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(54) **CERAMIC HYDRAULIC DISTRIBUTOR FOR AN INK-JET PRINTER**

(57) The invention concerns a hydraulic distributor for an ink-jet printer, comprising:
- a first portion (2), comprising at least one 1st planar surface (4), a second portion (8, 108), comprising at least one 2nd planar surface (10), both planar surfaces being in friction contact with each other;
- at least one 1st conduct (6) in said 1st portion, each comprising a 1st opening in said 1st planar surface;
- at least one channel (12) extending in said second portion (8, 108), to conduct a fluid in a direction substantially parallel to said 2nd planar surface;
- at least one 2nd conduct in one of said portions, comprising a 2nd opening in said 1st planar surface or in said 2nd planar surface or in said at least one channel;
- means for moving both portions with respect to each other.

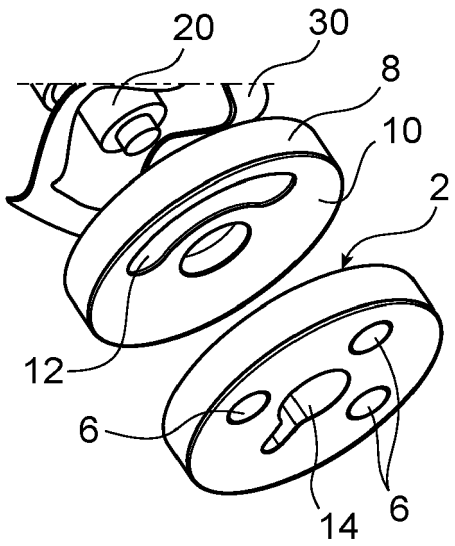

FIG.1B

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Description

TECHNICAL DOMAIN AND PRIOR ART

[0001] The invention relates to the domain of industrial inkjet printers, for example continuous inkjet (CIJ) printers.

[0002] In particular, it relates to a hydraulic distributor for such a printer and to an ink circuit of such a printer.

[0003] Typically, a fluid supply circuit of an ink jet printer comprises several valves, such as solenoid valves or electro-valves. A solenoid valve is an expensive and complex device; as a result, it can be inoperative or have faults which are difficult to identify and/or to repair. Furthermore, the pressure loss between the input and the output of such a valve is important.

[0004] CIJ printers include solenoid valves for large ink flows, but they are bulky, heavy and expensive.

[0005] There is thus a need for a fluid distributor to replace such valves in an ink circuit of an ink jet printer, in particular of a continuous ink jet printer for which the ink flow rates are quite important.

PRESENTATION OF THE INVENTION

[0006] A first object or purpose of the invention is a hydraulic distributor for an ink-jet printer, comprising:

- a first portion, comprising at least one 1st planar surface, for example in a glass or ceramic material or in stainless steel, a second portion, comprising at least one 2nd planar surface, for example in a glass or ceramic material or in stainless steel, both planar surfaces being in friction contact with each other;
- at least one 1st duct or conduct in said 1st portion, comprising a 1st opening in said 1st planar surface;
- at least 2nd one duct or through duct, to guide or conduct a fluid in a direction substantially perpendicular to said 2nd planar surface or to said 1st planar surface and/or at least one channel extending in said second portion, for example at least partly in said 2nd planar surface, to guide or conduct a fluid in a direction substantially parallel to said 2nd planar surface or to said 1st planar surface.

[0007] Said at least one 2nd conduct can be in one of said portions and comprises a 2nd opening in said 1st planar surface or in said 2nd planar surface or in said at least one channel.

[0008] A hydraulic distributor according to the invention preferably further comprises means for moving both portions with respect to each other, so that:

* in a first position, at least the 1st opening or the 1st duct or conduct and the 2nd opening or the 2nd duct or conduct are directly connected to each other (and a fluid can flow directly from one of them to the other one), or at least both the 1st opening (or the 1st duct or conduct) and the 2nd opening (or the 2nd duct or conduct) open in said at least one channel and are connected through said at least one channel (and a fluid can flow from one of them to said at least one channel and then to the other duct or conduct);
* and, in a second position, said 1st opening or 1st duct or conduct and said 2nd opening or 2nd duct or conduct are not connected to each other (and no fluid can flow from one of them to the other one), or at least one of said 1st opening (or 1st duct or conduct) and said 2nd opening (or 2nd duct or conduct) does not open in said at least one channel, and the openings or ducts or conducts are not connected through said at least one channel (and no fluid can flow from one of them to said at least one channel and then to the other duct or conduct).

[0009] A hydraulic distributor according to the invention can have more than 2 2 openings or ducts or conducts, so that in one or more relative position(s) of both portions more than 2 openings or ducts or conducts can be connected together, possibly through a channel in order to guide or conduct a fluid partly in a direction substantially parallel to said 2nd planar surface or said 1st planar surface, and fluid can flow from at least one opening or duct or conduct to at least two other openings or ducts or conducts or from at least 2 openings or ducts or conducts to at least one or more of them.

[0010] A hydraulic distributor according to the invention does not make use of any gaskets and is thus more robust than solenoid valves or electro-valves.

[0011] In an embodiment, said hydraulic distributor comprises at least one channel extending in said second portion, for example at least partly in said 2nd planar surface, to guide or conduct a fluid in a direction substantially parallel to said 2nd planar surface or to said 1st planar surface, and:

* in a first position, at least both the 1st opening (or the 1st duct or conduct) and the 2nd opening (or the 2nd duct or conduct) open in said at least one channel and are connected through said at least one channel, and a fluid can flow from one of them, to or through said at least one channel and then to the other opening or duct or conduct;
* and, in a second position, at least one of said 1st opening (or 1st duct or conduct) and said 2nd opening (or 2nd duct or conduct) does not open in said at least one channel, and said openings are not connected through said at least one channel, and no fluid can flow from one of them to said at least one channel and then to the other duct or conduct.

[0012] In another embodiment, said hydraulic distributor comprises at least one at least one 2nd conduct in said 2nd portion, comprising a 2nd opening in said 2nd planar surface and:

* in a first position, the 1st opening or the 1st duct or conduct and the 2nd opening or the 2nd duct or conduct are directly connected to each other (and a fluid can flow from one of them directly to the other one);
* and, in a second position, said 1st opening or 1st duct or conduct and said 2nd opening or 2nd duct or conduct are not connected to each other (and no fluid can flow from one of them to the other one).

[0013] In an embodiment of a hydraulic distributor according to the invention, said means for moving both portions with respect to each other are able to move at least one of said portions circularly around an axis perpendicular to both said 1st planar surface and said 2nd planar surface.

[0014] For example, said means may comprise a rotating shaft, which extends along said axis.

[0015] One end of said shaft being inserted in a hole in said 2nd portion.

[0016] Each of said shaft and said hole may comprise a flat surface which extends parallel to said axis and which cooperate which each other to rotate both said shaft and said 2nd portion.

[0017] In another embodiment of a hydraulic distributor according to the invention, said means for moving both portions with respect to each other are able to move at least one of said portions in translation along an axis parallel to both said 1st planar surface and said 2nd planar surface.

[0018] In any of the embodiments of a hydraulic distributor according to the invention, a hydraulic distributor according to the invention can further comprises means, for example a spring, for pressing said 1st planar surface and said 2nd planar surface against each other.

[0019] In a hydraulic distributor according to the invention:

- said 1st portion can comprise at least 2 or 3 conducts, each comprising an opening in said 1st planar surface;
- said 2nd portion can comprise at least one channel, to guide or conduct a fluid in a direction substantially parallel to said 2nd planar surface or to said 1st planar surface, and at least one conduct or 2nd conduct, to guide or conduct a fluid in a direction substantially perpendicular to said 2nd planar surface or to said 1st planar surface, said 2nd conduct comprising an opening in said channel;
- and/or said 1st planar surface and said 2nd planar surface can comprise a glass material or a ceramic material or in stainless steel;
- and/or said 1st planar surface and said 2nd planar surface have a roughness of between 0,4 μm and 0,8 μm.

[0020] In any embodiment of a hydraulic distributor according to the invention, said 1st portion can comprise at least 3 conducts, each comprising an opening in said 1st planar surface, so that said channel, which guides or conducts a fluid in a direction substantially parallel to said 2nd planar surface or to said 1st planar surface, connects:

- in said first position, at least a first pair of said at least 3 conducts;
- and, in said second position, another at least another pair of said at least 3 conducts.

[0021] A hydraulic distributor according to the invention can comprise a plurality of channels extending in said 2nd portion, or at least partly in said 2nd planar surface, to conduct a fluid in at least two different directions substantially parallel to said 2nd planar surface.

[0022] In a hydraulic distributor according to the invention, said means for moving both portions with respect to each other can comprise a motor, for example an electric or hydraulic or pneumatic motor.

[0023] The invention also concerns an ink jet printer comprising a print head and an ink supply circuit, said ink supply circuit comprising at least one hydraulic distributor according to the invention.

[0024] The invention also concerns a method for operating an inkjet printer according to the invention, in particular according to at least one of the embodiments described above or in this application.

[0025] Said method can comprise moving both portions of said at least one hydraulic distributor with respect to each other between said first positions and said second position, so that:

* in said first position, at least both the 1st opening (or the 1st duct or conduct) and the 2nd opening (or the 2nd duct or conduct) are connected together or open in at least one channel and a fluid, for example ink and/or solvent, flows from one of said opening to the other of said openings, possibly at least partly through at least one of said channel(s) in a direction substantially parallel to said 2nd planar surface or said 1st planar su rface;
* and, in said second position, at least one of said 1st opening and 2nd opening are not connected together or does not open in said at least one channel, and no fluid can flow from one opening or duct or conduct to the other one.

[0026] Or said method can comprise moving both portions of said at least one hydraulic distributor with respect to each other between said first positions and said second position, so that:

* in a first position, the 1st opening or the 1st duct or conduct and the 2nd opening or the 2nd duct or conduct are directly connected to each other, and a fluid can flow from one of them directly to the other one;
* and, in a second position, said 1st opening or 1st duct or conduct and said 2nd opening or 2nd duct or conduct are not connected to each other, and no

fluid can flow from one of them to the other one.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] Example embodiments of the invention will now be described with reference to the appended drawings among which:

Figures 1A and 1B represent different views of a hydraulic distributor according to the invention;
Figures 1C and 1D show another embodiment of a hydraulic distributor according to the invention;
Figure 1E shows an embodiment inserted in a guiding cylinder.
Figures 2A and 2B show further details of a hydraulic distributor according to the invention.
Figures 3A and 3B show two positions of a hydraulic distributor according to the invention.
Figure 4 shows an example of a hydraulic distributor according to the invention, forming a shutter;
Figures 5A and 5B show another example of a hydraulic distributor according to the invention, comprising 6 ducts and 2 connecting channels;
Figures 6A - 9B show different relative positions of the two portions of a hydraulic distributor according to the invention;
Figures 10A and 10B show an example of a linear hydraulic distributor according to the invention.
Figure 10C shows an example of a linear hydraulic distributor in a guiding structure.
Figures 11A and 11B represent different views of two parts of a portion of a hydraulic distributor according to the invention, assembled to form an inside channel.
Figure 12 shows an embodiment wherein the second portion includes two inside channels.
Figures 13A and 13B represent different views of another embodiment of a hydraulic distributor according to the invention, wherein the second portion includes through ducts.
Figures 14A - 14B represent assembling steps of a hydraulic distributor according to the invention.
Figure 14C represents a hydraulic distributor according to the invention assembled in a body of a printer.

[0028] Similar or identical technical elements are designated by the same reference numbers on the different figures.

DETAILED PRESENTATION OF EMBODIMENTS OF THE INVENTION.

[0029] A first example of an embodiment of a hydraulic distributor according to the invention is illustrated on figures 1A-2B.

[0030] It comprises:

- A first portion 2, which has a flat surface 4 and which comprises 3 though conducts or ducts 6 which open in said surface 4;
- A second portion 8, which has a flat surface 10 and which comprises a channel 12 (figure 1B) which extends in said surface 10.

[0031] When the device is assembled, both flat surfaces 4, 10 are in friction contact with each other: they can be rotated relative to each other but remain in contact during the rotation. No fluid can flow out of the device between both surfaces: the contact at the interface between both surfaces is watertight. A device according to the invention does not require any gasket.

[0032] Means 30, such as a spring, can be used to press both surfaces against each other.

[0033] The first portion rests on a support 11 on which it can be maintained in a fixed position; each of the first portion and the support can comprise means 13 (figure 2B), 14 (figure 1B) which cooperate with each other to keep the first portion in a fixed position.

[0034] In this example both portions 2, 8 have a cylindrical shape, but other shapes are possible, as described below in connection with figures 10A-10C.

[0035] In an embodiment, the hydraulic distributor comprises a shaft 20 which extends along an axis of rotation to rotate portion 8 with respect to portion 2.

[0036] A handle 27 is represented on figures 2A and 2B to manually control said shaft. Alternatively, said shaft can be controlled by a motor (as explained below in connection with figures 14A-14C), which itself can be controlled by the controller of a printer.

[0037] A cover 25 can cover the two portions (figure 2B): one end of the shaft 20 rises above the top surface of the cover so that it can be connected to a handle 27 or to any transmission mechanism from a motor.

[0038] Figures 1C and 1D show a variant of figure 1A and 1B. Like on figures 1A and 1B:

- the first portion 2 comprises 3 though conducts or ducts 6 which open in the surface 4;
- the second portion 8 comprises a channel 12 which extends in surface 10.

[0039] In this embodiment, the surface of the second portion opposed to surface 10 comprises several holes 21 which can accommodate studs of a tool or of a driving section (see figures 14A-14B), to rotate the second portion 8 with respect to the first portion 2. Thus, a central shaft which traverses through the second portion is not needed.

[0040] Both first and second portions can be guided in rotation in a guiding cylinder 37, as illustrated on figure 1E, fluid entering the distributor through one of said ducts 6, then flowing along said channel 12 and leaving the distributor through another one of said ducts 6.

[0041] Another example of portions guided in rotation is illustrated on figures 14A-14C and commented below.

[0042] As illustrated on figure 1E, the hydraulic distrib-

utor of figures 1C and 1D can be inserted in guiding cylinder 37, which guides both portions 2, 8 with respect to each other, portion 2 being maintained fixed with help of means (like means 13, 14 described above) not illustrated on the figure.

[0043] The arrows show how the fluid flows into the distributor through duct 6_1, then flows in or through the channel 12 and flows out of the distributor through duct 6_2. In a variant (not represented on figure 1E), the portion 2 has 3 through ducts, which are connected together in a certain relative position of both portions 2, 8.

[0044] Figures 3A and 3B show surface 4 of the first portion (which comprises 3 through ducts 6_1 - 6_3) and surface 10 of the second portion (which comprises one channel 12); as illustrated on figures 3A and 3B (on which hole 14 is not represented):

* in a first position (figure 3A), a first pair of ducts 6_1, 6_2 open in said channel 12; a 1st fluid can circulate from duct 6_1 to duct 6_2 (or from one duct of said first pair of ducts to the other duct) through said channel 12; no fluid can circulate from duct 6_1 to duct 6_3;
* and, in a second position (figure 3B), a second pair of ducts 6_1, 6_3 open in said channel 12; a 2nd fluid can circulate from duct 6_1 to duct 6_3 (or from of one duct of said second pair of ducts to the other duct) through said channel 12, but the 1st fluid can no longer circulate from duct 6_1 to duct 6_2.

[0045] In any embodiment of a device according to the invention, a spring 30 can be used to press said first portion 2 against said second portion 8.

[0046] Fig.4 shows a simpler example of a hydraulic distributor (actually a hydraulic shutter) according to the invention, the first portion 2 comprising two through ducts 6_1, 6_2 and the 2nd portion 6 having one channel 12. In a first position of the 2nd portion, the channel 12 connects both ducts 6_1, 6_2 and the fluid can circulate from one of said ducts to the other one. In a second position (not represented) of the 2nd portion, the channel 12 does not connect ducts 6_1, 6_2 together and the fluid circulation is stopped.

[0047] Fig. 5A and 5B show an example of a hydraulic distributor according to the invention, the first portion 2 comprising 6 through ducts 6_1 - 6_6 and the 2nd portion 8 having 2 channels 12_1, 12_2.

[0048] Figure 6A (resp.7A, 8A, 9A) shows the surface 10' of the second portion 8 opposed to surface 10; this surface 18 comprises several holes 21 as explained above to drive the second portion with respect to the first portion.

[0049] Figure 6B (resp.7A, 8A, 9A) shows the surface 10 of the second portion 8 which comprises the 2 channels 12_1, 12_2.

[0050] 4 different relative positions of the both portions are illustrated on figures 6A-9B to connect different pairs or series of through ducts 6_1 - 6_6.; figures 6B, 7B, 8B, 9B show the different positions of the 2 channels 12_1, 12_2 and the projection on surface 10 of the positions of the ducts 6_1 - 6_6:

- in figures 6A and 6B, channel 12_2 connects through ducts 6_3 and 6_6 and channel 12_1 connects through ducts 6_2 and 6_1;
- in figures 7A and 7B, channel 12_1 connects through ducts 6_1, 6_5 and 6_4 (thus allowing flow from one of said 3 ducts 6_1, 6_5 and 6_4 to the two other ducts or a flow from two of said ducts to the third one) and channel 12_2 connects through ducts 6_2 and 6_6;
- in figures 8A and 8B, channel 12_1 connects through ducts 6_3 and 6_4 and channel 12_2 connects through ducts 6_1, 6_5 and 6_6 (thus allowing flow from one of said 3 ducts 6_1, 6_5 and 6_6 to the two other ducts or a flow from two of said ducts to the third one);
- in figures 9A and 9B, channel 12_1 connects through ducts 6_3 and 6_2 and channel 12_2 connects through ducts 6_4 and 6_6.

[0051] The above example of Fig. 5A and 5B, and those of figures 7A-B and 8A-B, shows that, in one or more relative position of both portions, a hydraulic distributor according to the invention can connect more than two ducts together.

[0052] A linear hydraulic distributor according to the invention is disclosed in connection with fig.10A-11; like the circular device disclosed above, it can have any number of through ducts 6, and any number of appropriate channels to establish the required connections between the through ducts in the different relative positions of the two portions 2, 8.

[0053] As illustrated on figures 10A and 10B, a linear hydraulic distributor according to the invention implements a relative translation of the 2 portions rather than a rotation.

[0054] Both portions can be maintained by lateral guiding walls 47 guiding the translation of one portion of said hydraulic distributor with respect to the other; this translation can be actuated by an actuating link or a button or by a motor, for example an electric or hydraulic or pneumatic motor, coupled to one of the portions 108, 102

[0055] A spring can be used between one of the guiding walls, parallel to the direction of the translation to press said both portions of said hydraulic distributor against each other.

[0056] In the above examples:

- both portions are preferably made of a glass material (which can be polished) or a ceramic material; one example of such material is alumina (Al_2O_3) but other ceramic materials are possible; another example of material is stainless steel (which can also be polished);
- and/or the surfaces 4, 10 (resp.104, 110) have a roughness between 0,4 and 0,8 μm, which favours the water tightness of the system.

[0057] In the above examples, a channel 12 opens at least partly or is at least partly comprised in the surface 10. In another embodiment, said channel is made inside said 2nd portion and does not appear in the surface 10 of said 2nd portion.

[0058] Figures 11A and11B shows an example of a second portion made by assembling two parts 8_1, 8_2, to form an inside channel 12a, which can be connected to any of the main surfaces 10, 10' by one or more ducts 121, 122 which extend substantially perpendicularly to said surfaces 10, 10'. In certain positions of the two portions 2, 8b Both ducts 121 and 122 can cooperate with ducts 6 of figures 1A-1D: for example, a fluid flows from the first portion 2 into the second portion 8 through duct 121, then flows through channel 12a and flows out of second portion 8 through duct 122 and then flows back to the 1st portion.

[0059] Figures 11A-11B show only one inside channel but several channels 12_1, 12_2 can be made inside the second portion, each comprising one or more duct(s) to connect with surface 10 and/or with surface 10'.

[0060] Figure 12 shows 2 inside channels 120_2, 120_2 distributed like those of figure 5A but made inside the second portion by assembling two parts 8_1, 8_2 as explained above. Each channel has its own ducts 121_1, 122_1 and 121_2, 122_2 to communicate with the surface 10 and/or with surface 10'.

[0061] Assembling the two parts 8_1, 8_2 can be made by gluing or soldering said two parts after aligning them so that both half channels 12_1, 12_2 can form a single channel 12a. There is an assembly plane between said two part.

[0062] Inside channels like those illustrated on figures 11A - 12 offer the advantage of avoiding any edge 12s, 12's' (see figure 1C) on the surface which is in contact with surface 4 of the 1st portion 2 of the device; indeed, dirt and/or ink can be deposited at these edges and dry, which can pose problems of tightness of both contacting surfaces 4, 10. An inside channel can be easily cleaned by a flow of solvent.

[0063] In the above examples, any of the ducts 6, 6_1-6_5, 106, 106_1-106_4 and/or of the channel(s) 12, 12_1-12_2, 112_1-112_3 can have a diameter of up to 2 mm or more, allowing important flow rates, up to 10 l/h or 15 l/h or even more, for example 20 l/h or 100 l/h. Some solenoid valves are compatible with such flow rates, but they are bulky, heavy and expensive.

[0064] In the above examples of figures 11A - 12, the second portion 8 of the device comprises at least one inside channel in which a fluid can flow parallel to surface 10 or 10'.

[0065] In another embodiment, illustrated for example on figures 13A-13B, the second portion 8 has one or more ducts or through ducts 60_1, 60_2 but has no channel for a flow parallel to surface 10 or 10'. Depending on the rotation of portion 8 with respect to portion 2, one or more ducts or through ducts 60_1, 60_2 can be aligned or not with one or more duct(s) 6_1 - 6_3 of the first portion 2; thus, a flow a fluid to flow from one side of the device to the other or from one or more duct(s) 6_1 - 6_3 of the first portion 2 directly to one or more ducts 60_1, 60_2 of the other portion 8.

[0066] This embodiment can also include, in addition, one or more channel(s) 12, 12_1, 12_2 like illustrated on figures 1A-9B or 112_1-112_3 (linear embodiment), and/or one or more inside channel(s) 12a, 12a1, 12a2 like illustrated on figures 11A-12. Thus, a fluid can also flow partly parallel to surface 10 or 10'.

[0067] Assembling steps of a device according to the invention are illustrated on figures 14A-14B.

[0068] A driving section 40 has 2 parallel surfaces 40' and 40". It comprises studs 41 distributed on one of said surface 40' to penetrate into holes 21 of second section 8.

[0069] The other main surface 40" of said driving section 40 comprises a drive shaft 43s.

[0070] A pressure spring 31 presses on the driving section of the hydraulic distributor when the device is assembled and accommodated in a hole 51 of a body 50 (figure 14C), said spring being compressed between said driving section 43 and an end plate 52 of the body 50 which closes the hole 51. The driving shaft 43s traverses the plate 52 through a central hole 52_h. A motor (not illustrated on the figure), for example an electric or hydraulic or pneumatic motor, can drive the shaft 43s, and the second portion 8, in rotation, to change the position of the channel 12 with respect to the first portion, thus varying the fluid communication of the distributor, for example as illustrated on figures 3A and 3B.

[0071] A device according to the invention is adapted to a printer comprising a single-nozzle or a multi-nozzle ink jet print head, as represented on figures 1 and 17 of EP 17186002.

[0072] A device according to the invention is implemented in any part of a fluid circuit of a CIJ printer, to replace any known valve, in particular any solenoid valve.

[0073] In particular a device according to the invention can be positioned upstream of any pump which pumps ink or solvent from an ink tank or from an ink cartridge or from a solvent tank or cartridge and which is to be sent to a main tank or to a print head of a CIJ printer.

[0074] Alternatively, it can be positioned downstream of any pump which pumps ink or solvent, with a pressure of fluid circulating in said pump of up to several bars, for example 3 or 5 bars.

[0075] A device according to the invention can be operated so as to guide a flow of fluid, for example ink and/or solvent of an ink jet printer:

- from at least one duct or inlet duct,
- then possibly through a channel like channel 12, 112, thus flowing partly parallel to surface 10 or 10';
- and then through at least another duct or outlet duct.

[0076] The fluid flow rate can be comprised between 1l/h or 5 l/h and 10 l/h or 15 l/h or even more, for example 20 l/h or 100 l/h.

[0077] The pressure of fluid circulating in a device according to the invention can be higher than 1 or 2 bars, and up to several bars, for example less than 3 or 5 bars or even 10 bars.

[0078] Said fluid can be pumped by a pump of an ink circuit of a CIJ printer.

Claims

1. Hydraulic distributor for an ink-jet printer, comprising:

   - a first portion (2, 102), comprising at least one 1st planar surface (4, 104), a second portion (8, 108), comprising at least one 2nd planar surface (10, 110), both planar surfaces being in friction contact with each other;
   - at least one 1st conduct (6, 6_1 - 6_6, 106_1 - 106_4) in said 1st portion, each comprising a 1st opening in said 1st planar surface;
   - at least one channel (12, 12_1 - 12_2; 112_1 - 112_4) extending in said second portion (8, 108), to conduct a fluid in a direction substantially parallel to said 2nd planar surface;
   - at least one 2nd conduct in one of said portions, comprising a 2nd opening in said 1st planar surface or in said 2nd planar surface or in said at least one channel;
   - means (22, 27) for moving both portions with respect to each other, so that:

     * in a first position, at least both the 1st opening and the 2nd opening open in said at least one channel and are connected through said at least one channel;
     * and, in a second position, one of said 1st opening and 2nd opening does not open in said at least one channel, and are not connected through said at least one channel.

2. Hydraulic distributor according to claim 1, said at least one channel (12, 12_1 -12_2; 112_1 -112_4) extending in said 2nd planar surface.

3. Hydraulic distributor according to claim 1 or 2, said means (22, 27) for moving both portions with respect to each other being able to move at least one of said portions circularly around an axis perpendicular to both said 1st planar surface and said 2nd planar surface.

4. Hydraulic distributor according to claim 3, said means for moving both portions with respect to each other comprising a rotating shaft (22), which extends along said axis.

5. Hydraulic distributor according to claim 4, one end of said shaft being inserted in a hole in said 2nd portion.

6. Hydraulic distributor according to claim 5, each of said shaft and said hole comprising a flat surface (22, 24) which extends parallel to said axis and which cooperate which each other to rotate both said shaft and said 2nd portion.

7. Hydraulic distributor according to claim 1 or 2, said means for moving both portions with respect to each other being able to move at least one of said portions in translation along an axis parallel to both said 1st planar surface and said 2nd planar surface.

8. Hydraulic distributor according to any of claims 1 to 7, further comprising means (30), for example a spring, for pressing said 1st planar surface and said 2nd planar surface against each other.

9. Hydraulic distributor according to any of claims 1 to 8, said 1st portion comprising at least 2 or 3 conducts, each comprising an opening in said 1st planar surface.

10. Hydraulic distributor according to any of claims 1 to 9, said 1st planar surface and said 2nd planar surface:

    - being made of glass material or of a ceramic material or of stainless steel;
    - and/or having a roughness of between 0,4 μm and 0,8 μm.

11. Hydraulic distributor according to any of claims 1 to 10, said 1st portion comprising at least 3 conducts, each comprising an opening in said 1st planar surface, so that said channel connects, in said first position, a first pair of said at least 3 conducts and, in said second position, another pair of said at least 3 conducts.

12. Hydraulic distributor according to any of claims 1 to 11, comprising a plurality of channels extending in said 2nd planar surface, to conduct a fluid in at least two different directions substantially parallel to said 2nd planar surface.

13. Hydraulic distributor according to any of claims 1 to 12, said means for moving both portions with respect to each other comprising a motor.

14. An ink jet printer comprising a print head and an ink supply circuit, said ink supply circuit comprising at least one hydraulic distributor according to any of claims 1 to 13.

15. A method for operating an inkjet printer according to claim 14, comprises moving both portions of said at

least one hydraulic distributor with respect to each other between said first positions and said second position, so that:

* in said first position, both the 1st opening and the 2nd opening open in said at least one channel and a fluid, for example ink and/or solvent, flows from one of said opening to the channel and then to the other of said openings;
* and, in said second position, one of said 1st opening and 2nd opening does not open in said at least one channel, and no fluid flows from one of said openings to the other one.

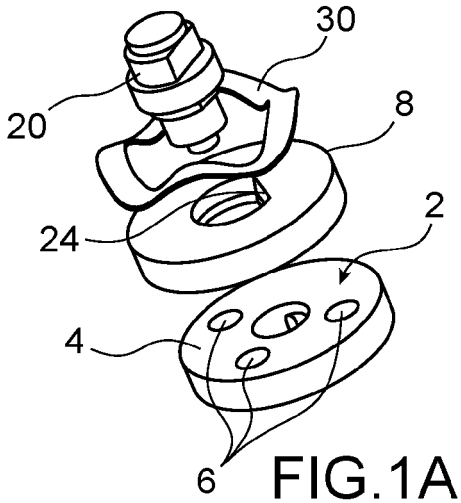


FIG.1A

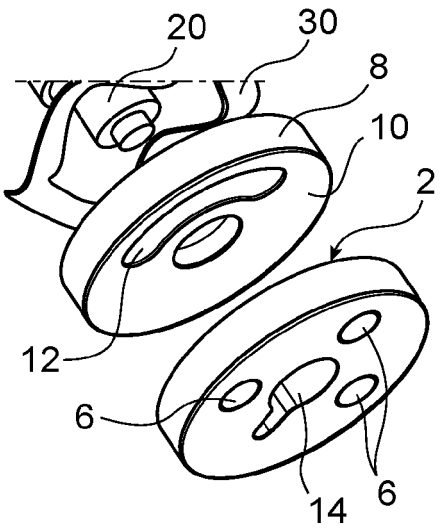


FIG.1B

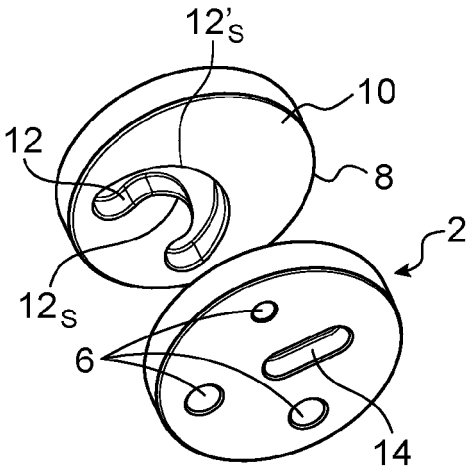


FIG.1C

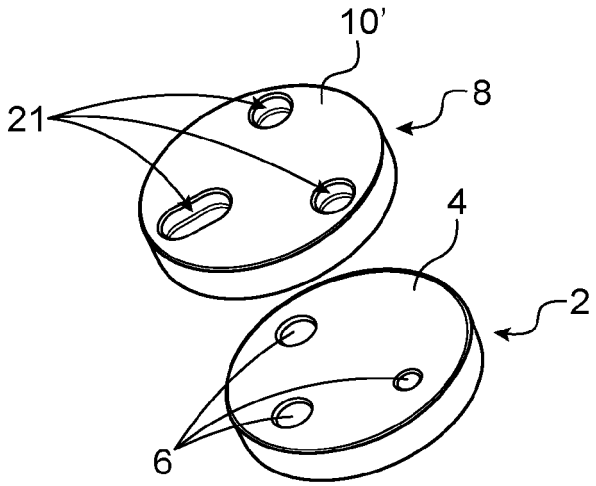


FIG.1D

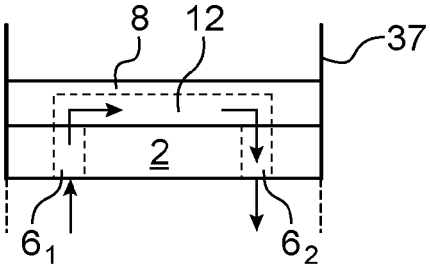


FIG.1E

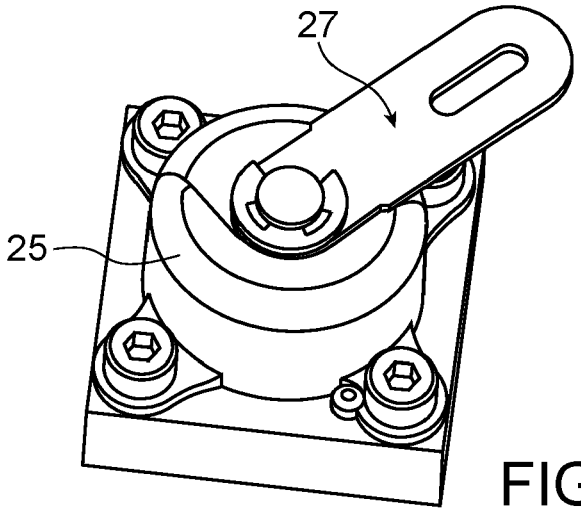


FIG.2A

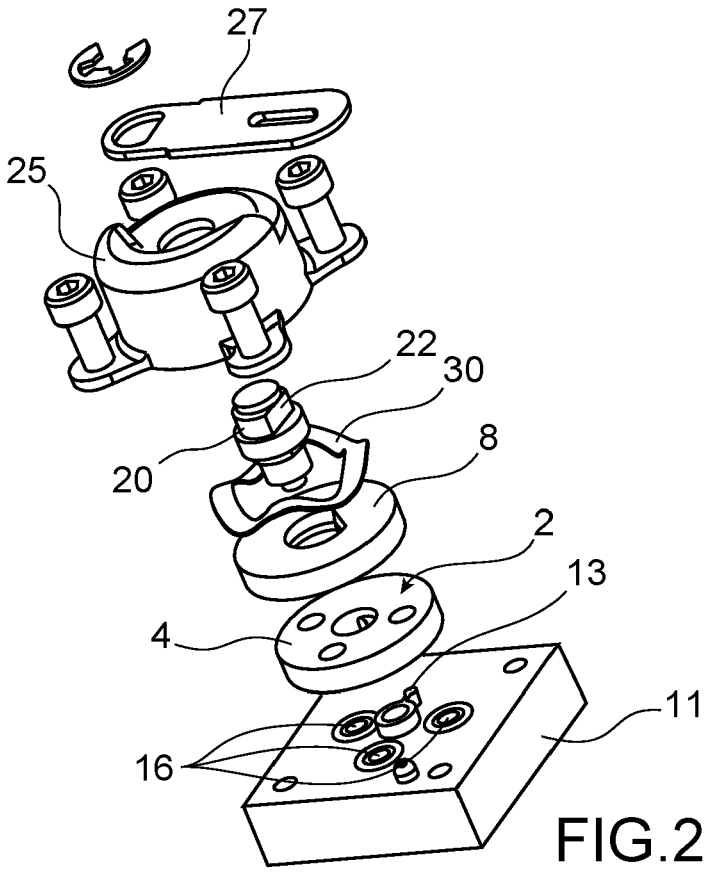
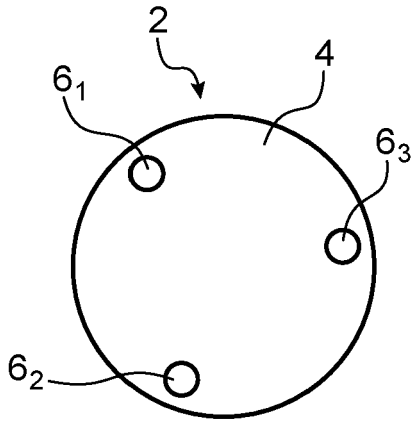


FIG.2B



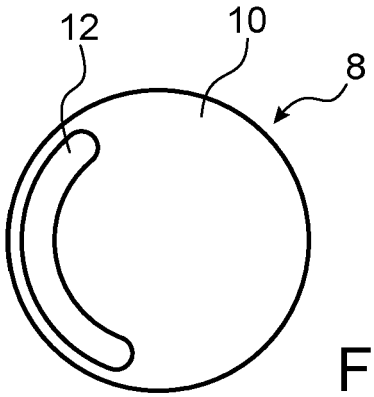
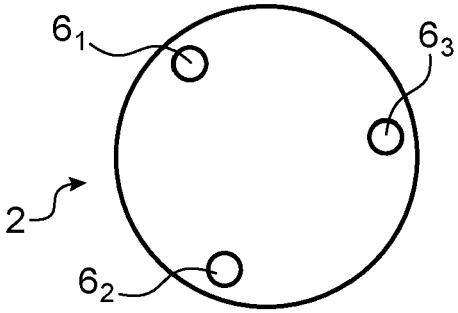


FIG.3A



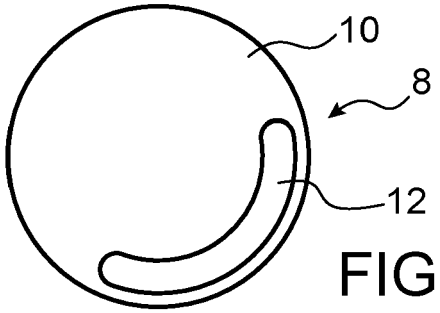
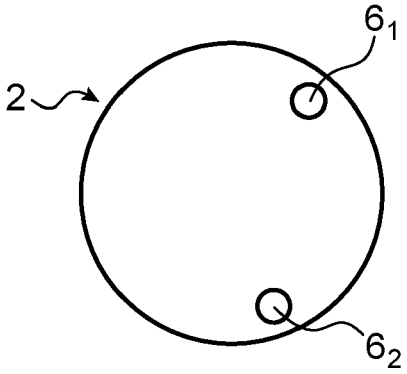


FIG.3B



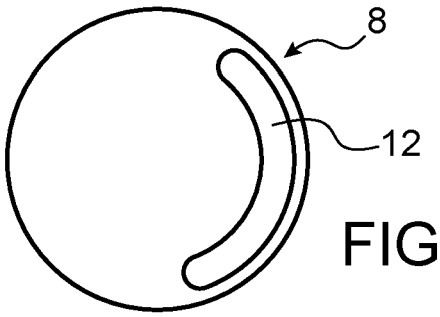


FIG.4

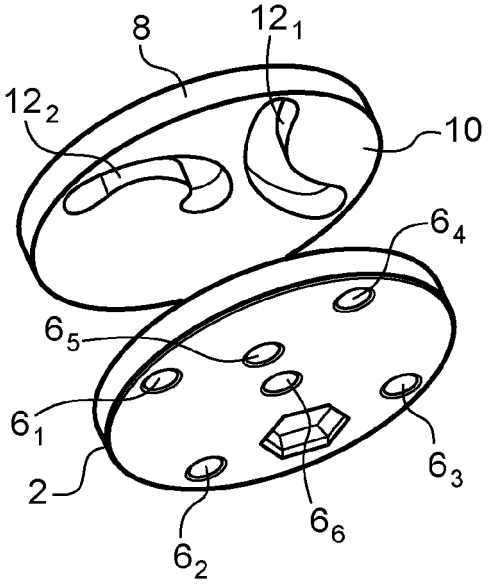


FIG.5A

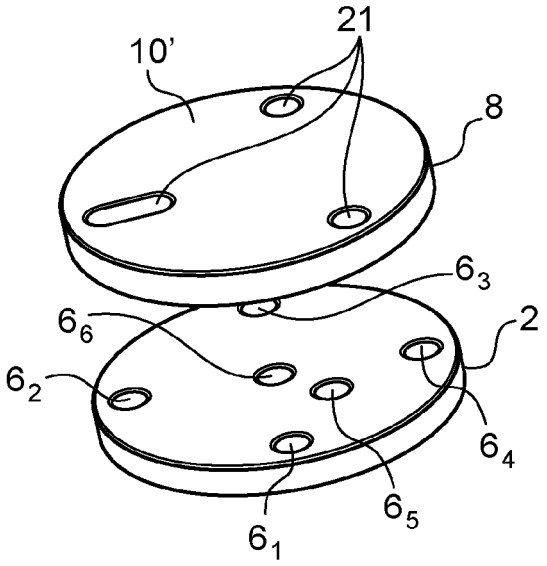


FIG.5B

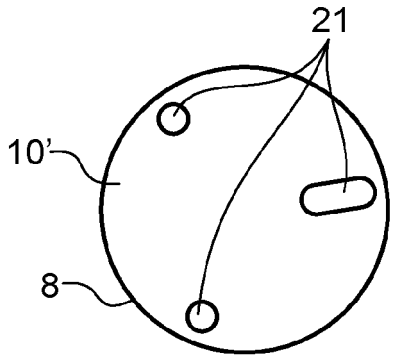


FIG.6A

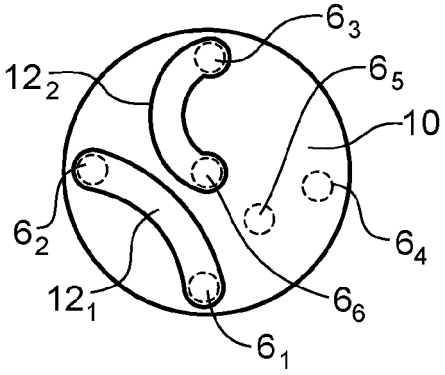


FIG.6B

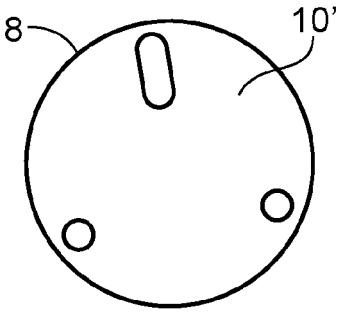


FIG.7A

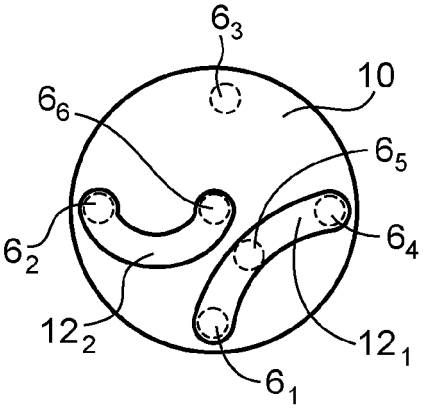


FIG.7B

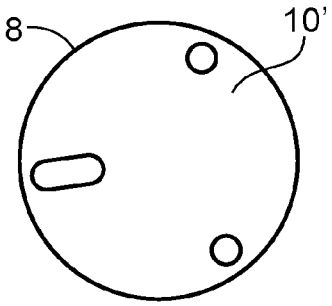


FIG.8A

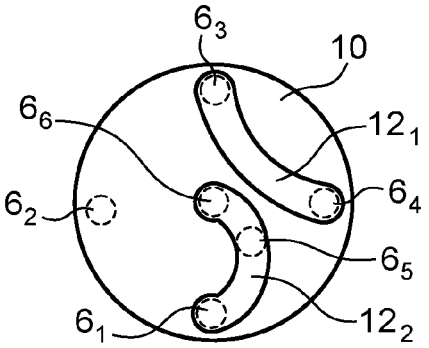


FIG.8B

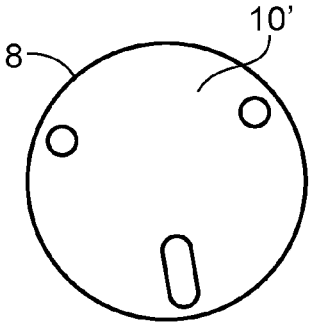


FIG.9A

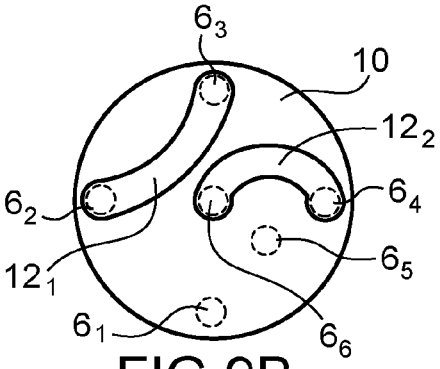


FIG.9B

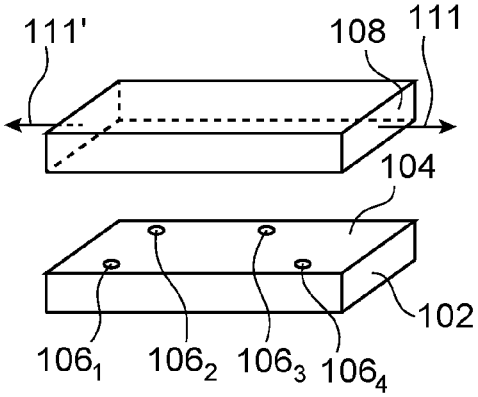


FIG.10A

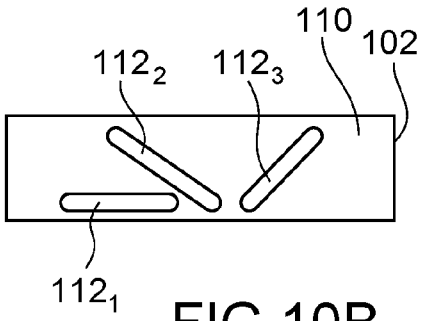


FIG.10B

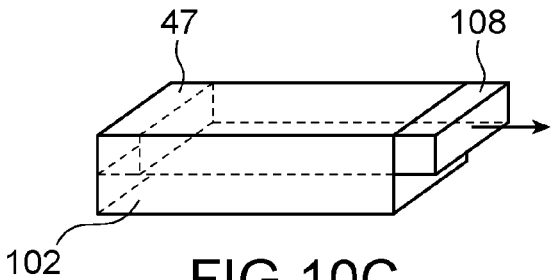


FIG.10C

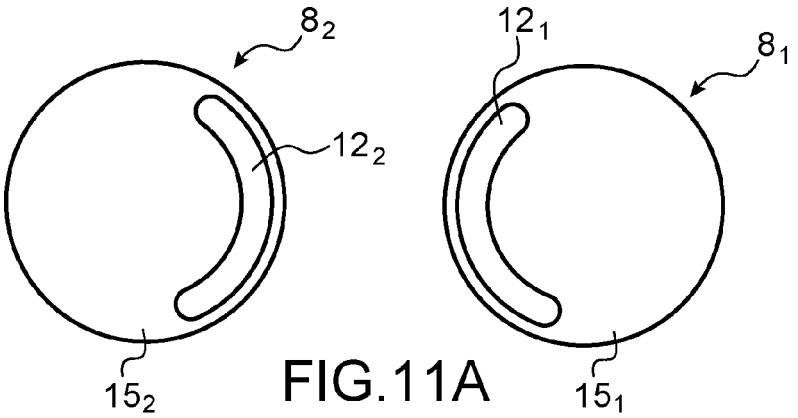


FIG.11A

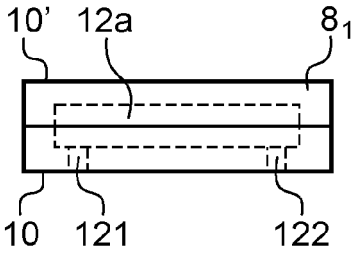


FIG.11B

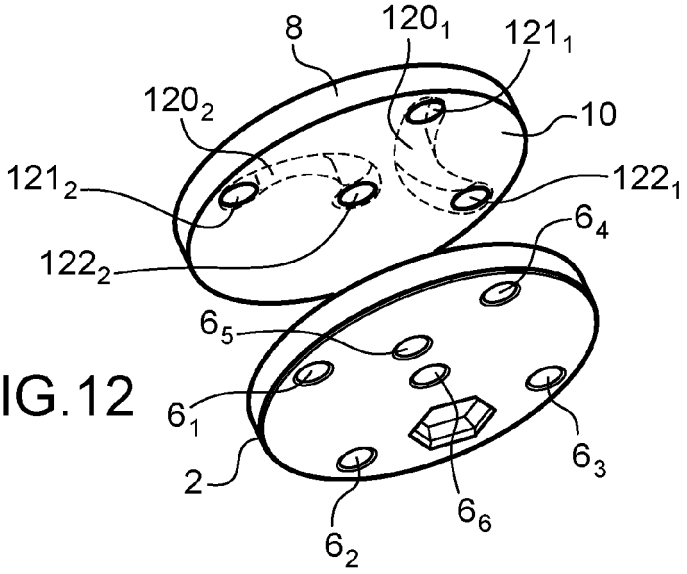


FIG.12

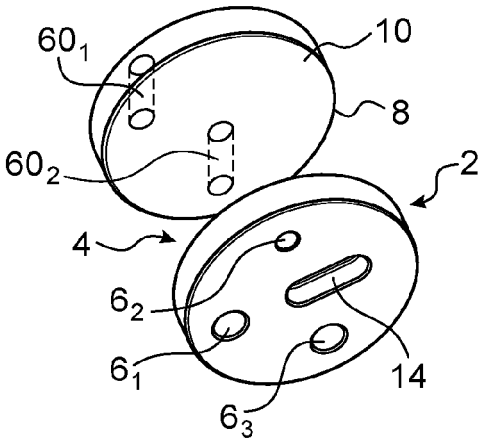


FIG.13A

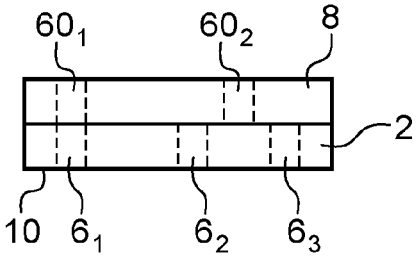
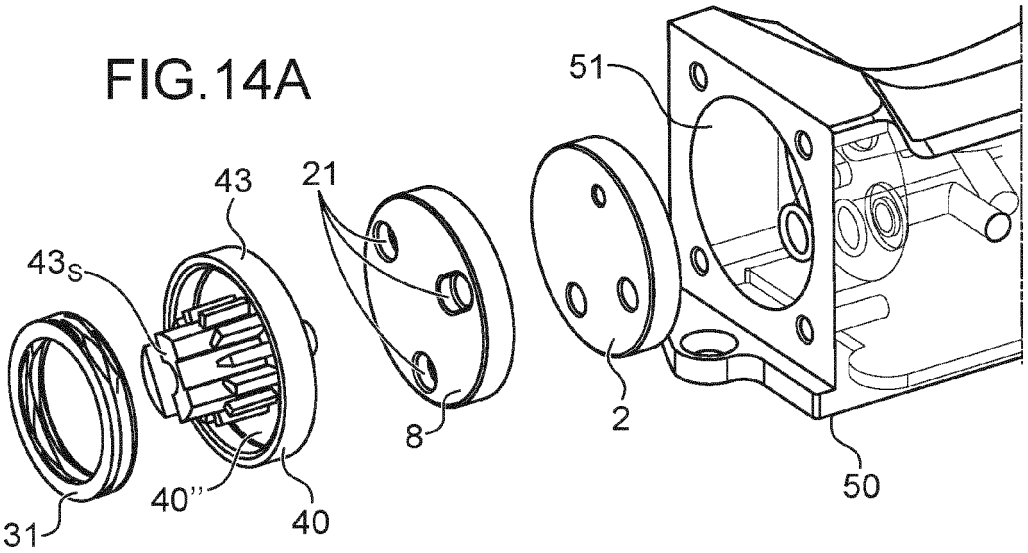


FIG.13B

FIG.14A



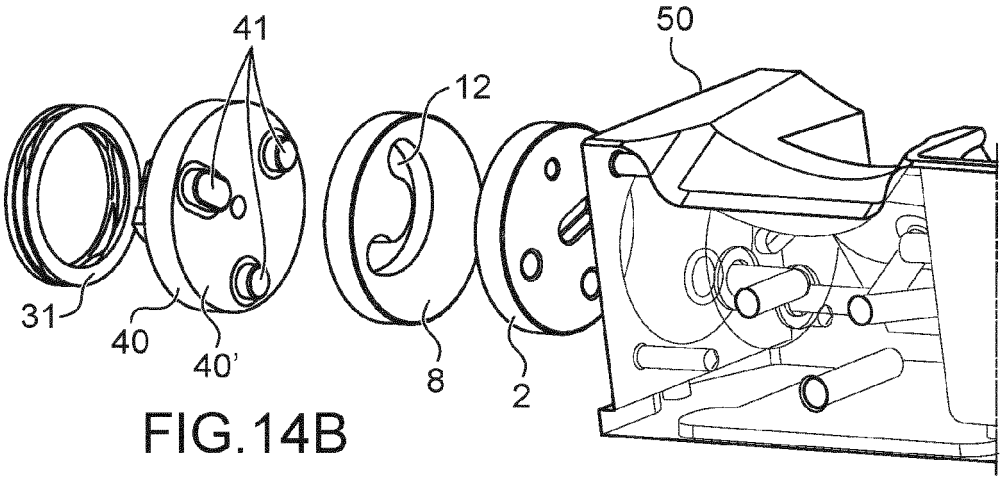


FIG.14B

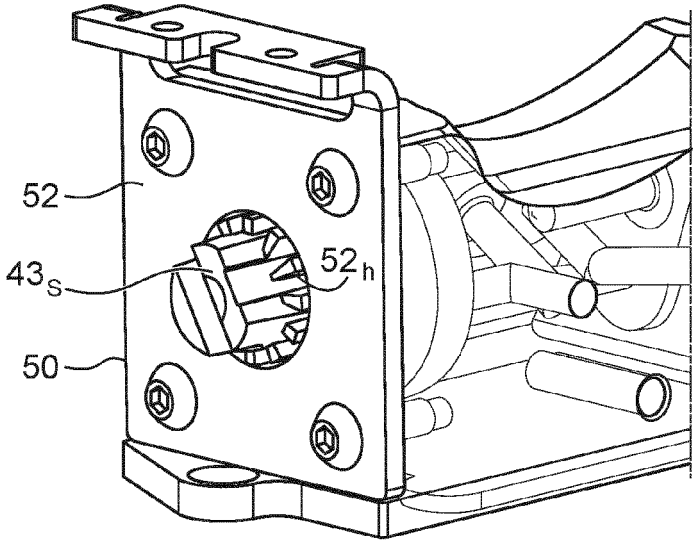


FIG.14C

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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 7 393 088 B2 (BROTHER IND LTD [JP]) 1 July 2008 (2008-07-01) * column 7, line 6 - column 9, line 65; figures 2, 3, 4a, 4b * * column 10, lines 3-16 *	1-15	INV. B41J2/175
X	US 2007/091152 A1 (RADEMAKERS ALBERT W [NL] ET AL) 26 April 2007 (2007-04-26) * paragraphs [0038] - [0044]; figures 5, 6, 9, 10 *	1,15	
X	US 2009/122121 A1 (KAWASAKI MASAYUKI [JP] ET AL) 14 May 2009 (2009-05-14) * figure 4 *	1,15	
X	US 6 874 876 B2 (SEIKO EPSON CORP [JP]) 5 April 2005 (2005-04-05) * column 39, line 28 - column 40, line 25; figure 32a *	1,15	
A	US 2009/295884 A1 (NISHIMORI TAKEHIRO [JP]) 3 December 2009 (2009-12-03) * paragraphs [0087], [0091], [0095] - [0097]; figures 9-14 *	1,15	TECHNICAL FIELDS SEARCHED (IPC) B41J
A	US 10 189 268 B2 (DOVER EUROPE SARL [CH]; DOVER EUROPE SARL [CH]) 29 January 2019 (2019-01-29) * column 11, line 59 - column 13, line 27; figures 6a, 6b, 7a, 7b *	1,15	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 June 2021	Adam, Emmanuel

CATEGORY OF CITED DOCUMENTS

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7393088 B2	01-07-2008	CN 1715057 A	04-01-2006
		CN 200970928 Y	07-11-2007
		EP 1607224 A1	21-12-2005
		JP 4321370 B2	26-08-2009
		JP 2005349786 A	22-12-2005
		US 2005275699 A1	15-12-2005
US 2007091152 A1	26-04-2007	AT 431253 T	15-05-2009
		CN 1951698 A	25-04-2007
		JP 5063077 B2	31-10-2012
		JP 2007112130 A	10-05-2007
		US 2007091152 A1	26-04-2007
US 2009122121 A1	14-05-2009	NONE	
US 6874876 B2	05-04-2005	AT 447488 T	15-11-2009
		AT 552980 T	15-04-2012
		AT 554936 T	15-05-2012
		AU 2708301 A	31-07-2001
		CN 1358137 A	10-07-2002
		CN 101372176 A	25-02-2009
		CN 101386229 A	18-03-2009
		CN 101386230 A	18-03-2009
		EP 1164025 A1	19-12-2001
		EP 2052862 A1	29-04-2009
		EP 2052863 A1	29-04-2009
		EP 2055489 A1	06-05-2009
		EP 2105308 A1	30-09-2009
		ES 2334100 T3	05-03-2010
		ES 2382127 T3	05-06-2012
		ES 2383777 T3	26-06-2012
		ES 2386656 T3	24-08-2012
		HK 1044911 A1	08-11-2002
		KR 20020012160 A	15-02-2002
		KR 20040007752 A	24-01-2004
		KR 20040007753 A	24-01-2004
		KR 20040014587 A	14-02-2004
		US 2002196312 A1	26-12-2002
		US 2003071874 A1	17-04-2003
		US 2006028517 A1	09-02-2006
		US 2007195140 A1	23-08-2007
		WO 0153104 A1	26-07-2001
US 2009295884 A1	03-12-2009	JP 2009286033 A	10-12-2009
		US 2009295884 A1	03-12-2009

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 10189268 B2	29-01-2019	US 2016375696 A1	29-12-2016
		US 2018134044 A1	17-05-2018

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Patent documents cited in the description

- EP 17186002 A **[0071]**