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

(11) **EP 3 604 641 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
05.02.2020 Bulletin 2020/06

(51) Int Cl.:
D01G 9/00 *(2006.01)* ***D01G 1/00*** *(2006.01)*

(21) Application number: **19165507.5**

(22) Date of filing: **27.03.2019**

(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: **30.07.2018 IT 201800003114 U**

(71) Applicant: **Tintoria Mancini**
13876 Sandigliano (BI) (IT)

(72) Inventor: **MANCINI, Maurizio**
13900 Biella (IT)

(74) Representative: **Torredimare, Luca**
Barzanò & Zanardo Milano S.p.A.
Corso Vittorio Emanuele II, 61
10128 Torino (IT)

(54) MACHINERY AND PROCESS TO TRANSFORM A SLIVER OF TEXTILE FIBERS INTO FLOCKS

(57) Machinery for transforming a sliver of textile fibres into flocks, comprising: at least one pair of opening cylinders (2, 4), through which a sliver (5) of textile fibres is made to pass, wherein the opening cylinders (2, 4) have a smooth outer surface; motor means for turning said at least one pair of opening cylinders (2, 4); retaining means, arranged upstream of the pair of opening cylinders (2, 4) with reference to a flow of the sliver (5) of textile fibres, for exerting a pulling action on the sliver of textile fibres when the pair of opening cylinders (2, 4) are turning, so that the sliver (5) of textile fibres can slide through said opening cylinders (2, 4); wherein the rotation of the pair of opening cylinders (2, 4) is intended to break up the sliver (5) of textile fibres and reduce it into flocks (F).

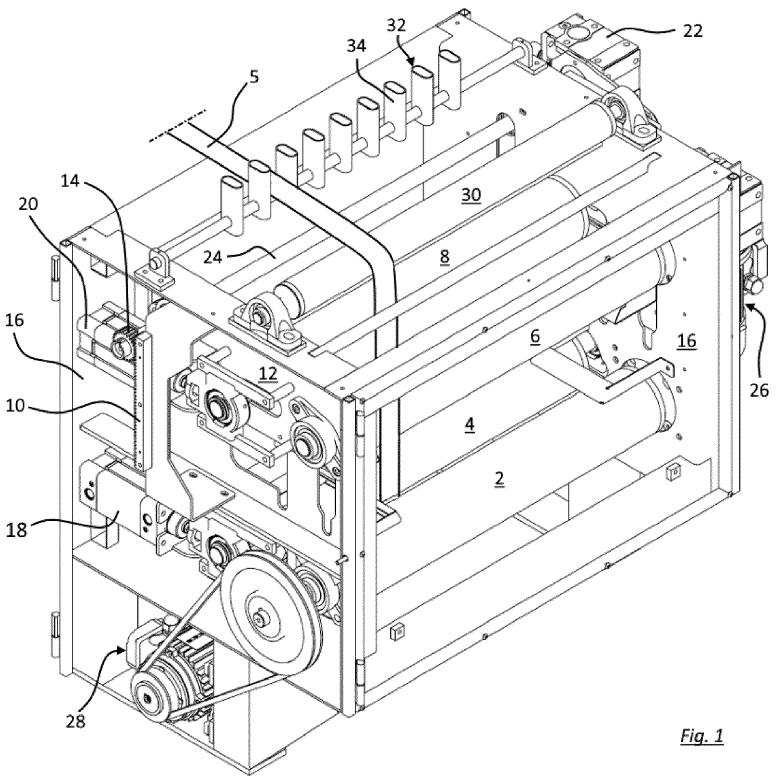

Fig. 1

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Description

Technical field

[0001] The present invention relates to a machinery and a process for transforming a sliver of textile fibres into flocks.

Background art

[0002] It is known in the art to reduce a sliver of textile fibres into flocks for the purpose of using such flocks for further processing, such as spinning, carding or, if necessary, dyeing. The sliver of textile fibres is generally a semifinished product, in particular a "top", wherein the fibres have some cohesion, but do not form a textile product yet. The sliver of textile fibres may be produced following a carding or teasing step.

[0003] The machines currently in use for flock production are known as "carding openers", "fine openers", or under the Italian name "cardalupo", which comprise cylinders having a plurality of needles, blades or the like on their outer surface. There is a drum that is bigger in diameter, and one or more cylinders, also known as worker cylinders, which cooperate with the drum. The textile fibres run on the drum and are subjected to the action of the needles on the drum and cylinders. However, such types of systems suffer from a number of drawbacks.

[0004] One drawback is that a large number of fibres are broken by the needles, resulting in an adverse impact on the final textile product. Another drawback is the high power consumption required for driving the drum and the cylinders. A further drawback is that such machineries are complex and costly to manufacture.

Summary of the invention

[0005] It is one object of the present invention to provide a machinery and a process which can overcome this and other drawbacks of the prior art, while at the same time being simple and economical.

[0006] According to the present invention, this and other objects are achieved through a machinery and a method made in accordance with the appended independent claims.

[0007] It is to be understood that the appended claims are an integral part of the technical teachings provided in the following detailed description of the invention. In particular, the appended dependent claims define some preferred embodiments of the present invention, which include some optional technical features.

Brief description of the drawings

[0008] Further features and advantages of the present invention will become apparent from the following detailed description, which is supplied merely by way of non-limiting example with reference to the annexed drawings, wherein:

- Figure 1 is a perspective view of a machinery according to an exemplary embodiment of the present invention;
- Figure 2 is a front view of the machine of Figure 1;
- Figure 3 is a side view of the machine along line III-III of Figure 2;
- Figure 4 is a perspective view of the machinery of Figure 1 with installed protection means;
- Figure 5 is a photograph of a machinery according to an exemplary embodiment of the present invention.

Detailed description of the invention

[0009] With reference to the annexed drawings, there is described a machinery for transforming a sliver of textile fibres into flocks. The machinery, which may also be called "opener", comprises:

- at least one pair of opening cylinders 2, 4, through which at least one sliver 5 of textile fibres is made to pass, wherein opening cylinders 2, 4 have a smooth outer surface;
- motor means for turning said at least one pair of opening cylinders 2, 4;
- retaining means, arranged upstream of the pair of opening cylinders 2, 4 with reference to a flow of sliver 5 of textile fibres, for exerting a pulling action on the sliver of textile fibres when the pair of opening cylinders 2, 4 are turning, while allowing sliver 5 of textile fibres to slide through opening cylinders 2, 4.

[0010] The rotation of the pair of opening cylinders 2, 4 is adapted to break up sliver 5 of textile fibres into flocks F.

[0011] Sliver 5 of textile fibres is a sliver formed by textile fibres having some cohesion, i.e. it is not an assembly of loose and separate flocks F. For example, sliver 5 of textile fibres is a semifinished sliver, in particular it is a "top". As is known, a top is a semifinished product obtained after a carding or teasing step carried out on fibres, e.g. wool. The top generally has a tubular or circular shape. As an alternative, sliver 5 of textile fibres is a two-dimensional web or strip. Therefore, sliver 5 of textile fibres is not a finished textile product.

[0012] When the pair of opening cylinders 2, 4 are turning, such opening cylinders 2, 4 exert a pulling force on the sliver, and therefore the pair of opening cylinders 2, 4 breaks up/tears/disunites said sliver 5, thereby transforming it into incoherent or poorly coherent flocks F. Sliver 5 is thus stretched between the pair of opening cylinders 2, 4 and the retaining means, in that the retaining means are adapted to exert a pulling action on sliver 5 as opening cylinders 2, 4 turn, while however allowing sliver 5 to run on and pass through opening cylinders 2, 4. Opening cylinders 2, 4 rotate in mutually opposite di-

rections.

[0013] Preferably, the retaining means comprise a pair of retaining cylinders 6, 8, through which sliver 5 of textile fibres is adapted to pass. Retaining cylinders 6, 8 rotate in mutually opposite directions. Preferably, retaining cylinders 6, 8 have a smooth outer surface.

[0014] The outer surface of opening cylinders 2, 4, in particular of that portion of such cylinders which is intended to get in contact with sliver 5, is smooth, i.e. it has no needles, blades, points or the like; in other words, such surface is not provided with the so-called "card clothing". By way of example, the outer surface of opening cylinders 2, 4 is metallic, e.g. made of steel or an alloy thereof, or aluminium or an alloy thereof. For example, such surface may have a glossy finish, e.g. chrome-plated or glazed. The same also applies to retaining cylinders 6, 8, if present (as in the illustrated example). Conveniently, the outer surfaces of opening cylinders 2, 4 and retaining cylinders 6, 8 are all alike, in particular in terms of roughness. As an alternative, the outer surfaces of opening cylinders 2, 4 and retaining cylinders 6, 8 are different, in particular in terms of roughness. Optionally, the outer surfaces of opening cylinders 2, 4 and/or retaining cylinders 6, 8 may be made of other materials, e.g. a polymeric material, or wood.

[0015] Conveniently, motor means are provided, such as a motor 26, conveniently an electric motor, for controlling the rotation of retaining cylinders 6, 8. According to one possible embodiment, the motor means for controlling the rotation of retaining cylinders 6, 8 are also adapted to control the rotation of opening cylinders 2, 4; for example, there is a single motor rotatably driving at least the pair of retaining cylinders and the pair of opening cylinders 2, 4. Conveniently, suitable transmission means transmit the motion from the motor means to the pairs of rollers 2, 4, 6, 8. According to the illustrated embodiment, there are a first motor 26 for controlling the rotation of retaining cylinders 6, 8, and a second motor 28 for controlling the rotation of opening cylinders 2, 4.

[0016] Preferably, the revolution speed of opening cylinders 2, 4 depends on the revolution speed of retaining cylinders 6, 8. Therefore, such speeds are related to each other. Therefore, the revolution speed of such pairs of cylinders is, or can be, predetermined. For example, mechanical transmission means are provided for keeping such revolution speed ratio. Optionally, the ratio between the revolution speeds of the two pairs of cylinders 2, 4, 6, 8 can be changed. According to a variant of the invention, a control unit adjusts the revolution speed of one of such pairs of cylinders (e.g. 2, 4) as a function of the revolution speed of the other pair of cylinders (e.g. 6, 8); optionally, a user can act upon the control unit in order to change the speed ratio.

[0017] In the illustrated embodiment, the rotation speed of the outer surface of the pair of opening cylinders 2, 4 is higher than that of the pair of retaining cylinders 6, 8. A pulling action is thus exerted on the sliver section comprised between the two pairs of cylinders. In particular, the two cylinders of the pair of opening cylinders 2, 4 have the same surface rotation speed; the same also applies, in this example, to retaining cylinders 6, 8. The "surface rotation speed" is meant to be the speed of the outer surface of cylinder 2, 4, 6, 8.

[0018] Preferably, distance D between the pair of opening cylinders 2, 4 and the pair of retaining cylinders 6, 8 is adjustable. It is thus possible to change the length of the sliver section stretched between the two pairs of cylinders. This advantageously allows treating different types or quantities of textile fibres. In particular, distance D is the distance between the two regions where the textile fibres have to run, which are defined by the pairs of cylinders 2, 4 and 6, 8.

[0019] In the example, a rack system is provided for adjusting distance D. A rack 10 is mounted to a supporting element 12, in particular a plate, which supports retaining cylinders 6, 8, in particular at a lateral end of retaining cylinders 6, 8. Rack 10 meshes with a toothed wheel 14 mounted on a supporting structure 16 of the machinery. Toothed wheel 14 is adapted to rotate, e.g. driven by a respective motor means 22, in order to move rack 10 and hence retaining cylinders 6, 8. Supporting element 12 is movably mounted to supporting structure 16. Conveniently, at a second end of retaining cylinders 6, 8 there is a second rack system like the above-described one. In the example, motor means 22 drives the two toothed wheels 14, which are arranged in proximity to the ends of rollers 2, 4, 6, 8, and which are rotatably constrained to each other by a shaft 24. As an alternative, further actuators, preferably of the linear type, may be installed for moving supporting structure 16 whereon retaining cylinders 6, 8 are mounted and change distance D. In the example, supporting element 12 is adapted to be moved vertically. In particular, at the ends of retaining cylinders 6, 8 there is a second supporting element 13 that supports the other ends of said retaining cylinders 6, 8 (Fig. 3). In the example, a rack system like the above-described one is mounted to the second supporting element 13.

[0020] As can be seen, the axes of rotation of opening cylinders 2, 4 are parallel. The axes of rotation of retaining cylinders 6, 8 are also parallel. In particular, the four axes of rotation of such four cylinders 2, 4, 6, 8 are parallel.

[0021] In the absence of a sliver of textile fibres, the two opening cylinders 2, 4 are either in contact with each other or separated by, for example, a few millimetres or 1-2 cm. Also the two retaining cylinders 6, 8 may be either in contact with each other or separated, e.g. by a few millimetres or 1-2 cm.

[0022] Optionally, the distance between the two opening cylinders 2, 4 and/or the distance between the two retaining cylinders 6, 8 is variable or can be adjusted by a user. This makes it advantageously possible to adapt the machinery to different types or quantities of textile fibres. Therefore, the distance between the first 2 and the second opening cylinder 4 is adjustable; in addition or as an alternative, this also applies to cylinders 6, 8.

[0023] In the example, there is a linear actuator 18 adapted to act upon an opening cylinder 4 in order to move such opening cylinder 4 closer to or away from the other opening cylinder 2. Likewise, there is a linear actuator 20 adapted to act upon a retaining cylinder 8 in order to move such retaining cylinder 8 closer to or away from the other retaining cylinder 6. In the example, linear actuators 18, 20 move the respective roller horizontally. Conveniently, there are two linear actuators 18, 19 acting upon both ends of opening cylinder 4. Conveniently, there are two linear actuators 20, 21 acting upon both ends of retaining cylinder 8.

[0024] Conveniently, there is an idle roller 30 arranged above retaining cylinders 6, 8, for guiding the textile fibres towards said retaining cylinders 6, 8. In particular, idle roller 30 is located, in a plan view, in the region where the textile fibres pass through retaining cylinders 6, 8. Conveniently, idle roller 30 has a smooth outer surface.

[0025] Preferably, a comb-like structure 32 is provided for guiding the at least one sliver 5 of textile fibres towards retaining cylinders 6, 8. Comb-like structure 32 is useful to evenly distribute a plurality of slivers 5 of textile fibres, in particular tops, along cylinders 2, 4, 6, 8. Comb-like structure 32 is optionally located at substantially the same height as idle roller 30. With reference to the fibre flow, idle roller 30 is interposed between comb-like structure 32 and retaining cylinders 6, 8. Comb-like structure 32 comprises a plurality of protrusions or teeth 34, between which the textile fibres are made to run, particularly when they are in tops form. In particular, comb-like structure 32 allows for parallel running of a plurality of slivers 5 of textile fibres, in particular when said slivers 5 are tops, while keeping slivers 5 separate from one another.

[0026] Some advantages of the present invention are due to the fact that the machinery is simple to manufacture and use, is compact, requires little maintenance, and requires little power to operate. The presence of smooth cylinders provides the advantage that the textile fibres of the sliver are damaged to the least extent, resulting in higher quality of the textile product that will be made starting from flocks F of textile fibres, e.g. avoiding the formation of "neps" in the textile fibre or preventing said fibre from breaking.

[0027] The present machinery overcomes the drawbacks of the prior art, in that it is not made up of components (such as toothed cards and/or cylinders) that may result in mechanical working and rubbing of the sliver, but only makes use of smooth cylinders that ensure that the opening into flocks F of sliver 5 will occur only because of the mere sliding action of the fibres relative to one another, thus achieving results that are very similar, in terms of quality, to those attainable by hand.

[0028] Furthermore, in the particular variant shown herein, the machinery has less chains and toothed gears, and has no carding rollers (which are included in all existing machines for this type of processing), which are driven by purely mechanical means and also pose serious dangers in safety terms. By avoiding the use of toothed cards and cylinders, it is possible to prevent situations of extreme danger for the operator while also overcoming the practical problems related to fibre integrity preservation, since the fibre, subjected to the action of smooth cylinders, will not break during the treatment and will not create any microscopic surface "neps" that may affect the quality of the final product.

[0029] The machinery is conveniently equipped with wheels, in particular having a locking system for preventing it from rolling. When unlocked, the wheels allow the machinery to be easily transported within the production shop.

[0030] The machinery can be handled and controlled by a single operator, who, after having started the machinery, verifies that the processing is going on correctly and collects flocks F for their subsequent baling and/or storage into containers or directly into the machines to be used for the next spinning operations.

[0031] Preferably, motors 22, 26, 28 are electric. Optionally, there is a positioning compartment 36 or area whereon the at least one sliver 5 to be worked can be placed; in Fig. 5 there is a coil B of tops.

[0032] The machinery may further comprise optional technical features that may be *per se* known, such as: an electric panel, control push-buttons or means for controlling the machinery, a screen for obtaining information about the machine and/or sending commands thereto, a control unit adapted to coordinate the various elements of the machine, in particular adapted to control the motor means (e.g. the motors 22, 26, 28).

[0033] Preferably, with reference to Figure 4, protection means prevent any undesired contact between a user and the moving parts of the machinery, such as opening rollers 2, 4 and the retaining rollers 6, 8, motors 22, 26, 28, or any additional transmission means. The protection means may include, for example, a door 38 (preferably transparent) or protective shields 40. Door 38 allows access to a compartment that houses cylinders 2, 4, 6, 8. Door 38 is useful for cleaning, maintenance and checking operations. Preferably, the machinery is so configured that, if sensor means detect the opening of door 38, then the machinery, in particular rollers 2, 4, 6, 8, will stop. User safety is thus improved because, if the user opens door 38 while rollers 2, 4, 6, 8 are turning, such rollers and the various moving parts will stop, thereby preventing possible accidents.

[0034] The invention also relates to a process for transforming a sliver of textile fibres into flocks F, comprising the steps of:

- providing a machinery according to any variant of the invention,
- running at least one sliver 5 of textile fibres from the retaining means to the pair of opening cylinders, and having the sliver of textile fibres pass through opening cylinders 2, 4,
- turning opening cylinders 2, 4, so as to break up sliver 5 of textile fibres and reduce it into flocks F.

[0035] When flocks F come out of the at least one pair of opening cylinders 2, 4, the process is complete. In particular, there is only one pair of opening cylinders 2, 4.

[0036] As aforesaid, sliver 5 of textile fibres may be created in a carding or teasing process. After creating flocks F by means of the present invention, such flocks F may be dyed, or carded, or combed, or may undergo further chemical and/or mechanical treatments, which may be *per se* known in the textile industry.

[0037] By way of example, the processing cycle occurs according to the following steps: coils B, or "bumps", of tops are loaded onto a positioning compartment 36 or area, and sliver 5 to be worked is manually placed in the upper separation sections, i.e. between teeth 34. The ends of sliver 5 are manually inserted into the inlet region of the first pair of retaining cylinders 6, 8, and then, after closing retaining cylinders 6, 8, sliver 5 is fed until it overcomes the pair of opening cylinders 2, 4. Subsequently, after closing opening cylinders 2, 4, the machine is started in automatic mode by pressing the "Run" button, adjusting the processing speed in accordance with specific production requirements.

[0038] The material in the form of flocks F may be baled by using a baling press (to this end, the machine is conveniently fitted with a suitable chute allowing the material to fall directly into a pit), or it may be conveyed into a suction system for transferring it to other production processes.

[0039] The Applicant reserves the right to claim the following embodiments:

1) Opener with smooth cylinders;
2) Opener according to point 1), characterized by the absence of any teeth or knurls (which may cause structural or merely aesthetic damage to the fibre);
3) Opener according to points 1) and 2), characterized by an extremely simple structure, the operation of which is essentially based on sliding on smooth cylinders;
4) Opener according to points 1), 2) and 3), characterized by fully automatic operation, ensuring the utmost safety for the operator involved;
5) Opener according to points 1) - 4), characterized by the utmost quietness due to the mere sliding on which its functionality is based;
6) Opener according to points 1) - 5), characterized by maintenance requirements reduced to a minimum;
7) Opener according to points 1) - 6), characterized by broad versatility of use in the textile industry, such as to offer a final product that can be used in different phases ranging from dyeing to spinning.

[0040] Of course, without prejudice to the principle of the invention, the forms of embodiment and the implementation details may be extensively varied from those described and illustrated herein by way of non-limiting example, without however departing from the scope of the invention as set out in the appended claims.

Claims

1. Machinery for transforming a sliver of textile fibres into flocks, comprising:

   - at least one pair of opening cylinders (2, 4), through which at least one sliver (5) of textile fibres is made to pass, wherein the opening cylinders (2, 4) have a smooth outer surface;
   - motor means for turning said at least one pair of opening cylinders (2, 4);
   - retaining means, arranged upstream of the pair of opening cylinders (2, 4) with reference to a flow of the sliver (5) of textile fibres, for exerting a pulling action on the sliver of textile fibres when the pair of opening cylinders (2, 4) are turning, while allowing the sliver (5) of textile fibres to slide through said opening cylinders (2, 4);

   wherein the rotation of the pair of opening cylinders (2, 4) is adapted to break up the sliver (5) of textile fibres and reduce it into flocks (F).

2. Machinery according to claim 1, wherein the retaining means comprise a pair of retaining cylinders (6, 8), through which the sliver (5) of textile fibres is adapted to pass.

3. Machinery according to claim 2, comprising motor means for controlling the rotation of the retaining means (6, 8).

4. Machinery according to claim 2 or 3, wherein the retaining cylinders (6, 8) have a smooth outer surface.

5. Machinery according to any one of claims 2 to 4, wherein the distance (D) between the pair of opening cylinders (2, 4) and the pair of retaining cylinders (6, 8) is adjustable.

6. Machinery according to any one of claims 2 to 5, wherein the revolution speed of the opening cylinders (2, 4) depends on the revolution speed of the retaining cylinders (6, 8).

7. Machinery according to any one of claims 2 to 6, wherein the rotation speed of the outer surface of the pair of opening cylinders (2, 4) is higher than that of the pair of retaining cylinders (6, 8).

8. Machinery according to any one of the preceding claims, comprising a door (38) allowing access to a compartment that houses the opening cylinders (2, 4) and the retaining cylinders (6, 8); wherein the ma-

chinery is so configured that, if sensor means detect the opening of the door (38), the machinery will stop.

9. Machinery according to any one of the preceding claims, comprising a comb-like structure (32) for guiding the at least one sliver (5) of textile fibres towards the retaining cylinders (6, 8), the comb-like structure (32) comprising a plurality of protrusions or teeth (34), between which the at least one sliver (5) of textile fibres is adapted to run.

10. Machinery according to claim 9, comprising an idle roller (30) arranged over the retaining cylinders (6, 8), for guiding the at least one sliver (5) of textile fibres towards said retaining cylinders (6, 8); wherein, with reference to the flow of the sliver (5) of textile fibres, the idle roller (30) is interposed between the comb-like structure (32) and the retaining cylinders (6, 8).

11. Machinery according to any one of the preceding claims, wherein the distance between the two opening cylinders (2, 4) and/or the distance between the two retaining cylinders (6, 8) can be adjusted by a user.

12. Process for transforming a sliver of textile fibres into flocks, comprising the steps of:

- providing a machinery according to any one of the preceding claims,
- running at least one sliver (5) of textile fibres from the retaining means to the pair of opening cylinders (2, 4), and making the sliver (5) of textile fibres pass through the opening cylinders (2, 4),
- turning the opening cylinders (2, 4), so as to break up the sliver (5) of textile fibres and reduce it into flocks (F) .

13. Process according to claim 12, wherein the sliver (5) of textile fibres is a semifinished sliver.

14. Process according to claim 13, wherein the sliver (5) of textile fibres is a top.

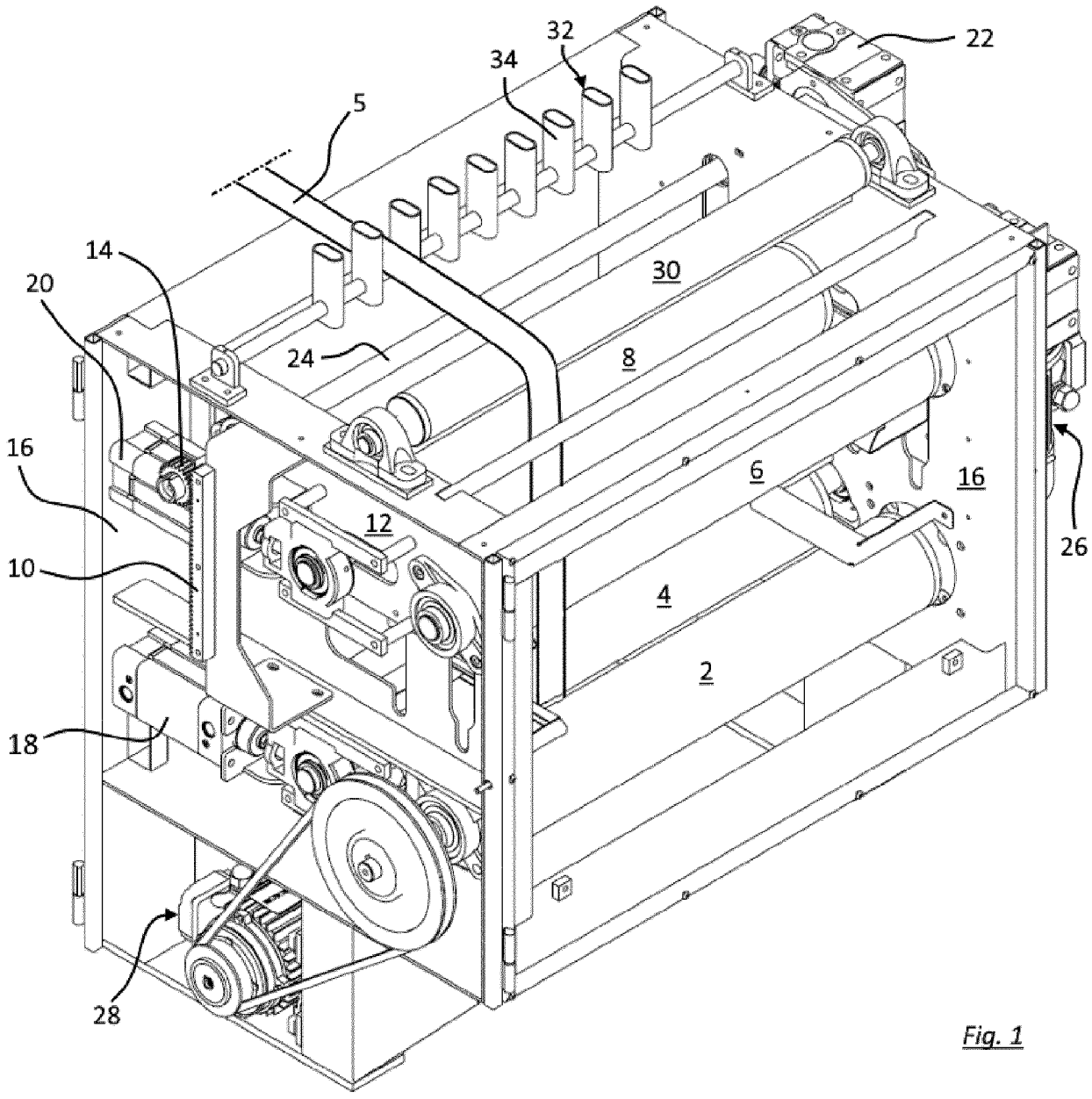

Fig. 1

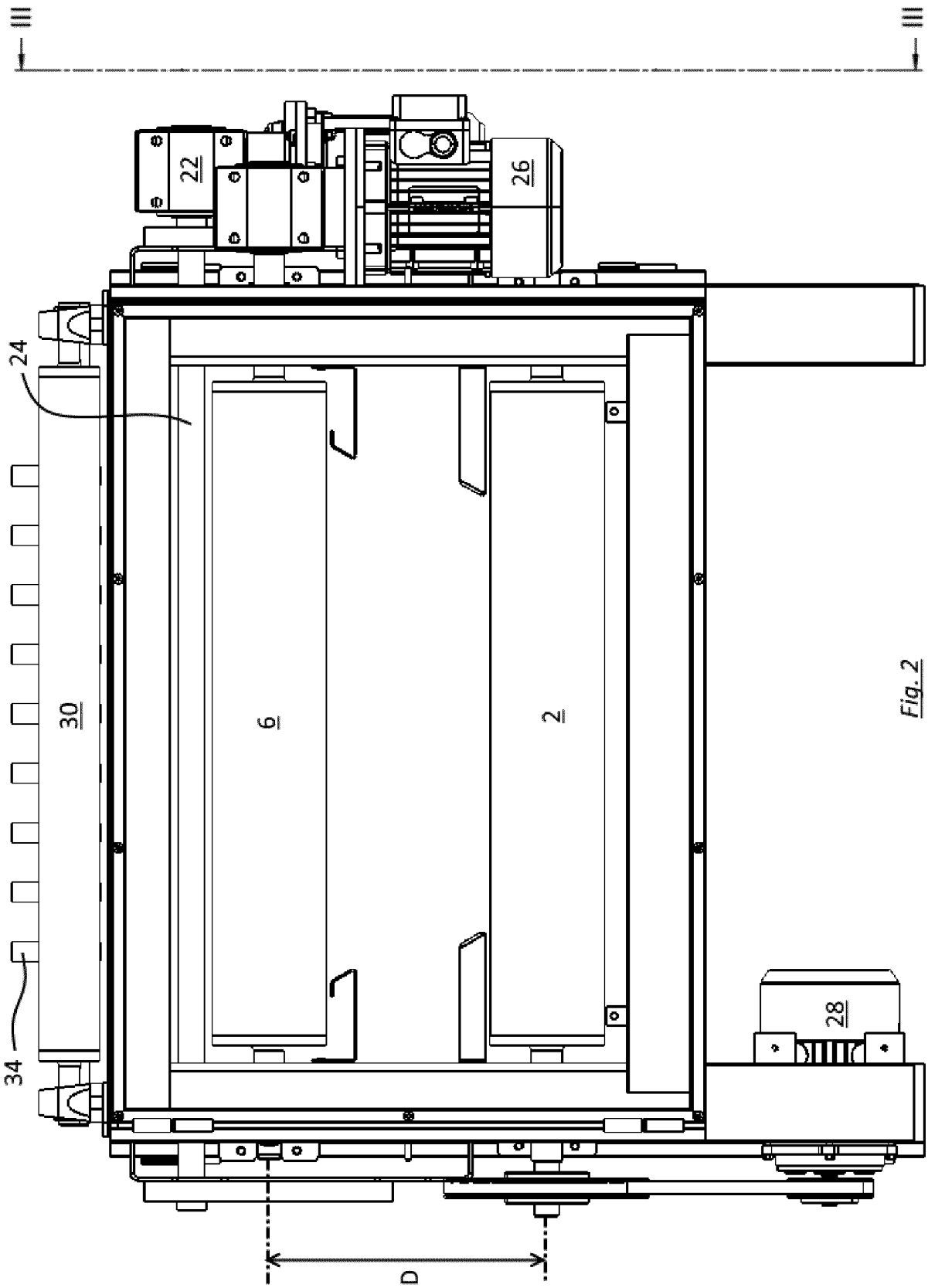

Fig. 2

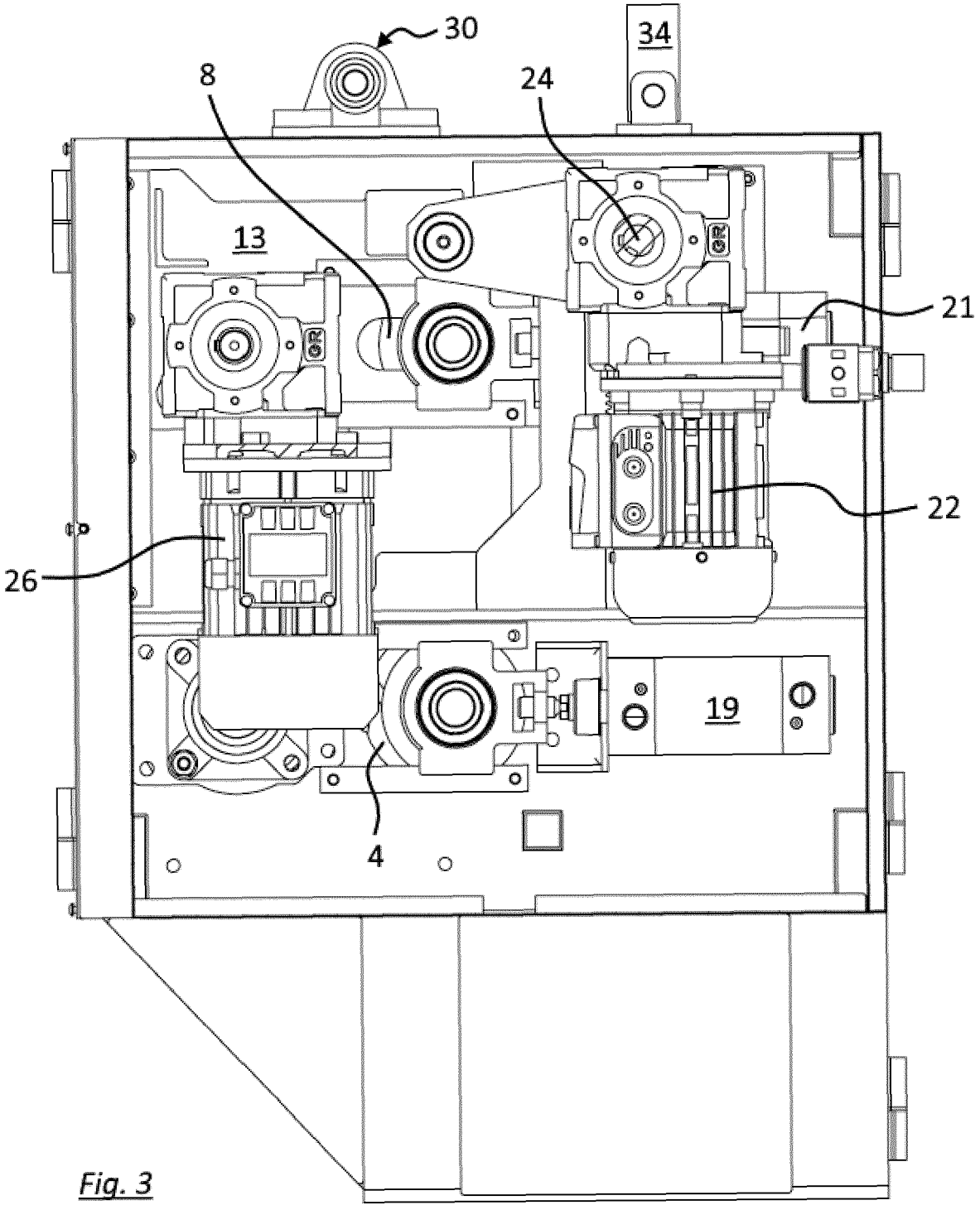

Fig. 3

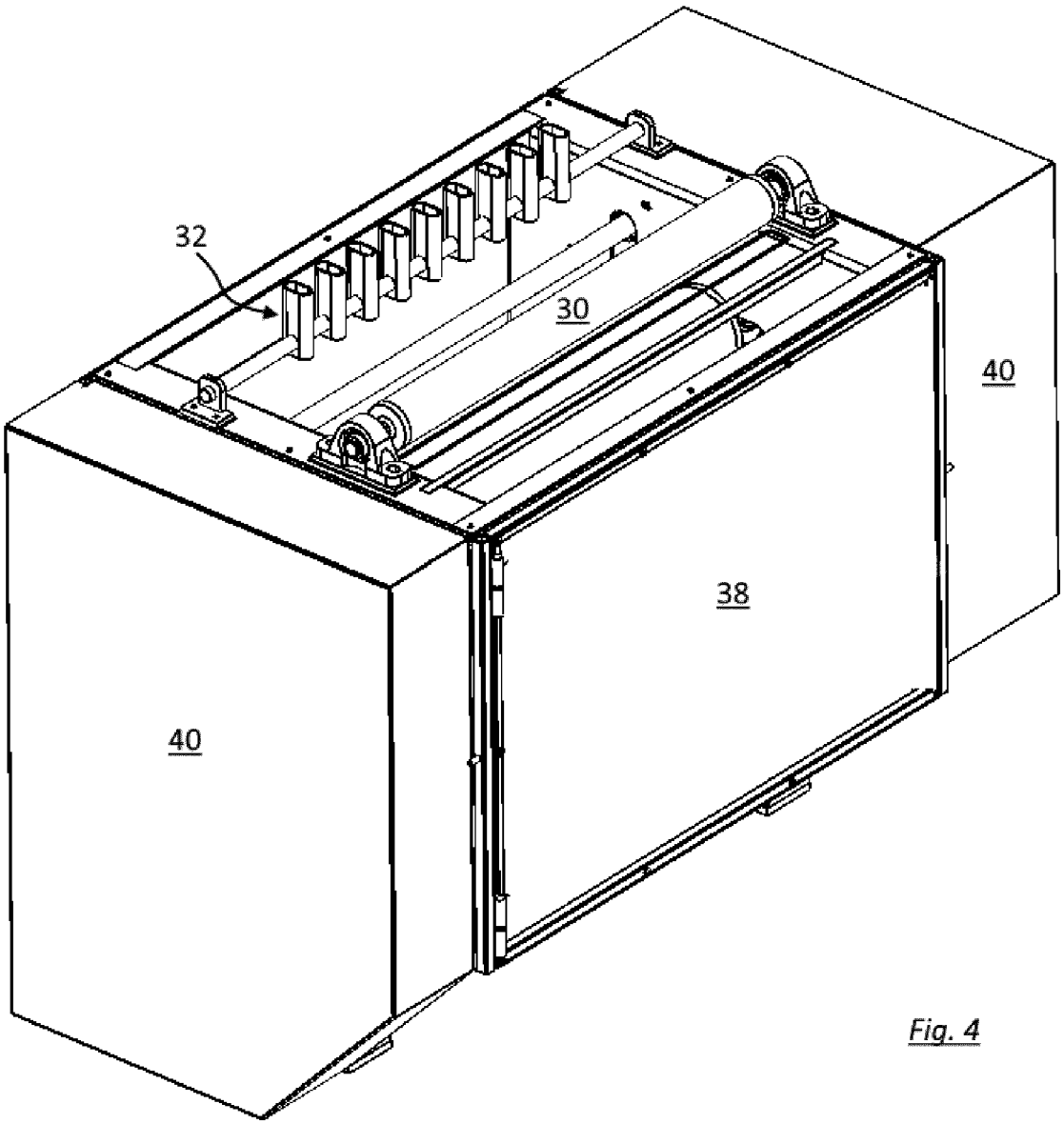

Fig. 4

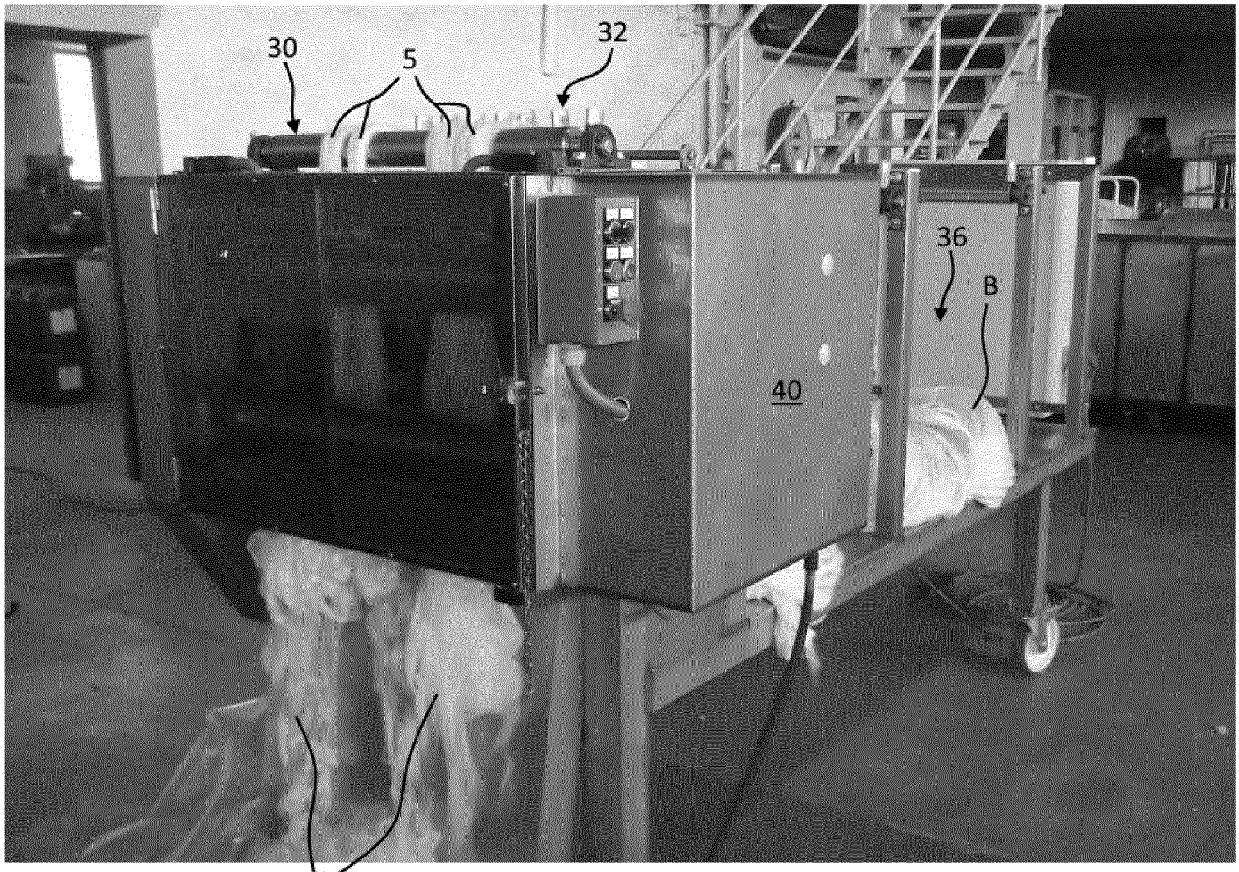

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 19 16 5507

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

D01G
D01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 November 2019	Todarello, Giovanni

CATEGORY OF CITED DOCUMENTS

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