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(54) METHOD OF CLEANING OF ROTATABLY MOUNTED TOOL, MAINLY A HEMMING HEAD, DEVICE FOR REALIZATION OF THIS METHOD

(57) The working tool (1) is placed inside the cleaning chamber (4); subsequently the working tool (1) is led into rotation by means of a transmission which acts upon the working tool (1) outside its polluted surface (2). The working tool (1) rotates in the speed of rotation which does not surpasses the allowed speed of rotation of the placement of the working tool (1); preferably it rotates in the speed close to the maximum speed of rotation of the used bearings of the placement of the working tool (1) at least for 2 seconds. Before the first working operation of the working tool (1) and/or after each rotational cleaning of the working tool (1) a separation liquid is applied onto the cleaned surface (2). The device has a stand (11), whereby the driving unit (3) with the engine (12) and the gear (13) is placed on the stand. The jib with the vessel (9) for the separation liquid and three dispersers (8) which are placed with the even angular pitch in the vertical plane, and which are connected with the vessel (9), whereby the collecting vessel (10) is placed below the dispersers (8), are connected to the stand (11).

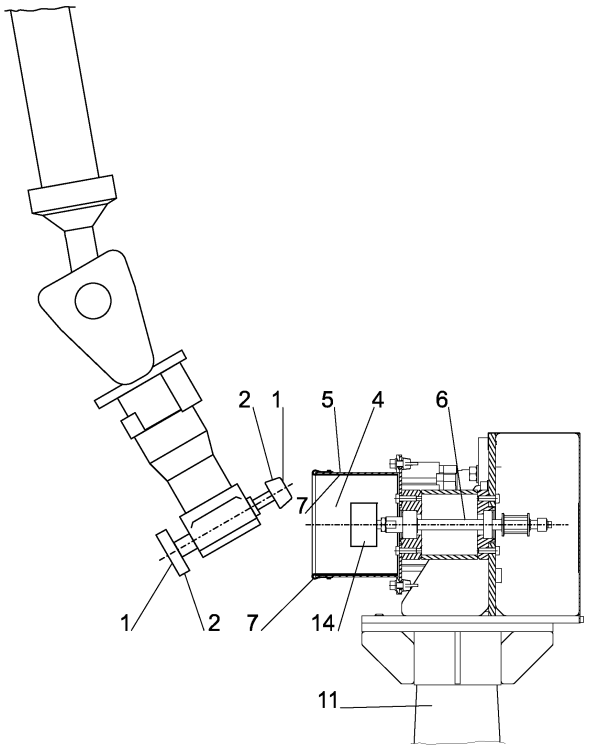

Fig. 1

EP 3 881 945 A1

Description

Field of technology

[0001] The invention concerns a method of cleaning of rotably (or rotationally) mounted tool, whereby in this method the impurities which result in the previous operation of the tool are removed by centrifugal forces. The invention also discloses a device for cleaning of the working tool with a simple separation and ecological collection of the impurities, whereby the device can be part of the robotized workplace.

Prior state of the art

[0002] Methods of cleaning of the working tools from impurities or dirt by means of brushes, squeegees, and so on, are commonly known. The impurities can come in form of paints, varnishes, glues, sealants or similar adhesive gels, and they lead to clogging of the cleaning tool and to high consumption of cleaning products. As the extent of utilization of the working tool, for example in sequenced automatized production, increases, the possibilities for manual cleaning, where the personnel cleans the working tool manually by piece cloth and, eventually, cleaning products, decrease. At the same time, it is preferable if the cleaning is realized regularly, before the substances forming the basis of impurities dry out or solidify. During the use, impurities accumulate and stick to the tools and subsequently on the shaped or processed products, too. This pollution is undesired and causes quality problems as well as problems with smoothness of the production.

[0003] Solution according to US4625355A uses contact method of cleaning of the working tool, whereby it uses centrifugally driven cleaning elements arranged into string. This solution is unsuitable in case of impurities which have a form of gel and which have higher adhesiveness than the cleaning elements themselves. Manual cleaning by means of cloths and cleaning products requires interruption of production. In case of automatized production lines, the manual cleaning requires that all machines in a given cell are stopped, which negatively affects the smoothness of the production and increases costs.

[0004] Publication KR20090064053 discloses a device and method where the pollution or damage of the hemming head is determined optically and the hemming head is then cleaned by a rotating brush, whereby the hemming head rotates thanks to gear wheel which approaches the hemming heard and presses onto it. The device is constructionally complicated and it requires a relatively close position compared to the working position of the hemming head, and a use of brushes during cleaning creates problem with accidental spreading of the impurities to the surroundings. This device and method partially solves the problems with manual cleaning which cannot be suitably included in the automatized production cycle, but it is complicated and it does not achieve sufficient efficacy when the cleaning period is short. Similar deficiencies arise from the use of rotating brush with a robot pursuant to KR100666630 (B1), where a device with motor-driven rotating brush is mounted on the end arm of the robot. The wear and tear of the brush must be regularly checked. The penetration of the impurities into the brush constitutes a problem not only from the point of view of efficacy of cleaning, but also an ecological problem with regard to disposal of worn out brushes.

[0005] A rotational system of cleaning of the drill by means of a centrifugal force pursuant to CN108856066A is known; however, the drill must be dismounted from its operative position and mounted in the special device. Any device which requires dismounting of the tool from the working device is unusable in case mass production, since it cannot be inserted into the work cycle of the production line. The solution according to this publication is thus only suitable for mining industry.

[0006] A new method and process of cleaning of the working tool is thus desirable, where the cleaning will be effective and usable for short period. The device for realization of this method should be used without the need to amend other parts of the working system, so that the new device can be quickly used in existing working systems.

Essence of the invention

[0007] The invention is further disclosed in patent claims 1 to 15. The method is disclosed in patent claims 1 to 7. Deficiencies in the prior state of the art are significantly remedied by the method of cleaning of the rotably placed working tool, mainly hemming head, where the impurities from the surface of the tool are removed by centrifugation, whereby the tool rotates in the placement which otherwise serves the purpose of rolling of the tool during its operation, according to this invention, which essence lies in the fact that the working tool is placed inside the cleaning chamber, subsequently the working tool starts to rotate, and the working tool starts to rotate at speed (rpm) which does not surpass the allowed speed of the deposition of the tool. In a preferably arrangement the working tool is led into rotation by means of a mechanical gear acting upon the tool outside its polluted surface, for example by means of friction gear.

[0008] The essence of the proposed invention lies in the use of the centrifugal separation of the impurities from the surface of the working tool, where the separated impurities are thrown from the surface of the working tool to the inner surface of the sheath, which delimits the cleaning chamber. Thanks to the use of the centrifugal force it is no longer necessary to use the element acting in contact with the surface, such as mechanical squeegee or a brush, cloth, and so on. The effect of the centrifugal forces with sufficient centrifugal acceleration, that is, with sufficient rotation speed relative to the semi-diameter of the rotation point of the polluted surface, en-

sures the separation of the impurities and the movement of the impurity towards the sheath of the cleaning chamber.

[0009] A pollution of other components does not happen during this process, and therefore risks related to pollution by subsequent contact, which may decrease the efficacy of the cleaning, are avoided. It is thus preferable of the gear for rotation of the working tool operates outside the polluted surface and if the gear element does not enter into contact with impurities. This means that the gear element can touch the working too, but preferably in such a zone which is not exposed to impurities, or which is polluted only sporadically or to low degree, respectively. Basically, the gear element should be clean for the contact with the working tool during next cleaning cycle.

[0010] Such a centrifugal separation of the impurities from the components is known in the prior art, where the separation takes place by means of centrifugation in baskets where the components are placed together and then the basket is rotated. Such centrifugation is, however, useless for tools mounted in sequence or during mass production. In the proposed technical solution an existing rotational placement of the working tool, which serves primarily for the normal operation of the working tool, is used. The working tool in form of a hemming head moves on the sheet during its operation, it shapes the sheet and forms it into a desired position, whereby most of the contact of the hemming head with the shaped sheet consists of rolling. The hemming head is placed rotably and with high solidity so that the repeat precision of its position is achieved. This rotational placement of the hemming head is used for its rotation during cleaning according to this invention, whereby allowed speed of rotation (rpm) is considered during the choice of rotation speed. Preferably the working tool is rotated close to the maximum allowed rotation speed as determined by the used bearings of the deposition. During the centrifugal cleaning with high rotation speed the short-term cleaning - lasting, for example, in order of seconds - suffices, which is important for the purposes of regularity of the cleaning in the robotized operations. When the method according to this invention is applied in the existing production systems with already created rotational placements of the working tool, the maximum allowed rotation speed - as allowed by the bearings used in the depositions of working tools - are taken into account. When designing new workplaces, the bearings with higher allowed rotation speed can be used. Since during the cleaning the working tool rotates without outside load, the cleaning does not wear out the deposition - it does not shorten its durability.

[0011] The increase of the efficacy of the cleaning increases if the separation liquid is applied onto the cleaned surface before the working operation of the tool and/or after the rotational cleaning. Pursuant to the chosen setting, the separation liquid can be applied after each rotational cleaning or after some of the rotational cleanings. The use of separation liquid is preferable to the use of the cleaning liquid or cleaning product mainly in the fact that already small amount of separation liquid suffices in order to achieve the separation effect and therefore the amount of waste, which one will have to dispose of, does not increase. That means that the separation liquid is not applied onto the impurities, but it is applied onto the clean surface which is then cleaned more easily and effectively precisely by use of the centrifugal force. The use of separation liquid significantly speeds up the centrifugal cleaning and increases its efficacy. In order to achieve separation of the impurities from the polluted surface according to this invention it is necessary to overcome adhesive forces without the work of some mechanical element. This is why the diminishing of the adhesive forces by means of separation liquid is an important synergic feature of the invention of the centrifugal cleaning.

[0012] A transfer of the torque from the respective driving unit onto the working tool can be an important feature of the method, whereby this transfer is realized without touching of the polluted surface of the working tool. Moreover, any surface which can be polluted during the working operation in such a way that it would later undesirable affect the operation of the working tool during the next working cycle, is considered a polluted surface. Surface which will be polluted will be mostly the surface which is in touch with the processed material. In case of the hemming head, the polluted surface will be mostly its cylindrical, conical or other rolling surface. The transfer of the torque from the respective driving unit onto the working tool can produced by a temporary mechanical connection of the output of the driving unit with the working tool; a preferable way is, however, that the output of the driving unit is not polluted in contact with the working tool. In another arrangement the rotation of the tool can use an engine permanently connected with the working too, whereby during the main operation of the working tool itself the engine is inactive.

[0013] Deficiencies in the prior state of the art are significantly remedied by the device for the cleaning of the rotably placed working tool, mainly a hemming head, itself, pursuant to patent claims 8 to 13. The device includes a driving unit and cleaning chamber which is delimited by the sheath, whereby the driving unit is designed for rotation of the working tool after its placement in the cleaning chamber.

[0014] The driving unit can be carried together with the working tool, for example in form of a pneumatic or electric engine which does not block or inhibit the rotation of the working tool during its working operation and after the placement of the working tool inside the cleaning chamber it rotates the working tool. In such a case, each carrier of the working too, that is, for example, end arm of the robot, must be equipped by the driving unit for each working tool, which, however, complicates the implementation of the solution into already existing systems, and which would postpone the application of the new method only for the newly designed workplaces.

[0015] Therefore, in the preferable arrangement, the

driving unit is placed outside the carrier of the working tool and the working tool is led into the contact with the output of the driving unit during the cleaning. A gear clutch, where each member of the gear clutch is connected to the front of the working tool, and the axis of the gear clutch is within the axis of the rotational placement of the working tool, and the second member of the gear clutch is placed on the output of the driving unit, can be, for example, used for the purposes of creation of contact. Such shaped transmission contact requires only slight amendment of the working tool - for example, a toothed circle is welded onto the front of the working tool.

[0016] In the preferable arrangement the friction contact between the front of the working tool and the output of the driving unit is used for the transfer of the rotation from the output of the driving unit onto the working tool. In such case, the friction element, for example flexible rubber driver, which presses onto the front of the working tool, is used on the output of the driving unit.

[0017] The output of the driving unit during the cleaning will achieve speed of rotation at least 2500 rpm, preferably more than 4500 rpm, especially preferable more than 6000 rpm. Such values will be usually achieved by use of available electric or pneumatic engines with use of speeding gear, for example, by means of belt transmission or planetary gear. In order to achieve the regulated start of rotation, it is preferable that the driving unit has rotations that can be smoothly, continuously, gradually regulated, for example by means of frequency converter.

[0018] In order to achieve the optimal transfer of the rotation it is preferable that the working tool is first led to the contact with the output of the driving unit, whereby the axis of the rotational placement of the working tool is basically identical with the axis of the output of the driving unit and after the creation of joint (gear clutch or friction contact) the driving unit continuously, gradually starts to rotate until it reaches set maximal value, which corresponds to or is lower than the maximum allowed speed of rotation of the bearings of the working tool.

[0019] The cleaning chamber can be placed with varying orientation; the axis of output of the driving unit can be horizontal or vertical, or skewed pursuant to dominant orientation of the working tool.

[0020] The impurities thrown onto the inner surface of the sheath of the cleaning chamber can be mechanically collected and used for recycling or the sheath can be equipped by the removable insert which can be replaced as a whole. In the preferable arrangement, the removable insert will be formed by the paper strip which is wound onto the inner surface of the sheath and held in the designed position in such a way that the edge of the paper strip it hangs over the edge of the sheath, it is folded onto the outer side of the sheath, where it is held in place by the clips or circumferential flexible element. The sheath can be equipped by the circumferential rim which maintains the position of the flexible element. Such attachment of the paper strip is preferable in the fact that it appears on the outer, clean side, where the impurities do not fall during the centrifugation. Manual replacement of the removable insert and release of the clips or the flexible element does not cause the pollution of hands or other tools, and the paper strip together with the impurities can be sent for recycling or disposal in accordance to the environmental regulations.

[0021] The cleaning space can be equipped by the sensor of the level of the accumulation of impurities. This can be an optical sensor of the width of the layer, or weight sensor of the weight of the sheath, and so on. The personnel replaces or cleans the removable insert pursuant to the instruction from the control system.

[0022] An increase of the cleaning is achieved during the method where before the working operation of the tool and/or after its rotational cleaning a separation liquid is applied onto the cleaned surface. Pursuant to the desired setting the separation liquid can be applied after each rotational cleaning or after some of the rotational cleanings.

[0023] The separation liquid is preferably applied by spraying and/or dipping and/or soaking and/or offset. The separation liquid can be a mineral oil, for example a mineral oil used as a separation oil during shaping. The separation liquid has no adverse effects on the working operation of the working tool. On the contrary, for example in case of the hemming head it improves the durability of the working tool, since it decreases the friction during the movement which is not pure rolling - for example, during sudden changes of the trajectory of the hemming head. Thanks to the application of the separation liquid the adhesion of the impurities, glues, sealants, etc. onto the cleaned surface diminishes. The impurities during the working operation of the tool will be pressed onto its surface by the high pressure; the presence of the separation liquid significantly decreases the adhesion of the impurities and it is thus preferable if the separation liquid is applied already onto the working tool before the first working action; that is, before the first touch with the impurities.

[0024] It is preferable if every act of cleaning by means of rotation is subsequently followed by the application of the separation liquid; the device for cleaning can have a zone for the application of the separation liquid produced as a separate place alongside the cleaning chamber, or this zone can follow directly onto the mouth of the cleaning chamber. A simple way of application of the separation liquid consists of its controlled spraying by means of a sprayer (disperser), where the pressurized air pushes the separation liquid out from the directionally oriented jet nozzle. The separation liquid is drawn from the vessel and it sprays by at least one disperser onto the cleaned surface of the working tool. If only one disperser is used, the mutual rotation of the dispersers relative to the working tool is ensured, for example by rotation of the working tool. In the preferable arrangement at least three dispersers are used, which are radially distanced from the axis of the rotational placement of the working too and which

have basically the same angular pitch. Such arrangement functions even in case of a static position of the working tool.

[0025] An important feature of the proposed invention is the use of centrifugal separation of the impurities at relatively high rotation speed, as well as suitable combination with the application of the separation liquid, which produces a synergic advantage in form of improvement of the friction ratios between the cleaned surface of the working tool and the shaped or formed material. The cleaning of the working tool according to this invention improves the durability of the surface of the working tool.

[0026] The proposed method of rotational cleaning, preferably combined with the application of the separation liquid, is highly effective with regard to cleaning of the working tool during the short time, whereby the method can be applied in the working cycle in the automatized system, it does not cause idle time and does not require manual operation. The advantage of the proposed invention also lies in its flexible use in existing production systems, since no hardware changes on the part of the working tool are required. A single device for the realization of the disclosed method can serve the cleaning of many, even different, working tools if they have a common operating reach within the zone of placement of the device. An advantage is the ruling out or shortening of idle time, an effective maintenance, saving of workforce and ecological decrease in the amount of polluted objects and tools.

Description of drawings

[0027] The invention is further disclosed by drawings 1 to 5. The scale in which individual elements are shown, for example, the dimensions of the driving unit, the shape of the working tool, the connection of the removable insert, and so on, are only examples and cannot be interpreted as limiting the scope of protection.

Figure 1 shows a part of the device with the cleaning chamber, whereby the approaching working tool on the end of the arm of the hemming robot is depicted. Subsequently, figure 2 shows the working tool depicted in the position in which it is led to contact with the output of the driving unit. The arrow shows the rotation of the friction element and the working tool. Figures 1 and 2 depict the cleaning chamber in central vertical cross-section and for the purposes of clarity the electric engine in the background, behind the sheath of the cleaning chamber, is not depicted.

Figure 3 is a view of a complete device with a stand shown from the side of the mouth of the cleaning chamber and the zone of the application of the separation liquid.

Figure 4 is a view of another method of holding the removable insert in place, with the electric engine in the background.

Figure 5 is a more detailed view of the zone of application of the separation liquid with three dispersers, where the dashed lines schematically depict the spraying of the separation liquid onto the cleaned surface.

Examples of realization

Example 1

[0028] In this example according to figures 1 to 3 and 5 the device for cleaning of the working tool 1 is stably placed within the reach of the arm of the hemming robot.

[0029] The hemming head during the folding (falzen) presses the edge of the sheet, in this example it can be an edge of the sheet during the hemming of the outer panel of the car's door. Before the folding some other device applies an adhesive sealant onto the edge of the sheet, whereby the sealant protects the joint against corrosion. In automotive industry, folding is often substitute for welding, which would otherwise require welds on the visible view side of the construction. Even though the application of the adhesive sealant is automatized, during the folding the excess adhesive sealant is pressed outside the fold, too, and the sealant can thus get onto the surface of the working tool 1. During the folding in the subsequent working cycle the working tool 1 is polluted and it can undesirably pollute another component, too.

[0030] During the technical break (pause), when the working tool 1 moves away from the shaped component - for example during the change of the component by means of a manipulator, the shaped component is released from the clamps and a new set of components is inserted into the working position - the arm of the hemming robot moves towards the device according to this invention. As depicted on figures 1 and 2, the arm moves the working tool 1 into a position in which the axis of the rotational placement of the working tool 1 is basically identical with the axis of the output 6 of the driving unit 3. After the placement of the working tool 1 to the friction element 14, the instruction reaches the engine 12 to start. The information about the creation of contact between the front of the working tool 1 and the friction element 14 is gathered from the position of the working tool 1 in the coordinates system as defined by the control of the hemming robot. In another example the device itself can be equipped by the sensor, for example, a sensor of the pressing of the friction element 14 or sensor of the presence of the working tool 1 in the cleaning chamber 4. A solution proved simple and reliable, however, which uses a position data from the control of the hemming robot. A frequency converter is used in order to start the rotation of the engine 12 continuously, gradually; the frequency converter also regulates the maximum speed of rotation pursuant to the limit chosen for the bearings of the respective working tool 1. Rotation of output 6 and the friction element 14 rotates the working tool 1, too, whereby a separation of the impurities and their throwing onto the removable insert 7 - place inside the sheath 5 - takes

place.

[0031] In this example the device for cleaning of the working tool 1 is construed with a horizontal axis of rotation of the output 6 of the driving unit 3. The device has a stand 11 which is designed for the transfer of the load and also for the transfer of the folding moments produced by the pressure of the working tool 1 onto the friction element 14. A driving unit 3 including an engine 12 connected to the frequency converter and gear 13 increasing the rotation speed of the engine 12 to the level of the rotation speed of the output 6, is placed on the stand 11. In this example the output 6 is equipped by the friction element 14 from the flexible material. The cleaning zone 4 is delimited by the sheath 5 which is formed by the cylinder screwed to the vertical surface of the driving unit 3.

[0032] Inside the sheath 5 there is placed a removable insert 7 from the strip of paper, whereby the strip of paper hangs over the outer edge of the sheath 5 and the protruding edge of the strip is folded onto the outer surface of the sheath 5 where it is kept in place by a flexible ring. The outer part of the removable insert 7 remains clean and grasping this part can easily remove this insert 7 together with the accumulated impurities. In order to increase the stability of the position of the flexible ring, which holds the folded edge of the strip in place, the sheath 5 can be equipped by one circumferential rim oriented inside, into which the flexible strip falls, or the sheath 5 can be equipped by two outside oriented circumferential rims between which the flexible strip can easily stay even when the vibrations of the device during the rotation of the output 6 are considered.

[0033] In this particular example the friction element 14 is held on the shaft of the output 6. The shaft is placed in the bearing house through the gear 13 and it is connected with the shaft of the engine 12.

[0034] In this example there is a jib on the stand 11; in it is a zone for application of the separation liquid. The zone has three dispersers 8 which are connected to the vessel 9 with the separation liquid through the pipe. The separation liquid in this example is formed by the mineral separation oil. Three dispersers 8 are angularly evenly distributed in the vertical plane, so the orientation of the working tool 1 does not have to change during the change of the position of the working tool 1 from the cleaning chamber 4 to the zone of application of the separation liquid. The excess separation liquid is collected in the collecting vessel 10 from which it can be either recycled or passed on for disposal.

[0035] Multiple working tools 1 can be placed on the arm of the hemming robot; in the control system the maximum allowed rotation speed of the placements of individual working tools 1 are stored; the control of the speed of rotation of the output 6 of the driving unit 3 corresponds to these data. It is preferable if the rotation speed during the cleaning is close to the maximum allowed rotation speed with some safety margin, for example -500 rpm.

[0036] In this example the rotational cleaning of the working tool 1 takes place in regular cycles after each working cycle, during the technical break, when the hemming robot awaits replacement and placement of the new component. At the same time, before the first working cycle and then after each rotational cleaning, a separation liquid is applied onto the cleaned surface 2. The data from the control system of the hemming robot are used in order to start the rotation of the output 6 and to spray the separation liquid. The rotation starts at the moment when the working tool 1 according to the position data of the hemming robot is at the position of pressure towards the friction element 14. After achieving set speed of rotation the cleaning lasts for several seconds; in this example it is less than 5 second; the working tool 1 is then, subsequently, disconnected by the movement of the arm of the hemming robot from the connection with the friction element 14. The working tool 1 is moved towards the dispersers 8; when the working tool 1 achieves the desired position according to position data of the hemming robot a short spraying takes places, where the pressurized air pushes the separation liquid into the dispersers 8. After this step the working tool 1 is ready for hemming. The length of individual stages and the speed of the movement of the arm of the hemming robot or, eventually, its remaining in the zone of the application of the separation liquid already with the inactive dispersers 8, can be set pursuant to the time schedule of a particular robotized workplace. The impurities do not stick that much onto the working tool 1 treated by the separation liquid and the whole process of cleaning is much more effective.

[0037] The friction element 14 can also regularly rotate without the presence of the working tool 1 in order to achieve the permanent separation of eventual impurities or separation liquid from the surface of the friction element 14.

Example 2

[0038] In this example according to figure 4 the removable insert 7 is a plastic cylinder which can be recycled together with the dried impurities.

Example 3

[0039] The kinematic scheme for the connection of the output 6 of the driving unit 3 and the working tool 1 is opposite of the example 1. The manipulator carries the driving unit 3 on the arm's end and during technical break it approaches the working tool 1 and rotates it as in example 1.

[0040] The zone of application of the separation liquid is produced by the mouth of the cleaning chamber 4. In this example the zone of application of the separation liquid is equipped by one more disperser 8, whereby the working tool 1 comes out of the cleaning chamber 4 with one finishing rotation, thanks to which the separation liquid covers whole circumference of the cleaned surface 2.

Example 4

[0041] The solutions pursuant to previous examples are changed in such a way that on the front of the working tool 1 there is one member of a gear clutch. It has a form of a ring with evenly radially led protrusions. Another member of the gear clutch is designed for falling into the first member, it is placed on the output 6 of the driving unit 3. After the use of the gear clutch there is no need for pressure of the working tool 1 to the friction element 14 and the folding load of the stand 11 diminishes.

Example 5

[0042] In this example without figure the output 6 of the driving unit 3 has a vertical axis. The pressure between the working tool 1 and the friction element 14 is transferred as a pressure force to the basis.

Example 6

[0043] In this example the working tool 1 is designed in such a way that directly on the end of the mechanical arm which carries the working tool 1 there is a pneumatic engine 12 which does not prevent the rotation during the working operation, when the working tool 1 rotates at low speed of 500 rpm. During the technical break the working tool 1 moves inside the cleaning chamber 4 and it is rotated by the engine 12. Subsequently, when the rotation of the working tool 1 is finishing, the separation liquid is applied onto the cleaned surface 2, for example by means of dipping of the edge of the rotating working tool 1 into the vessel 9 with the separation liquid.

Example 7

[0044] A single device according to this invention is in this example placed on the cross-section of the working zones of multiple hemming robots and these one after another clean their working tools 1 in a single cleaning chamber 4. The sheath 5 of the cleaning chamber 4 is designed for the mechanical collection of the separated non-dried adhesive sealant and this is then returned to the process of hemming, which from the point of view of ecology lowers the amount of waste.

Industrial applicability

[0045] Industrial applicability is obvious. According to this invention it is possible to industrially and repeatedly produce and use the device for cleaning of the rotably placed working tool, for example hemming head.

List of symbols

[0046]

1 - working tool
2 - surface
3 - driving unit
4 - cleaning chamber
5 - sheath
6 - output of the driving unit
7 - removable insert
8 - disperser
9 - vessel for separation liquid
10 - collecting vessel
11 - stand
12 - engine
13 - gear
14 - friction element

Claims

1. A method of cleaning of a rotably placed working tool, mainly a hemming head, where impurities are removed from a surface of the working tool (1) by a centrifugation, whereby the working tool (1) rotates in a placement which otherwise serves a purpose of a rolling of the working tool (1) during its operation, **is characterized by the fact**, that
the working tool (1) is placed inside a cleaning chamber (4),
subsequently the working tool (1) is led into a rotation by means of a transmission which acts upon the working tool (1) outside its polluted surface (2),
the working tool (1) starts to rotate at a speed which does not surpass an allowed speed of the rotation of the placement of the working tool (1),
whereby before first working operation of the working tool (1) and/or after at least some rotational cleaning of the working tool (1) a separation liquid is applied onto its surface (2).

2. The method of cleaning of the rotably placed working tool, mainly the hemming head, according to the claim 1, **is characterized by the fact**, that the separation liquid is applied after each rotational cleaning of the working tool (1).

3. The method of cleaning of the rotably placed working tool, mainly the hemming head, according to the claim 1 or 2, **is characterized by the fact,** that the working tool (1) rotates at the speed corresponding to the maximum allowed speed of the rotation of bearings of the placement of the working tool (1), preferably the difference is less than 500 rpm, whereby the working tool (1) rotates at least for 2 seconds, preferably at least for 5 seconds.

4. The method of cleaning of the rotably placed working tool, mainly the hemming head, according to any of the claims 1 to 3, **is characterized by the fact**, that the working tool (1) rotates at least at speed of 2500 rpm, preferably more than 4500 rpm, especially pref-

erably more than 6000 rpm.

5. The method of cleaning of the rotably placed working tool, mainly the hemming head, according to any of the claims 1 to 4, **is characterized by the fact**, that the working tool (1) enters into a temporary connection with an output (6) of a driving unit (3) in order to achieve the rotation, whereby the driving unit (3) is a part of a carrier of the working tool (1) or it is placed as an independent element of a workplace and the working tool (1) rotates at gradually increasing speed.

6. The method of cleaning of the rotably placed working tool, mainly the hemming head, according to any of the claims 1 to 5, **is characterized by the fact**, that the separation liquid is applied by spraying and/or soaking and/or dipping and/or offset.

7. The method of cleaning of the rotably placed working tool, mainly the hemming head, according to any of the claims 1 to 6, **is characterized by the fact**, that the separation liquid is a mineral oil.

8. A device for a cleaning of a rotably placed working tool, mainly a hemming head, which includes a driving unit (3), **is characterized by the fact**, that it includes a zone for an application of a separation liquid and a cleaning chamber (4) which is delimited by a sheath (5) in a direction of a centrifugation of impurities, whereby the driving unit (3) is designed for a rotation of the working tool (1) after its placement in the cleaning chamber (4).

9. The device for the cleaning of the rotably placed working tool, mainly the hemming head, according to the claim 8, **is characterized by** the f**act**, that in the zone for application of the separation liquid it has at least one disperser (8) for a spraying of the separation liquid towards the working tool (1).

10. The device for the cleaning of the rotably placed working tool, mainly the hemming head, according to the claim 8 or 9, **is characterized by the fact**, that the driving unit (3) has a friction element (14) on its output (6), whereby the friction element (14) is designed for a contact with a front of the working tool (1) and the output (6) is connected to an engine (12) through a gear (13).

11. The device for the cleaning of the rotably placed working tool, mainly the hemming head, according to any of the claims 8 to 10, **is characterized by the fact**, that there is a removable insert (7) on an inner surface of the sheath (5) for an accumulation or catching of impurities separated during the rotation of the working tool (1); preferably the removable insert (7) is formed by a strip from a malleable material whose edge hanging over an edge of the sheath (5) is folded onto an outer surface of the sheath (5).

12. The device for the cleaning of the rotably placed working tool, mainly the hemming head, according to any of the claims 8 to 11, **is characterized by the fact**, that it has a stand (11) on which the driving unit (3), with the engine (12) and the gear (13) with the horizontally oriented output (6) which is in the cleaning chamber (4) delimited by the sheath (5), is placed, whereby a jib with a vessel (9) for the separation liquid and three dispersers (8), distributed in a regular angular pitch in a vertical plane, are connected to the stand (11), whereby the dispersers (8) are connected with the vessel (9), whereby a collecting vessel (10) is placed below the dispersers (8).

13. The device for the cleaning of the rotably placed working tool, mainly the hemming head, according to any of the claims 8 to 12, **is characterized by the fact**, that it includes a frequency converter connected with the engine (12).

14. A robotized workplace including the device for the cleaning of the rotably placed working tool, mainly the hemming head, according to any of the claims 8 to 13, **is characterized by the fact**, that the device for the cleaning of the rotably placed working tool (1), mainly the hemming head, is placed in a working operative reach of a mechanical arm which carries the working tool (1).

15. The robotized workplace including the device for the cleaning of the rotably placed working tool, mainly the hemming head, according to the claim 14, **is characterized by the fact,** that the device for the cleaning of the rotably placed working tool (1), mainly the hemming head, is placed in an intersection of working operative reaches of multiple mechanical arms with the respective working tools (1).

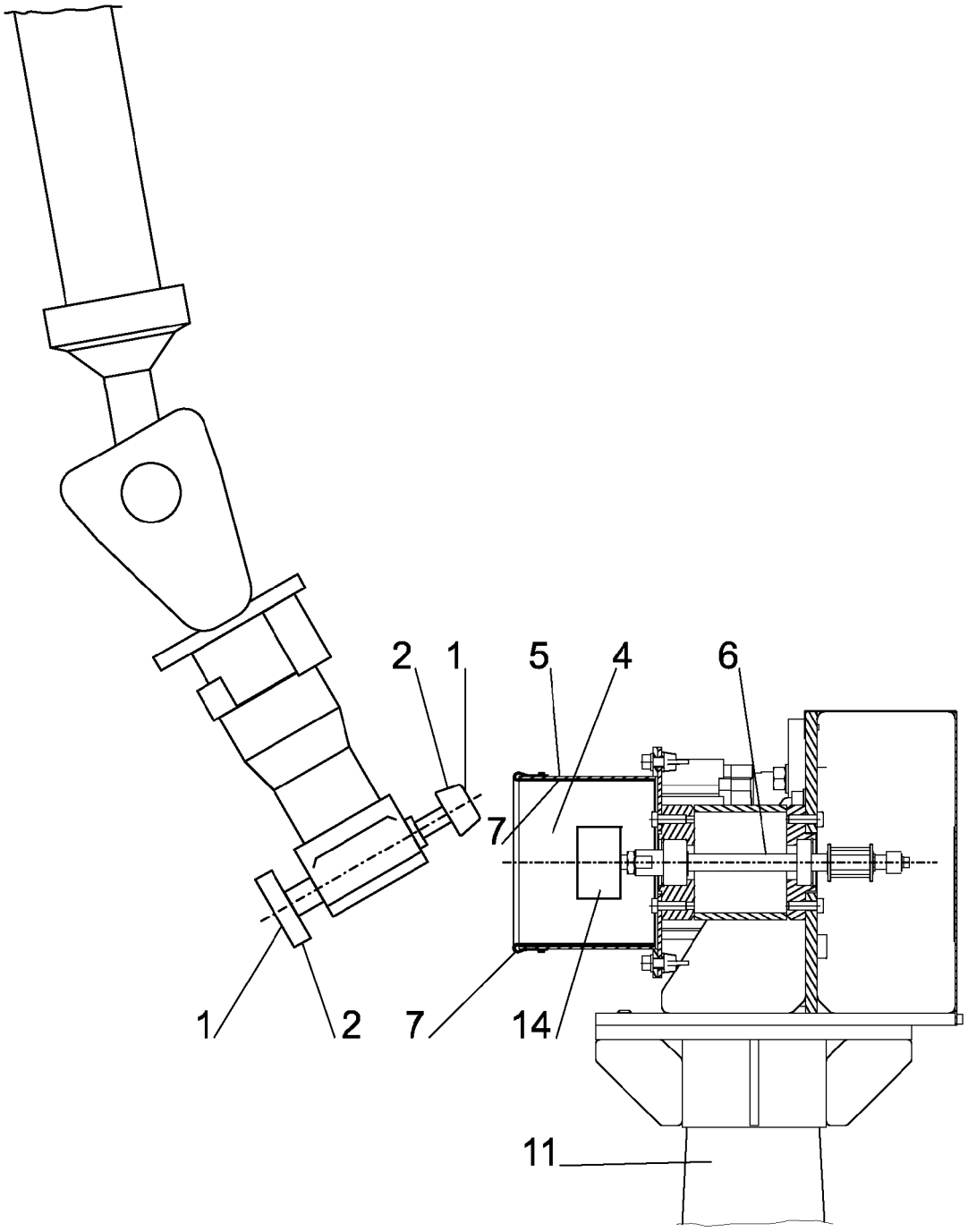

Fig. 1

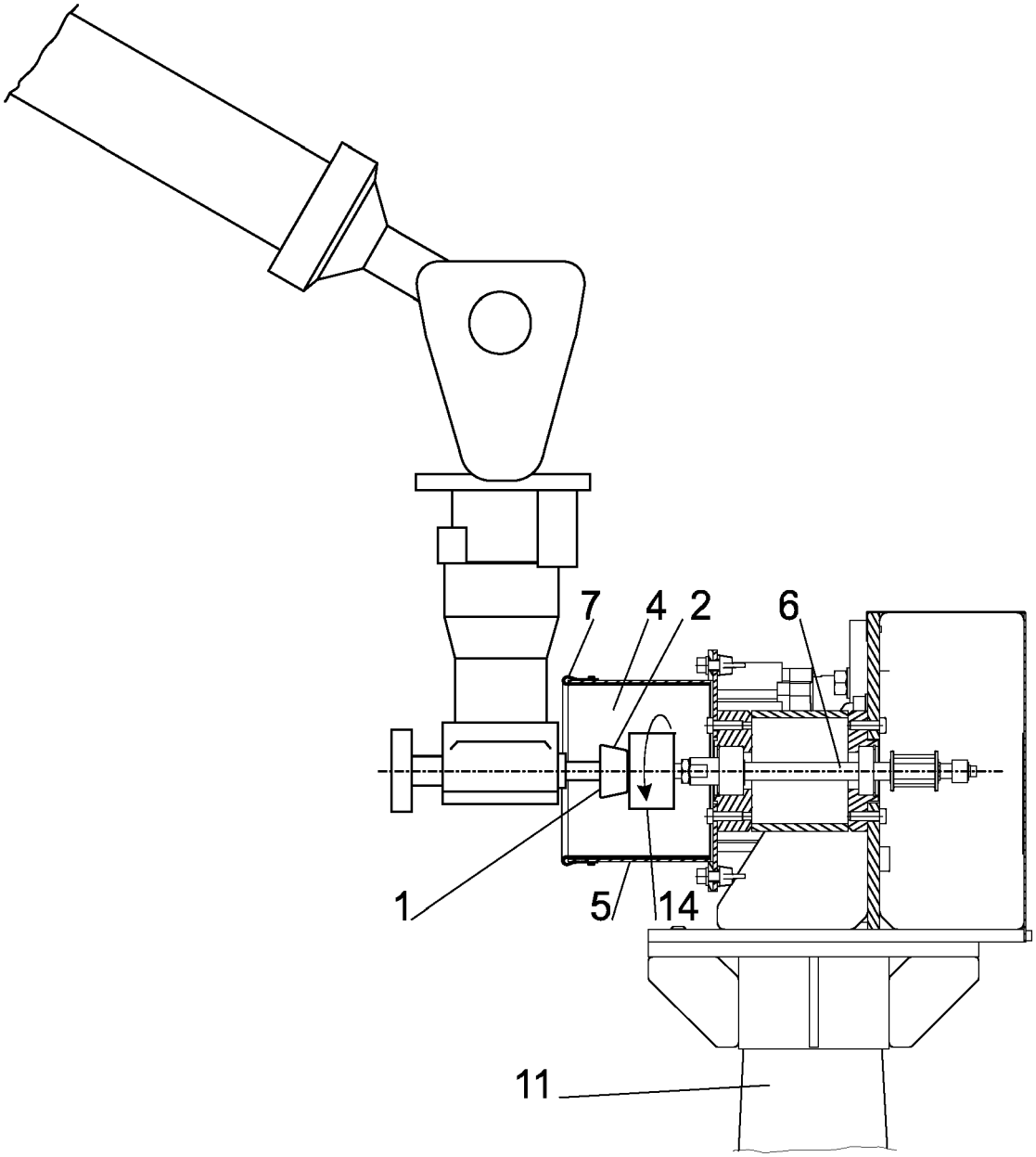

Fig. 2

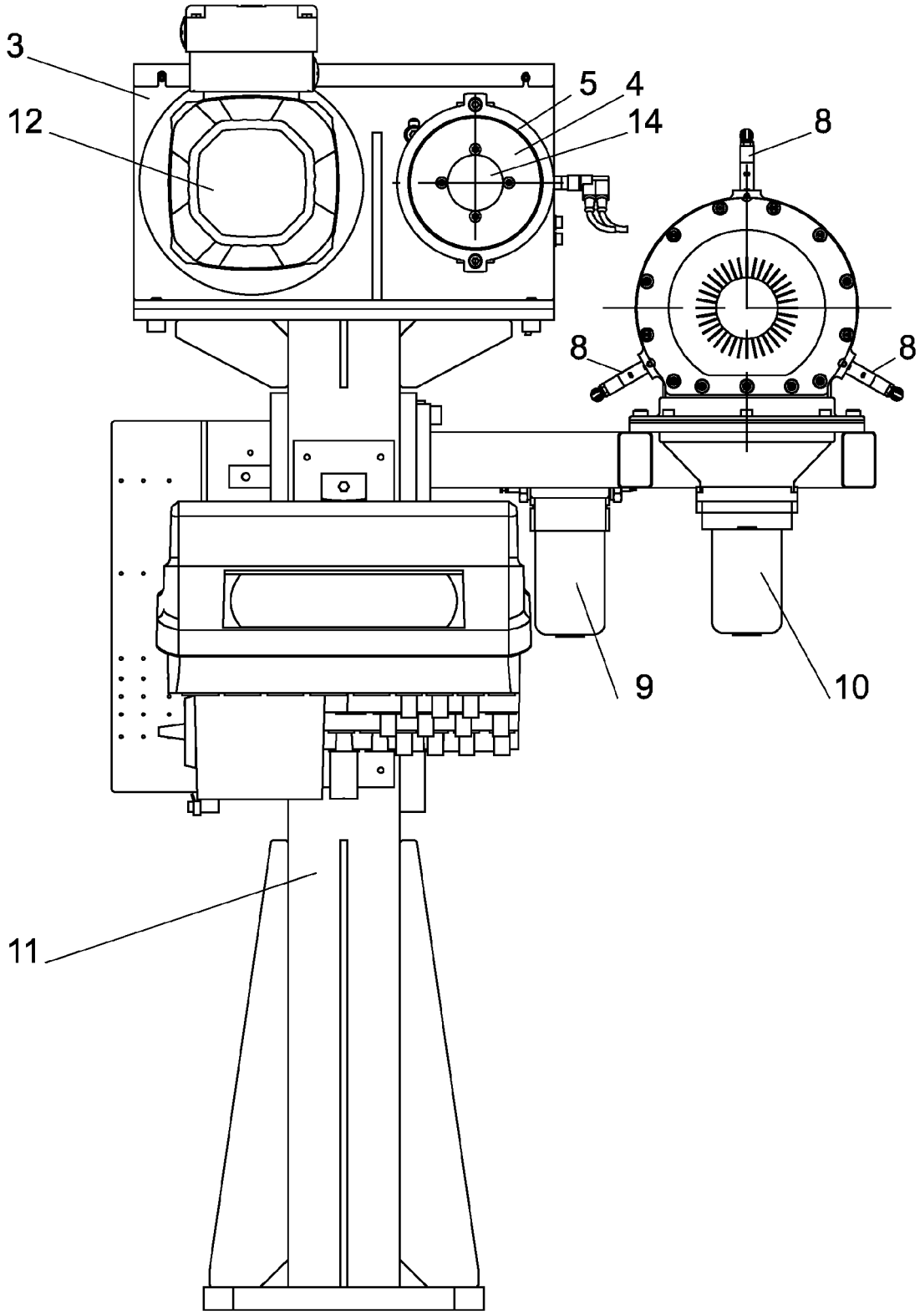

Fig. 3

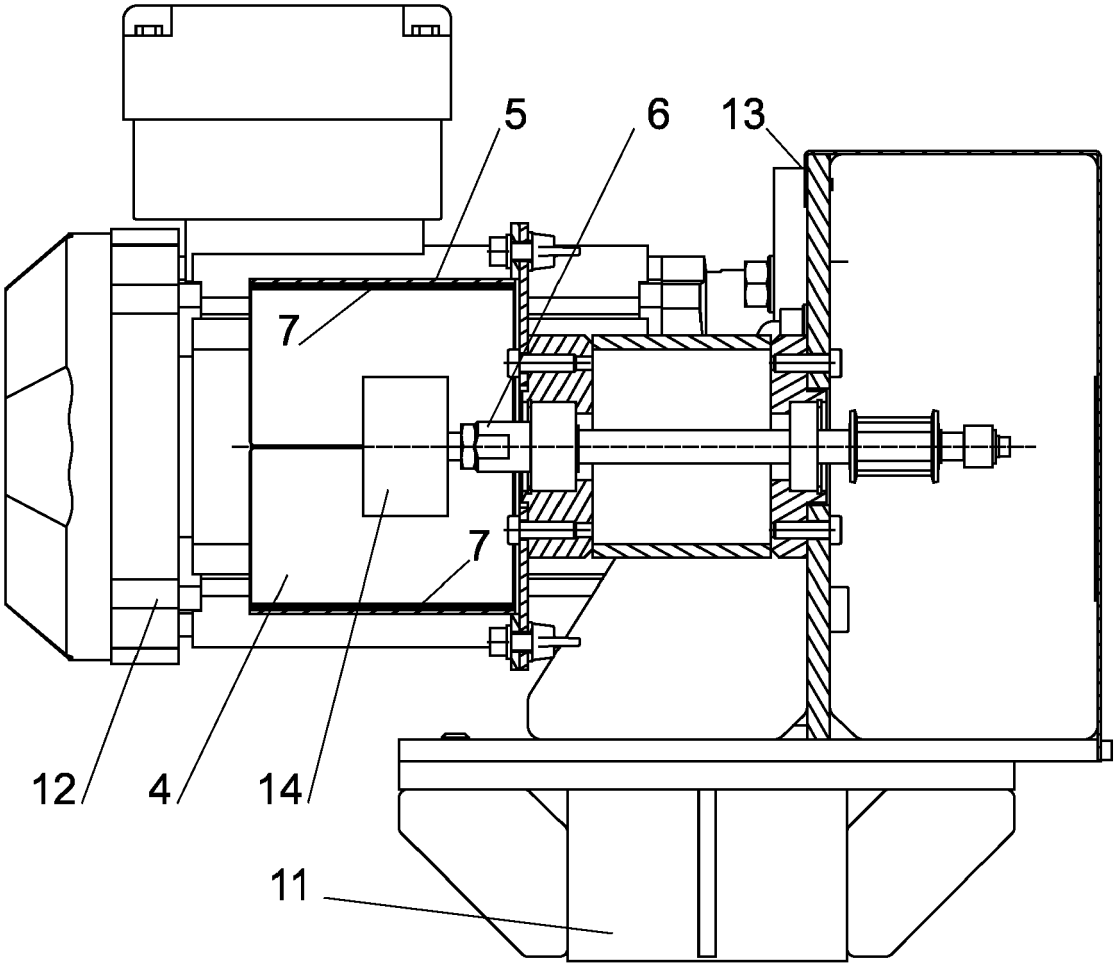

Fig. 4

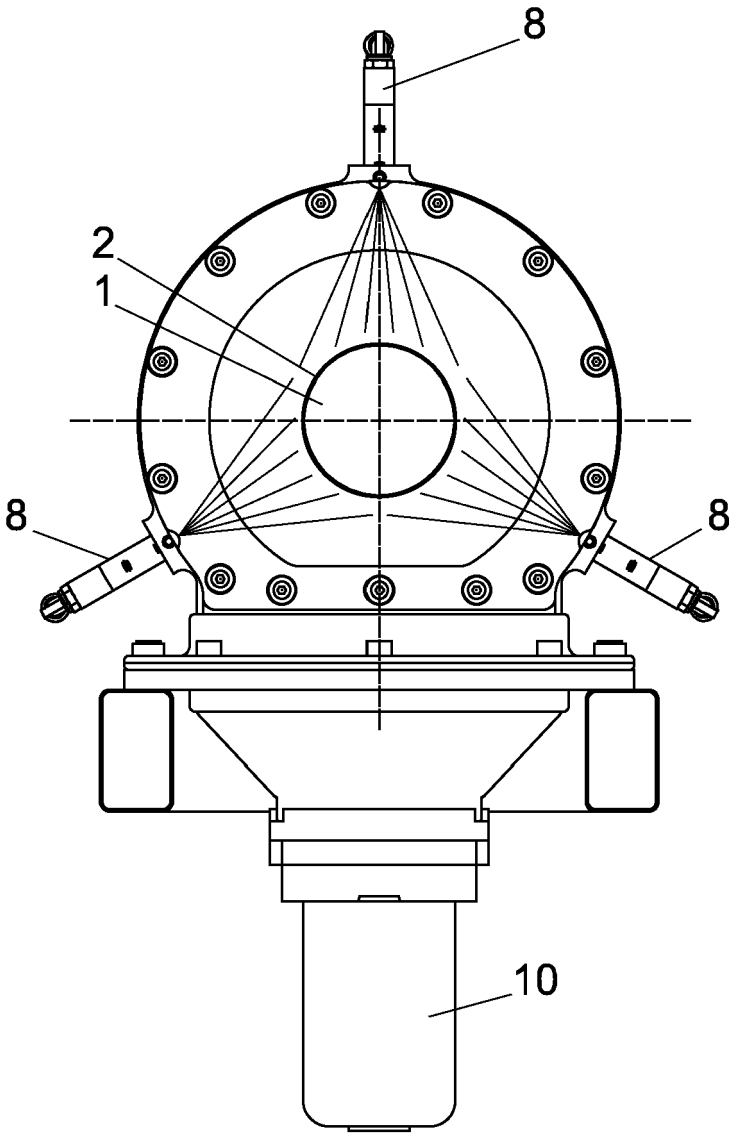

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 21 16 2128

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 July 2021	Martins Lopes, Luis

CATEGORY OF CITED DOCUMENTS

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