(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 584 082 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.12.2019 Bulletin 2019/52

(51) Int Cl.:
B41F 35/02 *(2006.01)* ***B41F 35/04*** *(2006.01)*
B08B 1/00 *(2006.01)*

(21) Application number: **19180706.4**

(22) Date of filing: **17.06.2019**

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

(30) Priority: **18.06.2018 IT 201800006425**

(71) Applicant: **Simec Group S.r.l.**
21057 Olgiate Olona (VA) (IT)

(72) Inventor: **DELLA TORRE, Emilio Alberto**
21057 Olgiate Olona (VA) (IT)

(74) Representative: **Mannucci, Michele et al**
Ufficio Tecnico
Ing. A. Mannucci S.r.l.
Via della Scala, 4
50123 Firenze (IT)

(54) **DEVICE FOR CLEANING CYLINDRICAL ROLLERS, MACHINE COMPRISING SAID DEVICE, AND CLEANING METHOD**

(57) The cleaning device (20) for cleaning a cylindrical roller (50), for example an anilox roller of a printing machine, comprises a cleaning head (30) with a cleaning chamber (110), in which there is housed a mechanical cleaning member (60), and with which feeding members (70) for feeding a cleaning liquid into the cleaning chamber (110) are associated. The mechanical member (60) and cleaning liquid dispensed by the feeding members (70) work in combination inside said cleaning chamber (110) to clean the lateral surface of the roller (50)

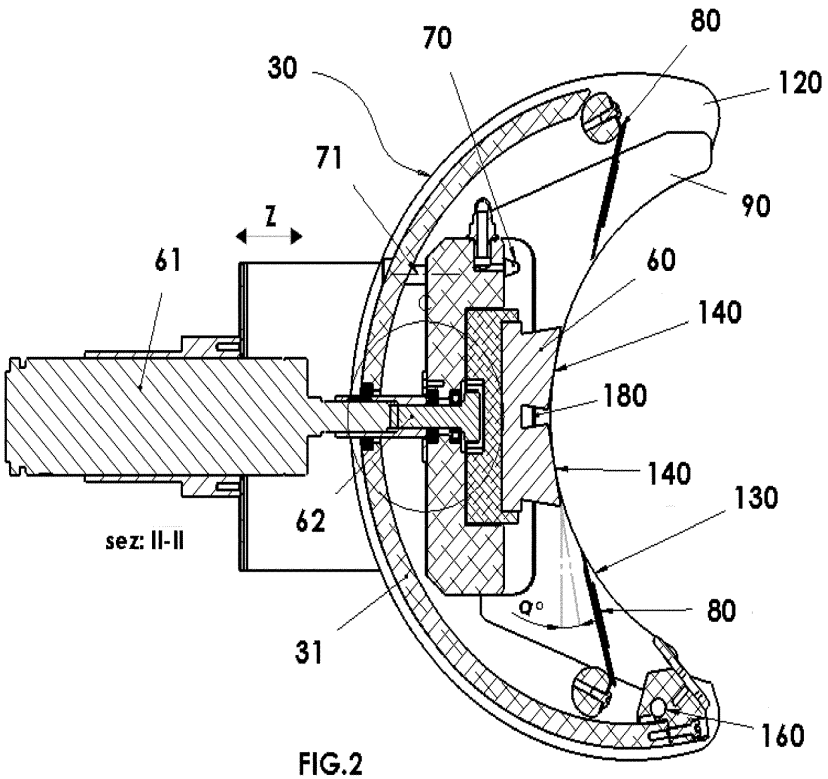

FIG.2

EP 3 584 082 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a device for cleaning cylindrical rollers, with smooth or engraved surfaces, in particular rollers for printing machines, fluid transfer rollers or the like, such as anilox rollers, cliché rollers, spreader rollers, finishers, laminators or other.

[0002] The invention also relates to a method for cleaning a roller.

BACKGROUND ART

[0003] Machines for printing web materials, such as, but not limited to, plies of tissue paper, are subject to frequent downtimes to allow cleaning of the rollers, as ply material tends to easily deposit small particles or fibers of material that, being in contact with the printing liquid (ink), soil or fill the small cells that transfer the ink.

[0004] These cells, which form the outer surfaces of the transport roller (also called anilox roller), must be kept clean and free from deposits, in order to best perform their function.

[0005] In fact, the liquid transferred, also becoming contaminated with debris from the web material to be printed, tends to stratify inside the cells used to transport the liquid, thereby reducing their capacity. This leads to a variation of the technical and/or visual features of the web material, for example due to a decrease in the density of the printing ink.

[0006] The frequent halts in the production line required to clean the rollers represent the main reason for loss of efficiency of the line.

[0007] Depending on the application field and type of printing machine, the characteristics of the rollers can vary, as can their structure. Therefore, machines have been designed that allow rapid removal of the rollers, in this way allowing them to be washed and cleaned off-line.

[0008] In other cases, situations can occur in which the removal of the roller would require very long disassembly, cleaning and reassembly times, for example in the field of rollers for processing corrugated cardboard.

[0009] Due to this variability, cleaning systems that operate off-line, i.e., systems in which the roller to be cleaned is disassembled from the production machine, as well as cleaning systems that are installed in-line, i.e., on the production machine, have been developed.

[0010] The cleaning systems currently available on the market can be summarized as follows:

[0011] manual systems with brushes, which allow the operator to clean the roller by rubbing it with the addition of chemical products. These systems do not guarantee the uniformity of the process and frequently do not comply with the current safety regulations;

[0012] Sodium bicarbonate systems, both in-line and off-line versions. These are efficient as regards the process, but very complex as regards management of the machine and of the product (*baking soda*) used, not always available with the ideal characteristics for the cleaning process;

[0013] laser systems applicable in-line or off-line. These systems are very costly and require the use of highly skilled personnel to avoid damaging the roller to be cleaned;

[0014] high-pressure water jet machines;

washing systems with dry ice;

washing systems using only chemical products. These can operate in-line and off-line. In the first case, the ink must be replaced. This system has the drawback that the cleaning liquid comes into contact with all the machine components and, being very aggressive, may damage some of the components. Moreover, the action of the cleaning liquid is not combined with a mechanical action. Therefore, in order to be effective, in addition to the use of an aggressive liquid, the washing operation also requires very long performance times.

[0015] In the case of off-line systems, the roller to be cleaned must be removed from the production line and machines used to clean it are very cumbersome.

[0016] Prior art cleaning systems are not sufficiently fast and reliable. In fact, known cleaning systems make use of consumables that are wasteful, polluting and have a high environmental impact (also for the operators in the immediate vicinity), or that do not guarantee satisfactory results in reasonable times.

[0017] Known cleaning systems, which use jets of cleaning liquid directed at a roller of a printing machine are disclosed in US7,428,868; US 6,957,607; WO1997000173.

[0018] Therefore, there is the need to produce cleaning devices for cylindrical rollers that completely or partially solve one or more of the problems of the prior art devices.

OBJECTS AND SUMMARY OF THE INVENTION

[0019] The main object of the present invention is to provide a device that is fast, reliable and inexpensive, with regard to the cost of the system and the cost of the consumables.

[0020] The object of some embodiments is to obtain a cleaning device that can be easily installed, both in-line (i.e., on the machine) and off-line, in any working environment and without requiring particular safety equipment, as it has a small size, low weight, limited consumption of material and reduced cleaning cycle performance times. This means it can also be installed on existing machines with a quick replacement of existing devices, or added to plants without cleaning devices.

[0021] According to a first aspect, there is provided for this purpose a cleaning device comprising a cleaning head with a cleaning chamber, in which a mechanical

cleaning member is housed, and with which feeding members are associated for feeding a cleaning liquid into the cleaning chamber. With this layout, the mechanical member and the cleaning liquid dispensed by the feeding members work in combination inside the cleaning chamber to clean the cylindrical surface of the roller to be cleaned.

[0022] To clean rollers of considerable axial length with a device of limited dimensions, according to advantageous embodiments the cleaning head is provided with a translation movement in a direction parallel to the axis of the cylindrical roller. The combination of the rotation movement of the roller and the translation movement of the cleaning head allows the whole of the cylindrical surface of a roller, even with considerable radial and/or axial dimensions, to be washed efficiently in a small space.

[0023] In advantageous embodiments the cleaning head can be provided with a movement toward and away from the roller. The movement can be in an axial direction, i.e., can be such as to move the head away beyond an axial end of the roller. However, in preferred embodiments, the movement of the cleaning head toward or away from the lateral surface of the roller is orthogonal to the rotation axis of the roller, or in any case a movement that has at least one component orthogonal to the axis of the roller.

[0024] To obtain efficient washing, the cleaning head and, together with it, the mechanical cleaning member can be moved with respect to the lateral surface of the roller to be washed, maintaining the contact between mechanical cleaning member and surfaces of the roller. However, for more efficient washing and to reduce mechanical stresses on the components of the device, advantageously the mechanical cleaning member is provided with a movement inside the cleaning chamber, movement that does not involve the remaining parts of the cleaning head.

[0025] In some embodiments, this movement can be a rotation movement. For example, the mechanical cleaning member can comprise a rotating brush, or preferably two counter-rotating brushes.

[0026] In currently preferred embodiments, the movement of the mechanical cleaning member is a reciprocating movement, preferably in a direction parallel to the rotation axis of the roller.

[0027] To delimit the cleaning chamber (110), the cleaning head can comprise lateral sealing gaskets. These lateral sealing gaskets can have concave edges, with a curvature corresponding to, or slightly lower than that of the roller to be cleaned, so as to embrace the roller if necessary with a slight elastic deformation of the gaskets, to improve the lateral seal.

[0028] The lateral sealing gaskets can be replaceable as a function of the diameter of the roller to be cleaned. For example, the lateral sealing gaskets can be housed in respective side elements that form lateral walls of the cleaning chamber. The side elements can be adapted to house the lateral sealing gaskets of variable dimensions, as a function of the variable diameter of said roller to be cleaned.

[0029] For efficient closing of the cleaning chamber, in some embodiments the cleaning head comprises an upper sealing blade and a lower sealing blade, adapted to delimit the cleaning chamber above and below. In advantageous embodiments the blades can be biased against the roller to be cleaned to improve the seal. For this purpose, the blades can be elastic, or can be associated with pressure members, such as piston-cylinder actuators, or springs or other elastic biasing members.

[0030] The mechanical cleaning member can comprise at least one brush.

[0031] According to a further aspect, the present invention also relates to a machine comprising a cylindrical roller to be cleaned and a device as defined above and as better described below with reference to examples of embodiment.

[0032] According to yet another aspect, the invention relates to a method for cleaning a roller, comprising the following steps:

moving, toward a lateral cylindrical surface of the roller, a cleaning head comprising a cleaning chamber open toward the cylindrical surface of the roller and containing therein a mechanical cleaning member and feeding members of a cleaning liquid into the cleaning chamber;

bringing the mechanical cleaning member into contact with the lateral cylindrical surface of the roller to be cleaned, so as to substantially close the cleaning chamber from the front side;

moving the mechanical cleaning member into contact with the lateral surface of the roller dispensing cleaning liquid into the cleaning chamber.

[0033] Further aspects and embodiments of the device and of the method according to the present invention are described hereunder with reference to the accompanying drawings and are defined in the appended claims, which form an integral part of the present description.

DETAILED DESCRIPTION OF EMBODIMENTS

[0034] The present invention will be better understood with reference to the accompanying figures, which show an application, but without limiting the scope of the present invention. In the accompanying drawings:

Fig.1 shows an overall view of an embodiment of the device of the present invention, installed on a printing machine;

Fig. 2 shows a partial sectional view of the cleaning head of the device obtained according to II-II of Fig. 3;

Fig.3A shows a front view of the cleaning head of Fig. 2;

Fig. 3B shows a lateral view of the cleaning head;

Fig.3C shows an axonometric view of the cleaning

head;

Fig. 4 shows an axonometric view of the mechanical cleaning member;

Fig. 5 shows a lateral view of the mechanical cleaning member of Fig. 4;

Fig. 6 shows an axonometric view of two cleaning heads with the same function but with different dimensions,

Fig.7 shows an axonometric view of a further embodiment of the cleaning head, with lateral rinsing chambers.

DETAILED DESCRIPTION OF EMBODIMENTS

[0035] Hereunder the cleaning device is described in combination with an anilox roller of a printing machine. However, it must be understood that a cleaning device of the type described here can also advantageously be applied to clean other rollers affected by similar problems.

[0036] Fig. 1 shows an overall view of a printing machine generically indicated with 10, for example destined for printing and decorating a ply web material (not shown), which houses a cleaning device 20 of the invention. The cleaning device 20 is essentially composed of two parts, indicated respectively with 30 (cleaning head) and 40 (movement assembly).

[0037] The cleaning head 30 acts, in the example illustrated, on an anilox roller 50, which has on the surface a coating made of a hard material, for example a ceramic material, engraved with small cells, which transport the printing liquid, typically an ink. These cells (not shown) can become at least partially clogged with debris consisting of particles of paper and ink. When this occurs the anilox roller 50 becomes unusable and requires a cleaning operation. For this purpose, the cleaning head 30 is brought into close proximity of the anilox roller 50 and subsequently made to translate in a direction parallel to the axis of the roller 50, as better described below.

[0038] With reference to Figs. 3A, 3B, 3C, the cleaning head 30 comprises various components, including a mechanical cleaning tool 60, which can be a brush or the like. The cleaning head further comprises a pair of nozzles 70 for spraying a cleaning liquid, upper and lower sealing blades 80 and lateral sealing gaskets 90. When the cleaning head 30 is in the operating position and coacts with the anilox roller 50, the assembly made up of the upper and lower blades 80 and of the sealing gaskets 90 forms, together with the cylindrical surface of the roller 50, a fluid tight cleaning chamber 110.

[0039] In advantageous embodiments, the blades 80 are adjustable and held with pressure against the roller 50 to be cleaned through the use of compression members 100 (Figs.3B, 3C) exemplified here in the form of springs, which allow fluid tightness in the upper and lower part of the cleaning chamber 110 also when the there is a variation in the diameter of the roller 50 to be cleaned, as the blades 80 are always in contact and with a certain pressure against the roller 50.

[0040] The sealing gaskets 90 are supported by respective side elements 120 that, in the same way as the blades 80, can accommodate gaskets 90 of different dimensions, or rather with a concave profile 130 adapted to the variable diameter of the roller 50. This means that, with the same cleaning head 30 and the same side elements 120 it is possible to clean rollers 50 with various diameters, as the cleaning chamber 110 will in any case remain exempt from seepages or leakages of liquid, due to the spring adaptability of the blades 80 and to simple replacement of the sealing gaskets 90.

[0041] As the variation of the diameter of the rollers 50 to be cleaned ranges from around 150 mm to around 300 mm, in some embodiments the side elements 120, and with these elements the whole cleaning head 30, can cover roughly half of the range indicated above. This means that it will be possible, for example, to have a first cleaning head 30, and respective side elements 120, to install on the cleaning device 20 for rollers 50 of diameter comprised between around 150 mm and around 220 mm, and a second different (larger) cleaning head 30 with side elements 120 of a size which is larger than previous ones, for rollers 50 with a diameter comprised between around 220 mm and around 300 mm. Fig.6 shows, in an axonometric view, compared with each other, two cleaning heads 30 of different dimensions to cover the whole range of diameters of the roller 50 to be cleaned.

[0042] In this way with two different cleaning heads 30, with dimensions different from one another, it will be possible to perform cleaning of rollers 50 with any diameter comprised between around 150 mm and around 300 mm. In fact, it will be sufficient to install on the cleaning device 20 the head 30 with larger or smaller side elements 120 depending upon the diameter of the roller 50 to be cleaned.

[0043] In the case of a small variation in the diameter of the roller 50 it will not be necessary to change the side elements 120, but it will be sufficient to replace the sealing gaskets 90 corresponding to the new diameter of the roller 50 to be cleaned.

[0044] As mentioned above, a mechanical cleaning member, in this case a brush 60, is arranged inside the cleaning chamber 110. Advantageously, the brush 60 is translated with a reciprocating movement in a direction parallel to the axis of the roller 50. In this way, the combined action of the liquid injected at low pressure by the nozzles 70 and the reciprocating movement of the brush 60 allows fast, efficient and low cost cleaning of the cylindrical surface of the roller 50. In the illustrated example, the movement of the brush or other mechanical cleaning member 60 is obtained with an actuator, for example a pneumatic motor 61, and the motion is transmitted, for example, through a cam and eccentric or the like, indicated schematically with 62, although it would also be possible to use other systems known in the art.

[0045] In some embodiments, the brush 60 is advantageously formed of two parts 140 (Fig. 4) extending in

transverse direction (parallel to the axis of the roller 50), so as to leave a channel 180 between the two parts 140. In this way, a small amount of cleaning liquid coming from the nozzles 70 is maintained in direct contact both with the roller 50 and with the bristles forming the two parts 140.

[0046] The two parts 140 of the brush 60 advantageously have a dovetail shape (see in particular Figs.2 and 5), so as to bring the bristles of the two parts 140 as close as possible to the roller 50 to be cleaned, and to create an obligatory path for the cleaning liquid (maximizing the contact time of the cleaning liquid on the roller and consequently its removal efficiency).

[0047] More in particular, as shown in Fig. 5, each of the two parts 140 of the brush 60 has a surface (for example formed by the tips of the bristles that make up each part 140 of the brush 60) that form an angle α with a vertical plane. The angle α can for example be from around 5° to around 20°, preferably from around 10° to around 15°, preferably of around 12°. The aforesaid inclined surfaces of the parts 140 of the brush 60 are inclined in opposite directions, so as to be arranged, in substance, on the two sides of a "V" with opening (180-2α) degrees, so that the two parts 140 of the brush 60 embrace the cylindrical surface of the roller 50 as much as possible.

[0048] The brush 60 can be provided with bristles of different thickness and material, for example the bristles can have dimensions comprised between 0.05 and 0.5 mm, advantageously between 0.1 and 0.2 mm and be made of filaments of brass, steel, plastic or animal material, or the like. The aforesaid parameters and materials can vary as a function of the shape and of the material of the surfaces to be cleaned, and of the pressure required and expected useful life of the bristles. It would also be possible to use brushes 60 provided with mixed bristles, i.e. made of different materials, for example harder and softer bristles, which can have various arrangements. For example, clumps or groups of bristles of a first type can be arranged alternated with clumps or groups of bristles of a second type.

[0049] To be able to adapt to rollers 50 to be cleaned with different diameters, the brush 60 can be supported so that it also slides in a direction (indicated with Z in Fig. 2) toward the roller 50 to be cleaned. This forward movement according to the direction Z has the dual purpose of offsetting any differences in the diameter of the roller 50 to be cleaned, and of adjusting the pressure exerted by the bristles 140 on the roller 50. This latter characteristic can also be exploited to offset partial wear of the bristles, so that the effectiveness of the action of the brush 60 remains more or less constant, extending the useful life of the brush 60. The number 71 (Fig.2) indicates a fixing and adjustment column, along which the cleaning head 30 can translate to move toward the axis of the roller 50.

[0050] For the same reason, the cleaning head 30 can be supported by an arm (not shown) adjustable in length, so that the seal of the blades 80 and of the sealing gaskets 90 is guaranteed against seepage of cleaning liquid and of any residues removed from the roller 50.

[0051] As mentioned initially, the cleaning head 30 (see. Fig. 1) is mounted on a movement assembly 40 that controls translation of the cleaning head 30 in a direction parallel to the axis of the roller 50. The movement is indicated by the double arrow X in Fig.1 and is advantageously a two-way movement, so that the cleaning head 30 can translate in the two directions to act on the whole cylindrical surface of the roller 50. The translation movement can be imparted to the head 30 by any known movement system. In the case shown, a rack and pinion system is used, but it would be possible to use other known systems, for example with belt and pulley, with gears, with recirculating ball screws or the like.

[0052] In some embodiments, one or more holes 160 (Fig.2) are arranged in the lower part of the cleaning chamber 110, connected to which are pipes 165 (Fig.3A) for collecting and recovering the cleaning liquid and any debris detached from the roller 50. Evacuation of the remaining cleaning liquid and of any debris can take place through gravity or vacuum, both induced from the outside, or through slight overpressure that is created in the cleaning chamber 110.

[0053] The lateral sealing gaskets 90 can be housed in respective seats, obtained in negative in the side elements 120, so that the gaskets 90 with concavity 130 with different diameters (to operate on rollers 50 with different diameters), can in any case be installed on the same side elements 120. This makes the cleaning head 30, and hence the whole cleaning device, extremely versatile. Moreover, the shape of the gaskets 90 is such that they are very easy to replace without the aid of particular tools.

[0054] In fact, as described above, simply by replacing the sealing gaskets 90, it is possible to obtain effective cleaning of rollers 50 with very variable diameters, for example in a range comprised between around 150 and around 220 mm, or between around 220 and around 300 mm. Advantageously, also the blades 80 contribute to this flexibility of the device, as for the aforesaid range of diameters of the roller 50 to be cleaned, the simple action of the springs 100 (Fig.3A) is sufficient to guarantee the seal in the direction of rotation of the roller 50, both in the upper part and in the lower part of the cleaning chamber 110.

[0055] The lateral sealing gaskets 90 can be made of different materials, provided the material has sufficient resistance to sliding friction and does not overheat. A particularly suitable material has proven to be "EVA" closed cell expanded polyethylene, with a density comprised between 50 and 120 kg/m^3. However, it would also be possible to use other materials with similar or improved characteristics with respect thereto.

[0056] The device described above functions as follows.

[0057] The cleaning head 30 of the device 20 is brought

into close proximity of the roller 50 to be cleaned. A slight forward movement of the head 30 in the direction of the roller 50 causes closing of the cleaning chamber 110, delimited laterally by the sealing gaskets 90, which can have the concave front part 130 with a radius of curvature equal to or slightly smaller than the radius of the roller 50. The sealing gaskets 90 can be moved toward the roller 50 with a slight pressure against the cylindrical lateral surface of said roller 50. The cleaning chamber 110 is delimited on top and on the bottom by the blades 80 held with pressure against the roller 50 by the springs 100 or another suitable member, for example another elastic member, a piston-cylinder actuator or other suitable means. Thanks to the particular structure of the blades 80 and of the gaskets 90 that the cleaning chamber 110 remains sealingly closed regardless of the direction of rotation of the roller 50. The cylindrical surface of the roller 50 completes the front closing of the cleaning chamber 110, while a wall 31 (Fig.2) of the cleaning head 30 closes it at the rear.

[0058] After the forward movement and sealing of the cleaning chamber 110, the brush 60, with its bristles 140 coming into contact with the surfaces of the roller 50 to be cleaned through the forward movement of the head 30 toward the roller 50, starts to move inside the cleaning chamber 110 in a direction transverse to the roller, i.e., parallel to the axis thereof, so as to cause the bristles of the brush 60 or other mechanical cleaning member to rub against the surfaces of the roller 50 to be cleaned.

[0059] Simultaneously, the nozzles 70 inject cleaning liquid, which can consist of water, a solution of water and detergent, or another liquid product with a cleansing action. The combined action of rubbing of the bristles of the brush 60 and of the cleaning liquid, ensure that the portion of surfaces of the roller 50 to be cleaned involved and circumscribed by the cleaning chamber 110 is easily cleaned. The particles of paper, ink, or any other processing residues that have deposited in the cells of the roller 50 are easily removed. The used cleaning liquid flows downward, thus drawing the debris toward the hole or holes 160, from where it is removed through the pipe or pipes 165. The supply and removal of the cleaning liquid can take place discontinuously or preferably continuously.

[0060] In particular cases, for example in case of particularly stubborn dirt, it is possible to use a heated cleaning liquid, so that it is even more effective on the dirt to be removed. The cleaning liquid can be water or any cleaning product, pure or diluted, and can be heated, for example, to a temperature comprised between 25°C and 50°C, preferably between 30 °C and 45°C.

[0061] To perform cleaning of the whole cylindrical surface of the roller 50 it is sufficient to rotate the roller 50 to cover the entire circumference thereof. Through a simple translation of the cleaning head 30 in the direction X (Fig.1), parallel to the axis of the roller 50, it is possible to gradually clean the various annular portions of the roller from one end to the other. By providing an operation with continuous movements, i.e. with continuous rotation of the roller 50 and continuous translation of the cleaning head 30, fast and efficient cleaning can be obtained with a simple device, which requires a small operating space around the roller 50 to be cleaned.

[0062] According to further embodiments, the cleaning head 30 can be provided with means to prevent or limit the lateral seepage of cleaning liquid during use. For example, Fig. 7 shows a configuration of cleaning head 30 with double containment chamber. The same numbers indicate the same or equivalent parts to those already described with reference to the preceding figures, which will not be described again. The main difference between the cleaning head 30 of Fig.7 and those illustrated in the preceding figures substantially consists in that a further lateral sealing gasket 91, adjacent to the respective sealing gasket 90 described above, is added laterally on the left and right sides of the cleaning head 30.

[0063] An empty chamber 92 is formed between the two lateral gaskets 90, 91 of each side of the cleaning head 30. Nozzles 93 for feeding a rinsing liquid, for example water, flow into said chamber 92.

[0064] With this configuration of the cleaning head 30 it is possible to manage both the cleaning step of the roller 50 by means of liquid detergents, and the subsequent rinsing step.

[0065] It would also be possible to add, if necessary, in a further lateral chamber for each side, a suction system of the cleaning liquid and/or of the rinsing liquid.

[0066] Summarizing, the advantages that can be obtained with embodiments of the device according to the present invention are:

- the cleaning process can combine the action of any chemical detergent with the action of a mechanical member;
- with the same process effectiveness, the system is less expensive than existing systems;
- it is possible to process any engraving profile and up to very high line counts (600 lines/cm);
- there are no dispersions of cleaning product;
- the amount of cleaning product used is very small;
- with the same process effectiveness, the system is faster than existing systems;
- it can be used in any working environment without the operator requiring particular protective and/or safety equipment;
- it is very simple to use and the operator does not require to have any particular training.

[0067] It is understood that the description above merely represents an example of the invention, and that this invention can vary in form and arrangement without departing from the scope of protection of the appended claims.

Claims

1. A cleaning device (20) for cleaning a cylindrical roller (50), comprising a cleaning head (30) with a cleaning chamber (110), in which a mechanical cleaning member (60) is housed, and with which feeding members (70) are associated for feeding a cleaning liquid into the cleaning chamber (110); wherein the mechanical member (60) and cleaning liquid dispensed by said feeding members work in combination inside said cleaning chamber (110).

2. Device according to claim 1, wherein the cleaning head (30) is provided with a translation movement in a direction parallel to the axis of the cylindrical roller (50).

3. Device according to claim 1 or 2, wherein the cleaning head (30) is provided with a movement toward and away from the roller (50), having at least a component orthogonal to the axis of the roller (50).

4. Device according to claim 1 or 2 or 3, wherein the mechanical cleaning member (60) is provided with a movement inside the cleaning chamber (110).

5. Device according to claim 4, wherein said movement of the mechanical cleaning member (60) inside the cleaning chamber (110) is a reciprocating movement.

6. Device according to claim 4 or 5, wherein said movement of the mechanical cleaning member (60) inside the cleaning chamber (110) is a reciprocating movement according to a direction parallel to the axis of the roller (50).

7. Device according to one or more of the preceding claims, wherein said mechanical cleaning member (60) is provided with a movement, with respect to the cleaning chamber (110), toward or away from the roller (50).

8. Device according to one or more of the preceding claims, wherein the cleaning head (30) comprises lateral sealing gaskets (90) of said cleaning chamber (110).

9. Device according to claim 8, wherein the lateral sealing gaskets (90) are elastically yielding to adapt to the lateral surface of the roller (50) to be cleaned.

10. Device according to claim 8 or 9, wherein the lateral sealing gaskets (90) are replaceable as a function of the diameter of the roller (50) to be cleaned.

11. Device according to claim 10, wherein the lateral sealing gaskets (90) are housed in respective side elements (120), said side elements (120) being adapted to house lateral sealing gaskets (90) of variable dimensions, as a function of the variable diameter of said roller (50) to be cleaned.

12. Device according to claim 11, wherein the side elements (120) are adapted to house lateral sealing gaskets (90) replaceable to cover a range of diameters of the roller (50) to be cleaned comprised between 150 and 220 mm, or between 220 and 300 mm.

13. Device according to one or more of the preceding claims, wherein the cleaning head (30) comprises an upper sealing blade (80) and a lower sealing blade (80) adapted to delimit the cleaning chamber (110), said blades (80) being held with pressure on the roller (50) to be cleaned through pressure members (100).

14. Device according to claim 13, when dependent at least on claim 11, wherein the upper sealing blade (80) and the lower sealing blade (80) are supported by said side elements (120).

15. Device according to claim 13, when dependent at least on claim 8, wherein the cleaning chamber (110) is made fluid tight, through the combination of said lateral sealing gaskets (90) and of said sealing blades (80) in cooperation with the lateral surface of the roller (50) to be cleaned.

16. Device according to one or more of the preceding claims, wherein the cleaning head (30) comprises lateral cleaning liquid containment chambers (92), open toward the lateral surface of the roller (50) to be cleaned.

17. Device according to claim 16, when dependent at least on claim 8, wherein the lateral chambers (92) are arranged along or inside the lateral sealing gaskets (90).

18. Device according to claim 17, wherein nozzles (93) for feeding a rinsing liquid open into the lateral chambers (92).

19. Device according to one or more of the preceding claims, wherein the mechanical cleaning member (60) comprises at least a brush.

20. Device according to one or more of the dependent claims, wherein the mechanical cleaning member (60) is divided into at least two parts (140) superimposed and separated along a channel (180) parallel to the roller (50) to be cleaned.

21. Device according to one or more of the preceding claims, wherein the mechanical cleaning member

(60) has two active surfaces adapted to act on the roller (50) to be cleaned, which are mutually inclined to form a V-shaped surface with the vertex oriented toward the inside of the cleaning chamber (110).

22. A machine comprising a cylindrical roller (50) to be cleaned and a device according to one or more of the preceding claims.

23. A method for cleaning a roller (50), comprising the following steps:

- moving, toward a lateral cylindrical surface of the roller (50), a cleaning head (30) comprising a cleaning chamber (110) open toward the cylindrical surface of the roller (50) and containing therein a mechanical cleaning member (60) and feeding members (70) of a cleaning liquid into the cleaning chamber (110);
- bringing the mechanical cleaning member (60) into contact with the lateral cylindrical surface of the roller (50) to be cleaned;
- moving the mechanical cleaning member (60) with respect to the lateral surface of the roller (50) and in contact therewith, dispensing cleaning liquid into the cleaning chamber (110).

24. The method of the claim 23, wherein the step of moving the mechanical cleaning member (60) in contact with the lateral surface of the roller (50) comprises the step of translating the mechanical cleaning member (60) with alternating movement according to a direction parallel to the axis of the roller (50).

25. The method of claim 23 or 24, comprising the step of rotating the roller (50) about its axis while the mechanical cleaning member (60) acts on the lateral surface of the roller (50).

26. The method of the claim 23, 24 or 25, further comprises the step of gradually translating the cleaning head (30) along the axis of the roller (50) to clean the whole lateral surface of the roller.

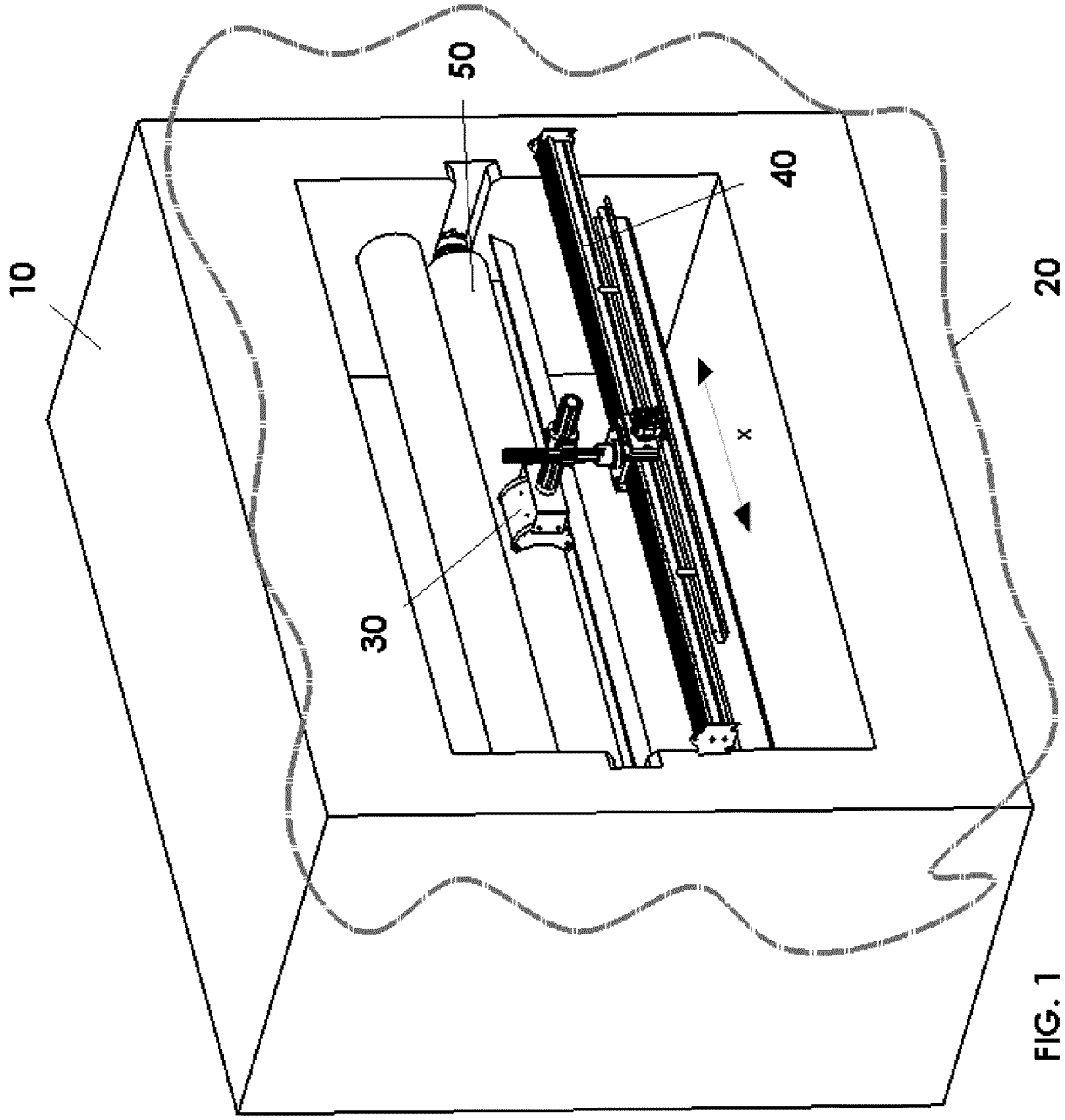

FIG. 1

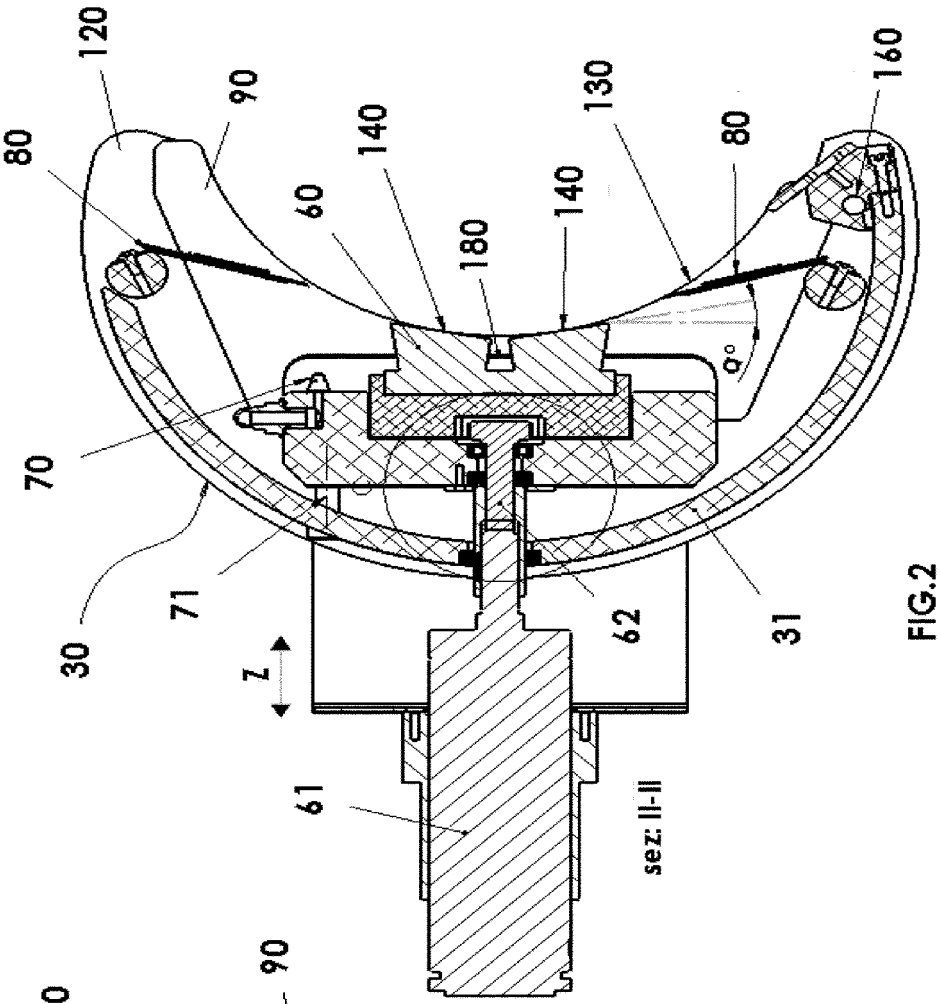
120
90
80
140
130
160
60
180
140
80
70
71
30
62
31
Z
61
sez: II-II

FIG.2

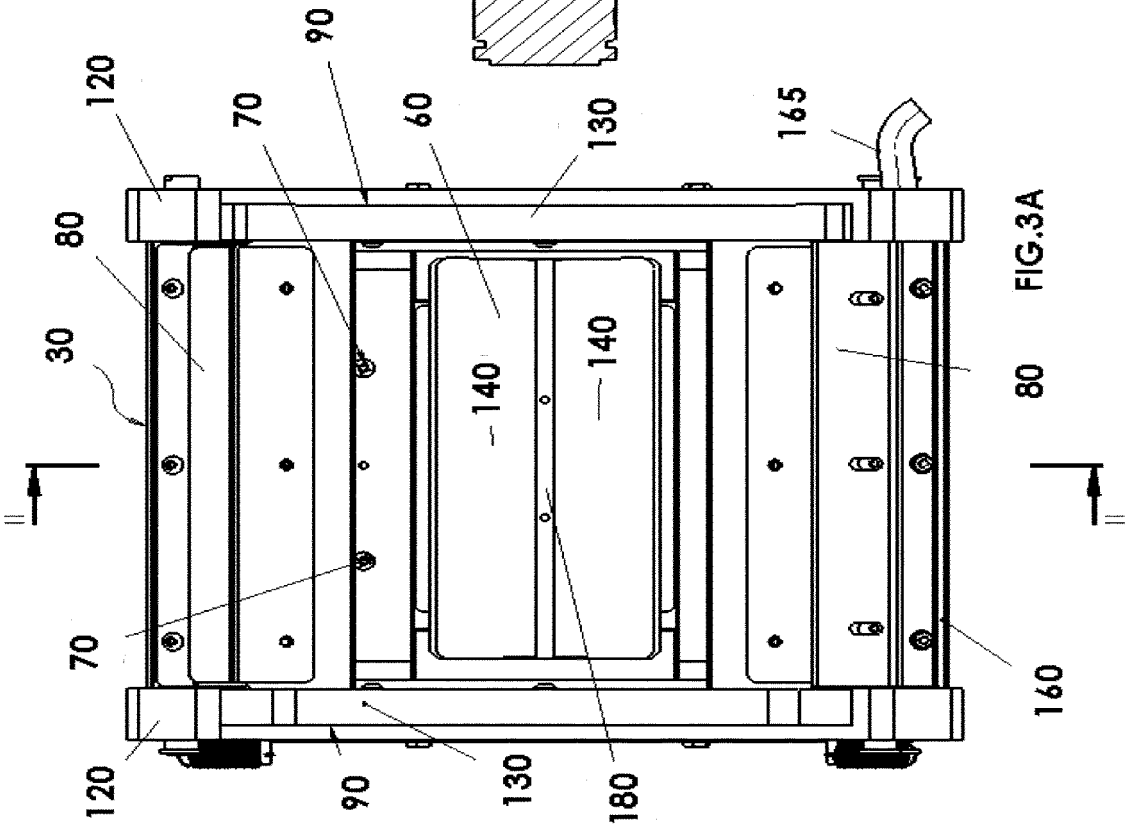
120
90
70
60
130
165
80
30
140
140
80
70
160
120
90
130
180

FIG.3A

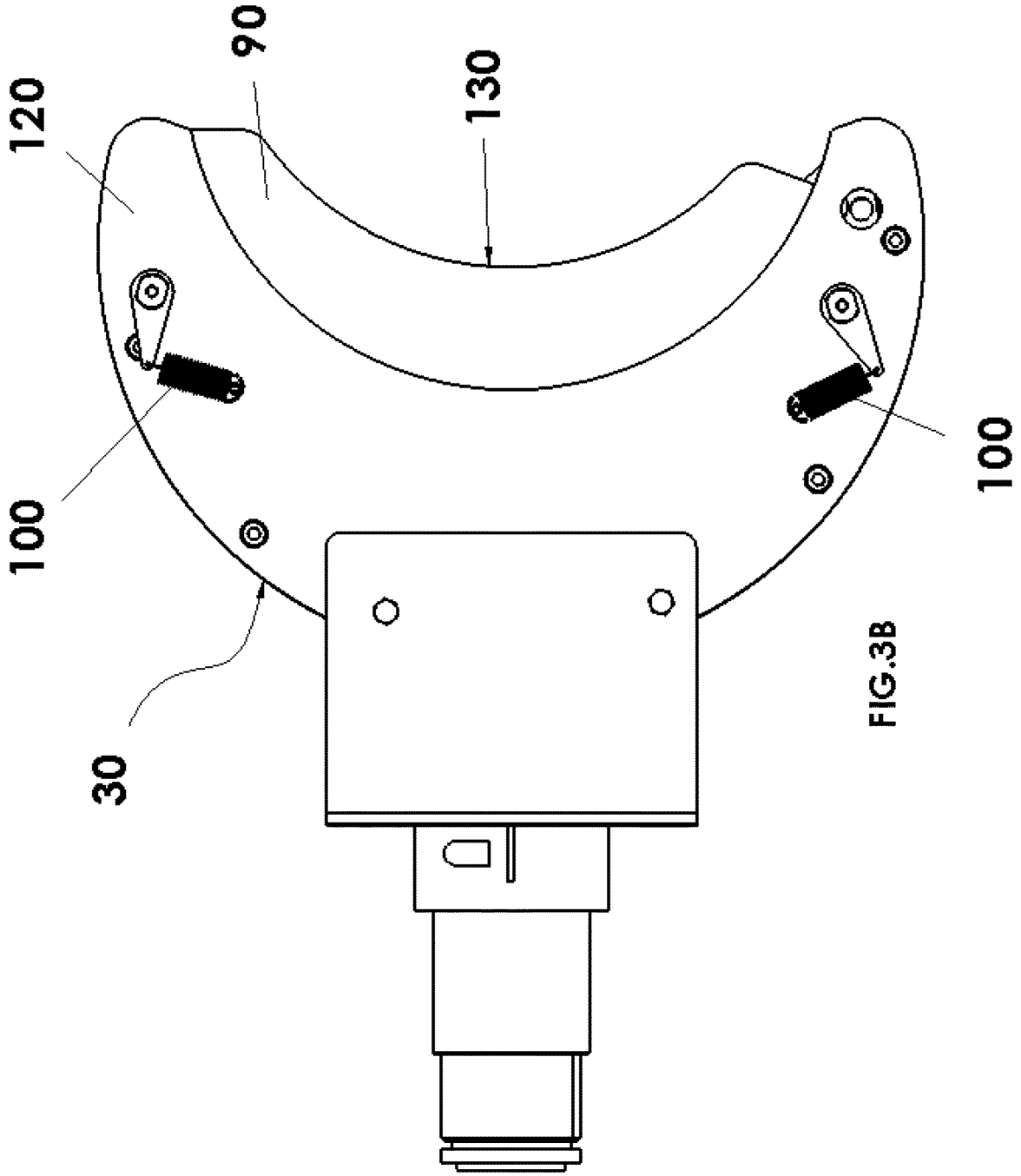

FIG.3B

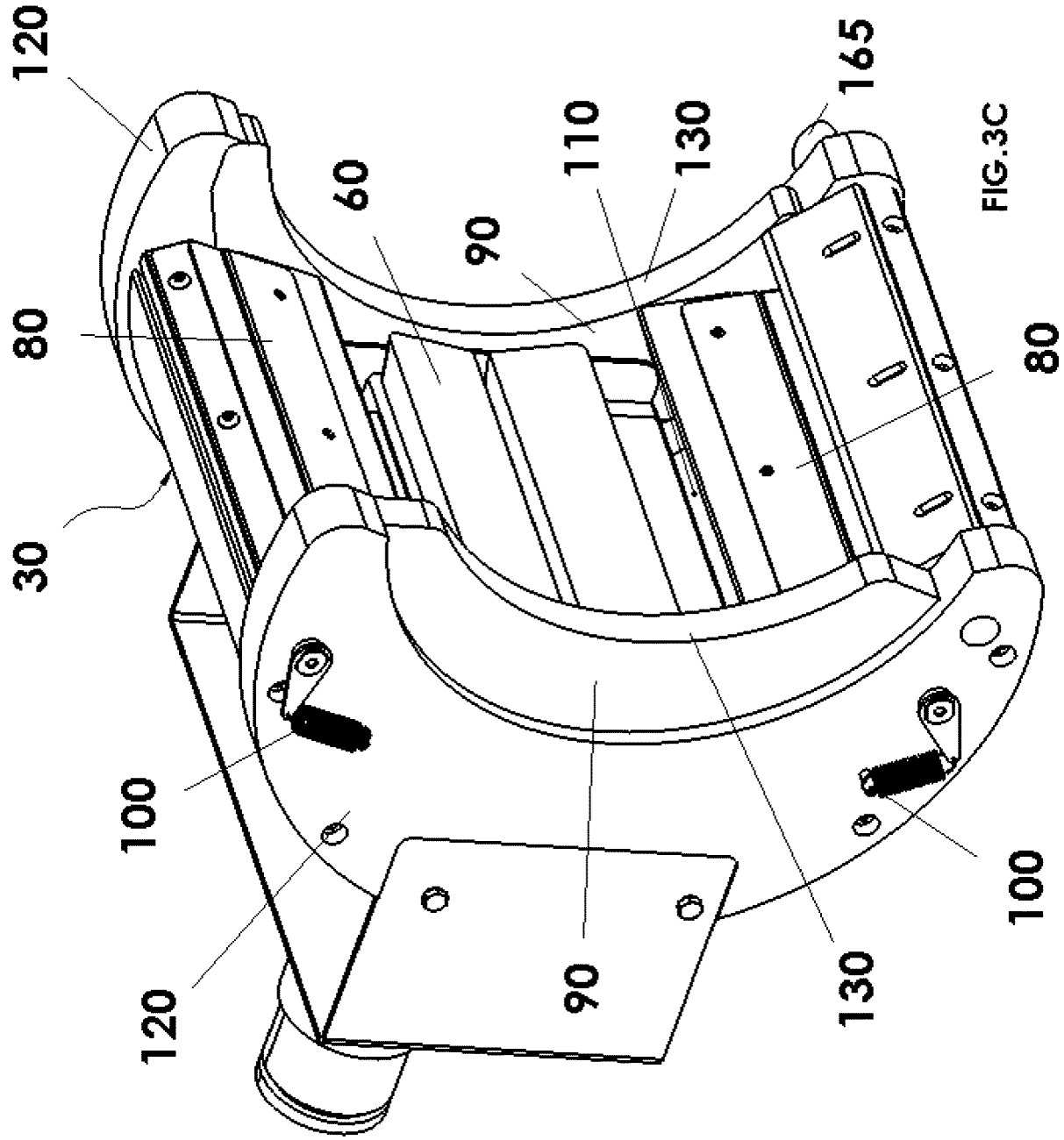

FIG.3C

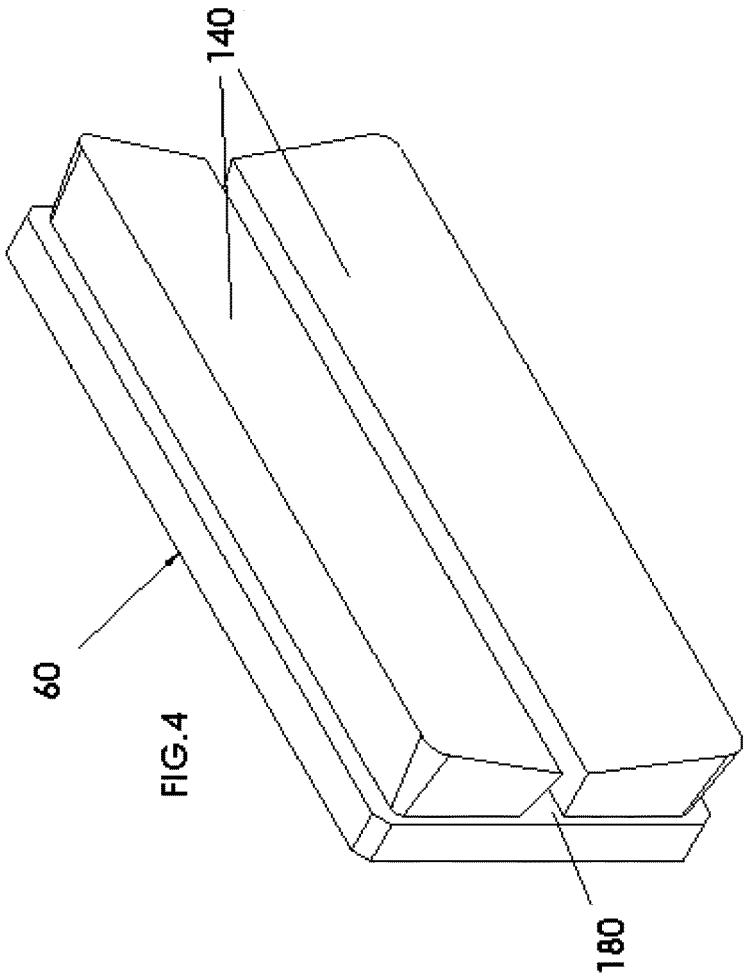

FIG.4

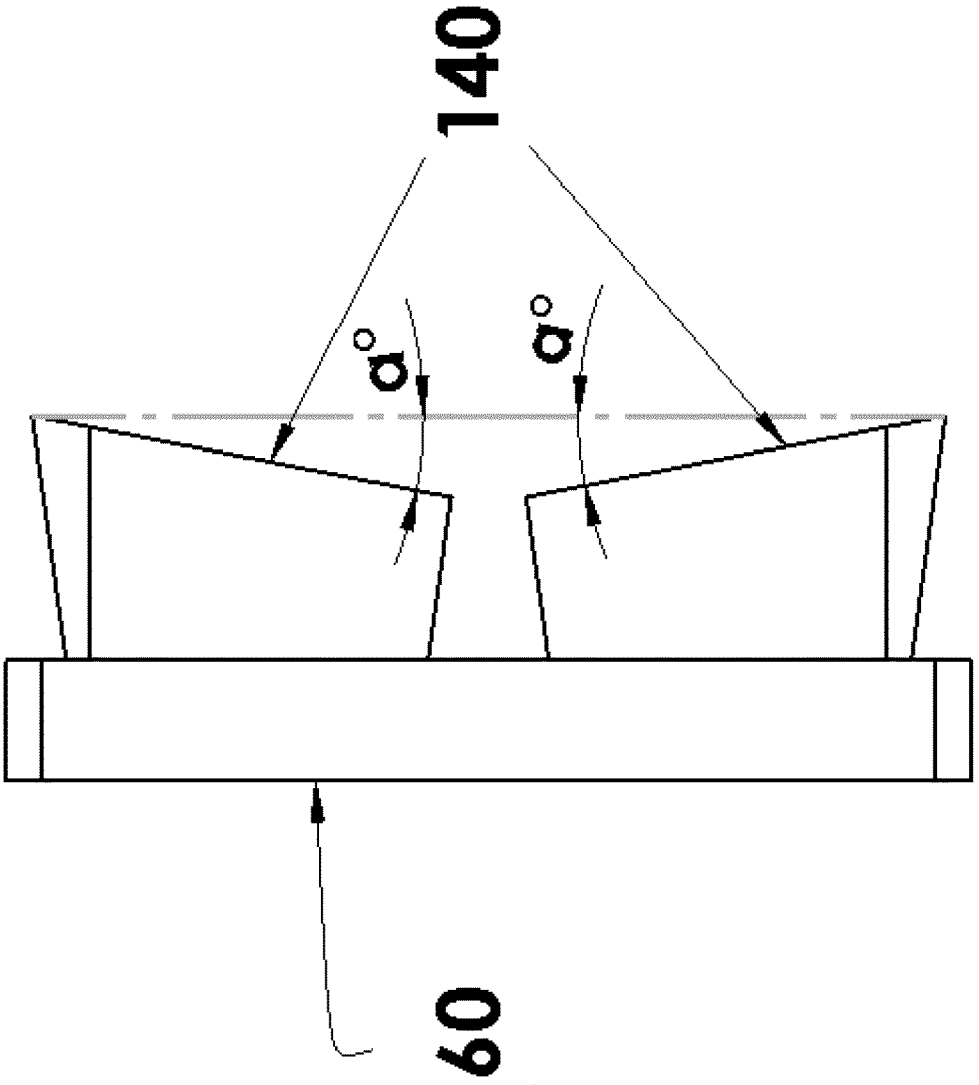

FIG.5

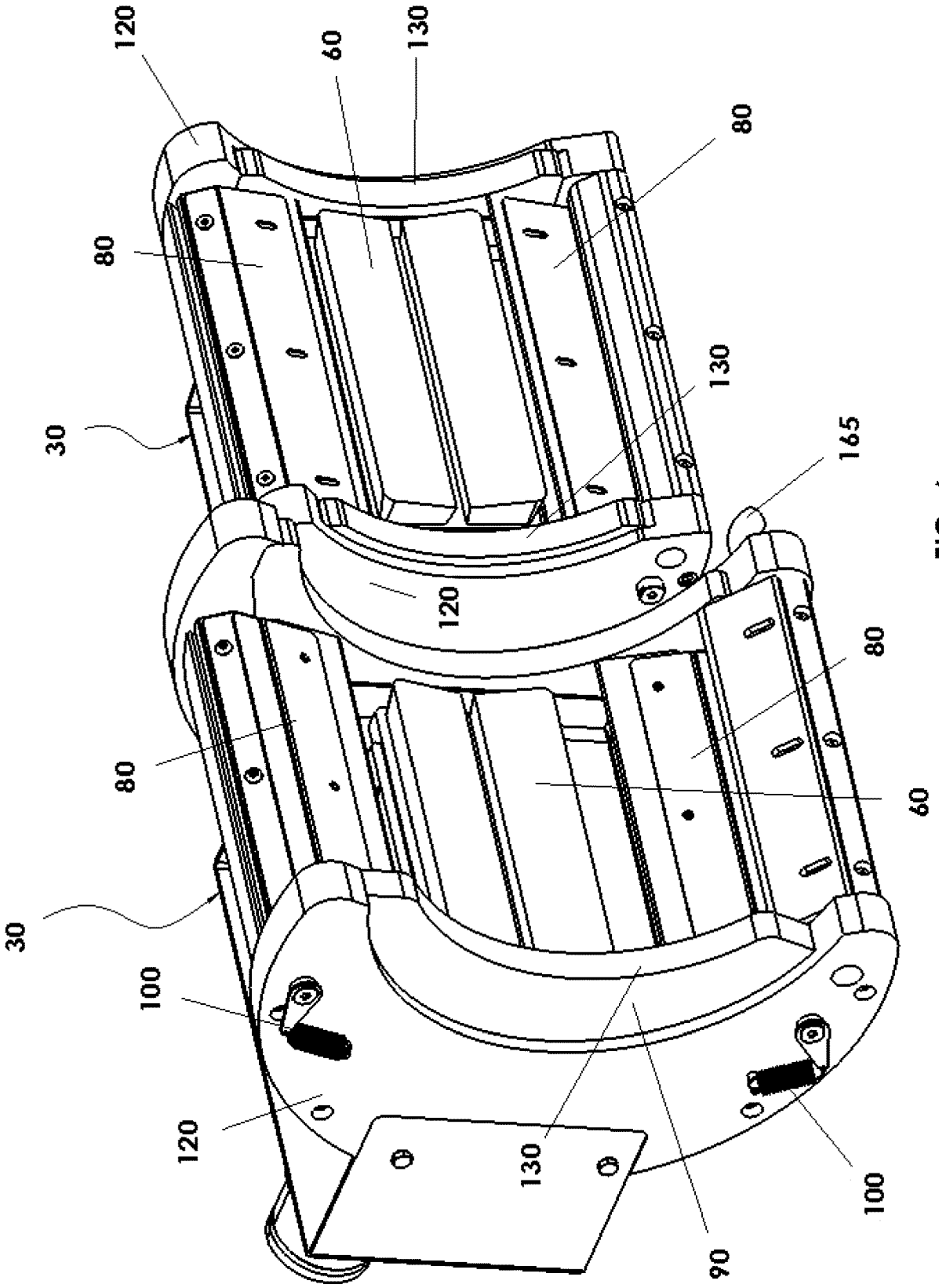

FIG. 6

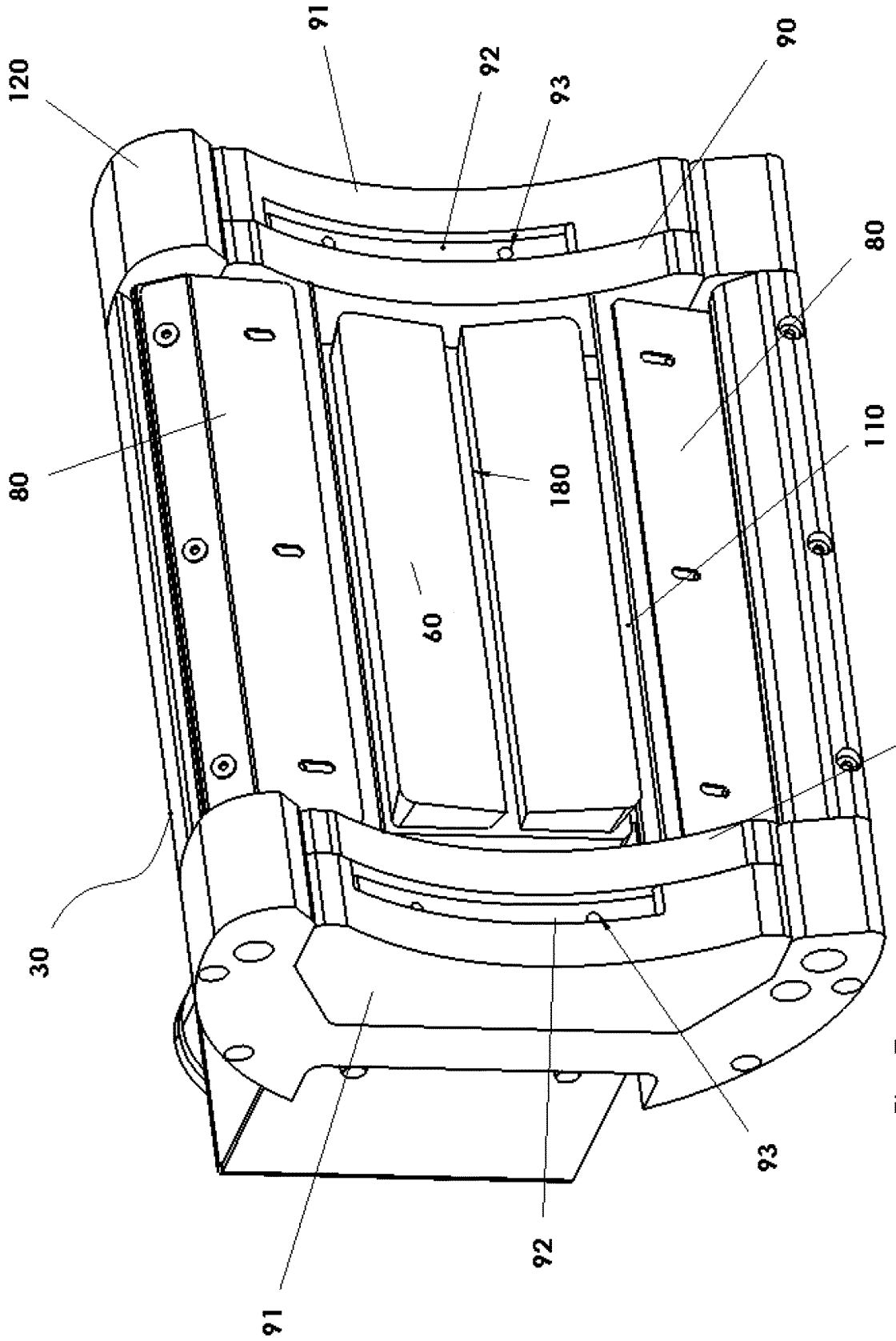

Fig. 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 18 0706

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	DE 10 2015 005535 A1 (HARRIS & BRUNO EUROPE GMBH [DE]) 3 November 2016 (2016-11-03) * abstract * * paragraphs [0003], [0007] - [0008], [0011] - [0012], [0020] - [0023], [0039], [0042] - [0048], [0052], [0056], [0060] * * figures 1-5 * -----	1,3, 7-15,21, 22	INV. B41F35/02 B41F35/04 B08B1/00
X	CA 2 161 478 A1 (HYCORR MACHINE CORP [US]) 29 April 1996 (1996-04-29) * abstract * * pages 3-4,7-14 * * figures 1-5 * -----	1,3-12, 19-25	
X	JP H06 262758 A (JPE KK) 20 September 1994 (1994-09-20) * abstract * * paragraphs [0001] - [0024] * * figures 1-4 * -----	1-3,8, 10-12, 16-18, 20-26	TECHNICAL FIELDS SEARCHED (IPC) B41F B08B
X	GB 1 328 512 A (OXY DRY INSTERNATIONAL LTD) 30 August 1973 (1973-08-30) * pages 1-5 * * figures 1-8 * -----	1,3-7, 19,22-25	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 September 2019	Bellofiore, Vincenzo

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 18 0706

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.

16-09-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102015005535 A1	03-11-2016	DE 102015005535 A1	03-11-2016
		WO 2016177721 A1	10-11-2016
CA 2161478 A1	29-04-1996	NONE	
JP H06262758 A	20-09-1994	JP 2839176 B2	16-12-1998
		JP H06262758 A	20-09-1994
GB 1328512 A	30-08-1973	NONE	

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

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 7428868 B **[0017]**
- US 6957607 B **[0017]**
- WO 1997000173 A **[0017]**