



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.03.2009 Bulletin 2009/13

(51) Int Cl.:
B24B 21/08 (2006.01)

(21) Application number: **08165042.6**

(22) Date of filing: **24.09.2008**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

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(30) Priority: **24.09.2007 IT BO20070648**

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(54) **Pushing device for a pad of a polishing machine**

(57) A pushing device for a pad, or pad sector (2), of a polishing machine, is provided for pushing an abrasive means (A) against an element to be polished (P).

The device comprises a plunger piston means (3) sliding in a respective cylinder (4) and in cooperation with the head of said cylinder (4) forms a pressure room (5) fed, by means of a duct (12), with a pressurized gas for pushing the plunger piston means (3).

Said pad or pad sector (2) is fixed to the plunger piston means (3).

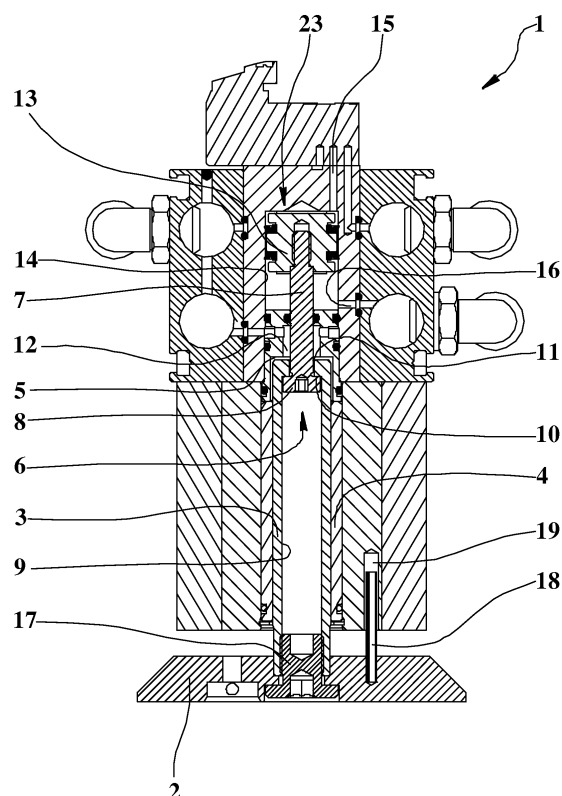


FIG.1

Description

[0001] The present invention concerns sandpapering and smoothing and refers to a pushing device for a pad provided for pushing an abrasive means, for example a tape or abrasive cloth sheet, and for pushing against a surface, for example of a wood panel, its derivatives or other synthetic or natural materials, specially suitable for polishing machines, sanders and/or thickness-sanding machines.

[0002] The known pushing devices for pressing abrasive belts of grinding machines are equipped with respective pneumatic cylinders for generating the movement forces of pad sectors and forces for matching the grinding against the surface.

[0003] A disadvantage of the known devices is that these devices are not suitable for generating the very small and regular needed forces, for example, for water varnishes because of frictions, mainly the first detachment friction.

[0004] An object of this invention is to propose a pushing device for a pad of a polishing or sanding machine designed to work with very low grinding forces and with regular movements and without jamming in order to uniformly smoothing both flat panels and strongly irregular panels.

[0005] The characteristics of invention are in the following evidenced with particular reference to the enclosed drawings in which:

- figure 1 shows a sectional view of the pushing device for a pad of a polishing machine, object of the present invention, in a rest condition;
- figure 2 shows a sectional view of the device of figure 1 in an operative condition and associated with an abrasive means and with a panel to be worked, only partially illustrated;
- figure 3 shows a sectional view of a variant of the device of figure 1.

[0006] With reference to figures 1 and 2, numeral 1 indicated the pushing device for a pad or for a pad sector 2 of a polishing or sanding machine, object of the present invention, for smoothing, for grinding or for sanding to thickness an element to be polished P, for example a panel, a leaf, a door, a furniture element, a wooden casing frame or the like, wood derivatives, metallic alloy, plastic material or any natural or synthetic material.

[0007] The pad or, when the pad consists of a plurality of sectors, the pad sector 2 is provided for acting onto an abrasive means A, for example a movable abrasive tape, for pressing it against the element P to be polished, for example a constant thickness or variable panel, with a reduced value force and almost constant also in presence of thickness variations of the panel and other changing conditions.

[0008] As disclosed in figure 2, the element P to be polished is moved on a horizontal plane while the pushing

force of the pad against the abrasive means A and the element P to be polished is vertically and downwardly directed.

[0009] The pad 2 is fixed, by means of threaded means 17, at an external end of a plunger piston means 3 sliding vertically in a cylinder 4 thereof with vertical axis. The upper end of the cylinder 4 ends with the head which, on the upper part, delimits a pressure room 5 downwardly delimited by the plunger piston means 3.

[0010] Said pressure room 5 is fed by means of duct 12 of a gas under pressure, for example filtered and compressed air, for the downwardly pushing of the plunger piston means 3.

[0011] As disclosed in the figures, the plunger piston means 3 is of the type without gaskets in order to minimize the first detachment friction to make more constant the pushing force onto the pad also in presence of movements of the latter due to different levels of element to be smoothed. The clearance, that is the diameter difference, between the plunger piston means 3 and the respective cylinder 4 is so to allow the passage of a slight or negligible air flow according to feeding amount. Said flow reduces the frictions further improving the pushing force constancy and precludes the entry of working residues and of other powders between the plunger piston means 3 and the respective cylinder 4 preventing the reciprocal locking.

[0012] As an alternative the invention provides that the device 1 can include an annular seal means, of material and forms with low friction, applied to the plunger piston means 3 and sliding onto the surface of the cylinder 4 or vice-versa. Preferably the annular seal means is applied at the free end of the cylinder so that the plunging piston 3 glides therein with very low friction and in order to prevent the powder and/or dirty entrance between cylinder and floating piston.

[0013] To avoid that the pad is always in the lowered position and for carrying it into a rest raised condition, in which the pad does not press the abrasive means against the element, the device includes movable stroke stop means 6, fit for limiting the stroke of the plunger piston means 3 in the direction opposite to the pressure room 5 imposing a lower arrest condition.

[0014] The movable stroke stop means 6 are actuated by lifting means 23 for moving the arrest condition between an operating external condition, in which the stroke stop means 6 allow maximum stroke of the plunger piston means 3 downwardly, and an inner rest condition in which the stroke stop means 6 raise at the upper end the arrest condition locking the plunger piston means 3 against the cylinder 4 head, or near this latter.

[0015] The stroke stop means 6 include a cylindrical stem 7 an end thereof has an enlargement means 8, for example cylindrical shaped, sliding inside the longitudinal bore 9 of the plunger piston means 3 of tubular type.

[0016] The enlargement means 8 is provided for matching an inner abutment 10 of the longitudinal bore 9 in the stop and rest internal conditions.

[0017] The longitudinal bore 9 of the plunger piston means 3 upwardly flows, towards the pressure room 5, by means of opening 11 having diameter lower than that of the bore 9 and to that of the enlargement means and slightly higher than that of the stem 7 crossing it. In this way the inner mouth of the opening 11 is defined by the inner abutment 10.

[0018] The lifting means 23 include a floating piston means 13 fixed at the upper end of the stem 7 and sliding in a respective cylinder 14. The floating piston 13 divides the cylinder 14 into two opposite chambers supplied by respective ducts 15, 16 feeding an operating pressurized fluid flowing into the ends of said cylinder 14.

[0019] Therefore the cylinder 14 of the floating piston means 13 is of the double-acting type with each end fed by a respective duct 15, 16 but, as an alternative, the invention provides that the single lower chamber is equipped with a respective duct 16. In such a case the lifting means 23 would be able only to move upwardly the plunger piston means 3, that is in the rest condition, while the translation of the enlargement means 8 downwardly in the lower locking condition that is operative, is entrusted to the plunger piston means at the beginning of the operation. Also in this case the downwardly pushing force is produced by the plunger piston means 3.

[0020] The stem 7, the longitudinal bore 9, the floating piston means 13, the double acting cylinder 14 and the stem 7, are coaxial.

[0021] Generally, it is sufficient to allow that the plunger piston means 3 and the respective pad 2 have a stroke of about 10 mm and therefore the difference between the longitudinal extensions of the floating piston 13 and of the respective cylinder 14 is of about 10 mm. To increase the free stroke of the pad is sufficient, for example, lengthen the longitudinal extension of the cylinder of the floating piston.

[0022] As an alternative of the oscillating piston, is provided that the lifting means 23 are of the electromagnetic type and may include a linear actuator with output translating shaft or arm fixed to the stem 7 or in single body with this latter.

[0023] The pad 2 has a stop rotation pin 18 parallel to the plunger piston means 3 and slidingly engaged into a respective housing 19 obtained in a cylinder 4 support of the plunger piston means 3.

[0024] The end portion, flowing in the pressure room 5, of the duct 12 is coaxial to the stem 7.

[0025] Each device 1 can be separated from the others or associated to all or part of the other devices controlling all sectors forming the pad. In particular the device can comprise at least one supporting body that is common with a plurality of devices 1. The body is monolithic and joins the devices 1 of all pad sectors forming the pad or sub-assemblies thereof. More bodies can be reciprocally joined, by means of support beams, for making a complete pad.

[0026] The number of pad sectors can be any, for example it is possible to have 60 devices with the same

number of sectors of a pad for a nominal working width of 1350 mm or 48 sectors for the working width of 1100. Pads consisting of 42 sectors for the width 1350 are provided and of 35 sectors for the width 1100.

5 **[0027]** The pad with 60 sectors can have 5 bodies, everyone with 12 devices for the same number of sectors, the pad with 48 sectors can be of 4 bodies, everyone with 12 devices for the same number of sectors. A pad with 48 or with 35 sectors can have 48 or 35 devices kept together by one or more beams.

10 **[0028]** For the pad operation, the ducts 12, 15, 16 can be opened and closed by respective electro-valves controlled by a control means of each device 1, fixed to the same device 1, or by a remote and centralized single control means.

15 **[0029]** A possible operation of the device, starting from the rest raised condition in which the single lower chamber of the cylinder 14 of the floating piston means 13 is under pressure, provides that the pressure of the upper chamber of the cylinder 14 of the floating piston means 13 is progressively increased by getting over the pressure of the lower chamber and translating downwardly the floating piston 13 and the enlargement means 8. The raising of the pressure in the pressure room 5 of the cylinder 4 of the plunging piston 3 produces the pushing force transmitted by the same plunging piston 3 to the pad or its sector 2 and from this latter to the abrasive means and to the element to be worked. Near the terminal border of element to be worked, the pad is lifted by connecting the duct 15, of the upper chamber of the cylinder 14 of the floating piston means 13, with the pressure of the external environment.

20 **[0030]** In the variant of the device of figure 3, the duct 12 feeding the pressure room 5 of the cylinder 4 of the plunging piston 3 is connected, by means of valve means 20, with two gas sources with different pressures P1. P2.

25 **[0031]** The valve means 20 commute the pushing pressure, transmitted by the pad or pad sector 2 to the abrasive means and to the element P to be polished, by means of a pneumatic ring seal 21.

30 **[0032]** The operation of the variant of the device of figure 3 differs from that previously described because of the exercised force from the pad can assume two different intensities.

35 **[0033]** An advantage of this invention is to supply a pushing device for a pad of a polishing machine fit for working with very low grinding forces and with regular movements and without jamming in order to uniformly smooth both flat panels and strongly irregular panels.

40 **[0034]** Other advantage consists in that the device can be used in the longitudinal and transversal pads.

45 **[0035]** Additional advantage consists in that the device can be used in grinding machines for elements of any material.

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Claims

1. Pushing device for a pad, or pad sector (2), of a polishing machine, provided for pushing an abrasive means (A) against an element to be polished (P), said device (1) is **characterized in that** it comprises a plunger piston means (3) sliding in a respective cylinder (4) and that delimits, in cooperation with the head of said cylinder (4), a pressure room (5) fed, by means of a duct (12), with a pressurized gas for pushing the plunger piston means (3), said pad or pad sector (2) is fixed to the plunger piston means (3). 5
2. Device according to claim 1 **characterized in that** the plunger piston means (3) is of the kind without seals and that the interspace between said plunger piston means (3) and the respective cylinder (4) allows the passage of a slight or negligible air flow. 10
3. Device according to claim 1 **characterized in that** the free end of the cylinder (4) is provided with a low friction seal means sliding on the plunger piston means (3) for avoiding the dust incoming. 20
4. Device according to claim 1 **characterized in that** it comprises stroke stop means (6) fit for stop the stroke of the plunger piston means (3) in the direction opposite to the pressure room (5) up to an arrest condition; said stroke stop means (6) being mobile and operated by lifting means (23) between an operating external condition, in which the stroke stop means (6) allows the maximum stroke of the plunger piston means (3) up to the arrest condition, and an inner rest condition in which the stroke stop means (6) stops the plunger piston means (3) against, or close to, the head of the cylinder (4). 30
5. Device according to claim 4 **characterized in that** the stroke stop means (6) comprises a stem (7) one end of which has an enlargement means (8) sliding inside a longitudinal bore (9) of the plunger piston means (3) and provided for matching an inner abutment (10) of the longitudinal bore (9) at least in the arrest and inner rest conditions, were the stem (7), the longitudinal bore (9) and the plunger piston means (3) are coaxial. 35
6. Device according to claim 5 **characterized in that** the longitudinal bore (9) of the plunger piston means (3) flows towards the pressure room (5) by means of an opening (11) whose diameter is smaller than that of the bore (9) and that of the enlargement means (8) and slightly bigger than that of the stem (7) crossing it, the inner mouth of the opening (11) being defined by the inner abutment (10). 40
7. Device according to claim 5 or 6 **characterized in that** the lifting means (23) includes a floating piston means (13) fixed to the stem (7) and sliding in a respective cylinder (14) fed of at least a duct (15, 16) feeding an operating pressurized fluid flowing in at least one end of said cylinder (14). 45
8. Device according to claim 7 **characterized in that** the cylinder (14) of the floating piston means (13) is of the double acting type with each end fed by a respective duct (15, 16) where the floating piston means (13), the double acting cylinder (14) and the stem (7) are coaxial. 50
9. Device according to claim 5 **characterized in that** the lifting means (23) includes a linear actuator having a translating output stem or arm fixed to the stem (7) or integral with the latter, said linear actuator of the lifting means (23) being of electromagnetic kind or the like. 55
10. Device according to any of the preceding claims **characterized in that** the pad or pad sector (2) is fixed to the end of the plunger piston means (3) opposite to the pressure room (5) by means of threaded means (17).
11. Device according to any of the preceding claims **characterized in that** the pad or pad sector (2) has a stop rotation pin (18) parallel to the plunger piston means (3) and engaged, in a sliding manner, in a respective housing (19) carried out in a support for the cylinder (4) of the plunger piston means (3).
12. Device according to claim 5 **characterized in that** the end portion of the duct (12), flowing into the pressure room (5), is coaxial with respect to the stem (7).
13. Device according to claim 5 **characterized in that** the duct (12) is connected with two gas sources at different pressures (P1, P2) by means of valve means (20) fit for switching the pushing pressure of the pad or pad sector (2) against the abrasive means (A) and against the element to be polished (P).
14. Device according to claim 13 **characterized in that** the valve means (20) includes a pneumatic ring seal (21) for switching the pushing pressures.
15. Device according to any of the preceding claims **characterized in that** it includes at least a single supporting body for a plurality of devices (1), said body being monolithic made and fit for joining all the devices (1) of all the pad sectors that forms the pad or subset thereof.

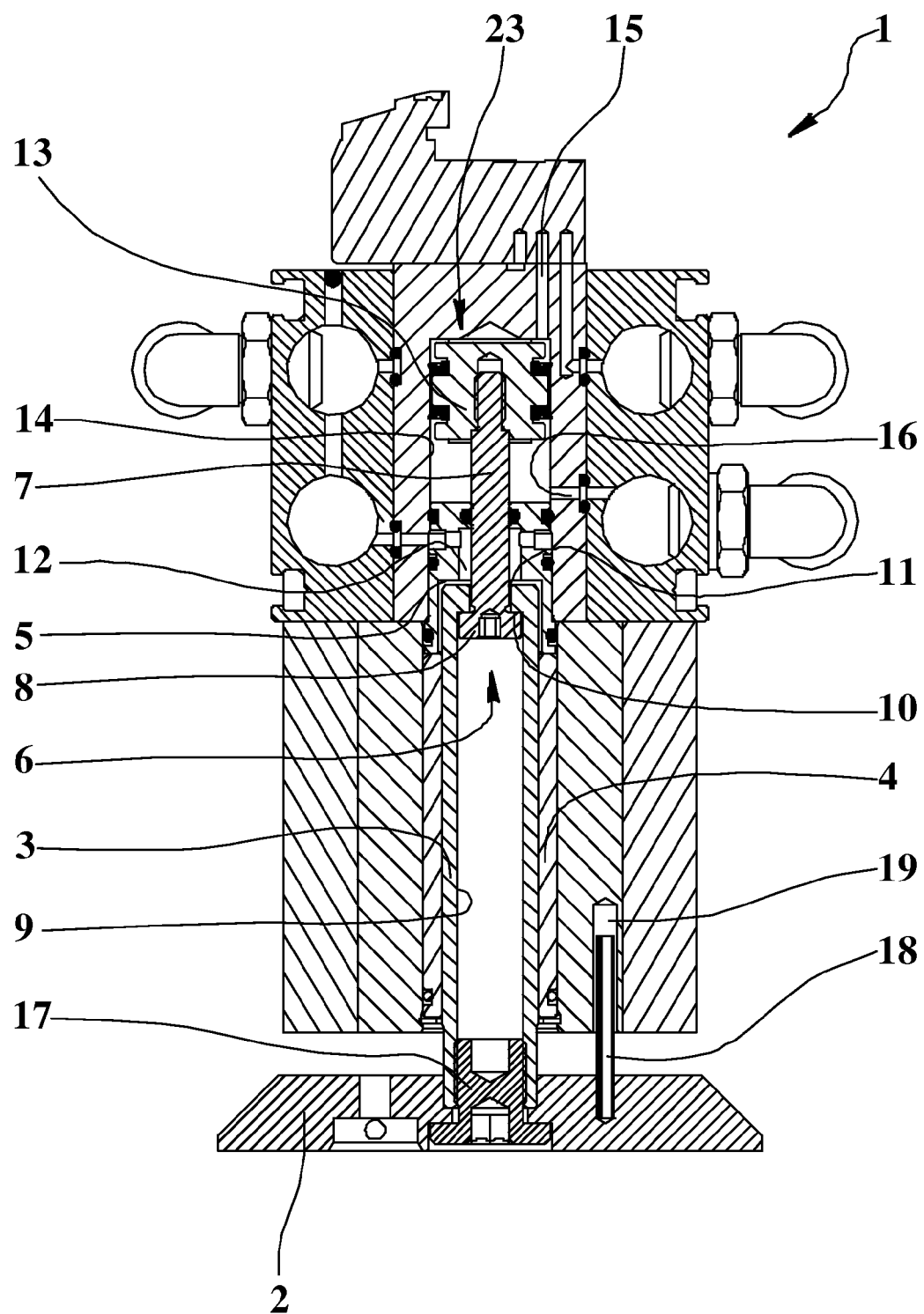


FIG.1

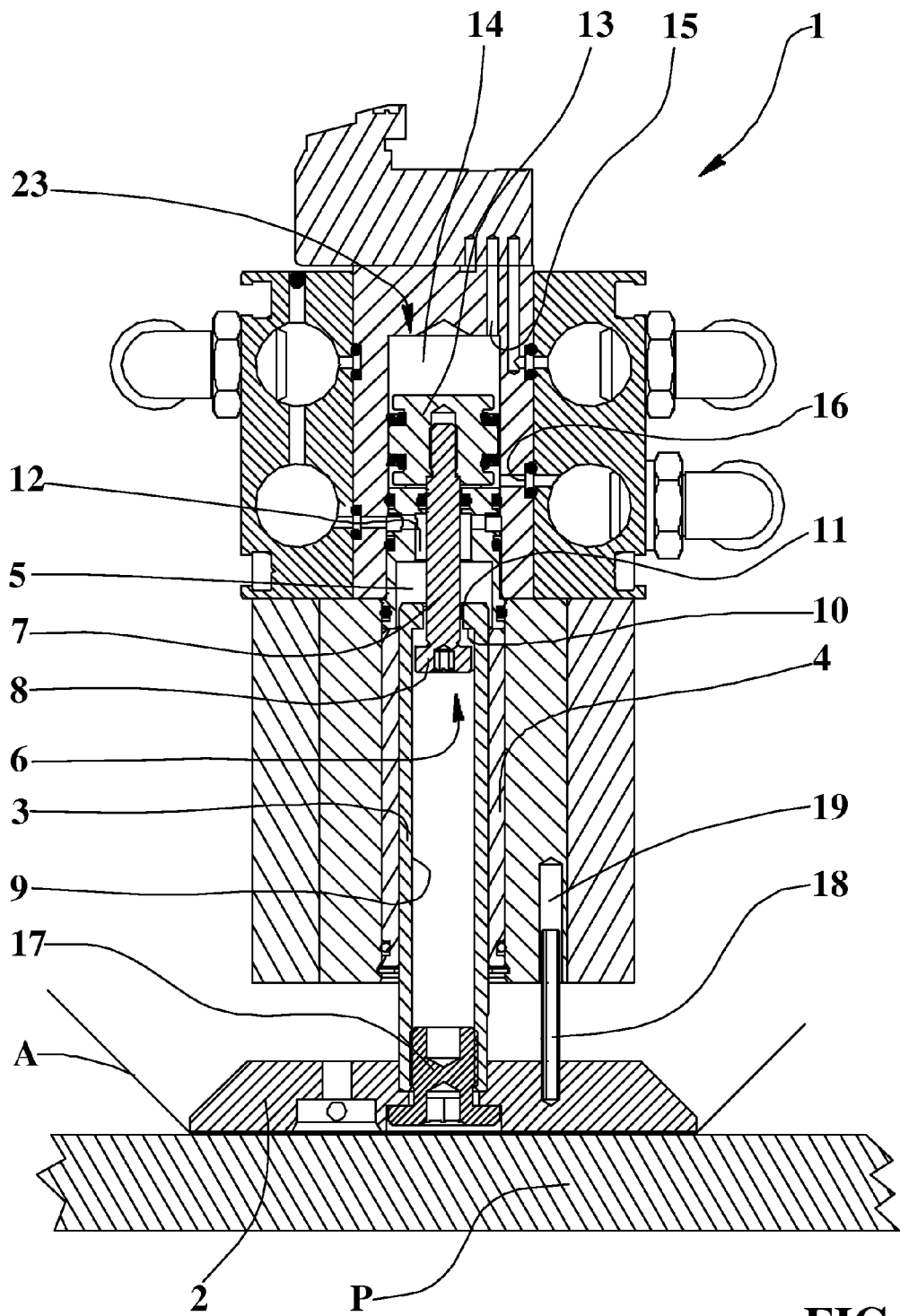


FIG. 2

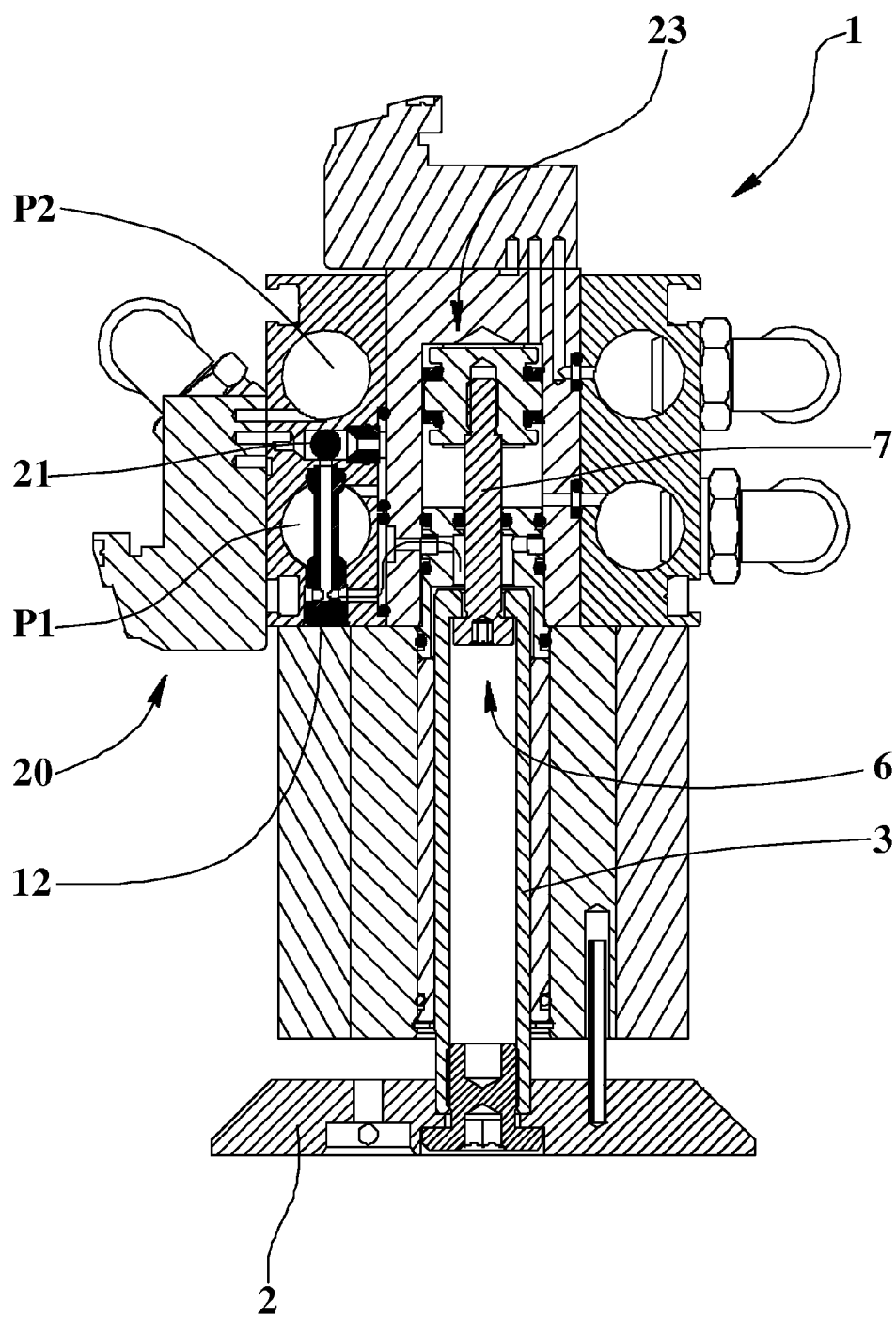


FIG.3



EUROPEAN SEARCH REPORT

Application Number
EP 08 16 5042

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 13 November 2008	Examiner Meritano, Luciano
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 08 16 5042

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