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

(11) EP 3 112 156 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.01.2017 Bulletin 2017/01

(21) Application number: **16176466.7**

(22) Date of filing: **27.06.2016**

(51) Int Cl.:
B41F 31/30 *(2006.01)* ***B41F 31/34*** *(2006.01)*
B41F 5/18 *(2006.01)* ***B41F 5/24*** *(2006.01)*
B41F 13/02 *(2006.01)* ***B41F 13/10*** *(2006.01)*
B41F 13/30 *(2006.01)* ***B41F 13/36*** *(2006.01)*
B41F 23/04 *(2006.01)* ***B41F 27/00*** *(2006.01)*
B41F 27/06 *(2006.01)* ***B41F 27/12*** *(2006.01)*
B65H 18/00 *(2006.01)*

(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:
MA MD

(30) Priority: **30.06.2015 IT UB20151805**

(71) Applicant: **Maklaus S.r.l.**
50129 Firenze (IT)

(72) Inventor: **ATTUCCI, Giovanni**
56128 Tirrenia PI (IT)

(74) Representative: **Modiano, Micaela Nadia et al**
Modiano & Partners
Via Meravigli, 16
20123 Milano (IT)

(54) FLEXOGRAPHIC MACHINE WITH INCREASED FUNCTIONALITY, PARTICULARLY FOR PRINTING FINE AND EXTENSIBLE MATERIAL

(57) A flexographic machine (1) with increased functionality, particularly for printing fine and extensible material, comprising:
- an assembly (2) for unwinding a spool (3) of a film (4) of material to be printed along a printing path,
- at least one assembly (5) for printing the film (4) in output from the unwinding assembly (2),
- at least one assembly (6) for drying the film (4) in output from the printing assembly (5), and
- an assembly (7) for spooling the film (4) in output from the at least one drying assembly (6); the spooling assembly (5) comprises a presser roller (31) that is adapted to fix the film (4) on a spooling cylinder (32) intended to make contact with a core (9) onto which the film (4) is to be wound in a roll (11); the presser roller (31) is arranged in front of the spooling cylinder (32) with respect to the advancement direction of the film (4) and is provided with means (34) for movement away from the spooling cylinder (32) and for approach until contact with the spooling cylinder (32), so as to allow the selective placement of the film (4) on one of the two sides of the presser roller (31) and allow the winding of the roll (11) of printed film (4) selectively along a clockwise or counterclockwise direction.

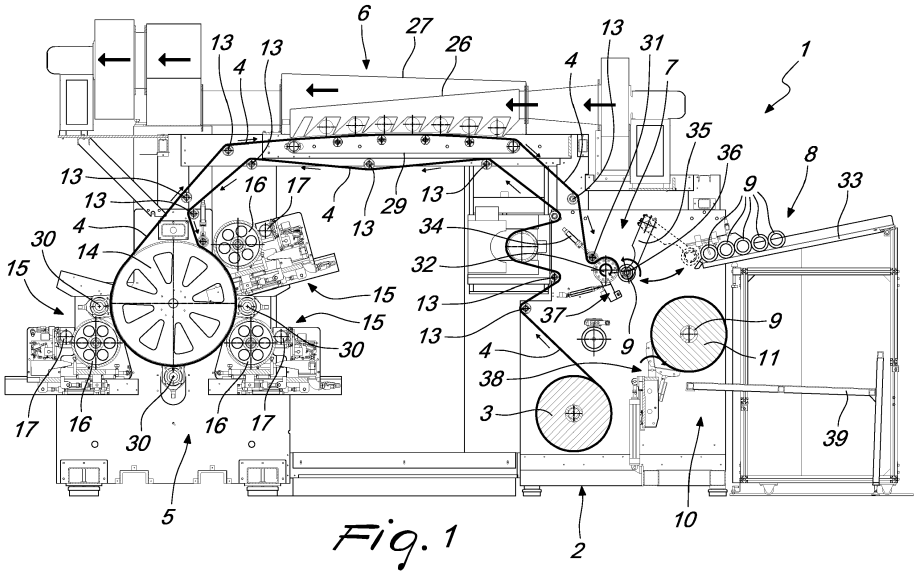


Fig. 1

EP 3 112 156 A1

Description

[0001] The present invention relates to a flexographic machine with increased functionality, particularly for printing fine and extensible material.

[0002] In the flexographic field, various types of machine, referenced hereinafter as of the "traditional" type, are known which suffer a series of drawbacks due to the difficulties in use in the field of fine and extensible material, deriving mainly from the low thickness of the material to be printed.

[0003] More specifically, the drawbacks cited above are listed hereafter in summary.

[0004] First of all, it is necessary to point out a first drawback due to the difficulty in maintaining a constant tension of the material over the entire path between the unwinding unit and the spooling unit.

[0005] In machines of the traditional type, this tension is usually adjusted by means of the use of gravity-actuated dandy rolls, the effectiveness of which is proportional to their manufacturing accuracy.

[0006] Tension control is fundamental for correct printing of the material, since extensible material does not tolerate well oscillations of traction tension.

[0007] The fluctuation of the tension in fact triggers sideways oscillations of the film during its travel, with a consequent loss of quality both in printing, due to a misalignment of the image among the individual colors, and in the printed roll, which thus has frayed edges.

[0008] A further drawback of machines of the traditional type resides in the difficulty of using printing plate cylinders with a large diameter, which by having large inertias due to their dimensions, clash with the structural limitations of the machine, which are not designed to withstand high stresses.

[0009] The use of these cylinders is necessary when a large print repeat is desired.

[0010] Printed extensible material is in fact used often to package goods with rather important volumes, and therefore in their "wrapping" various overlaps of the printing are created which make it illegible, when instead the broad repeat between contiguous prints would reduce the possibility of mutual overlap.

[0011] Another drawback of machines of the traditional type resides in the difficulty of quickly changing the printing plates on the printing roller, which makes the printing of medium-small batches of material economically scarcely convenient.

[0012] In greater detail, the poor convenience arises from machine downtimes caused by printing plate changing and by washing of the inking part.

[0013] Printing plate systems with a jacket are currently used, but their manufacture is extremely expensive, especially in a market in which printing is substantially a convenience and not a necessity.

[0014] In small runs, the final price of the service can only have modest increases and therefore the costs that it induces (such as machine downtime, tooling, etc.) must be reduced to a minimum.

[0015] A further drawback of machines of the traditional type resides in the difficulty of determining the pressure between the inking roller and the printing plate cylinder and between such cylinder and the impression roller.

[0016] Mechanical abutments are currently used which have to be adjusted by expert operators as a function of the thickness of the printing plate that is used in printing and of the quality of the film to be inked.

[0017] The mutual pressure between the printing rollers is in fact the fundamental parameter that ensures print quality, its definition and the correct addition of ink to the printing plate.

[0018] Moreover, the pressure adjustment operations are entrusted to the experience of print workers and are usually rather complex and lengthy, since they have to be performed whenever the printing plate and/or the material to be printed is changed.

[0019] Another drawback of machines of the traditional type resides in the difficulty in drying the color due to the impossibility to heat considerably the material, which poorly withstands high temperatures.

[0020] Usually, in these machines of the traditional type drying is performed by using large volumes of air at high speed, which is aspirated immediately in order to avoid dispersing into the environment the solvents used to fix the inks.

[0021] Although this method is effective from the operational standpoint, it has the drawback of triggering the so-called "sail effect" on the material, entailing the creation of air bubbles on the rewound spool and the sideways oscillation of the material in its path.

[0022] In order to obviate these drawbacks, it would be necessary to control the tension of the material and support it for all the time for which it is subjected to drying.

[0023] A further drawback of machines of the traditional type resides in the difficulty in winding the printed spool, since using oscillating tension control systems triggers sideways oscillation phenomena during spooling which can be eliminated only by using expensive and precise final alignment systems.

[0024] This drawback is characteristic in all rewinding systems in which tension control occurs mainly from the spooling shaft.

[0025] Another drawback of machines of the traditional type resides in the difficulty of fully automatic changing of the wound spools.

[0026] More specifically, a necessary condition in printing systems is the possibility to wind the printed extensible film in the two directions of rotation so that the printed face can remain selectively on the inside or on the outside of the spool.

[0027] In all machines of the traditional type, in order to achieve this result, systems with a plurality of rotating reels are used which, in addition to being significantly expensive, suffer the drawback of being rather complicated from the constructive standpoint and difficult to rapidly set in operating conditions.

[0028] This is due to the fact that the market of extensible material requires winding on cores that vary from the inside diameter of 38 millimeters up to 76 millimeters and changing the format of the reel that supports the core is an operation that requires time.

[0029] The aim of the present invention is to provide a flexographic machine with increased functionality, particularly for printing fine and extensible material, that is capable of obviating the drawbacks cited above.

[0030] Within this aim, an object of the present invention is to provide a flexographic machine that allows to print and spool a film of fine and extensible material in a manner that is simple, quick, effective, efficient, and most of all by automating all the ordinary and extraordinary operations required for the operation of the machine proper.

[0031] This aim, as well as these and other objects that will become better apparent hereinafter, are achieved by a flexographic machine with increased functionality, particularly for printing fine and extensible material, comprising:

- an assembly for unwinding a spool of a film of material to be printed along a printing path,
- at least one assembly for printing said film in output from said unwinding assembly,
- at least one assembly for drying said film in output from said at least one printing assembly, and
- an assembly for spooling said film in output from said at least one drying assembly,

characterized in that said spooling assembly comprises a presser roller that is adapted to fix said film on a spooling cylinder intended to make contact with a core onto which said film is to be wound in a roll, said presser roller being arranged in front of said spooling cylinder with respect to the advancement direction of said film and being provided with means for movement away from said spooling cylinder and for approach until contact with said spooling cylinder, so as to allow the selective placement of said film on one of the two sides of said presser roller and allow the winding of said roll of printed film selectively along a clockwise or counterclockwise direction.

[0032] Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of a flexographic machine with increased functionality, particularly for printing fine and extensible material, according to the invention, illustrated by way of nonlimiting example in the accompanying drawings, wherein:

Figures 1 to 4 are views in sequence of the steps of unwinding, printing, drying and spooling of a film printed by means of a flexographic machine, according to the present invention and in one winding direction;

Figure 5 is a partially sectional side elevation view of a printing plate cylinder of the flexographic machine shown in the preceding figures;

Figure 6 is a sectional view of the printing plate cylinder shown in Figure 5 and taken along the sectional line VI-VI;

Figure 7 is a partially sectional front elevation view of the printing plate cylinder shown in Figures 5 and 6;

Figure 8 is an enlarged-scale view of a detail of the printing plate cylinder shown in Figure 7;

Figures 9 and 10 are two side elevation views of part of the printing assembly of the flexographic machine shown in the preceding figures in two different operating adjustments;

Figure 11 is a side elevation view of part of the drying assembly of the flexographic machine shown in the preceding figures;

Figure 12 is an enlarged-scale view of a detail of the spooling assembly of the flexographic machine shown in Figure 1;

Figures 13 to 16 are views in sequence of the steps of unwinding, printing, drying and spooling of a film printed by means of the flexographic machine shown in the preceding figures, along a winding direction that is the opposite of the one shown in Figures 1 to 4;

Figure 17 is an enlarged-scale view of a detail of the spooling assembly of the flexographic machine shown in Figure 13.

[0033] With reference to the figures, the flexographic machine with increased functionality, particularly for printing fine and extensible material, generally designated with the reference numeral 1, comprises first of all:

- an assembly 2 for unwinding a spool 3 of a film 4 of material to be printed along a printing path,
- at least one assembly 5 for printing the film 4 in output from the unwinding assembly 2,
- at least one assembly 6 for drying the film 4 in output from the printing assembly 5, and
- an assembly 7 for spooling the film 4 in output from the drying assembly 6.

[0034] As completion of the flexographic machine 1, a station 8 for loading cores 9, made for example of cardboard, onto which the film 4 is to be wound so as to obtain a roll 11 of film 4 that is printed in the flexographic machine 1, is comprised; such roll is then unloaded in an unloading station 10 for its evacuation from the flexographic machine 1.

[0035] For the sake of simplicity in description, the assemblies and the stations cited above will be described hereinafter in an order that follows the path of the film 4.

[0036] After crossing a first portion of path, which is more or less structured depending on the layout chosen during design and has the purpose of spreading the film 4 uniformly, preparing it for printing, such film arrives at the printing assembly 5, which, as in the proposed embodiment, is only one, but which, in a hypothetical vari-

ation of the flexographic machine 1, might provide for multiple printing assemblies in series with each other.

[0037] In greater detail, the printing assembly 5 comprises an impression roller 14 and at least one printing subassembly 15 provided with a printing plate cylinder 16 and with an inking roller 17 which are pressed against each other, the first one being adapted to be pressed tangentially against the outer surface of the impression roller 14, with the film 4 interposed between the impression roller 14 and the printing plate cylinder 16 for its printing.

[0038] Furthermore, depending on the number of print colors provided, there can be a plurality of printing subassemblies 15, for example a number variable from two to four, each provided with a printing plate cylinder 16 and with an inking roller 17 and arranged peripherally, in a substantially uniformly distributed manner, around the impression roller 14.

[0039] For example, in the proposed embodiment, there are three printing subassemblies 15.

[0040] In the proposed embodiment, each printing plate cylinder 16 is made of aluminum alloy so as to be as lightweight as possible, so that it can have a large diameter so as to be able to accommodate plates up to 1000 mm in linear extension without encountering constraints on the rotation rate due to its inertia.

[0041] Advantageously, with particular reference to Figures 5 to 8, each printing plate cylinder 16 has a plurality of calibrated recesses 18 provided in the thickness of its external jacket and adapted to accommodate non-detachably a plurality of magnets, not shown for the sake of graphic simplicity, in such a manner as to engage by magnetic attraction a printing plate, for example made of rubber or photopolymeric materials, which is provided with a support made of a ferromagnetic material, which is constituted for example by a metal plate having a calibrated thickness.

[0042] The printing plate provided in this configuration allows far simpler and quicker placement and removal operations with respect to the standard of machines of the traditional type.

[0043] The use of a small spatula of non-magnetic material with which to remove the printing plate from the printing plate cylinder 16, is in fact sufficient for these printing plate removal operations.

[0044] As regards the magnets of the printing plate cylinder 16, they can be of the permanent-magnet type and glued, for example by means of an epoxy-based adhesive, in the respective calibrated recess 18.

[0045] In this manner, the interface between the printing plate cylinder 16 and the printing plate thus defined can operate at up to and beyond a rate of 700 m/minute, which is equivalent to more than twice the maximum rate provided for the operation of the flexographic machine 1, ensuring maximum adhesion.

[0046] In a possible variation, not shown, of the proposed embodiment of the flexographic machine 1, with the appropriate technical solutions one might provide for the use of electromagnets instead of the permanent magnets, so as to allow the removal of the printing plate simply by removing power from the printing plate cylinder.

[0047] As a completion of the printing plate cylinder 16 there are mechanical abutments that consists of pins that have a small diameter, have a height, with respect to the deck of the cylinder, that is lower than the thickness of the installed printing plate, are defined on the outer jacket of the printing plate 16, and on which the edge of such printing plate rests so as to simplify the operations for assembly and alignment of such printing plate.

[0048] More specifically, the alignment pins of the printing plate, which are not shown for the sake of simplicity in illustration, are aligned upon the reset of the printing plate cylinder 16, an operation that is required for synchronization for prints in a plurality of colors.

[0049] Therefore, since each individual printing plate cylinder 16 has electrical axis control, it is possible to mutually synchronize the individual printed colors in a simple manner.

[0050] With particular reference to Figures 9 and 10, for each printing subassembly 15 the printing plate cylinder 16 and the inking roller 17 are supported rotatably respectively by two sliders, respectively 19 and 20, which can move radially, for the first one, with respect to the impression roller 14 and, for the second one, with respect to the printing plate cylinder 15.

[0051] These sliders 19 and 20, each of which can consist for example of a carriage with double recirculating ballscrew on linear guides, moved by pneumatic cylinders, are adapted for the approach or spacing of the printing plate cylinder 16 with respect to the impression roller 14 and of the inking roller 17 with respect to the printing plate cylinder 16 so as to adjust the mutual pressure between the cylinders 14, 16 and 17 of the flexographic machine 1 with the film 4 interposed between the impression roller 14 and the printing plate cylinder 15 for its printing.

[0052] Advantageously, there are also means 21 for micrometric adjustment of the position of the sliders 19 and 20, which comprise, for each slider 19 or 20, an adjustment wheel 22 that can rotate eccentrically about a rotation axis 23 that is perpendicular to the direction of translational motion of the respective slider 19 or 20 so as to cause, in a controlled manner as a function of its rotation, a spacing or an approach of the respective slider 19 or 20 with respect to the rotation axis 23 and accordingly an approach or spacing of the printing plate cylinder 16 with respect to the impression roller 14 or of the inking roller 17 with respect to the printing plate cylinder 16.

[0053] Conveniently, the rotation of the adjustment wheel 22 is controlled by an actuator 24, for example of the linear type, and the slider 20 that supports the inking roller 17 is supported by the slider 19 that supports the printing plate cylinder 16.

[0054] In this manner, the adopted solution allows to have high precision of the position of each slider 19 or 20, since the actuator 24 is provided internally with a

potentiometer which, by reading the tension at the point where the stem is located, ensures the position thereof with a tolerance on the order of a tenth of a millimeter.

[0055] Considering for example a stroke of the actuator 24 that is equal to 40 millimeters, with an eccentricity of the adjustment wheel 22 equal to 3 millimeters, the error in the position of the adjustment wheel 22 is reduced by the ratio 1:13 with respect to that of the actuator 24 that rotates it, making the system extremely precise with respect to machines of the traditional type.

[0056] Furthermore, the abutment of each slider 19 and 20 can be ensured instead by an abutment that can be adjusted by means of a screw, which contrasts against the respective adjustment wheel 22.

[0057] This simple system ensures that the positions of the printing plate cylinder 16 with respect to the impression roller 14 and of the inking roller 17 with respect to the printing plate cylinder 16 are extremely precise.

[0058] At the same time, the adjustment of the abutments is substantially simplified, since it is sufficient to determine a reset of the system and therefore "adjust", even during printing, the position of the actuator 24 as a function of the required printing pressure.

[0059] A very important aspect is that the value of the position of the actuator 24 can be stored and therefore can be retrieved whenever the printing plate is used.

[0060] The two abutments, both the adjustment wheel 22 and the one mounted on the setting screw, constituted for example by a bearing, can have a tempered and ground contact surface in order to avoid local deformations that might cause positioning errors of each slider 19 or 20.

[0061] In this regard, the abutment mounted on the setting screw can be constituted by a ball bearing, so that the friction between the adjustment wheel 22 and the setting during adjustment of the abutment proper is reduced to a minimum.

[0062] Additionally, it is useful to point out that the adjustment step is performed simply by determining the position of the adjustment wheel 22 by means of the actuator 24, the stored position of which allows constant positioning precision at each printing cycle as regards printing plate and material thickness, allowing to prepare "programs" that facilitate machine setup.

[0063] Furthermore, in this manner discontinuous printing is also simplified, since it is sufficient to use the actuator 24 to "disconnect" the printing plate cylinder 16 from the impression roller 14 to then return it into contact once the film 4 has traveled for the desired extent.

[0064] As argued extensively in the initial preamble, the film 4, which is made of a fine and extensible material, is highly sensitive to high temperatures and therefore, once it has exited from the printing assembly 5, the drying of the inks, be they water-based or solvent-based, must occur by adding to its surface large volumes of air at high speed, and such air, once used, must be aspirated immediately in order to avoid harmful emissions, caused by the process of fixing the inks, into the surrounding environment.

[0065] Advantageously, with particular reference to Figure 11, the drying assembly 6 comprises a drying tunnel 25 through which the film 4 that exits from the printing assembly 5 and has, on the printed side of the film 4, two coaxial hoods 26 and 27, of which one is a blower hood and one is a suction hood, which are adapted respectively to dry by means of forced air, for example heated at low temperatures by a set of resistance heaters upstream of the fan, the printed side and to aspirate the air blown by the blower hood 26.

[0066] Conveniently, the blower hood 26 has a transverse cross-section that progressively converges along the direction of the forced air and has, on the side directed toward the film 4, a plurality of nozzles 28 that are distributed uniformly along a movable mat 29 arranged inside the drying tunnel 25 and are, for example, nine in number and have an air output cross-section equal to 3 millimeters.

[0067] As regards the movable mat 29, it is adapted to support tangentially the film 4 on the opposite side with respect to the one subjected to drying, so as to offer it a mechanical abutment so as to prevent the formation of bubbles or sails caused by the action of the coaxial hoods 26 and 27.

[0068] In greater detail, the movable mat 29 can be provided by a closed-loop belt of the motorized type, which is made of rubber and is synchronized with the other components of the flexographic machine 1, so as to have a tangential speed that is substantially identical to the tangential speed of the film 4 and prevent friction between the latter and the movable mat 29, with consequent deformation of the film 4, excessive heating thereof or accumulation of electrostatic charges.

[0069] Conveniently, the movable mat 29 has, at the region of contact with the film 4, a cambered curvilinear shape, so as to avoid sideways oscillations of such film 4.

[0070] The shape of the movable mat 29 significantly simplifies the operation of passing the film 4 between actual printing and the spooling assembly 7, since it is sufficient to fix with adhesive tape the film 4 on the side of the movable mat 29 and, by actuating it by means of a jogging system, recover it at the exit of the tunnel on the opposite side.

[0071] Furthermore, there can be at least one additional drying unit 30, which is arranged directly after each printing subassembly 15 and comprises an individual blower adapted to dry the freshly printed color.

[0072] In this case, it is the impression roller 14 that acts as a supporting element for the film 4 during this additional drying which, according to the layout, occurs before the drying provided in the drying tunnel 25.

[0073] According to the invention, in output from the drying assembly 6 transition occurs to the spooling assembly 7, where, by means of a rubber-covered presser roller 31, the film 4 is fixed on a spooling cylinder 32 that is intended to make contact with a core 9 taken from the loading station 8, which, in the proposed embodiment,

consists of an inclined plane 33 on which the cores 9 are arranged.

[0074] Advantageously, with particular reference to Figures 12 and 17, the presser roller 31 is of the passive type, is arranged in front of the spooling cylinder 32 with respect to the advancement direction of the film 4 and is provided with movement means 34, which consist for example of a pneumatic actuator, for movement away from the spooling cylinder 32 and towards up to contact with said spooling cylinder 32 so as to allow the selective positioning of the film 4 on one of the two sides of the presser roller 31 and allow the winding of the roll 11 of printed film 4 selectively clockwise or counterclockwise.

[0075] Additionally, the spooling assembly 7 comprises an oscillating arm 35, which can move between a position for picking up the core 9, in output from the pickup station 8, onto which the film 4 is to be wound and a spooling position in order to obtain the roll 11 by passing through a position for unloading it.

[0076] In greater detail, the oscillating arm 35 supports rotatably a core supporting spindle 36, which can be arranged, in the spooling position, against the spooling cylinder 32 that supports the film 4 in output from the drying assembly 6.

[0077] Conveniently, the spooling cylinder 32 is of the active type and the core supporting spindle 36 is of the passive type; constant tension of the film 4 is ensured in this manner.

[0078] In greater detail, in order to have a solid structure there are two core supporting spindles 36, supported by two respective oscillating arms 35, so as to bear the weight of the roll 11 between two resting elements and not in a cantilever manner.

[0079] Furthermore, the spooling assembly 7 is provided with means for the temporary adhesion of the film 4 to the core 9, which comprise at least one single-polarity electrostatic charge generator bar or, as an alternative, the adhesion of the film 4 to the core 9 can be obtained by using specific adhesives.

[0080] Conveniently, there are also electric brushes adapted to discharge to the ground the electrostatic charges induced by the film 4 and accumulated by the spooling cylinder 32.

[0081] Finally, the spooling assembly 7 is provided with cutting means 37, which consist for example of an oscillating arm provided with a tungsten wire that is heated by means of electric current and acts proximate to the spooling cylinder 32 to cut the film 4 once spooling has been performed.

[0082] Conveniently, in the unloading station 10 there is a movable cradle 38 which can be raised, for example by means of a pneumatic cylinder that is guided on carriages, to pick up the roll 11 of printed film 4 and can be rotated for its evacuation onto an unloading surface 39.

[0083] Advantageously, the film 4 passes through the flexographic machine 1 by means of the use of a plurality of guiding rollers 13, which are of the passive type with low inertia and low friction, differently from the printing plate cylinders 16, from the inking rollers 17, from the impression roller 14, from the movable mat 29, and from the spooling cylinder 32, which are of the motorized type and are electrically mutually connected for a synchronized adjustment of the respective rotation rates.

[0084] In this manner, the film 4 is entrained through the individual assemblies cited above, thus extending from the unwinding assembly 2 to the spooling assembly 7, in order to be able to have a precise control of the tension of the film 4 over its entire path inside the flexographic machine 1, so as to be able to vary constantly the tension conditions thereof and obviate simply and rapidly the problems induced by the quality of the material used in the flexographic machine 1.

[0085] Operation of the flexographic machine 1 according to the present invention is clear and intuitive from what has been described so far.

[0086] With particular reference to Figures 1 to 4 and 13 to 16, the main functional steps of operation of the spooling assembly 7 for winding the roll 11 in both winding directions, clockwise for the first set of figures and counterclockwise for the second set, are now described.

[0087] As shown in Figures 1 and 13, the first step consists in loading the core 9 on the core supporting spindle 36 in order to begin actual spooling.

[0088] The film 4 is arranged so as to adhere to the spooling cylinder 32 and is "attracted", as mentioned, onto the cardboard core 9 that is supported by the core supporting spindle 36 either due to the effect of an electrostatic charge (in the case of an electrostatic charger) or by means of a specific adhesive.

[0089] The spooling cylinder 32 begins its rotation and the film 4 is wound onto the core 9 clockwise or counterclockwise depending on the side of the presser roller 31 on which the operator has placed the film 4.

[0090] As already mentioned, spooling occurs by means of the spooling cylinder 32, which is of the active type, while both the core supporting spindle 36 and the presser roller 31 are of the passive type and are entrained by friction by the spooling cylinder 32.

[0091] Therefore, in order to be able to allow the winding of the film 4 in both directions, depending on whether one wishes spooling with the printed part outward or toward the inside of the roll 11, the spooling cylinder 32 must be able to rotate equally clockwise or counterclockwise. Tension of the film is ensured, in this step, by control of the rotation rate of the motor with respect to the speed of the incoming film.

[0092] As shown in Figures 2 and 14, once the desired roll format has been achieved, by means of automatic diameter control, the cylinder stops (with a descending ramp that is determined by control and can in any case be configured by the user) and the movable cradle 38 moves to the position for unloading the roll 11, i.e., below it, depending on where it is arranged. In fact, as the diameter of the roll 11 varies, so does the position thereof.

[0093] As shown in Figures 3 and 15, the movable cradle 38 then rises to pick up the roll 11.

[0094] Thanks to the oscillating arm 35, which allows to process rolls 11 of considerable size, the flexographic machine 1 is capable of spooling all diameters until it equals the diameter of the initial spool 3.

[0095] In order to ensure the unloading of any format, the movable cradle 3 8 can translate vertically, reaching the roll 11, the height of which depends on its diameter.

[0096] This function is necessary both to create the space sufficient for the movement of the cutting means 37, which act proximate to the spooling cylinder 32 to cut the film 4, and to "accommodate" the rewound roll 11 in output without making it fall from above, obviating a possibility that would lead to damage of the edge of the spooled material.

[0097] As shown in Figures 4 and 16, finally one moves on to the unloading of the roll 11 and to the cutting of the film 4, so as to allow the flexographic machine 1 to begin immediately the spooling of another roll 11.

[0098] In greater detail, the movable cradle 38, once it has reached the unloading position, receives the rewound roll 11, which falls onto it due to the opening of the core supporting spindle 36, which is provided with an extractor to release the core 9.

[0099] The oscillating arm 35 at this point is unloaded and moves toward the loading of the new core 9 and at the same time the movable cradle 3 8 moves downward, carrying along the freshly spooled roll 11.

[0100] Once the roll 11 has reached a low position, the oscillating arm 35 moves the new core 9 toward the spooling cylinder 32 and, as soon as it has reached this position, the cutting means 37 rotate to cut the film 4.

[0101] An electrostatic bar, powered by an external charger, which loads the trailing end of the cut film 4, facilitating its adhesion to the cardboard core 9, can be provided integrally with the support of the hot wire, as already mentioned.

[0102] If the electrostatic bar is not present, adhesion of the film to the cardboard core is ensured by an adapted adhesive, which is spread beforehand onto the new core 9.

[0103] Once the film 4 has attached to the new core 9, the spooling of the film 4 can begin again.

[0104] At this point the movable cradle 38 rotates to unload the roll 11 onto the unloading surface 39, which, by being slightly inclined, allows the evacuation of the roll 11 by rolling due to gravity.

[0105] The process for loading the film 4, for spooling, cutting and unloading the role 11, occurs in a fully automatic manner both if clockwise spooling and if counterclockwise spooling is provided, since the process is determined only by the direction of rotation of the spooling cylinder 32 and by the initial arrangement of the film 4 on the spooling cylinder 32.

[0106] In practice it has been found that the flexographic machine with increased functionality, particularly for printing fine and extensible material, according to the invention, achieves fully the intended aim and objects, since it allows to provide, print and wind a film of fine and extensible material rapidly, reliably, efficiently and in a fully automated manner, obviating the drawbacks of flexographic machines of the traditional type.

[0107] The flexographic machine with increased functionality, particularly for printing fine and extensible material, thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0108] All the details may further be replaced with other technically equivalent elements.

[0109] In practice, the materials used, as well as the contingent shapes and dimensions, may be any according to requirements and to the state of the art.

[0110] The disclosures in Italian Patent Application No. 102015000028885 (UB2015A001805) from which this application claims priority are incorporated herein by reference.

[0111] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A flexographic machine (1) with increased functionality, particularly for printing fine and extensible material, comprising:

- an assembly (2) for unwinding a spool (3) of a film (4) of material to be printed along a printing path,
- at least one assembly (5) for printing said film (4) in output from said unwinding assembly (2),
- at least one assembly (6) for drying said film (4) in output from said at least one printing assembly (5), and
- an assembly (7) for spooling said film (4) in output from said at least one drying assembly (6),

characterized in that said spooling assembly (7) comprises a presser roller (31) that is adapted to fix said film (4) on a spooling cylinder (32) intended to make contact with a core (9) onto which said film (4) is to be wound in a roll (11), said presser roller (31) being arranged in front of said spooling cylinder (32) with respect to the advancement direction of said film (4) and being provided with means (34) for movement away from said spooling cylinder (32) and for approach until contact with said spooling cylinder (32), so as to allow the selective placement of said film (4) on one of the two sides of said presser roller (31) and allow the winding of said roll (11) of printed film (4) selectively along a clockwise or counterclock-

wise direction.

2. The flexographic machine (1) according to claim 1, **characterized in that** said presser roller (31) is of the passive type.

3. The flexographic machine (1) according to claim 1 or 2, **characterized in that** said presser roller (31) is of the rubber-covered type.

4. The flexographic machine (1) according to one or more of the preceding claims, **characterized in that** said movement means (34) comprise a pneumatic actuator.

5. The flexographic machine (1) according to one or more of the preceding claims, **characterized in that** said spooling assembly (7) comprises an oscillating arm (35) that can move between a position for picking up said core (9) onto which said film (4) is to be wound and a spooling position in order to obtain said roll (11) by passing through a position for unloading said roll (11), said oscillating arm (35) supporting rotatably a core supporting spindle (36) which can be arranged, in said spooling position, against said spooling cylinder (32) that supports said film (4) in output from said drying assembly (6), said spooling cylinder (32) being of the active type and said core supporting spindle (36) being of the passive type.

6. The flexographic machine (1) according to one or more of the preceding claims, **characterized in that** said spooling assembly (7) is provided with means for the temporary adhesion of said film (4) to said core (9), which comprise at least one bar for generating single-polarity electrostatic charges.

7. The flexographic machine (1) according to claim 6, **characterized in that** said spooling assembly (7) is provided with electric brushes adapted to discharge to the ground the electrostatic charges induced by said film (4) and accumulated by said spooling cylinder (32).

8. The flexographic machine (1) according to one or more of the preceding claims, **characterized in that** said spooling assembly (7) is provided with cutting means (37) which act proximate to said spooling cylinder (32) in order to cut said film (4) after spooling has been performed.

9. The flexographic machine (1) according to one or more of the preceding claims, **characterized in that** said at least one drying assembly (6) comprises a drying tunnel (25), through which said film (4) runs in output from said printing assembly (5) and is provided, on the printed side of said film (4), with two coaxial hoods (26, 27), a blower hood and a suction hood, adapted respectively to dry said printed side by means of forced air and to aspirate the air blown by said blower hood (26), there being also a movable mat (29) that is adapted to support said film (4) tangentially on the opposite side with respect to the one subjected to drying, so as to offer said film (4) a mechanical abutment, so as to prevent the formation of bubbles or sails produced by the action of said coaxial hoods (26, 27).

10. The flexographic machine (1) according to claim 9, **characterized in that** said movable mat (29) is a closed-loop belt of the type that is motorized so as to have a tangential speed that is substantially identical to the tangential speed of said film (4) and so as to prevent friction between said film (4) and said movable mat (29).

11. The flexographic machine (1) according to claim 9 or 10, **characterized in that** said movable mat (29) has, at the region of contact with said film (4), a curvilinear shape, so as to avoid any sideways oscillation of said film (4).

12. The flexographic machine (1) according to one or more of claims 9 to 11, **characterized in that** said movable mat (29) is made of rubber.

13. The flexographic machine (1) according to one or more of claims 9 to 12, **characterized in that** said blower hood (26) has a transverse cross-section that converges progressively in the direction of said forced air and has, on the side directed toward said film (4), a plurality of nozzles (28) that are distributed uniformly along said movable mat (29).

14. The flexographic machine (1) according to one or more of the preceding claims, **characterized in that** it comprises a plurality of guiding rollers (13) of said film (4) which extends from said unwinding assembly (2) to said spooling assembly (7) of the passive type with low inertia and low friction.

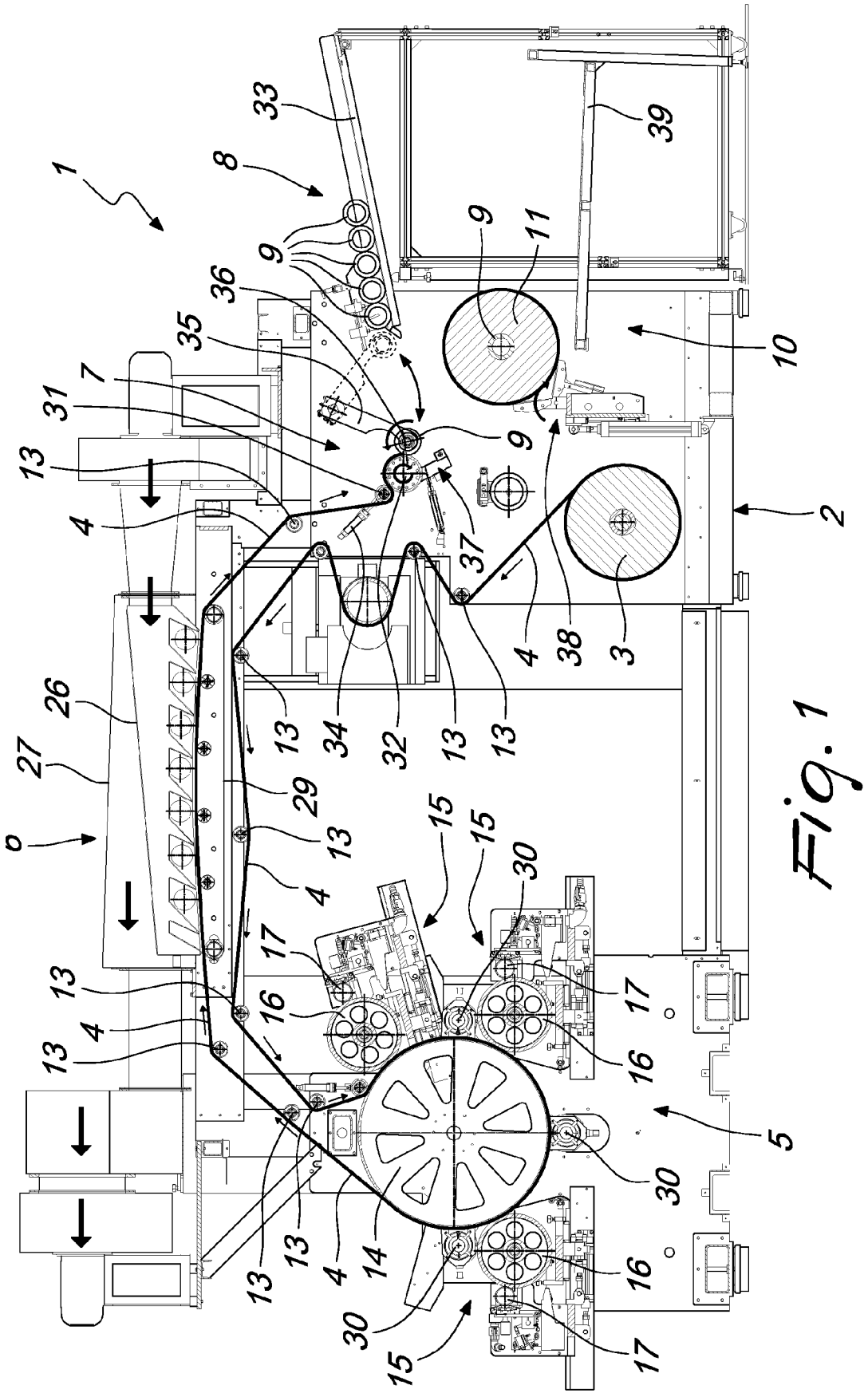


Fig. 1

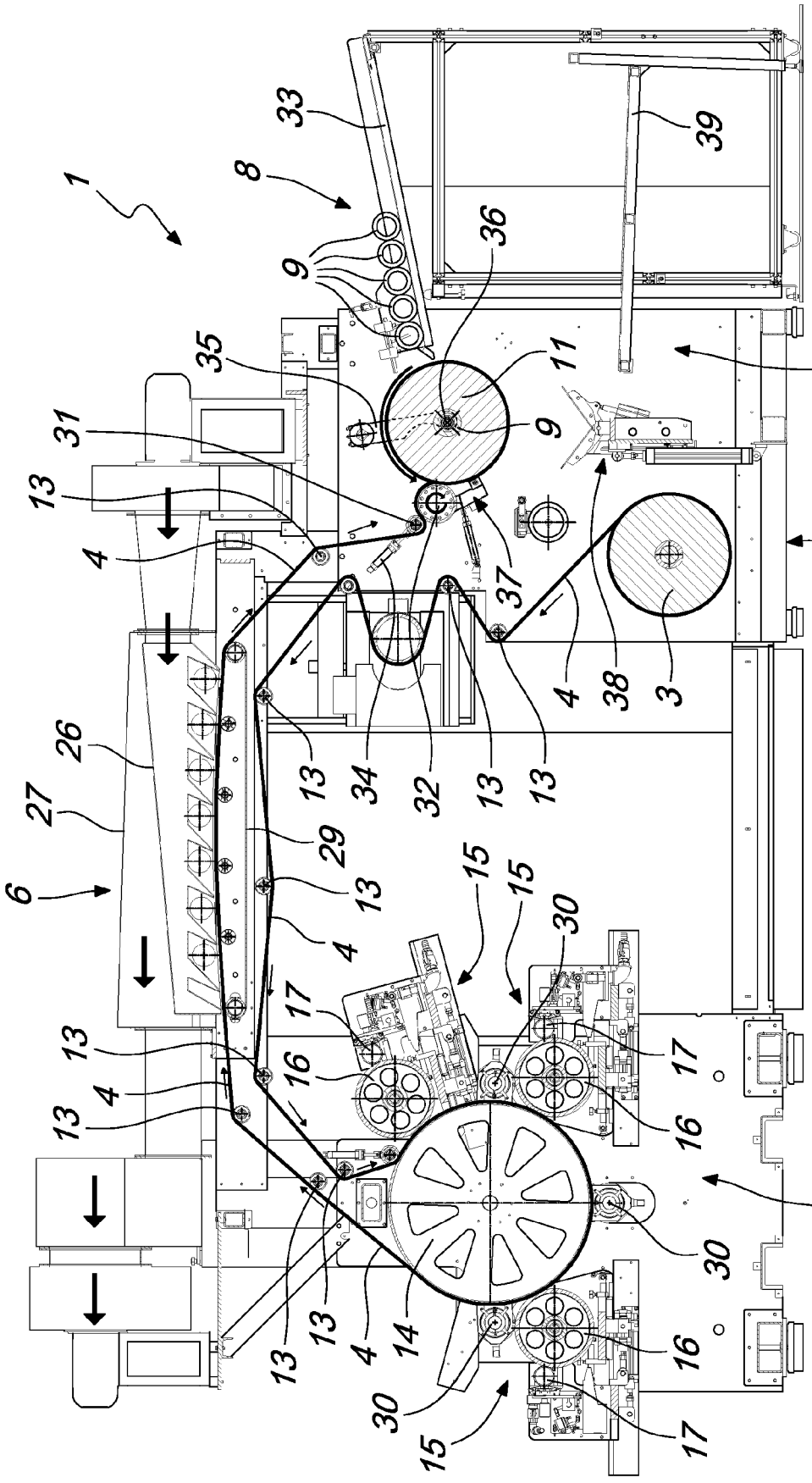


Fig. 2

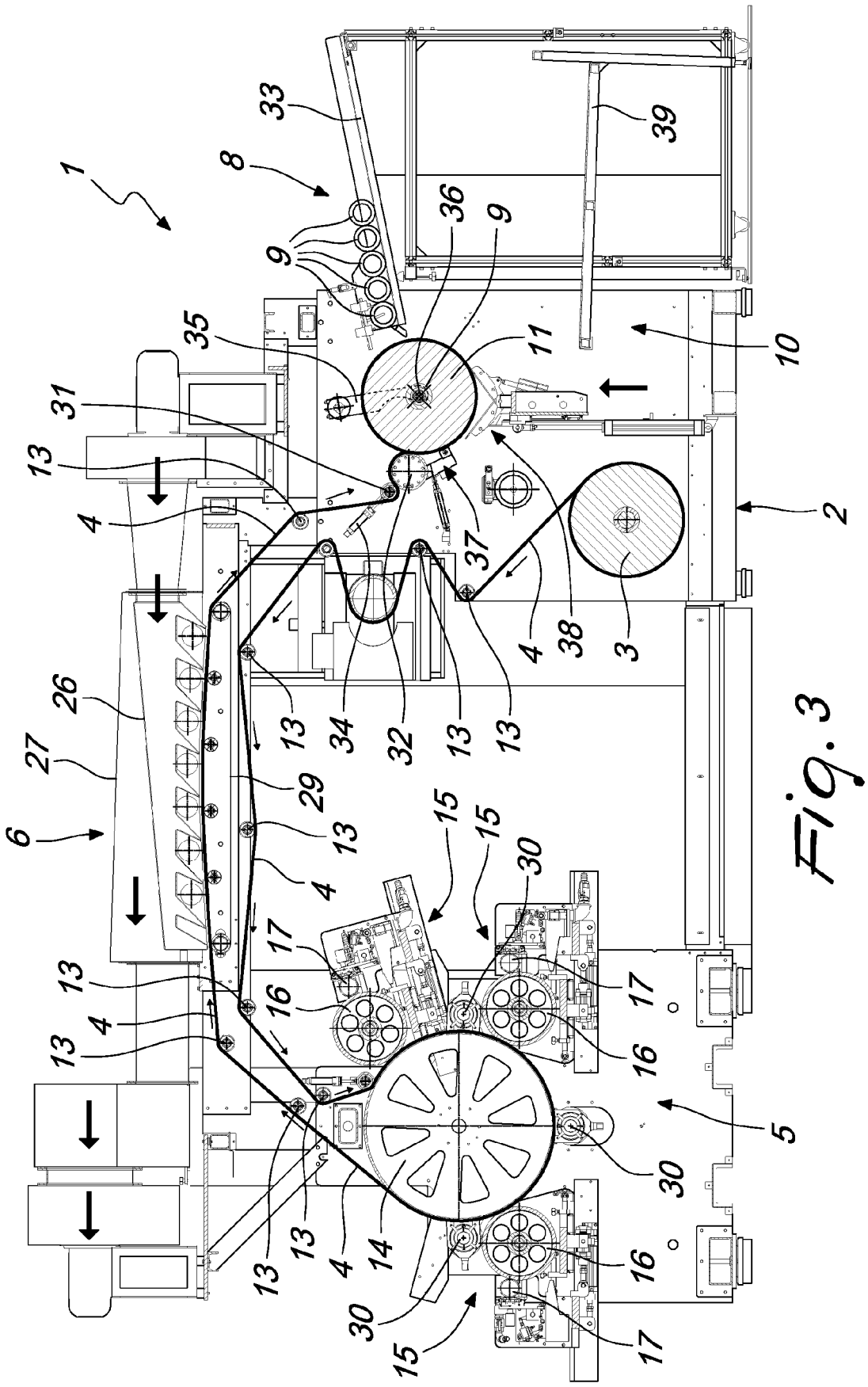


Fig. 3

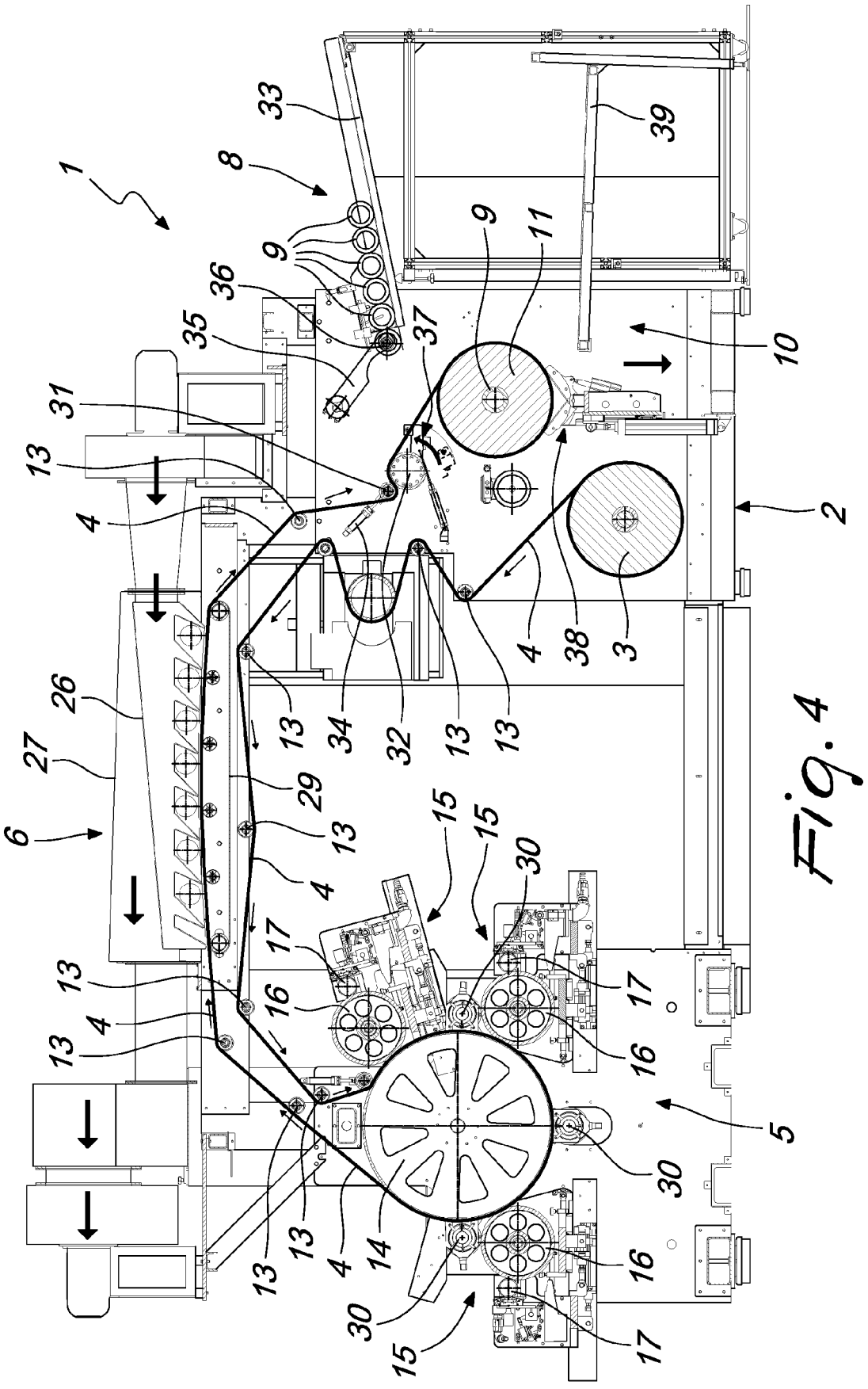


Fig. 4

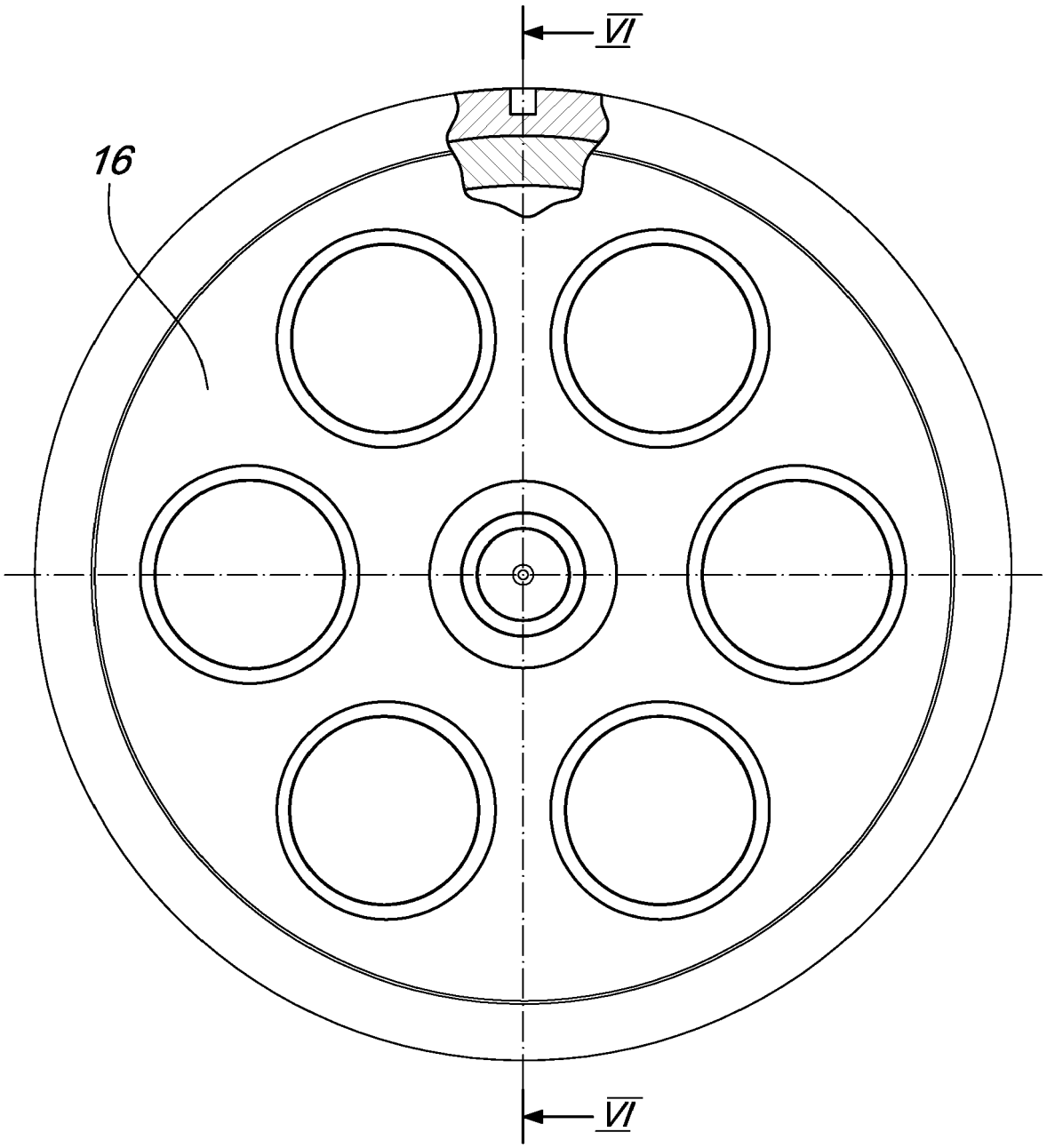


Fig. 5

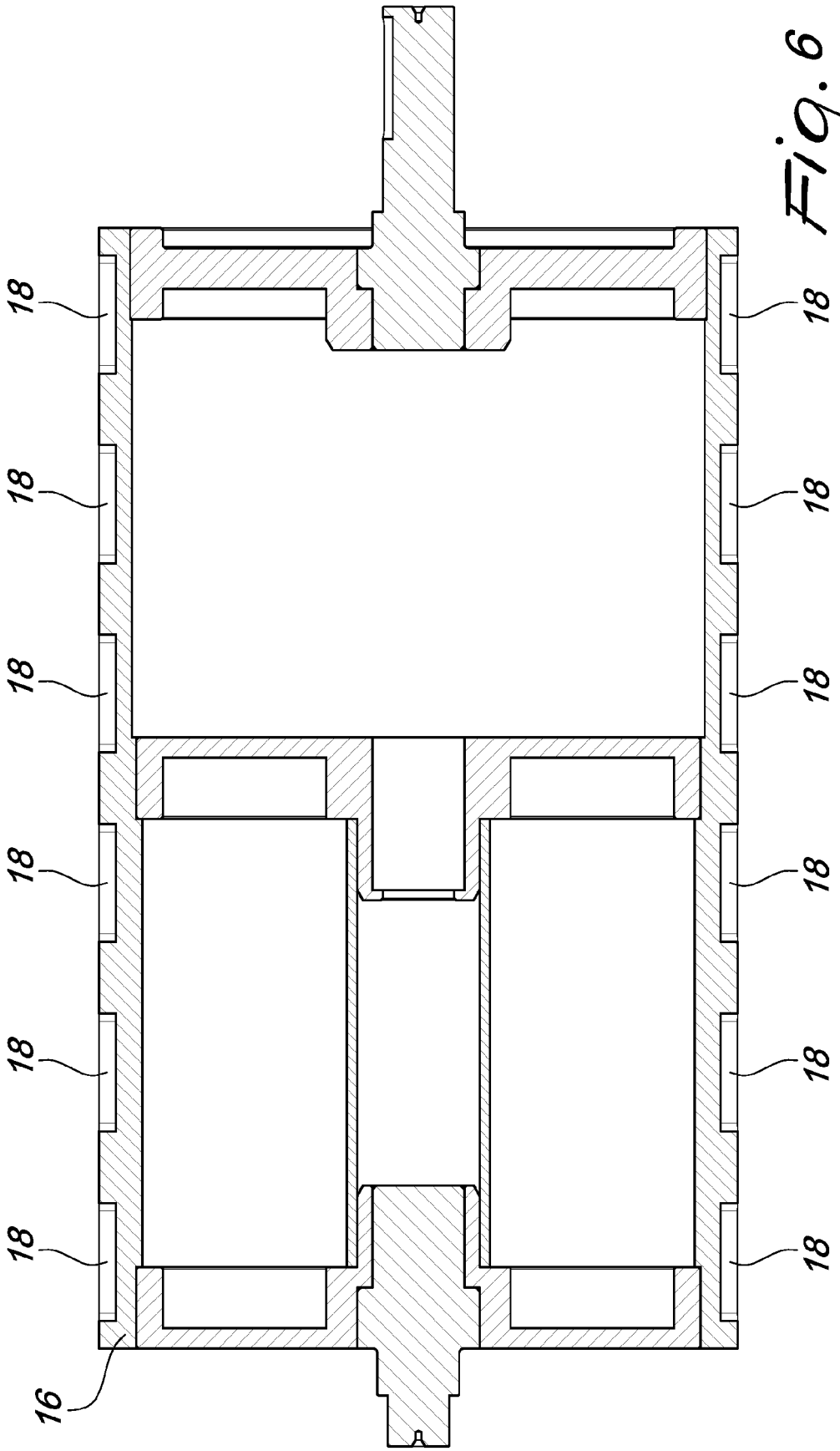


Fig. 6

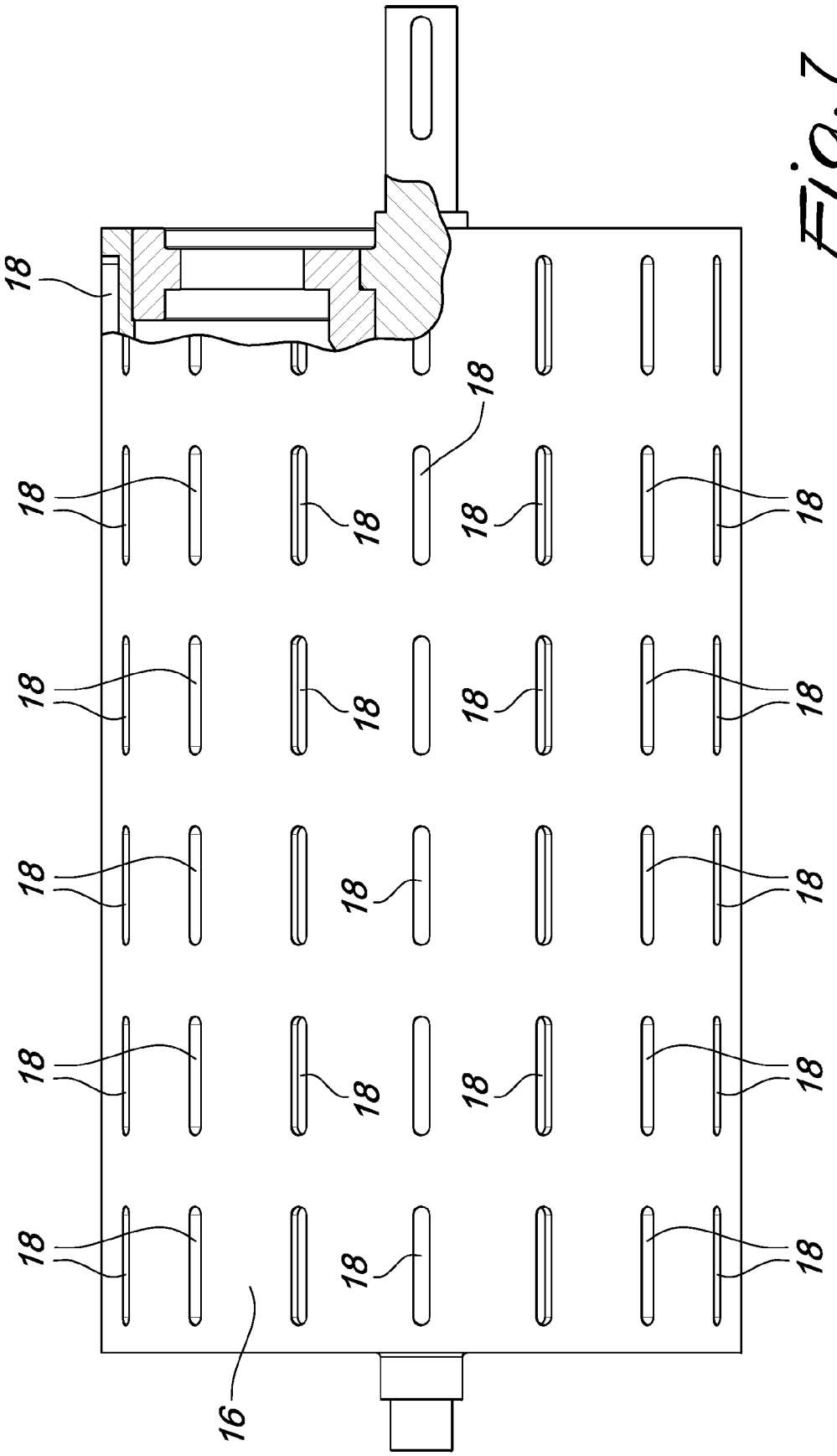


Fig. 7

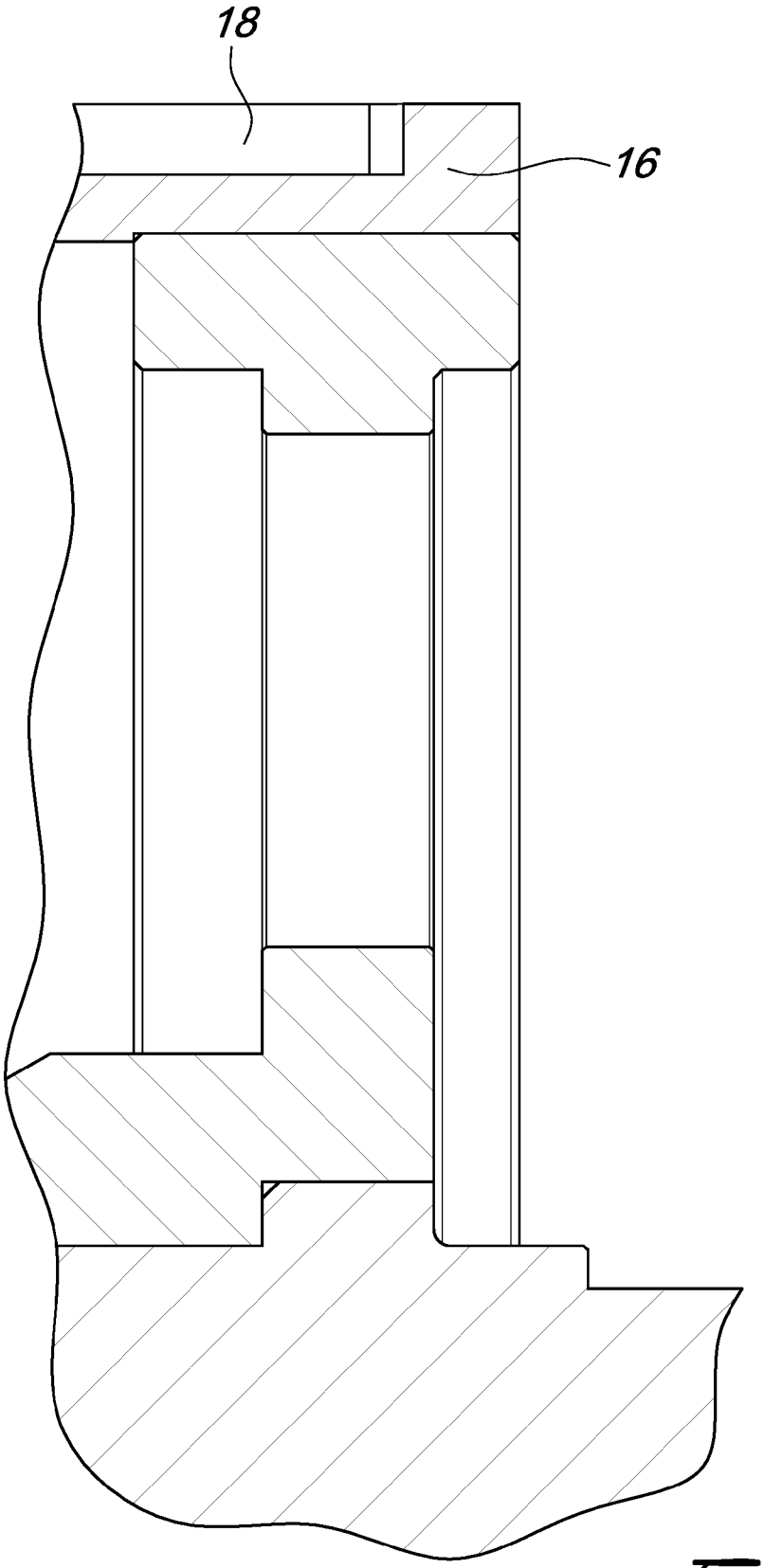


Fig. 8

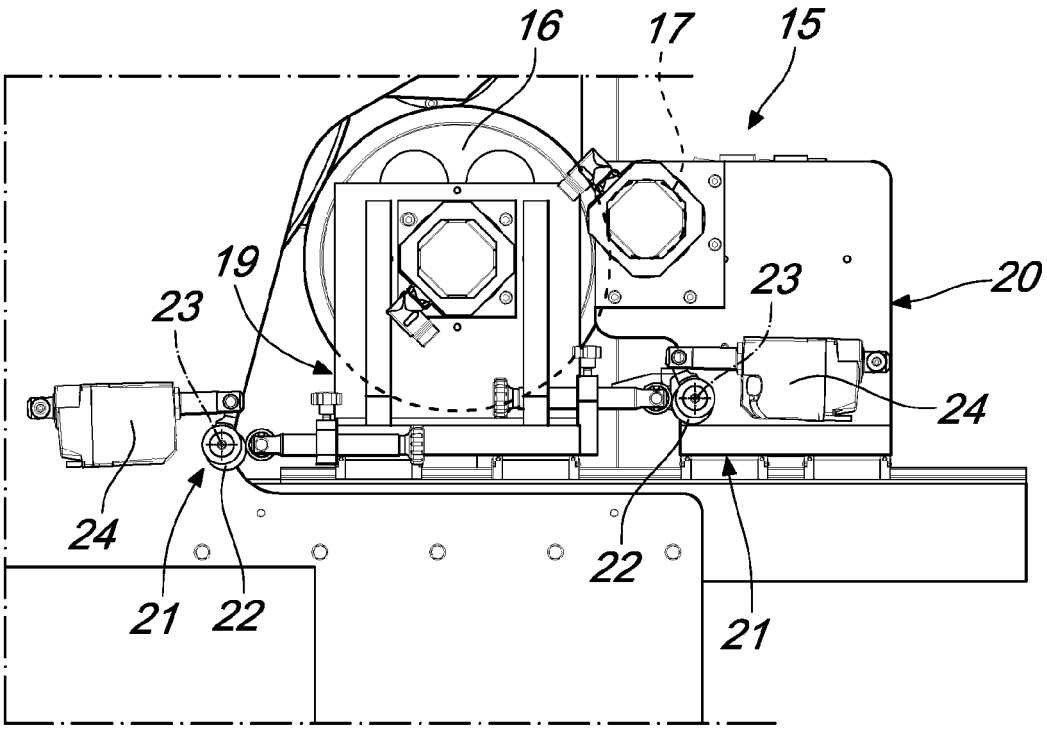

16
17
15
19
23
23
20
24
24
22
21
21
22

Fig. 9

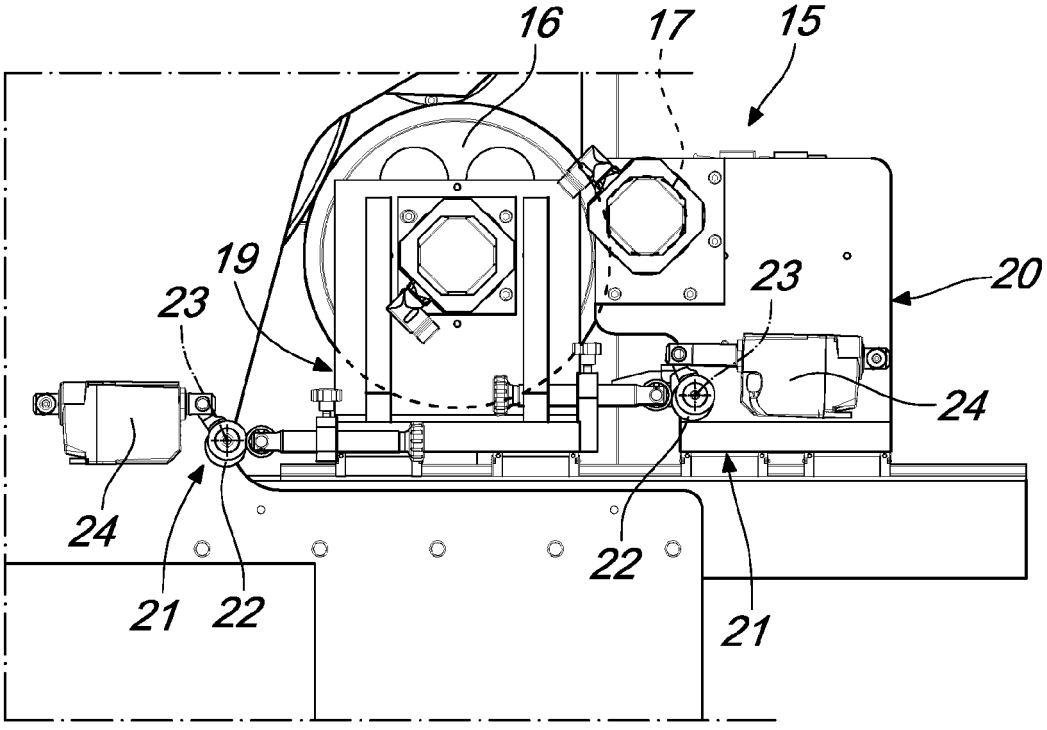

16
17
15
19
23
23
20
24
24
22
21
21
22

Fig. 10

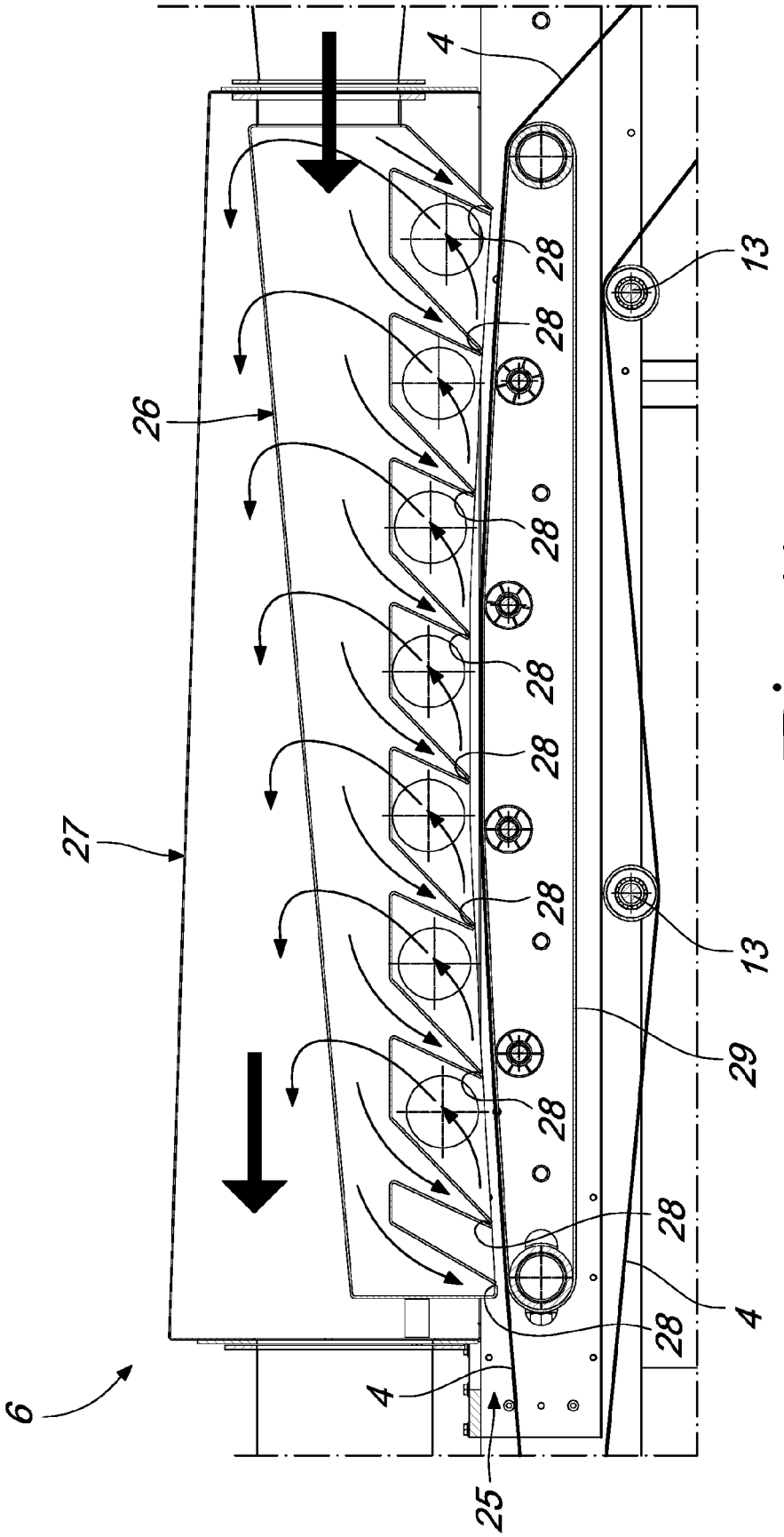
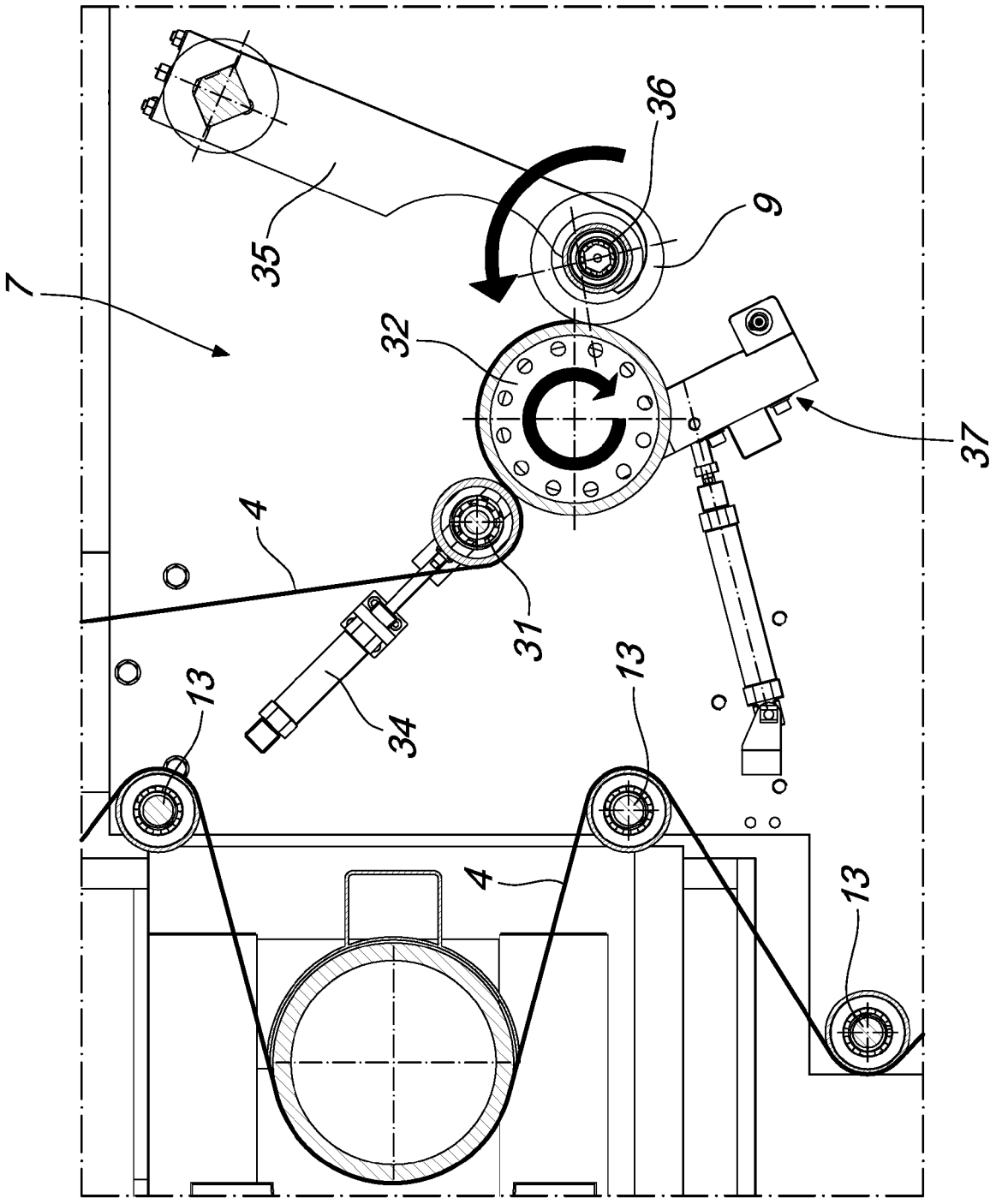


Fig. 11

Fig. 12



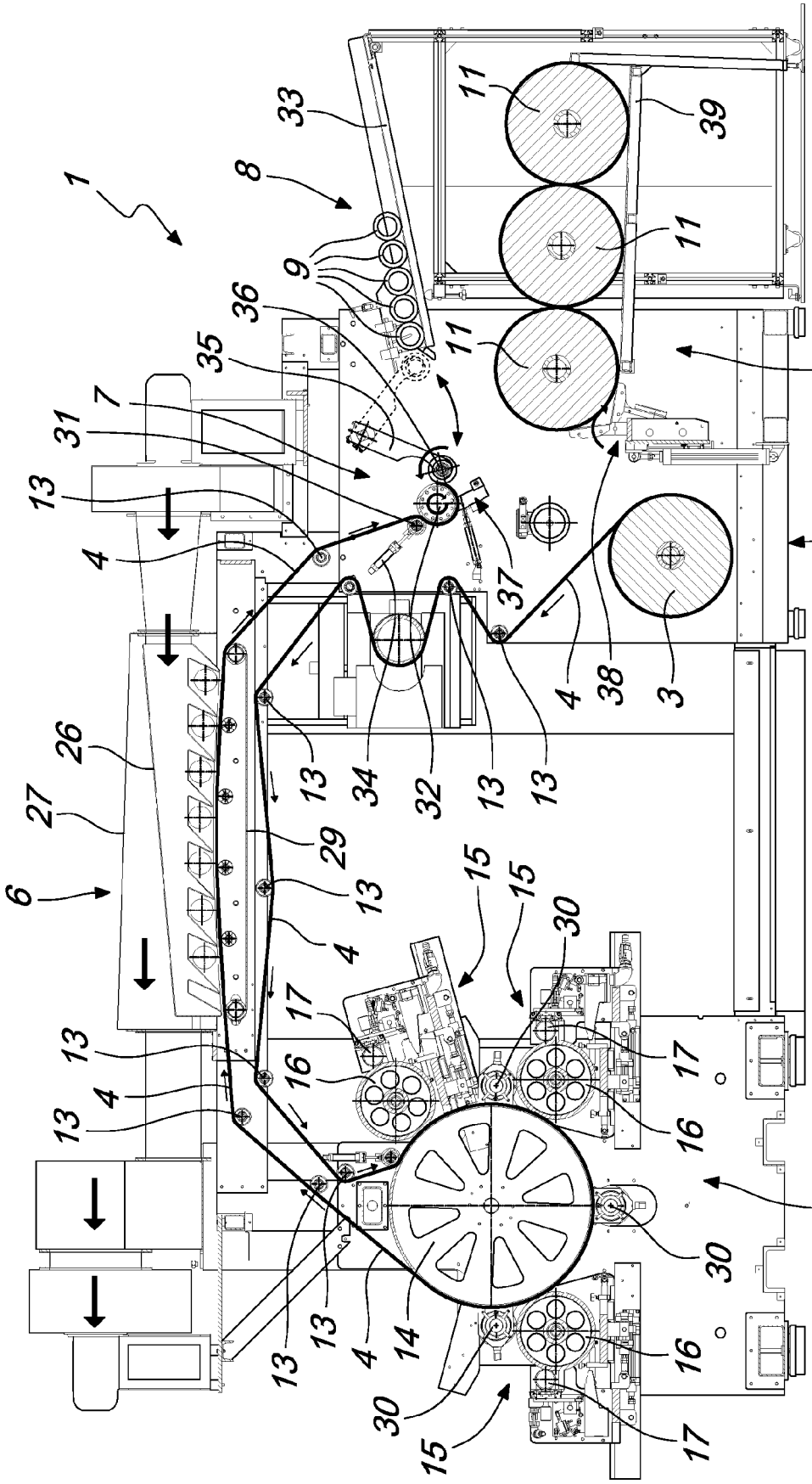


Fig. 13

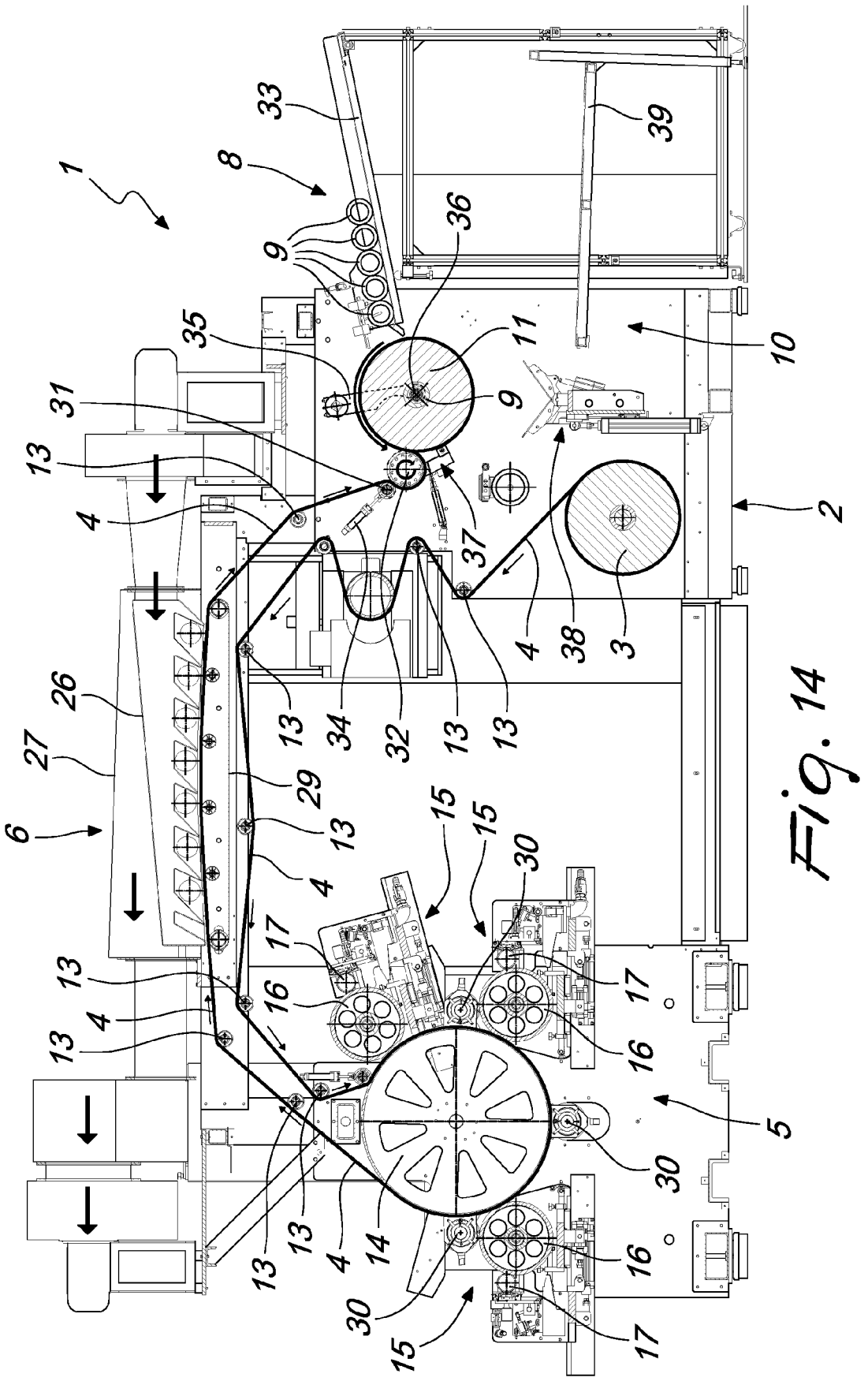


Fig. 14

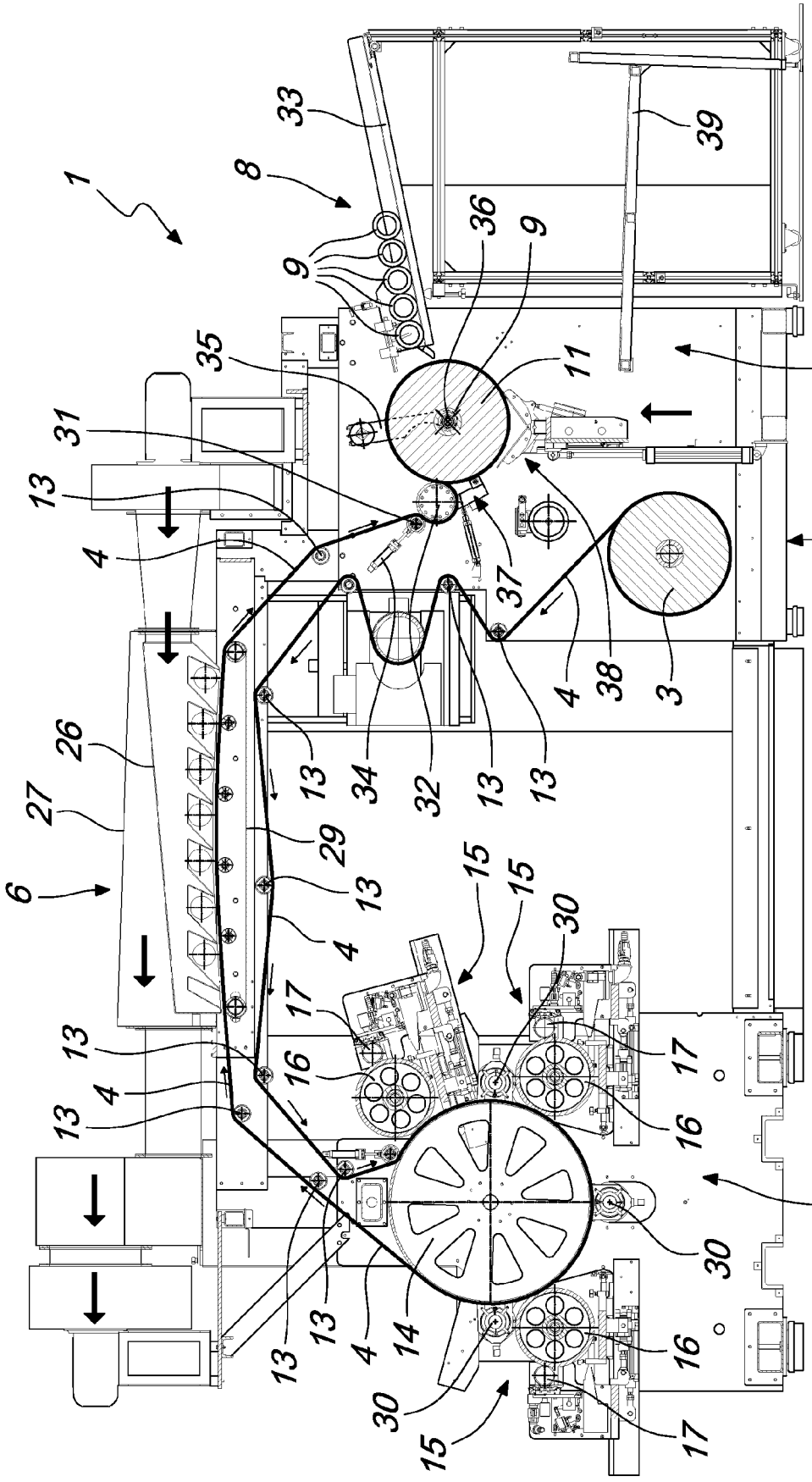


Fig. 15

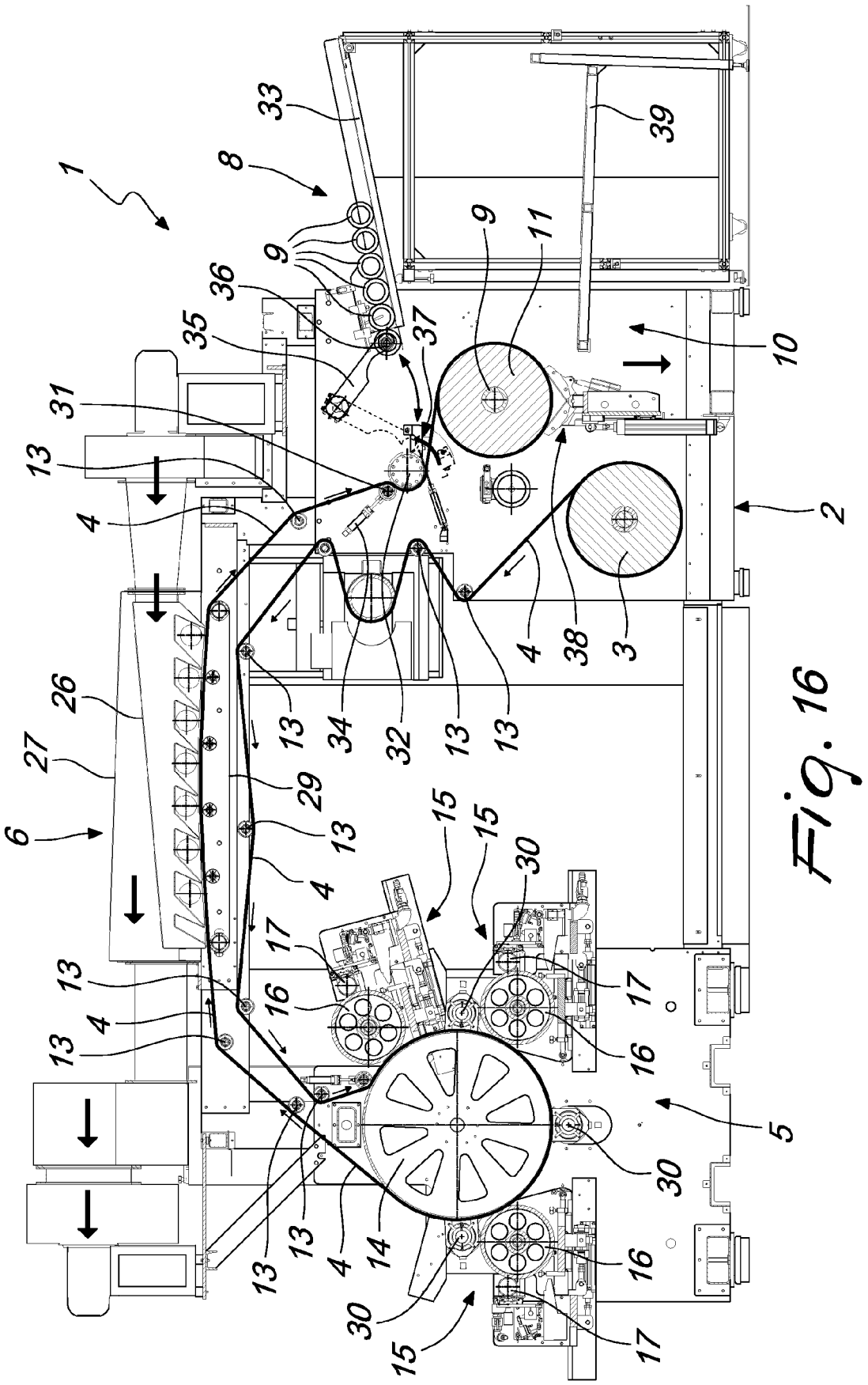
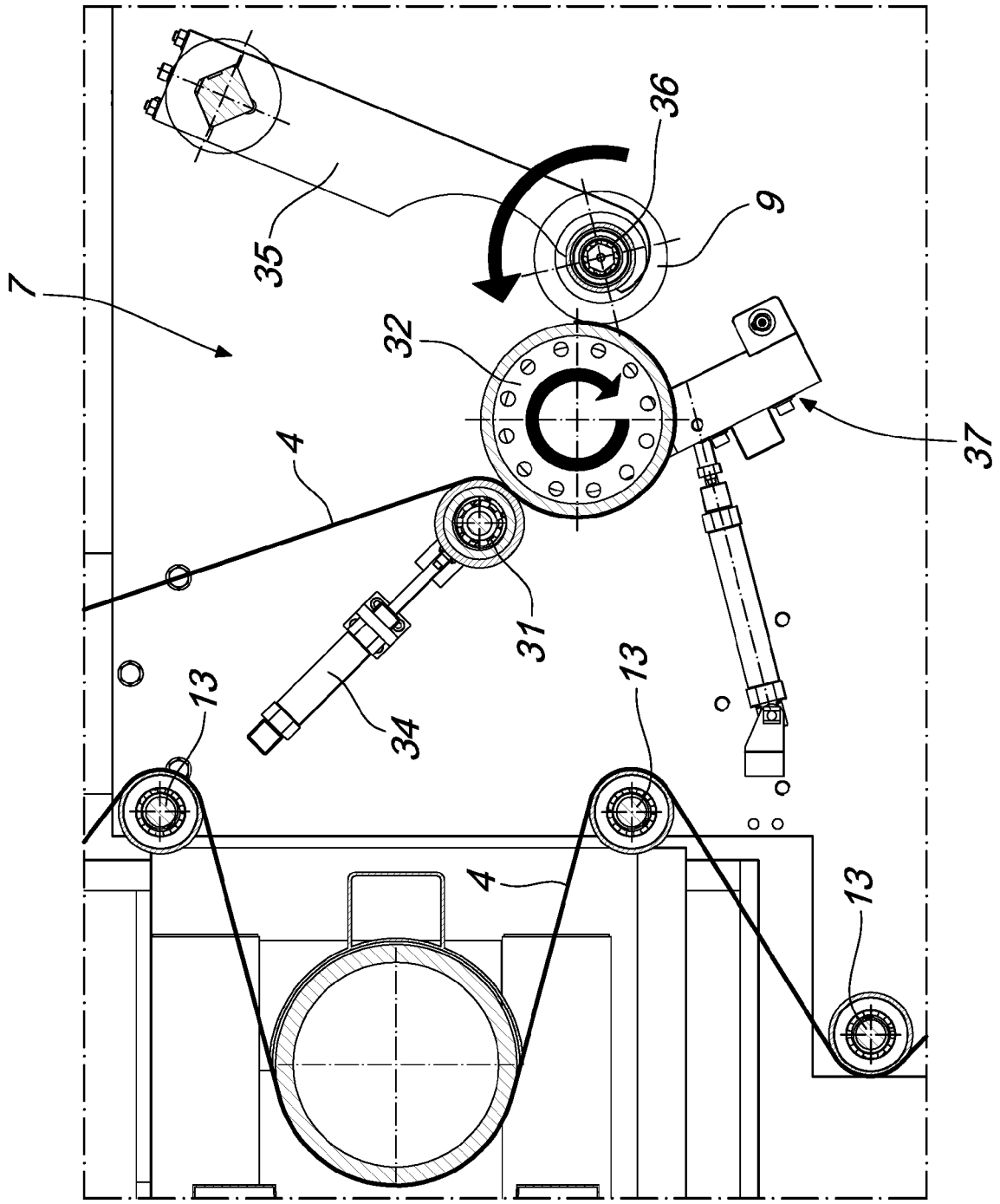


Fig. 16

Fig. 17



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 17 6466

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2005/257704 A1 (PAS JON V [US] ET AL) 24 November 2005 (2005-11-24) * abstract * * paragraphs [0001] - [0033] * * figures 1-3 *	1-14	INV. B41F31/30 B41F31/34 B41F5/18 B41F5/24 B41F13/02 B41F13/10 B41F13/30 B41F13/36 B41F23/04 B41F27/00 B41F27/06 B41F27/12 B65H18/00
Y	DE 100 59 622 A1 (WINDMOELLER & HOELSCHER [DE]) 16 May 2002 (2002-05-16) * abstract * * paragraphs [0001] - [0002], [0006], [0009], [0012], [0025] - [0029], [0033] - [0036], [0041] * * figures 1-4 *	1-14	
A	DE 201 15 325 U1 (REIFENHAEUSER MASCH [DE]) 31 January 2002 (2002-01-31) * abstract * * pages 1, 4 * * pages 8-11 * * figures 1-4 *	6,7	
A	GB 1 164 814 A (STRACHAN & HENSHAW LTD) 24 September 1969 (1969-09-24) * pages 1-3 * * figure 1 *	9-13	TECHNICAL FIELDS SEARCHED (IPC) B41F B65H
A	DE 41 04 082 A1 (STAHLKONTOR MASCHINENBAU [DE]) 13 August 1992 (1992-08-13) * abstract * * columns 1-5 * * figures 1-7 *	1-14	
A	US 2010/264248 A1 (BUTTERWORTH TAD T [US]) 21 October 2010 (2010-10-21) * the whole document *	1-14	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 August 2016	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 16 17 6466

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.

17-08-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005257704 A1	24-11-2005	US 2005257704 A1	24-11-2005
		WO 2005119881 A1	15-12-2005
DE 10059622 A1	16-05-2002	NONE	
DE 20115325 U1	31-01-2002	AT 318246 T	15-03-2006
		DE 10116973 A1	17-10-2002
		DE 20115325 U1	31-01-2002
		DK 1247773 T3	03-07-2006
		EP 1247773 A2	09-10-2002
		ES 2258574 T3	01-09-2006
		JP 3501792 B2	02-03-2004
		JP 2002332147 A	22-11-2002
		US 2002179769 A1	05-12-2002
GB 1164814 A	24-09-1969	NONE	
DE 4104082 A1	13-08-1992	DE 4104082 A1	13-08-1992
		IT 1254427 B	25-09-1995
		JP H0570003 A	23-03-1993
		US 5251836 A	12-10-1993
US 2010264248 A1	21-10-2010	EP 2419357 A2	22-02-2012
		US 2010264248 A1	21-10-2010
		WO 2010121252 A2	21-10-2010

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

- IT 102015000028885 **[0110]**