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(71) Applicant: **Paper Converting Machine Company Italia S.p.A.**
**55051 Fornaci di Barga (LU) (IT)**

(72) Inventors:
- **BERTOLI BARSOTTI, Giovanni**
  **55051 Fornaci di Barga (Lucca) (IT)**
- **MOSCARDINI, Emilano**
  **55051 Fornaci di Barga (Lucca) (IT)**
- **BIAGIONI, Roberto**
  **55051 Fornaci di Barga (Lucca) (IT)**
- **TAGLIASACCHI, Luca**
  **55051 Fornaci di Barga (Lucca) (IT)**
- **LIPPARELLI, Nicola**
  **55051 Fornaci di Barga (Lucca) (IT)**

(74) Representative: **Petruzziello, Aldo**
**Racheli S.r.l.**
**Viale San Michele del Carso, 4**
**20144 Milano (IT)**

## (54) PERFORATOR ASSEMBLY FOR REWINDER OF SHEET MATERIAL

(57) Perforator assembly (2) for rewinder machines (1) of sheet material, particularly paper, comprising a perforator cylinder (5) rotating around its own axis, provided on its shell with an even number plurality of blades (31) with continuous cutting edge and helical profile, and a normally fixed counter-cylinder (3) having a rectilinear counter-blade (33) with discontinuous cutting edge, such that during rotation of the perforator cylinder (31) there is a continuous punctiform contact between a blade (31) and the counter-blade (33), determining, on a web material (N) passing between the cylinders (5) and (3), transverse perforation lines at regular intervals dependent on the distance between the blades (31) and on the peripheral speed of the perforator cylinder (5) with respect to the feed rate of the web (N) wherein said blades (31) are mounted on the perforator cylinder (5) so as to be able to be brought from a work position in which they come into contact with said counter-blade (33) to produce the perforation of the web (N) to a rest position distanced from the counter-blade (33) to make the web (N) pass freely.

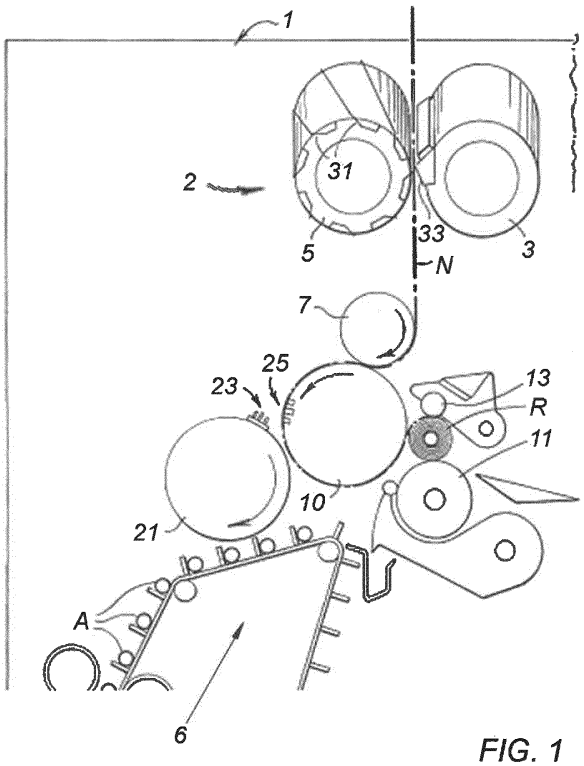


FIG. 1

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## Description

**[0001]** The object of the present invention is a perforator assembly for rewinder machines of sheet material, in particular paper.

**[0002]** In the paper processing industry a rewinder machine transforms a roll of paper of large diameter into a plurality of sticks or logs of reduced diameter which are subsequently cut along planes perpendicular to their longitudinal axis to obtain rolls of the required length, for example, of toilet paper, kitchen paper, absorbent paper, and the like

**[0003]** The perforator assembly is apt to provide transverse perforation lines equidistant along the web of material.

**[0004]** Each perforation line is obtained from the contact of a cutting blade having a continuous cutting edge, with a counter-blade which has a plurality of engravings on its cutting edge, that is its cutting edge is interrupted at regular intervals to provide a discontinuous cut of the web of paper along the perforation line.

**[0005]** The cutting blade with continuous edge is mounted on a rotating cylinder, while the counter-blade is normally mounted on a fixed cylinder, that is not rotating during the functioning, although it can also be provided as rotating.

**[0006]** The counter-blade is normally rectilinear in the transverse direction of the machine, while the cutting blade with continuous edge has a helical profile, so that the contact between blade and counter-blade is punctiform and continuous to avoid strong stresses which would lead to premature breakage of the blades.

**[0007]** Naturally the rotating cylinder carries several cutting blades with helical profile, equidistant on its shell.

**[0008]** In normal functioning it is common to have different distances between adjacent perforation lines, which determine the length of the sheets of paper following tearing from the final roll. For example, for rolls of toilet paper the distance between perforation lines varies normally from 70 mm to 200 mm, while for rolls of kitchen or absorbent paper, from 190 mm to 400 mm, even if recently smaller distances have been proposed.

**[0009]** The perforator cylinder normally has a nominal length between perforation lines which corresponds to the distance between the blades placed thereon, when its peripheral speed is equal to the feed rate of the web of paper.

**[0010]** In order to have different lengths between perforation lines, the peripheral speed of the perforator cylinder can be modified, without however exceeding + - 50% of the nominal value. In fact values outside of such an interval would cause excessive stresses on the paper which would tend to break.

**[0011]** Therefore, in order to have a wider variation of the length between perforations it is necessary to install physically on the perforator cylinder, or remove therefrom, some blades, or alternatively modify the position of the blades with respect to the perforator cylinder, to avoid some of them coming into contact with the paper.

**[0012]** For example, in the case of a cylinder equipped with six blades, it is possible to double the length between perforations, dismantling three blades, so that the distance between the remaining blades doubles.

**[0013]** This operation requires at least one hour, so that a rewinder machine is normally equipped with a double perforator, to avoid down times.

**[0014]** US 5 248 106 A describes a rewinder machine comprising a perforator assembly, with a perforator roller and a counter-roller, wherein the distance between the perforations on a web of paper can be varied by changing the phase in the peripheral speed of the perforator roller.

**[0015]** WO 99/43475 A1 describes a perforator assembly comprising a rotating perforator roller and a fixed contrast element. The perforator roller carries series of blades, wherein the blades of each series are at a prefixed distance, with the blades mounted on a slide.

**[0016]** Given the above, the importance of having a rapid change of the blades in order to adapt the perforator assembly to the product to be produced appears clear.

**[0017]** The solutions proposed to date, which normally require direct interventions on the blades, have not been found to be satisfactory and entail long times for the modifications.

**[0018]** The object of the invention is that of eliminating the disadvantages of the prior art.

**[0019]** More particularly an object of the invention is that of providing a perforator assembly for rewinder machines which allows an extensive regulation of the distance between perforation lines without having to intervene physically for the removal or the mounting of the blades.

**[0020]** Another object of the invention is that of providing such a perforator assembly which allows such an extensive regulation in extremely short times, and theoretically without having to interrupt the functioning of the machine.

**[0021]** Yet another object of the invention is that of providing such a perforator assembly wherein the regulation between perforation lines can be performed in a practically automatic way, without the manual intervention of the operator.

**[0022]** A further object of the invention is that of providing such a perforator assembly which is simple and economical to produce.

**[0023]** These and other objects are achieved by the perforator assembly according to the invention which has the features of the appended independent claim 1.

**[0024]** Advantageous embodiments of the invention are stated in the dependent claims.

**[0025]** Substantially the perforator assembly for rewinder machines of sheet material, particularly paper, comprising a perforator cylinder rotating around its own axis, provided on its shell with an even number plurality of blades with a continuous cutting edge and helical profile, and a normally fixed counter-cylinder with a rectilinear counter-blade with discontinuous cutting edge, such

that during rotation of the perforator cylinder there is a continuous punctiform contact between a blade and the counter-blade, determining on a web material passing between the cylinders transverse perforation lines at regular intervals dependent on the distance between the blades and on the peripheral speed of the perforator cylinder with respect to the feed rate of the web, wherein said blades are mounted on the perforator cylinder so as to be able to be brought automatically, without manual intervention by the operator, from a work position in which they come into contact with said counter-blade to perform the perforation of the web to a rest position distanced from the counter-blade to let the web pass freely.

**[0026]** The advantages of the solution proposed by the invention with respect to the prior art appear evident from the examples given here below.

**[0027]** A perforator cylinder is considered, equipped with six blades: nominal distance between perforation lines 140 mm; minimum and maximum distances between perforation lines 80 mm and 200 mm, varying the peripheral speed of the perforator cylinder.

**[0028]** Assuming that the machine is producing products with distance between perforation lines 100 mm and the intention is to pass to a distance of 250 mm, the state of the art would require the removal of three blades and times of about one hour.

**[0029]** With the perforator assembly according to the invention it is sufficient to make withdraw three of the six blades from the work area, with times of a few seconds.

**[0030]** If products are being produced with distance between perforation lines 250 mm and the intention is to pass to a distance of 100 mm, according to the state of the art it would be necessary to install three further blades in addition to the three already mounted with times of about two hours.

**[0031]** With the perforator assembly according to the invention it is sufficient to select three further blades in the work area, with times of a few seconds.

**[0032]** If products are being produced with distances between perforation lines of 100 mm and the intention is to pass to a distance of 900 mm, according to the state of the art it would be necessary to remove five of the six blades, with times of about one and a half hours, or alternatively remove a blade, and install a longer blade leaving the other five and move the perforator cylinder back with respect to the counter-cylinder so that only the longer blade goes into the work area, with times still longer than the hour.

**[0033]** With the perforator assembly according to the invention it is sufficient to select six blades outside of the work area, with times of about twenty seconds.

**[0034]** Further features of the invention will be made clearer by the following detailed description, referred to its embodiments purely by way of a non-limiting example, illustrated in the accompanying drawings, in which:

Fig. 1 is a schematic view of the basic components of a rewinder machine for sheet materials comprising a perforator assembly;

Fig. 2 is a schematic sectional view of a perforator cylinder with six blades according to the invention, showing the enlarged details of three blades in work condition and three inactive blades;

Fig. 3 is a view like that of Fig. 2 with two blades in work phase and four inactive blades;

Fig. 4 is an enlargement of a sector of the perforator cylinder of Figs. 2 and 3 showing a blade in work position;

Fig. 5 is a view like that of Fig. 4, wherein the blade is in inoperative position;

Figs. 6 and 7 are, respectively, a plan view and an axonometric view of an end part of the perforator cylinder of the preceding drawings;

Figs. 8 and 9 are views similar to Figs. 4 and 5 of a sector of a perforator cylinder according to a variant of embodiment of the invention;

Figs. 10 and 11 are views similar to Figs. 8 and 9 according to a further variant of the invention.

**[0035]** Referring to the schematic view of Fig. 1, a rewinder machine of sheet material, in particular paper, shown in its basic components, has been denoted by reference numeral 1.

**[0036]** It comprises a perforator assembly 2 constituted by a rotating cylinder 5 provided with a plurality of blades 31 with continuous cutting edge and helical profile and a normally fixed counter-cylinder 3, provided with a "discontinuous" rectilinear counter-blade 33.

**[0037]** A web N, passing between the two cylinders 5 and 3, undergoes transverse perforations at regular intervals on the basis of the distance between the blades 31 which work and at the peripheral speed of the perforator cylinder 5 with respect to the feed rate of the web of paper N.

**[0038]** After perforation the web N is deviated around a roller 7 and sent into a cradle formed by an upper winding roller 10, a lower winding roller 11 and a diameter control roller, or presser 13, where it is wound around a core A fed by a cores magazine 6, to form a log R which, once the diameter established has been reached, is expelled from the winding cradle to go to subsequent machinings, in particular transverse cutting to obtain the small rolls of the width required.

**[0039]** A counter-rotating roller 21 co-operates with the upper winding roller 10 and both rollers 10 and 21 are provided with co-operating blades 25, 23 for the cutting of the web at the end of winding of each log.

**[0040]** Obviously the rewinder machine structure previously described is to be understood purely as an example, it being able to vary under numerous aspects.

**[0041]** Thus, for example, rather than having blades 25 and 23 on the counter-rotating rollers 10 and 21 to perform the cutting of the web at the end of winding of each log, the cutting can take place through tearing by acting on the differential speeds of the winding rollers at each cycle end.

**[0042]** Referring now to Figs. 2 to 7, a description is given of a perforator cylinder according to a first embodiment of the invention, again denoted by reference numeral 5.

**[0043]** In the example given the cylinder 5 is with six blades 31, but it is clear that it can entail, compatibly with its dimensions, any even number of blades.

**[0044]** Details from A to F show the arrangement of the various blades. In particular in the configuration of Fig. 2 three blades, and precisely A, D and E, are in work position, which we shall call closed, and alternate with the remaining three which are in inoperative position, or open.

**[0045]** In the configuration of Fig. 3, two blades in diametrically opposite position, A and F, are in work position, while the remaining four are in inoperative position.

**[0046]** Naturally, in addition to those illustrated in Figs. 2 and 3, with a cylinder with six blades other configurations would be possible, and in particular all six closed blades, or one closed blade and five open.

**[0047]** It is noted that the radial movement of the blades for moving from the open inoperative position to the closed work position is millimetric.

**[0048]** Referring now in particular to Figs. 4 and 5 means are described which allow actuation of the blade 31 according to the first embodiment of the invention.

**[0049]** The blade 31 is mounted on a blade holder 40 on which a layer of rubber 41 is placed for a dampening effect of the blade. A blade stopper 42 placed above the blade 31, provided with a further layer of rubber 45, serves to block the blade on the blade holder 40.

**[0050]** The blade holder 40 is mounted on a block 43 of attachment to the cylinder 5.

**[0051]** According to this first embodiment the blade holder 40 is mounted oscillating on the block 5 around a support pin 44.

**[0052]** For the movement of the oscillating blade holder 40 respective inflatable tubes or sleeves are used in flexible material, such as rubber or the like, 46, 47, acting respectively in closure and opening of the blade holder 40, when filled with appropriate fluid.

**[0053]** The tube 46 is housed in a corresponding seat 48 of the attachment block 43 and acts against the front or outermost end of the blade holder 40 to bring it into closure or in the work condition on the trajectory L which indicates the path of the blade in work position (Fig. 4).

**[0054]** The tube 47 is housed instead in a seat 49 of the cylinder 5 and acts on the rear or innermost part of the blade holder 40 to actuate it in opening, or to bring the blade 31 into rest position along the trajectory indicated with R.

**[0055]** The distance between the two trajectories L and R, and that is the movement which the blade 31 has to undergo to bring itself from the work condition to the rest condition and vice versa, can be less than a millimetre, for example 0.45 mm.

**[0056]** Figs. 6 and 7, which are also valid for the other embodiments to be described here below, show an end part of the perforator cylinder 5, to show how the elements described previously, and that is the attachment block 43, the blade holder 40, the blade stopper 42 and optionally also the blade 31, are made in several separate pieces to cover the entire width of the cylinder 5 following the helical profile of the blade 31.

**[0057]** The fluid used for the alternative inflation of the tubes 48, 49 is conveniently air, but could also be water or oil.

**[0058]** The positions of work and of rest of the blade 31 are determined by appropriate end travel abutments of the oscillating movement of the blade holder 40 with the block 43 or corresponding shoulders in the cylinder 5.

**[0059]** As an alternative to what is illustrated, both seats 48, 49 of the closure and opening tubes 46 and 47 could be provided in the block 43, if this were differently configured with respect to what is illustrated, or directly in the cylinder 5, should the block 43 be absent.

**[0060]** It is preferred however to provide the attachment blocks 43 for reasons of production simplicity.

**[0061]** The second embodiment illustrated in Figs. 8 and 9 operates on the same principle of the previous embodiment, so that the same reference numerals have been used to distinguish identical or corresponding parts.

**[0062]** In this case the blade holder 40 is housed in a guided manner in the attachment block 43, but could also be housed directly in the cylinder 5, and the tubes or sleeves 46, 47 cause respectively the closure and the opening of the blade 31 acting in horizontal translation on the blade holder 40, which is guided on appropriate horizontal guides 50 of the block 43.

**[0063]** Figs. 8 and 9 show the blade 31 in work position and rest position respectively.

**[0064]** The third embodiment illustrated in Figs. 10 and 11 also operates on the same principle as the previous ones, with the only difference that in this case the tubes or sleeves 46 of closure and 47 of opening, acting between the blade holder 40 and the attachment block 43 or directly the cylinder 5, determine a vertical movement upwards and downwards of the blade holder 40, causing the exiting and the return of the blade 31.

**[0065]** In Figs. 10 and 11, which show the blade 31 respectively in work and rest position, two pairs of tubes or sleeves 46, 47 are shown operating as mentioned previously, to cause a guided vertical movement along the guides 50 provided in the block 43.

**[0066]** In the previous embodiments tubes or sleeves have been provided which, appropriately inflated, determine the exiting and the return of the blade 31 according to different modes of displacement.

**[0067]** It is however clear that in place of the fluid inflated sleeves other means can be provided for causing the exiting of the blades 31 in position of work and their return into rest position, such as screw mechanisms, magnets, pistons or others, actuated automatically by means of a control unit of the machine, without manual operations.

**[0068]** The essence of the invention is therefore to be

found in the automatism of the movement of the blades 31 which can be taken from the work position to the rest position virtually instantaneously, without manual intervention of the operator on the same blades being required. The person skilled in the art will therefore be able to replace the pneumatic means described previously by way of an example with other means, such as those indicated above in order to obtain the object preset.

**[0069]** From what has been disclosed the advantages appear clear of the embossing assembly according to the invention which allows selection in a simple and rapid manner of the blades which on each occasion have to work, on the basis of the particular production, without having to intervene physically on the same.

**[0070]** Naturally the invention is not limited to the particular embodiments described previously and illustrated in the accompanying drawings, but numerous detail changes may be made thereto, within the reach of the person skilled in the art, without thereby departing from the scope of the same invention, as defined by the appended claims.

## Claims

1. Perforator assembly (2) for rewinder machines (1) of sheet material, particularly paper, comprising a perforator cylinder (5) rotating around its own axis, whose cylindrical surface is provided with an even number of blades (31) with a continuous cutting edge and helical profile, and a normally fixed counter-cylinder (3) having a rectilinear counter-blade (33) with a discontinuous cutting edge, such that during rotation of the perforator cylinder (5) there is a continuous punctiform contact between a blade (31) and the counter-blade (33) which determines, on a web material (N) passing between the cylinders (5) and (3), transverse perforation lines at regular intervals which are dependent on the distance between the blades (31) and on the peripheral speed of the perforator cylinder (5) with respect to the feed speed of the web (N), **characterised in that** said blades (31) are mounted on the perforator cylinder (5) so as to be brought automatically, without manual intervention by the operator, from a work position in which they come into contact with said counter-blade (33) to perform the perforation of the web (N) to a rest position spaced away from the counter-blade (33) to let the web (N) pass freely.

2. Perforator assembly according to claim 1, **characterised in that** each of said blades (31) is mounted on a respective blade holder (40), operable to bring the blade (31) along a work trajectory (L) or a rest trajectory (R) by means of inflatable tubes or sleeves (46), (47) respectively.

3. Perforator assembly according to claim 2, **characterised in that** said inflatable tubes or sleeves (46), (47) act on said blade holder (40) to make it tilt around a bearing pin (44).

4. Perforator assembly according to claim 2, **characterised in that** said inflatable tubes or sleeves (46), (47) act on said blade holder (40) to move it in horizontal translation.

5. Perforator assembly according to claim 2, **characterised in that** said inflatable tubes or sleeves (46), (47) act on said blade holder (40) to move it in vertical translation upwards or downwards.

6. Perforator assembly according to any one of claims 2 to 5, **characterised in that** a blade stopper (42) is provided, apt to lock the blade (31) on the blade holder (40), rubber layers (41), (45) being provided respectively on the blade holder (40) and on the blade stopper (42) to come into contact with the blade (31).

7. Perforator assembly according to any one of claims 2 to 6, **characterised in that** said blade holder (40) is at least partly housed in a block (43) for the fastening to the cylinder (5).

8. Perforator assembly according to claim 7, **characterised in that** said blade holder (40), said blade stopper (42), said fastening block (43) and optionally said blade (31) are made of a plurality of separate pieces to cover the width of the cylinder (5) following the helical profile of the blade (31).

9. Perforator assembly according to claim 1, **characterised in that** the movement of said blades (31) is controlled by screw mechanisms, magnets, pistons or the like.

10. Rewinder machine of sheet material, in particular paper, for the production of rolls of toilet paper, kitchen paper and the like, comprising a perforator assembly (2) according to any one of the preceding claims, to perform transverse perforation lines which are equidistant on a paper web (N).

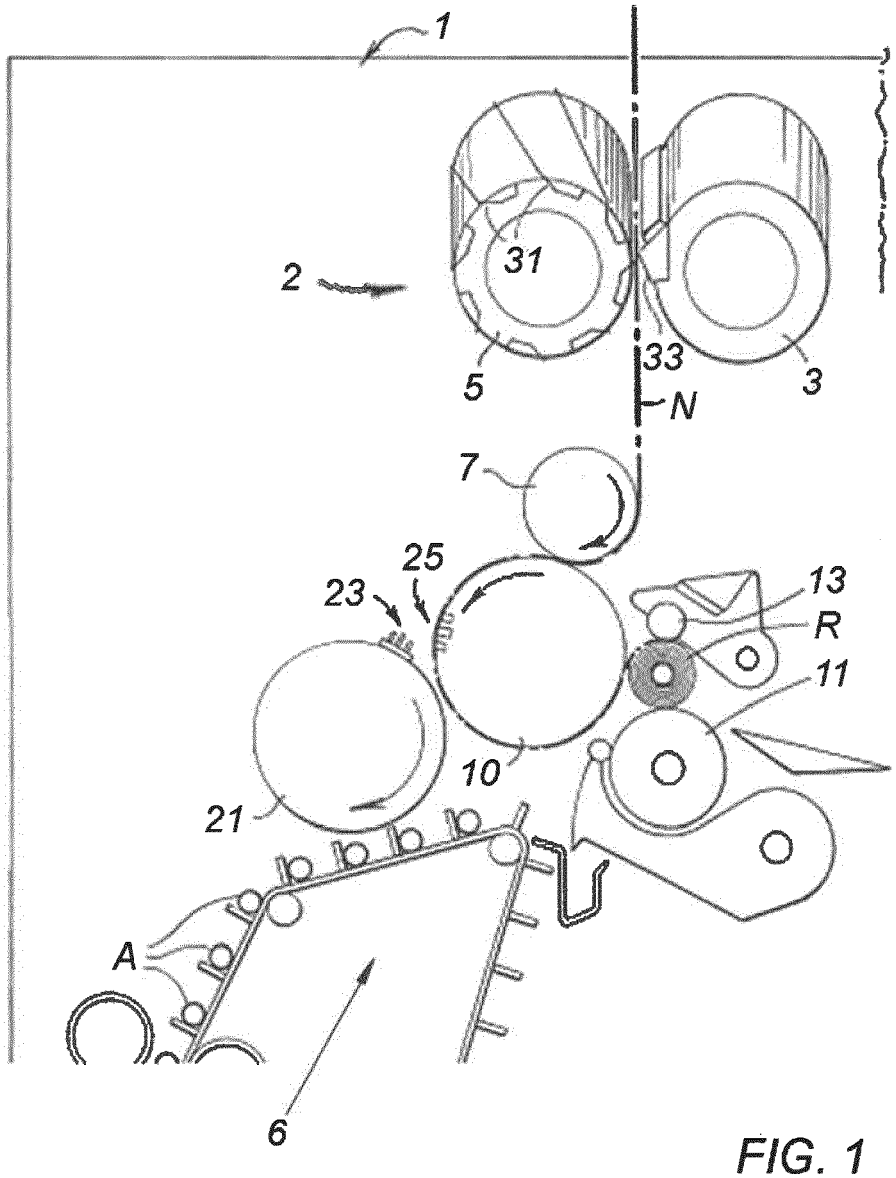
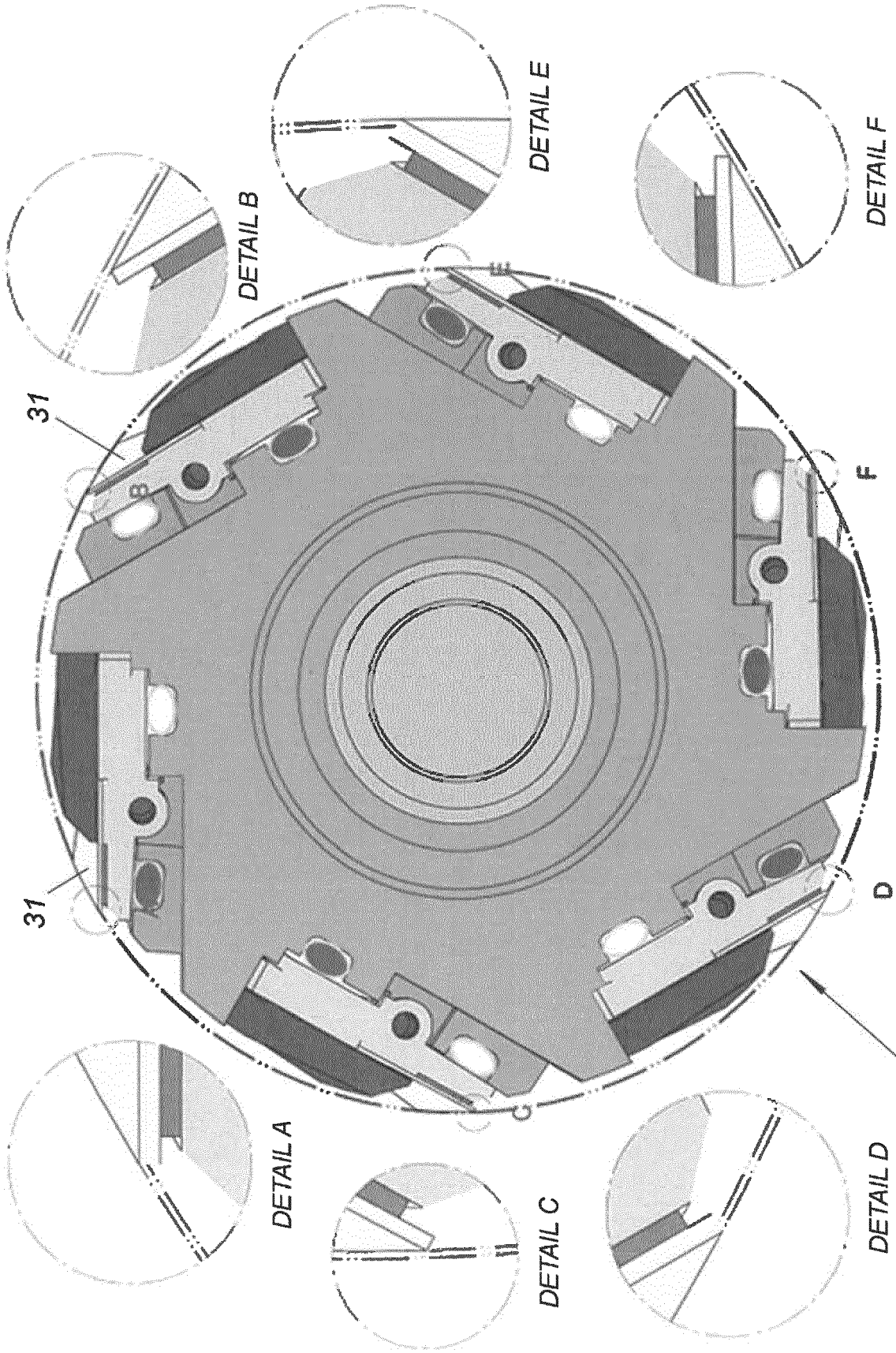



FIG. 1


DETAIL A
DETAIL B
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DETAIL E
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31
31
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5

FIG. 2

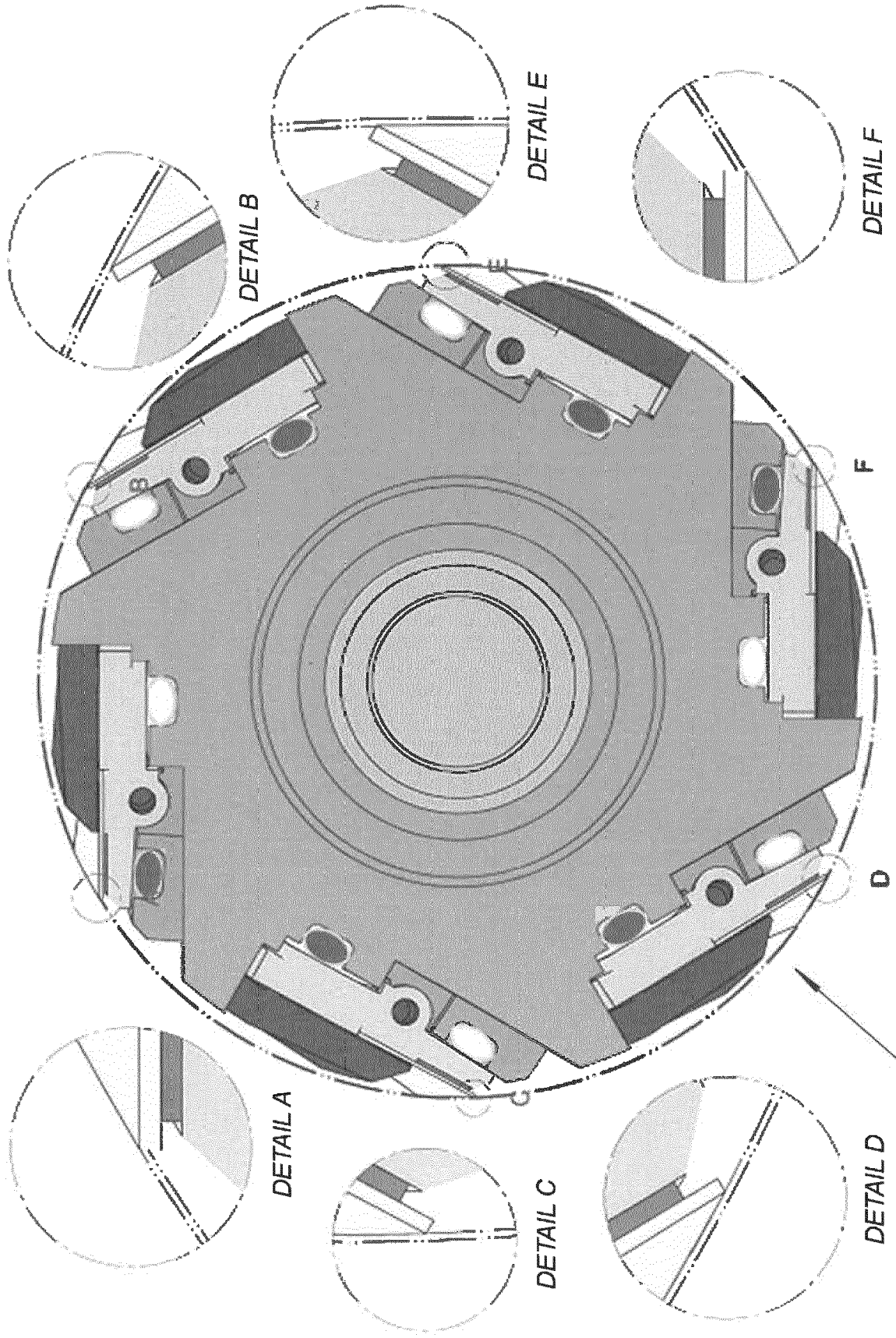


FIG. 3

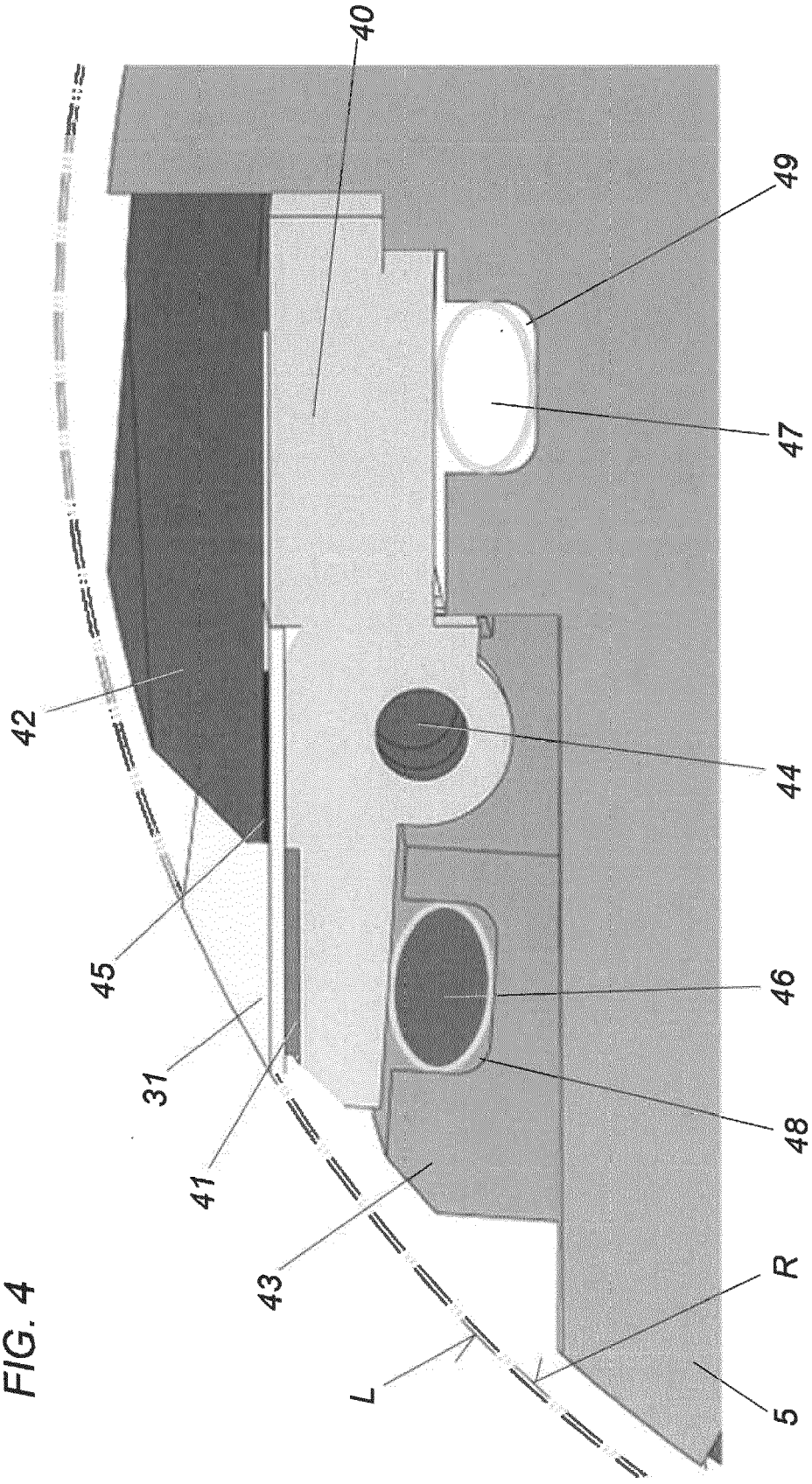


FIG. 4

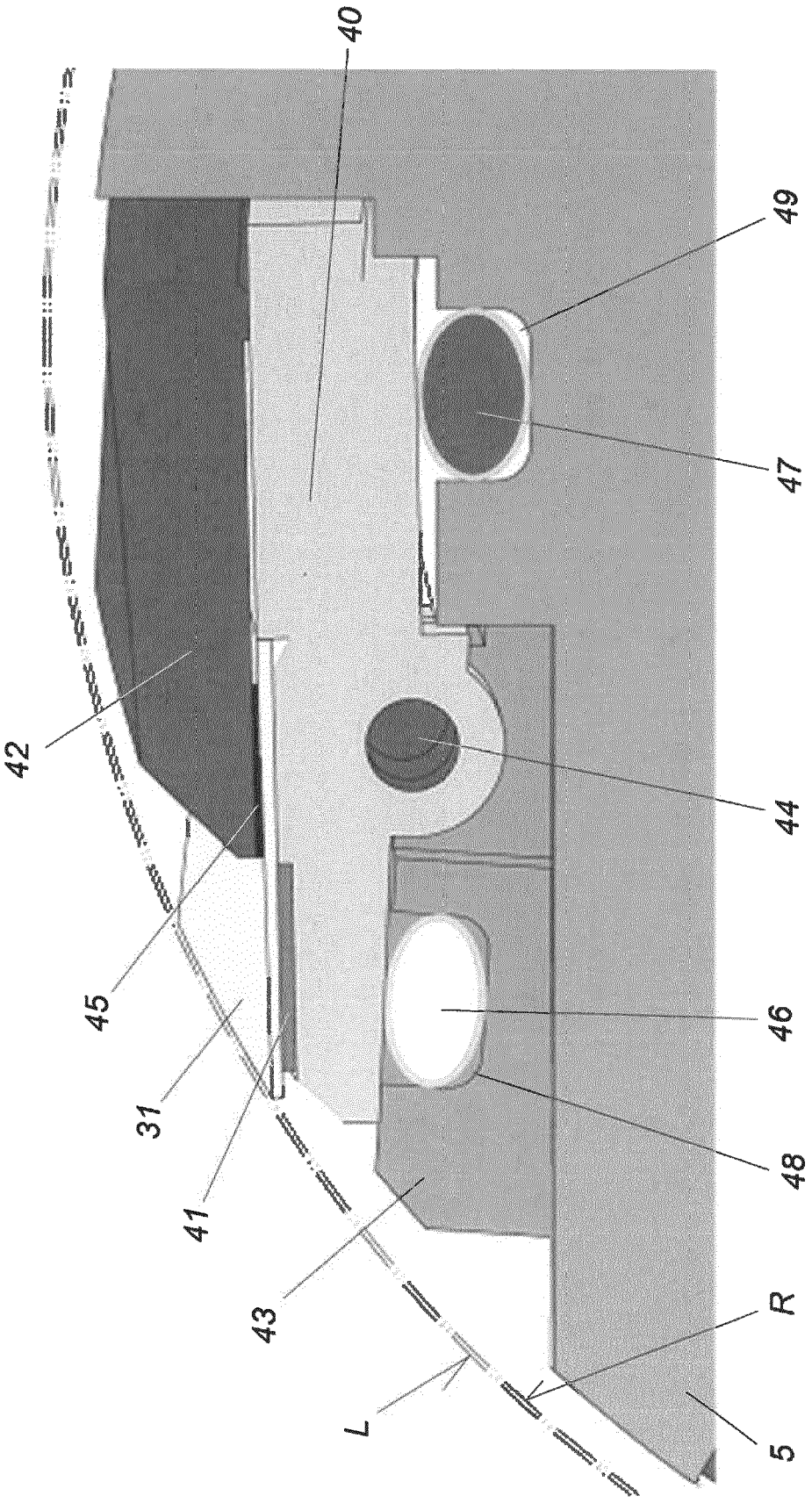


FIG. 5

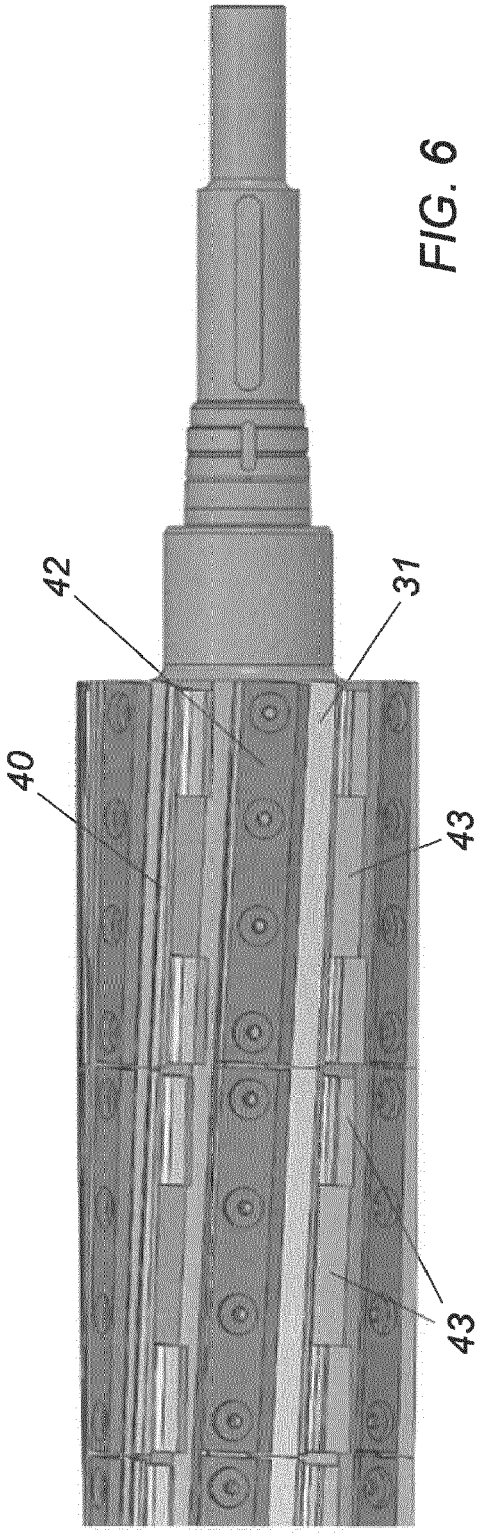


FIG. 6

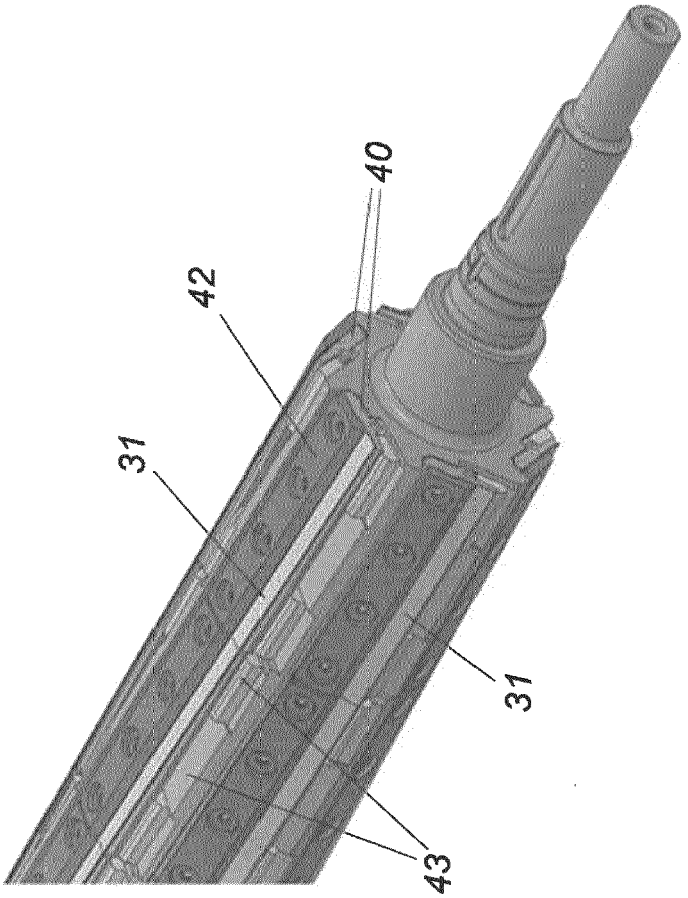


FIG. 7

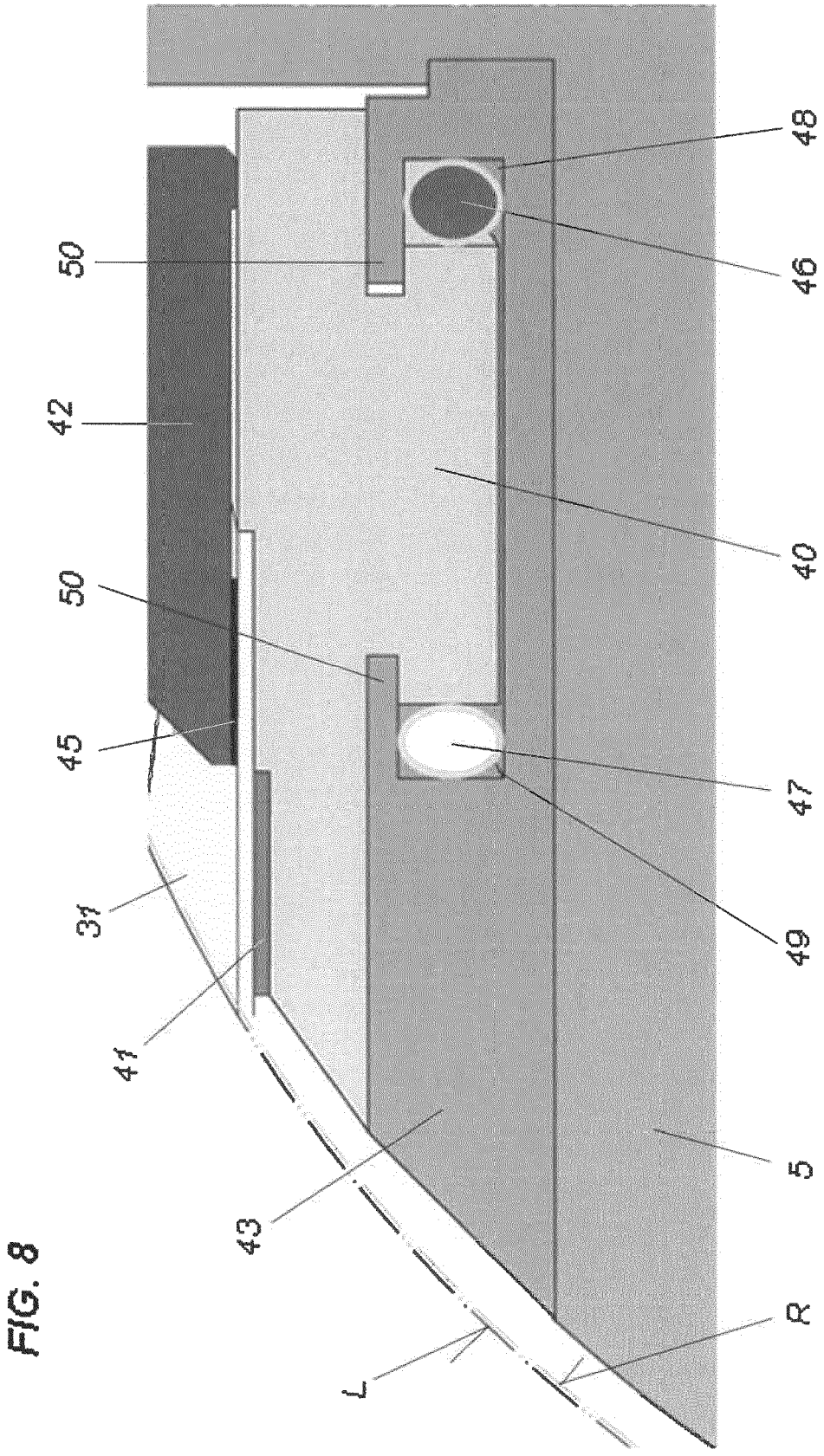


FIG. 8

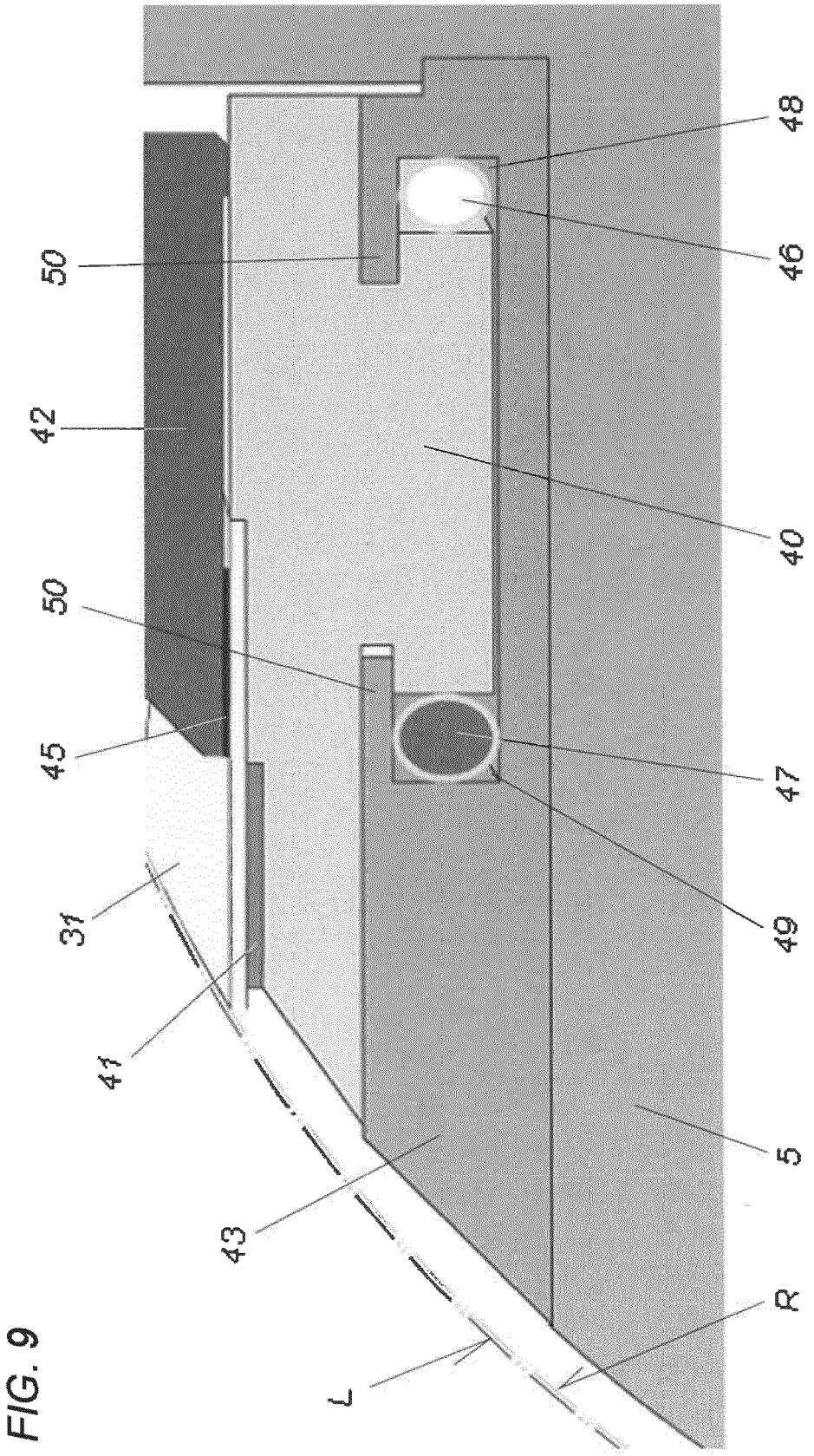


FIG. 9

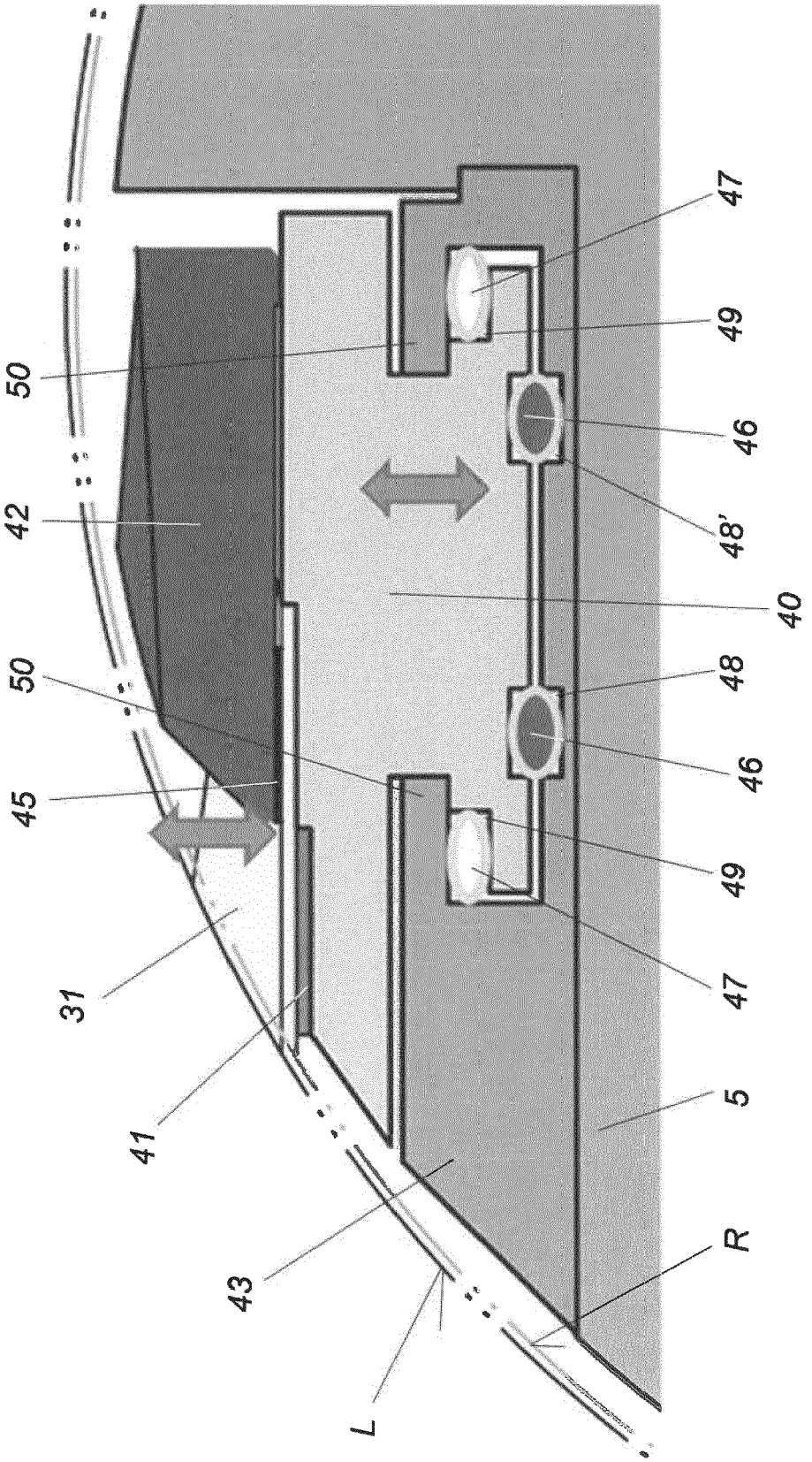


FIG. 10

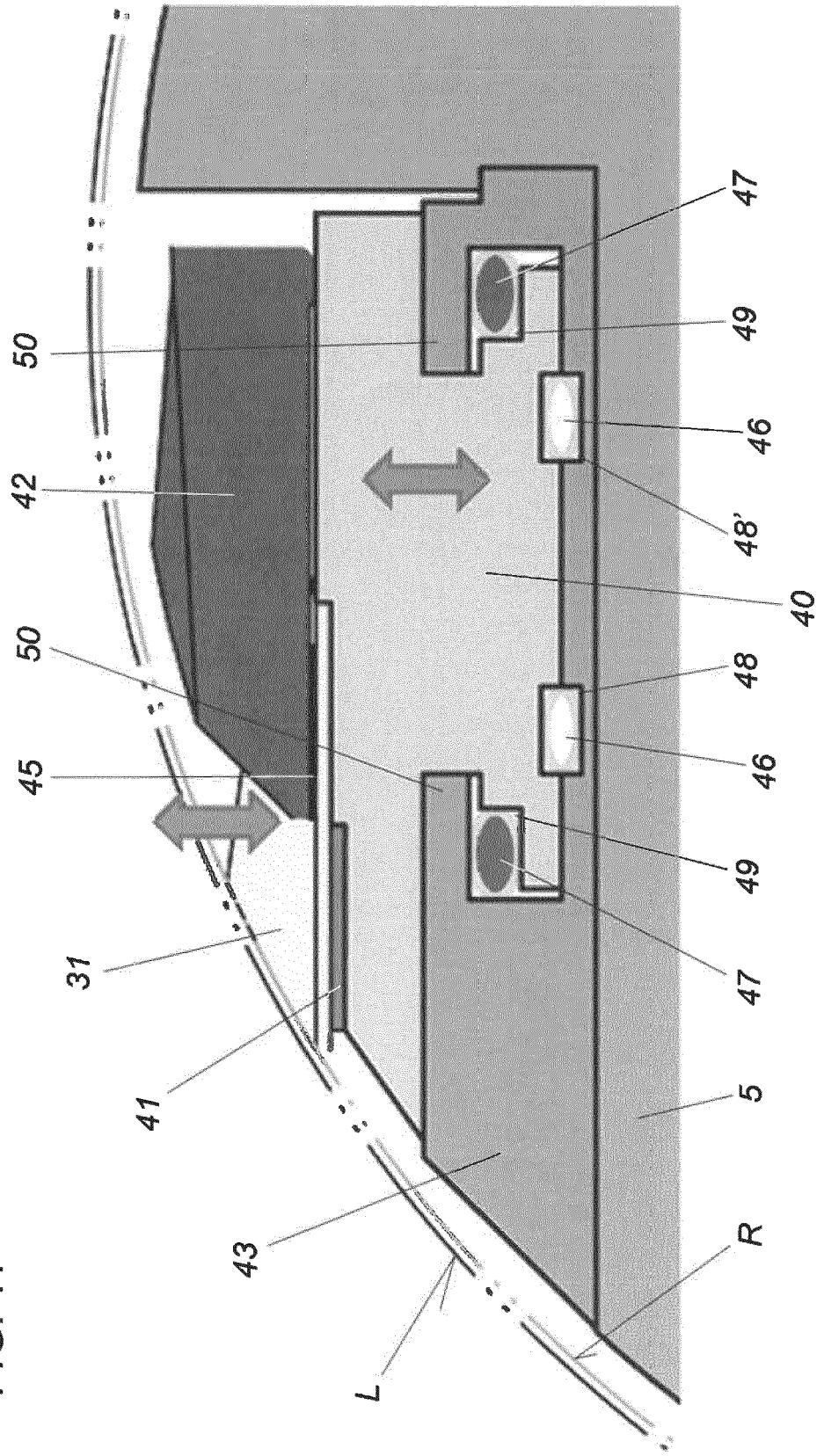


FIG. 11

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# EUROPEAN SEARCH REPORT

Application Number
EP 17 18 1682

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| Y<br>A | US 5 248 106 A (BIAGIOTTI GUGLIELMO [IT])<br>28 September 1993 (1993-09-28)<br>* column 1, lines 1-19 *<br>* column 5, lines 19-30 *<br>* column 5, line 61 - column 8, line 60 *<br>* figures 1-4 * | 1,9,10<br>2-8 | INV.<br>B65H35/00<br>B65H35/08<br>B65H19/22<br>B65H19/26<br>B26D5/04<br>B26F1/20 |
| Y | WO 99/43475 A1 (PROCTER & GAMBLE [US])<br>2 September 1999 (1999-09-02)<br>* page 8, line 14 - page 11, paragraph 2 *<br>* page 12, paragraph 4 - page 12, paragraph 1 *<br>* page 1, paragraph 1 *<br>* page 3, paragraphs 2, 3 *<br>* figures 1, 2, 3, 7 * | 1,9,10 | B26D7/26 |
| A | EP 0 382 689 A2 (PERINI FINANZIARIA SPA [IT]) 16 August 1990 (1990-08-16)<br>* column 3, lines 9-21 *<br>* column 3, line 57 - column 4, line 8 *<br>* column 4, line 45 - column 5, line 7 *<br>* figure 1 * | 1 | TECHNICAL FIELDS SEARCHED (IPC) |
| A | EP 0 507 747 A1 (PERINI FABIO SPA [IT])<br>7 October 1992 (1992-10-07)<br>* column 1, lines 1-14 *<br>* column 2, lines 45-56 *<br>* column 3, lines 31-58 *<br>* figures 1-3 * | 1 | B65H<br>B31F<br>B26D<br>B26F |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 10 November 2017 | Cescutti, Gabriel |

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

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EPO FORM 1503 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 18 1682

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The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-11-2017

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| US 5248106 A | 28-09-1993 | AT 112234 T | 15-10-1994 |
| | | BR 9101690 A | 26-11-1991 |
| | | CA 2041357 A1 | 28-10-1991 |
| | | DE 69104260 D1 | 03-11-1994 |
| | | DE 69104260 T2 | 09-03-1995 |
| | | EP 0454633 A2 | 30-10-1991 |
| | | ES 2060340 T3 | 16-11-1994 |
| | | IT 1238717 B | 01-09-1993 |
| | | JP H0592850 A | 16-04-1993 |
| | | US 5248106 A | 28-09-1993 |
| WO 9943475 A1 | 02-09-1999 | AT 246076 T | 15-08-2003 |
| | | AU 2181299 A | 15-09-1999 |
| | | CA 2321234 A1 | 02-09-1999 |
| | | CN 1298336 A | 06-06-2001 |
| | | DE 69909978 D1 | 04-09-2003 |
| | | DE 69909978 T2 | 27-05-2004 |
| | | EP 1058606 A1 | 13-12-2000 |
| | | JP 2002504441 A | 12-02-2002 |
| | | TW 418143 B | 11-01-2001 |
| | | US 6009781 A | 04-01-2000 |
| | | WO 9943475 A1 | 02-09-1999 |
| | | ZA 9901445 B | 27-08-1999 |
| EP 0382689 A2 | 16-08-1990 | AT 124642 T | 15-07-1995 |
| | | BR 9000516 A | 15-01-1991 |
| | | CA 2009428 A1 | 07-08-1990 |
| | | DE 69020593 D1 | 10-08-1995 |
| | | DE 69020593 T2 | 01-02-1996 |
| | | EP 0382689 A2 | 16-08-1990 |
| | | ES 2074154 T3 | 01-09-1995 |
| | | IT 1233145 B | 14-03-1992 |
| | | JP 3120988 B2 | 25-12-2000 |
| | | JP H02232197 A | 14-09-1990 |
| | | US 5125302 A | 30-06-1992 |
| EP 0507747 A1 | 07-10-1992 | AT 112999 T | 15-11-1994 |
| | | BR 9201171 A | 01-12-1992 |
| | | CA 2064680 A1 | 04-10-1992 |
| | | DE 69200533 D1 | 24-11-1994 |
| | | DE 69200533 T2 | 04-05-1995 |
| | | EP 0507747 A1 | 07-10-1992 |
| | | ES 2062879 T3 | 16-12-1994 |
| | | IL 101369 A | 29-12-1994 |
| | | IT 1247331 B | 12-12-1994 |
| | | JP H05208775 A | 20-08-1993 |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 18 1682

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-11-2017

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| | | US 5284304 A | 08-02-1994 |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- US 5248106 A **[0014]**
- WO 9943475 A1 **[0015]**