel (4) med i det mindste et beskyttelsesområde (5), hvor der på den bevægelige maskindel (4) ved hjælp af holderen (7) kan anbringes et værktøj (6) og/eller et arbejdsemne,
hvor distancesensorerne (2) er anbragt på holderen (7) og ved hjælp af holderen (7) kan anbringes på den bevægelige maskindel (4),
hvor der er anbragt et multiplum af distancesensorer (2), hvor distancesensorernes (2) detektionsstråler (9) danner et beskyttelsesfelt (10),
hvor holderen (7) har optagelser (11) for distancesensorerne (2), hvor der på holderen (7) er anbragt en første fastgørelsesadapter (12) til fastgørelse af holderen (7) på den bevægelige maskindel (4), og en anden fastgørelsesadapter (13) er anbragt på holderen (7) til fastgørelse af værktøjet (6) og/eller arbejdsemnet på holderen (7), og holderen (7) mellem fastgørelsesadapterne (12, 13) har et skiveformet hus (14), hvor det skiveformede hus (14) har runde overflader (15) og ikke har hjørner på yderfladerne, kendetegnet ved, at holderen (7) har en farvet signalvisning (19), hvor signalvisningen (19) viser en retning for en bevægelse af holderen (7).

2. Sensorsystem ifølge krav 1, kendetegnet ved, at holderens (7) optagelser (11) for distancesensorerne (2) har i det mindste en mekanisk fastgørelse for distancesensorerne (2), på hvilken distancesensorerne (2) kan monteres i i det mindste en foruddefineret position.

3. Sensorsystem ifølge i det mindste et af de foregående krav, kendetegnet ved, at holderen (7) har optagelser for printplader, elektronikmoduler og/eller kabelforbindelser (18).

4. Sensorsystem ifølge i det mindste et af de foregående krav, kendetegnet ved, at det skiveformede hus (14) har en sikkerhedslukning (20) for at åbne og lukke det skiveformede hus (14).

5. Sensorsystem ifølge i det mindste et af de foregående krav, kendetegnet ved, at overfladen af det skiveformede hus (14) er delvist elastisk, således at husoverfladen ved kraftpåvirkninger på husets (14) overflade kan deformeres.

6. Sensorsystem ifølge i det mindste et af de foregående krav, kendetegnet ved, at holderen (7) har midler til gennemkobling eller omføring af flere elektriske, pneumatiske og/eller hydrauliske tilslutninger.

7. Sensorsystem ifølge krav 1, kendetegnet ved, at den farvede signalvisnings (19) signalvisningsfarver er i det mindste grøn, gul og rød.

Fig.1

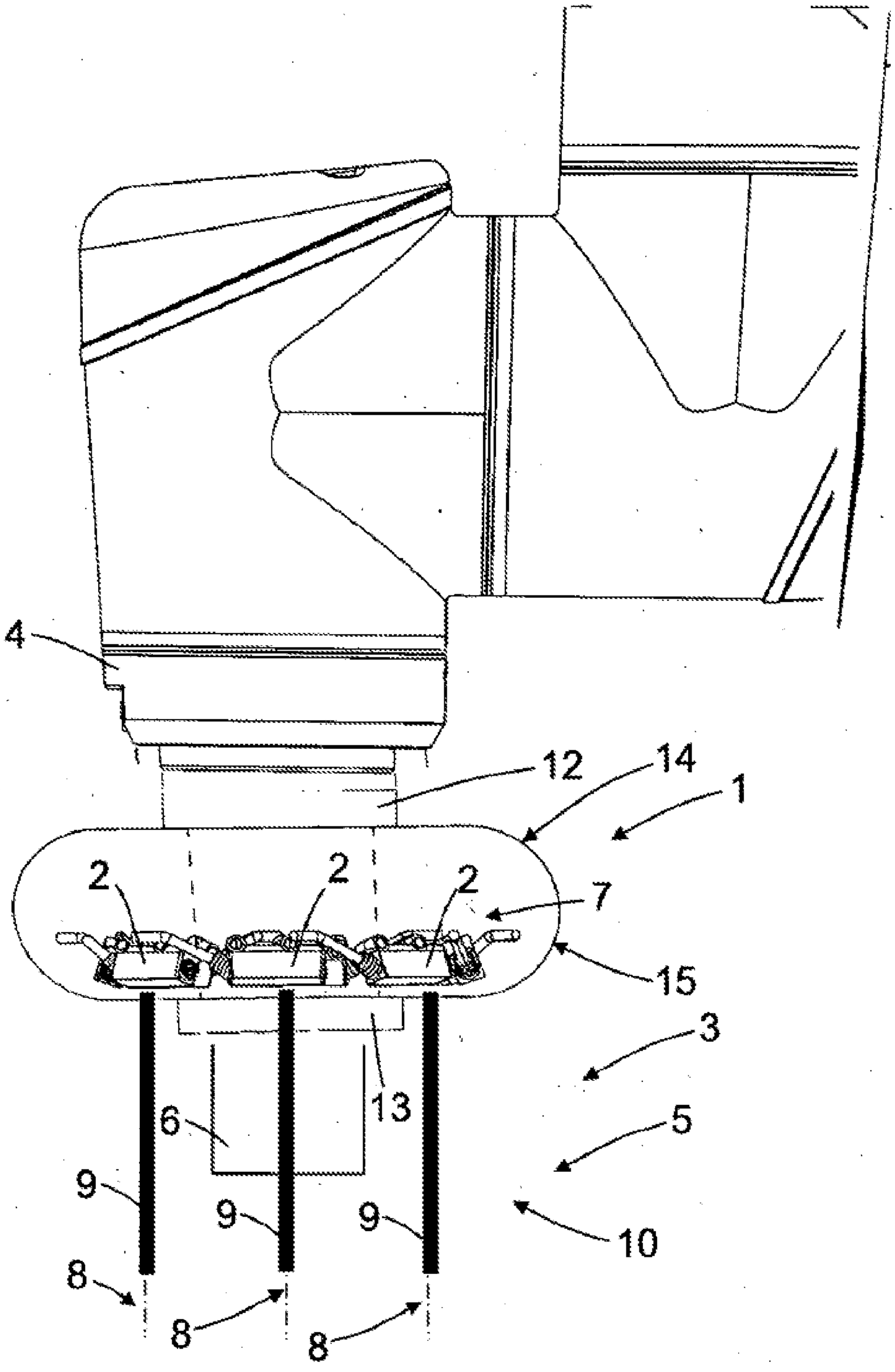

Fig.2

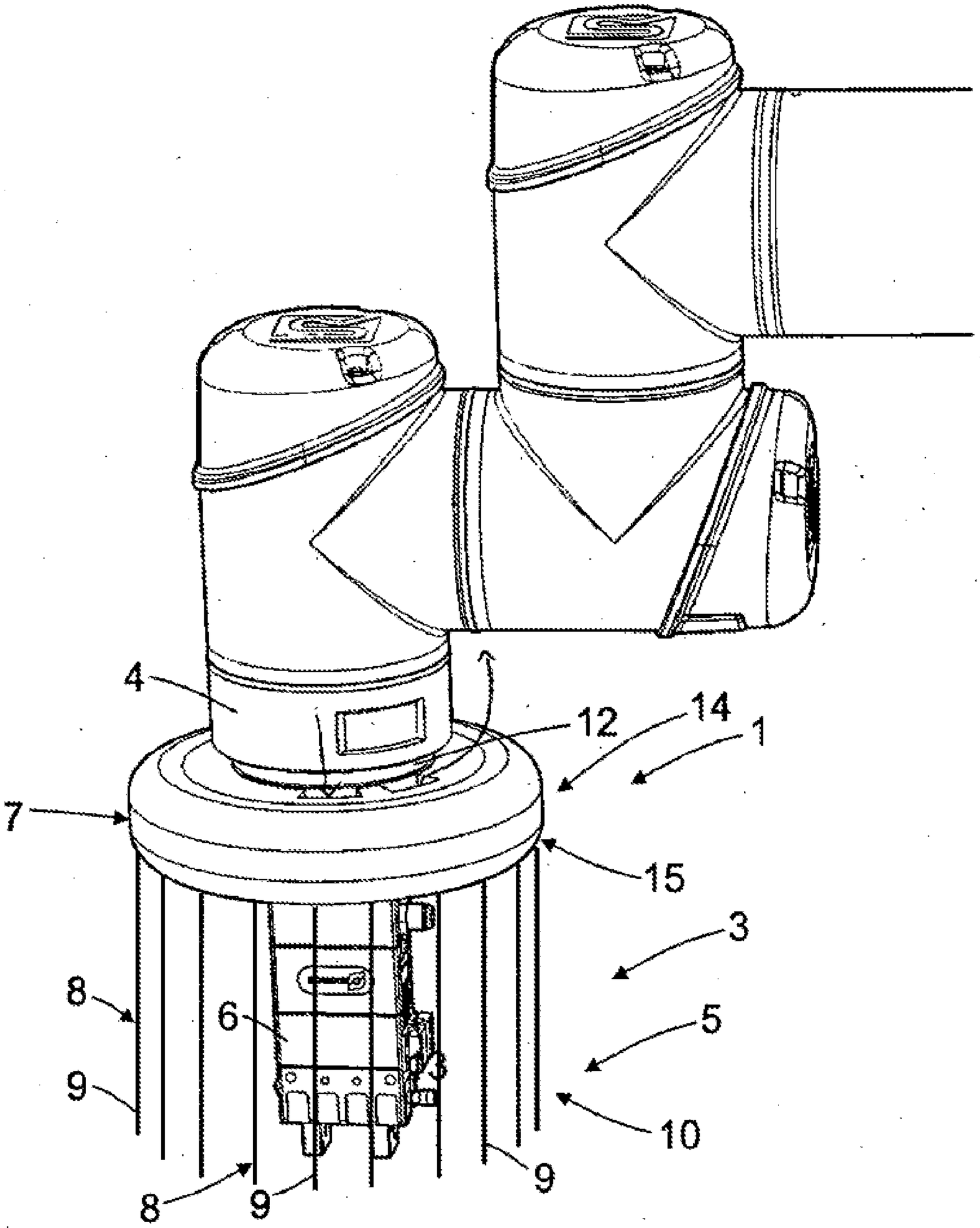

Fig.3

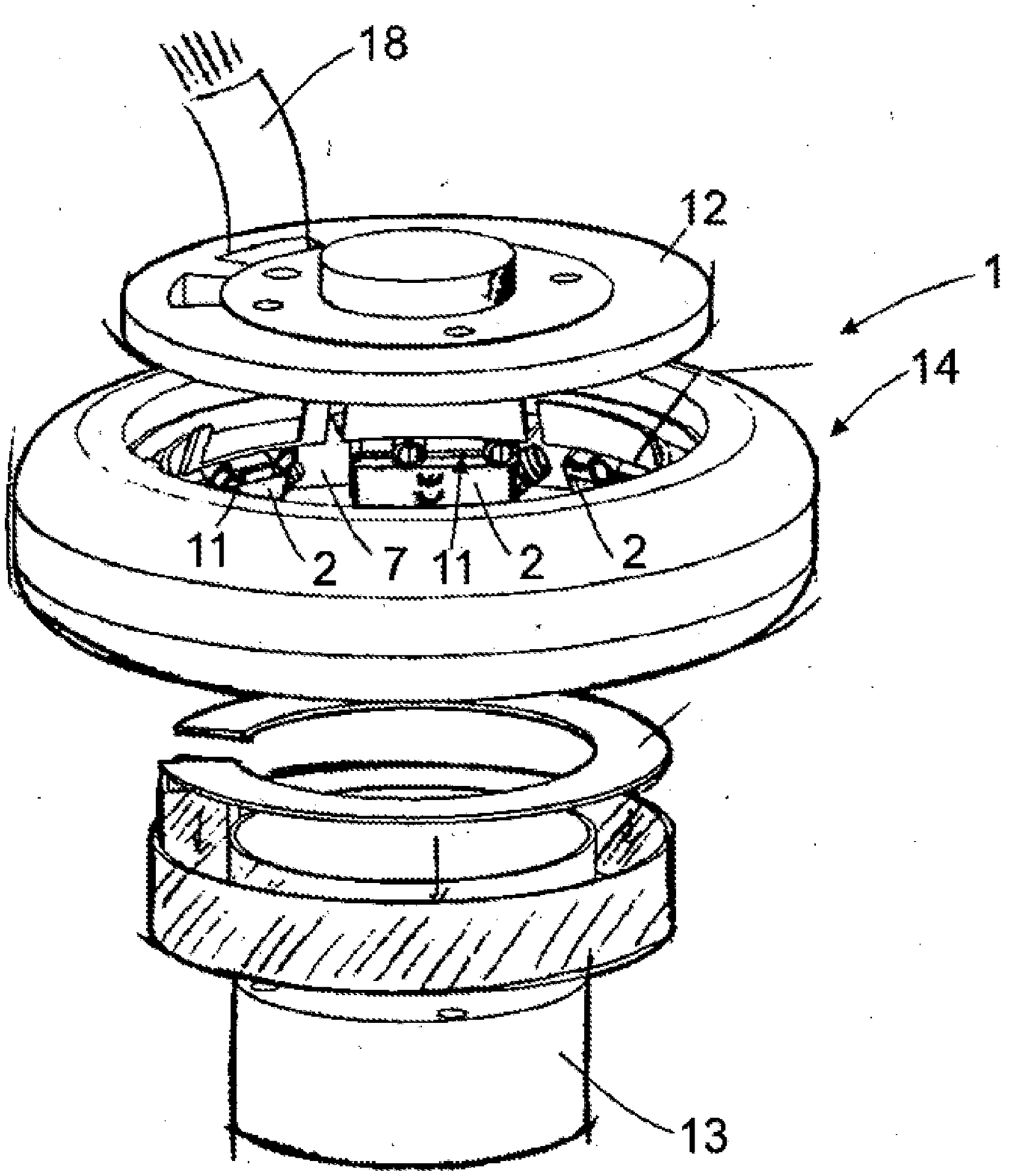

Fig.4

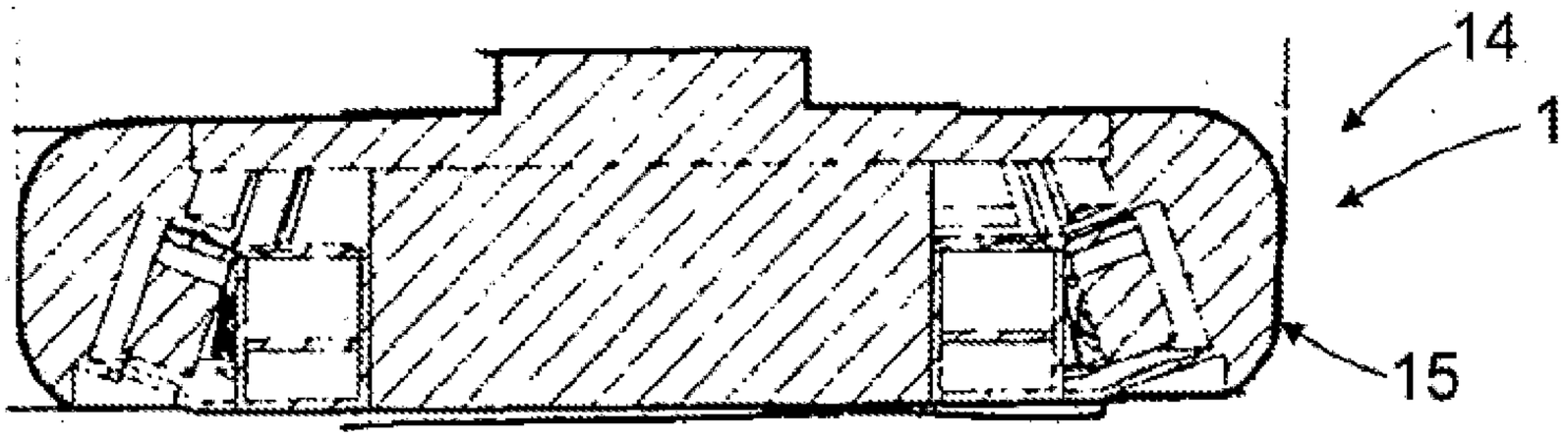


Fig.5

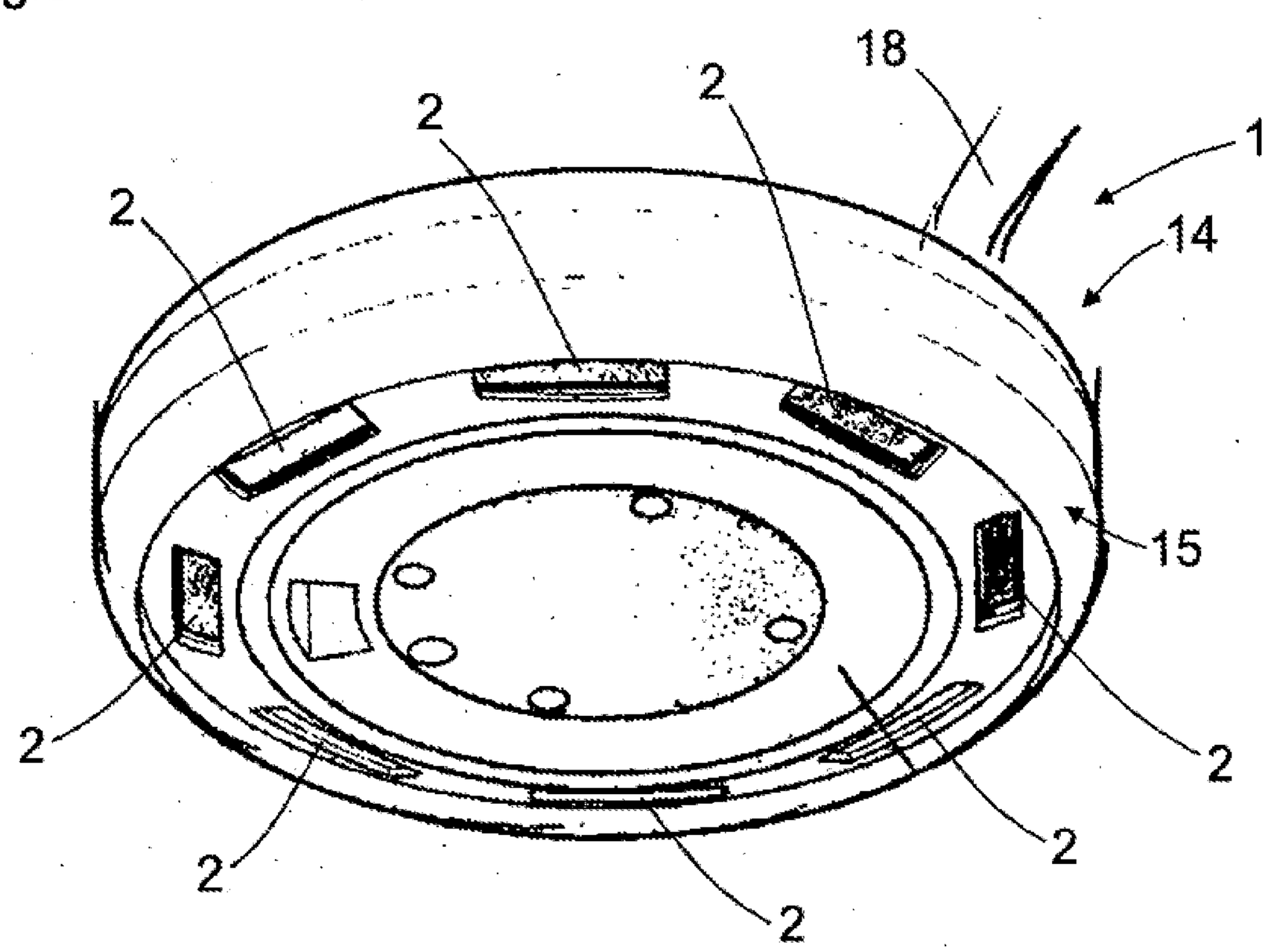

Fig.6

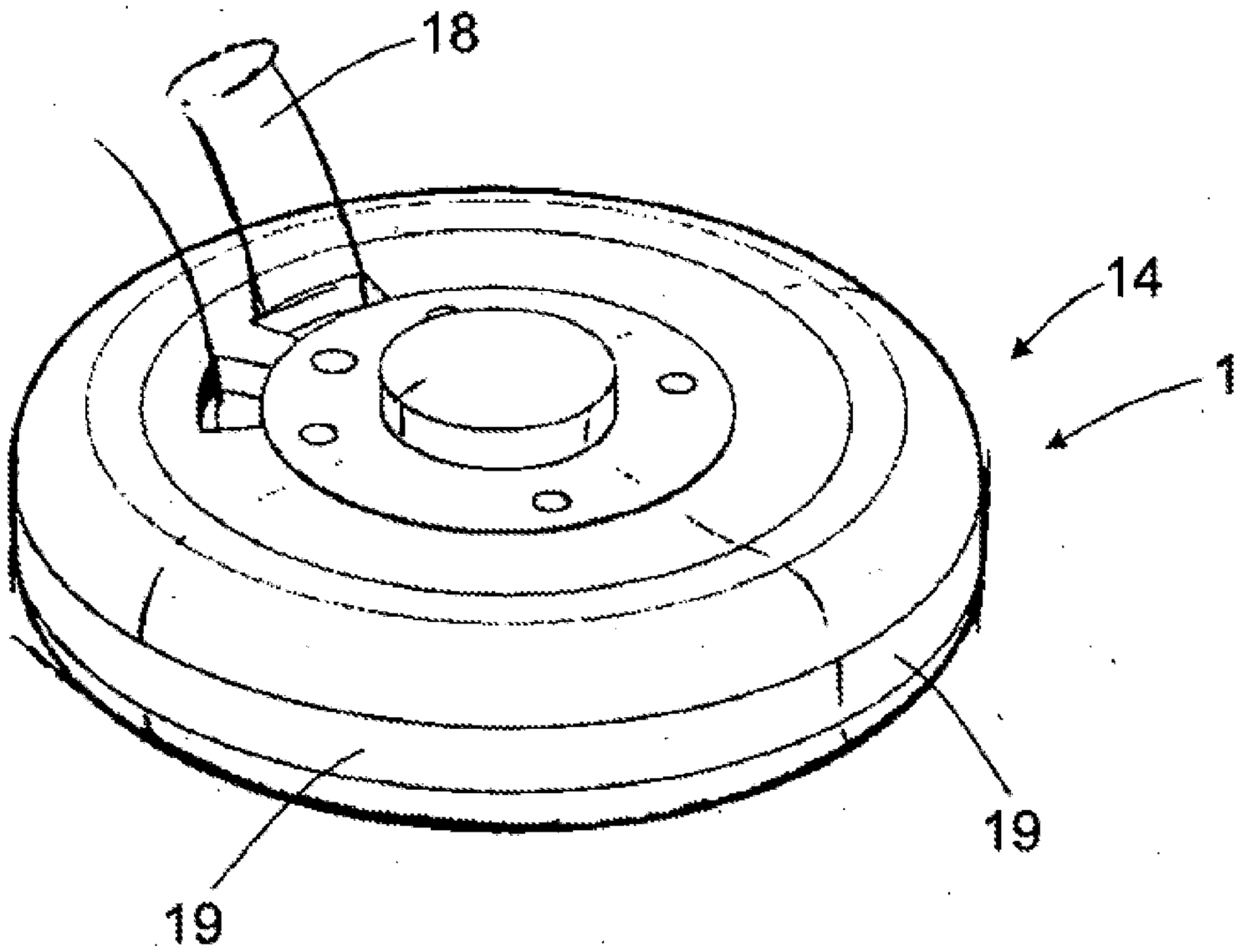

Fig.7

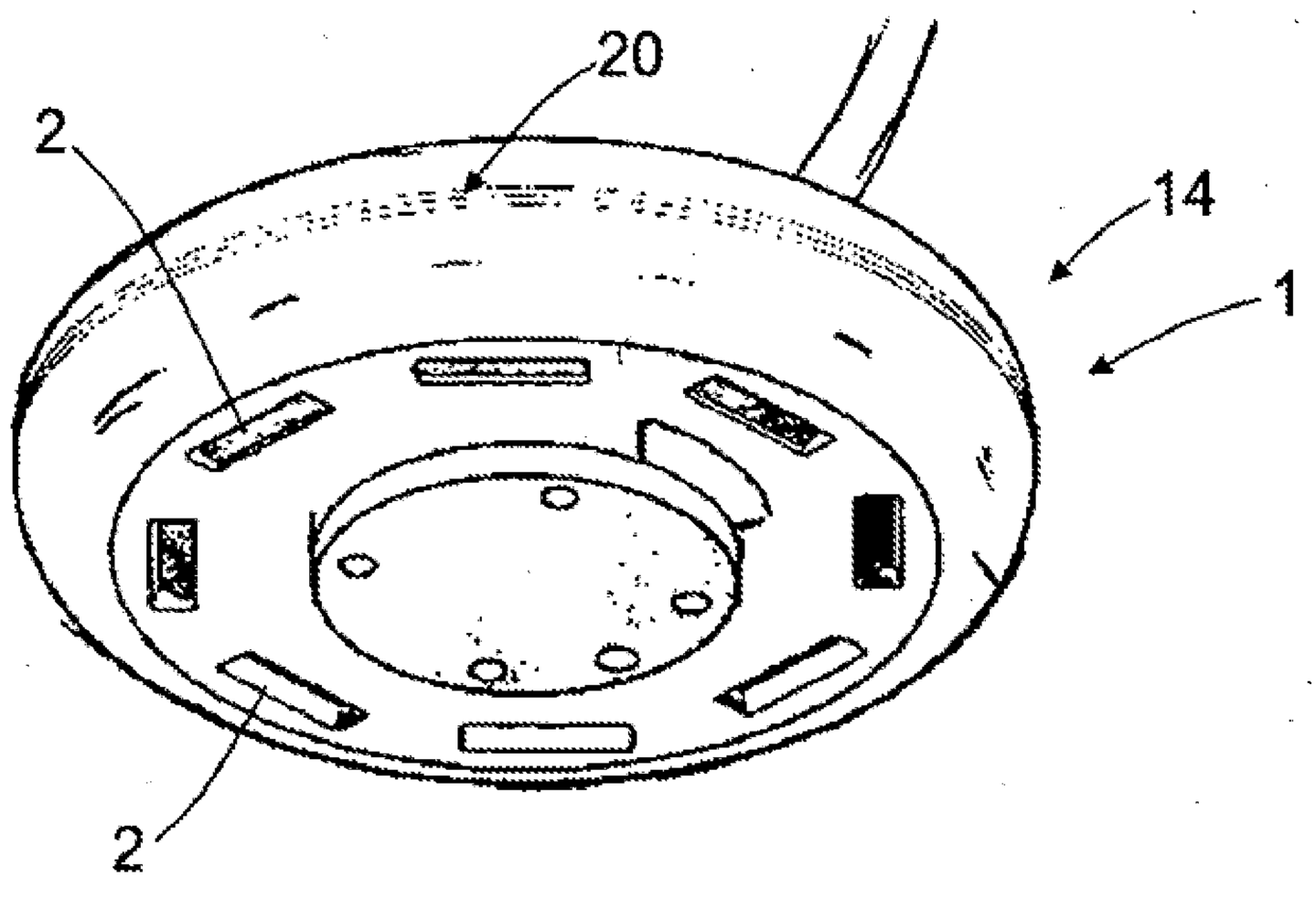


Fig.8

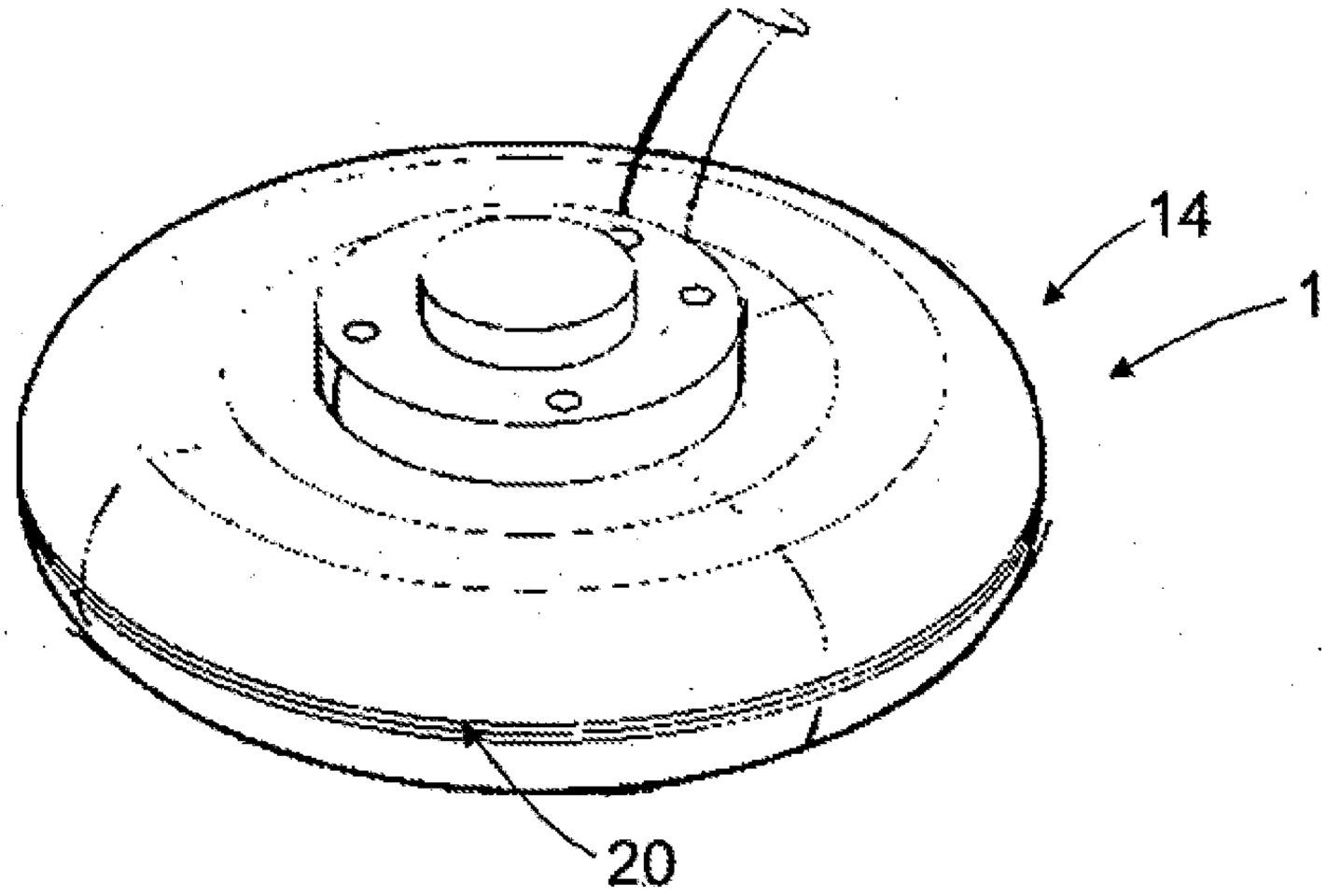

Fig.9

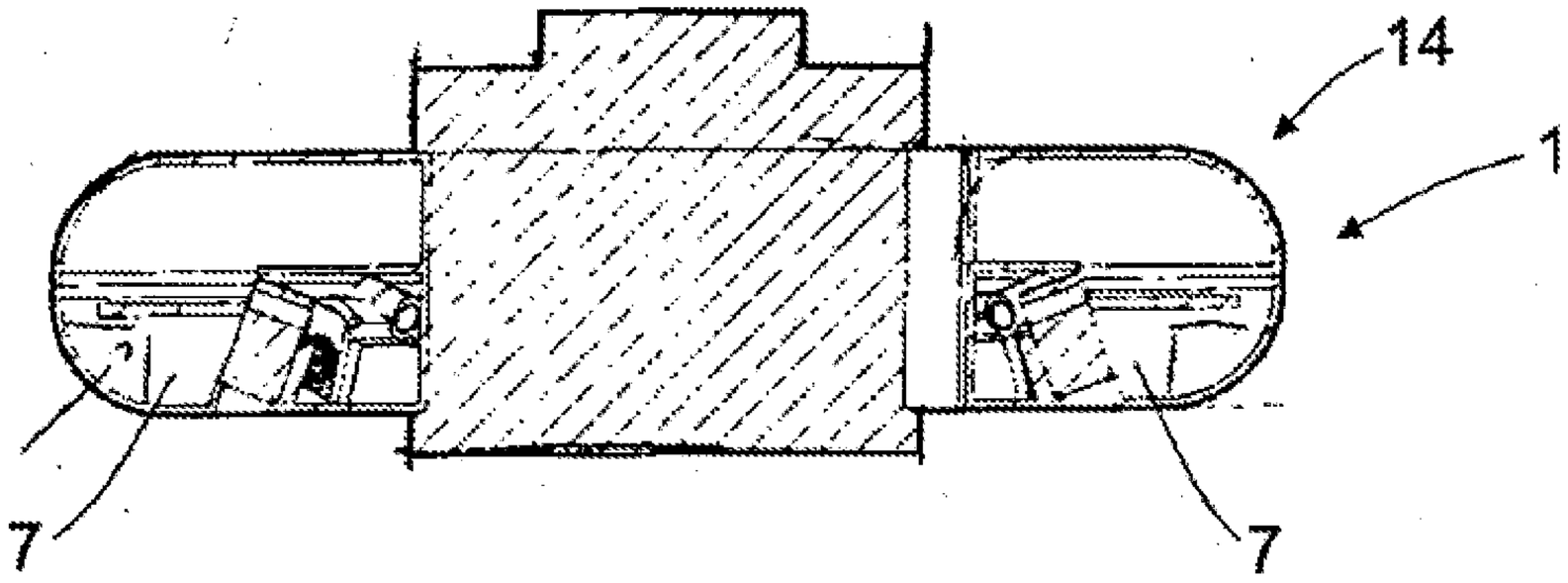


Fig.10

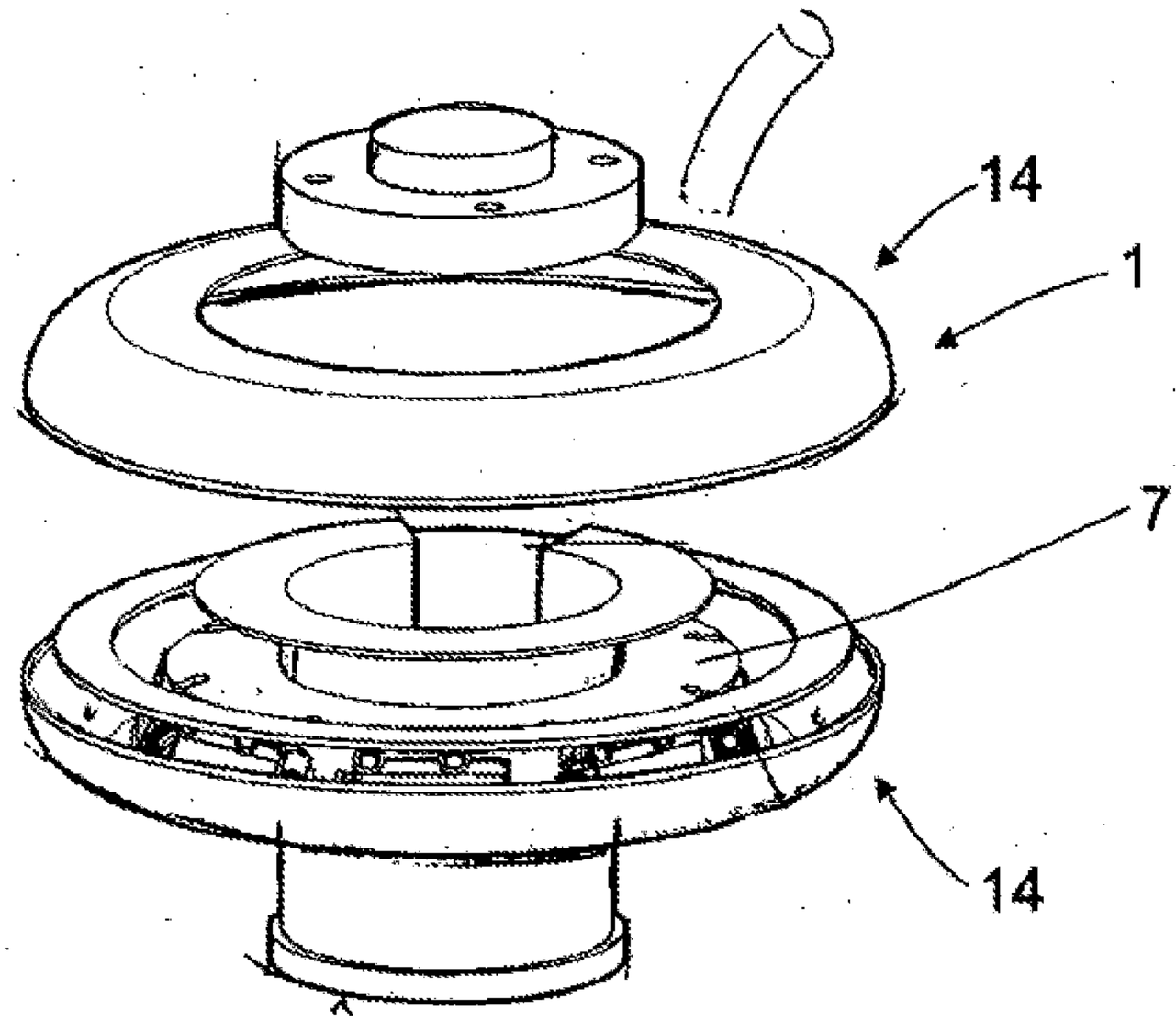

Fig.11

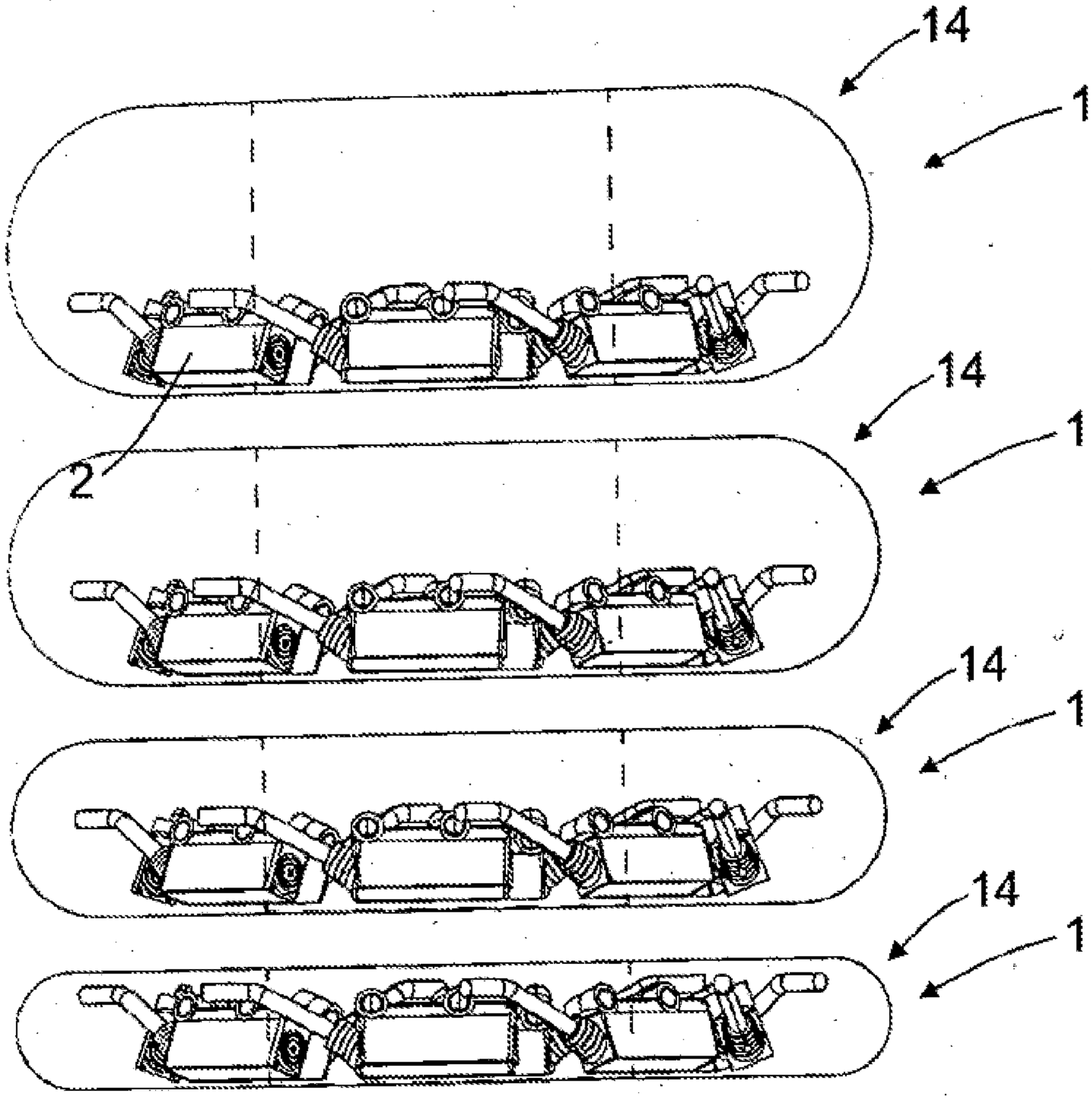

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Fig.12

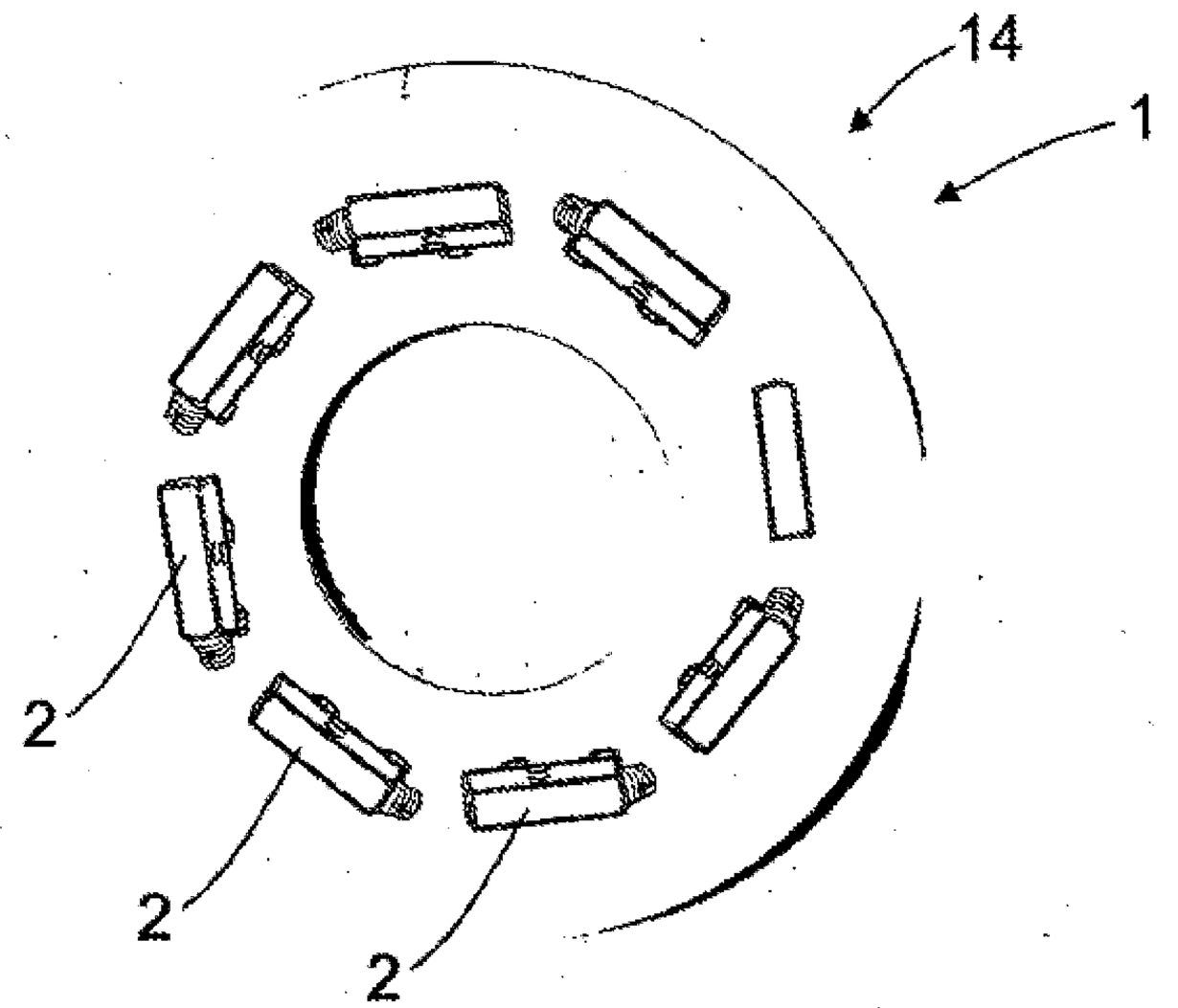


Fig.13