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(54) **MACHINE AND METHOD FOR MANUFACTURING TISSUE PAPER**

MASCHINE UND VERFAHREN ZUR HERSTELLUNG VON TISSUEPAPIER

MACHINE ET PROCÉDÉ DE FABRICATION DE PAPIER OUATÉ

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Description

TECHNICAL FIELD

[0001] Machines and methods are disclosed for wet manufacturing of cellulose plies or webs, especially tissue paper.

STATE OF THE ART

[0002] Paper is often manufactured using a wet production process. For example, for manufacturing tissue paper, from which kitchen towels, toilet paper, napkins, handkerchiefs, and the like are produced, a pulp is formed comprising a water suspension of cellulose fibers and other components, if necessary, such as wet-resistant resins, and the like. The pulp, having a low dry content, for example approximately 0.2% wt. (0.2% wt. fibers, 99.8% wt water) is distributed, through a headbox, onto a forming wire, or in a space between a forming wire, forming a closed path, and a continuous flexible member, for example a felt. The pulp forms a layer, from which water is gradually removed in order to increase the percentage of solid content, so as to have a web of cellulose fibers and other components with a solid content of, for example, approximately 6% wt.

[0003] This layer of partially dewatered cellulose pulp is moved from the continuous flexible member to a Yankee cylinder, which is internally heated and around which the cellulose web is driven in order to be dried. Air hoods surrounding the Yankee cylinder make hot air circulate outside the Yankee cylinder in the area along which the layer of cellulose pulp is driven, in order to accelerate the drying process, i.e. the dewatering process. The dried web is then detached from the Yankee cylinder by means of a doctor blade, and wound in a reel. Known machines and methods for producing paper webs with a wet process as mentioned above are disclosed for instance in EP1749934, DE10129613, WO2016/007081, WO2014/137274.

[0004] The production process requires a lot of energy. Typically, approximately 71% of the required energy is thermal energy necessary for heating the Yankee cylinder, usually heated by means of steam, and the air hoods. Usually, the required energy is obtained by burning a fuel, for example gas. The remaining 29% of the required energy is electricity, necessary for moving the various members of the production plant. It is therefore very important to reduce the consumption of thermal energy necessary for drying.

[0005] To this end, systems are used that mechanically remove part of the water from the pulp, squeezing the layer of cellulose fibers before it reaches the Yankee cylinder. These systems typically include suction presses or presses with dead holes, wherein a roller, having a structure suitable to dewater the layer of cellulose fibers, forms a pressure nip with the Yankee cylinder. In some cases, presses are used having rollers with a non-perforated cylindrical surface. The continuous flexible member, which is typically a felt, to which the layer of cellulose pulp adheres, passes through the pressure nip. The pressure causes dewatering of the cellulose layer and the adhesion thereof to the surface of the Yankee cylinder. The press increases the dry content in the cellulose pulp from approximately 6% to approximately 40%, before the cellulose layer is moved to the Yankee cylinder.

[0006] A further crucial parameter in paper manufacturing, and in particular in tissue paper manufacturing, is paper thickness (bulk), which shall be maximized in order to have a final product of better quality, greater absorption capacity, and greater softness. Increasing the paper thickness is also useful in order to optimize the production yield: given the same fiber weight, the greater the thickness of the paper, the greater the volume yield.

[0007] The thickness of the cellulose layer is affected by two parameters: the effective thickness of the fiber agglomerate forming the cellulose web; the creping degree obtained through the doctor blade which detaches the web from the Yankee cylinder. Given the same effective thickness of the fiber agglomerate, it is possible to increase the apparent web thickness by increasing creping.

[0008] The use of pressing systems for dewatering the layer of cellulose pulp before moving it to the Yankee cylinder allows saving thermal energy, as the percentage of water to be evaporated through the heat, produced by the Yankee cylinder and the air hoods, is reduced. However, the pressing systems negatively affect the production process as regards the final thickness of the cellulose web: given the same conditions, the greater the pressure exerted, the greater the quantity of water mechanically removed and therefore the less the thermal energy required for drying. However, given the same conditions, the greater the pressure applied to the cellulose layer, the lower the final thickness thereof.

[0009] In order to achieve a better compromise between the two conflicting requirements mentioned above, so-called shoe presses co-acting with the Yankee cylinder have been realized. Shoe presses comprise a cylindrical sleeve made of a water-proof flexible material. The cylindrical sleeve rotates around a rotation axis and is pressed against the Yankee cylinder by means of a hydrostatic pad having a concave surface. In this way, a pressure area is provided between the cylindrical sleeve and the Yankee cylinder, whose extension in the direction of the circumference of the Yankee cylinder is greater than that of the pressure area provided in the traditional presses with suction rollers or rollers with dead holes. The layer of cellulose fibers is thus subjected to pressure for a longer time. In this way, efficient dewatering is possible with relatively low specific pressures, compared to those used in traditional presses with suction rollers. As a result, water is efficiently removed with a lower compression of the layer of cellulose fibers.

[0010] In this way a better compromise is achieved between the two conflicting requirements: pressing the layer of cellulose fibers is thus subjected to pressure for a longer time. In this way, efficient dewatering is possible with relatively low specific pressures, compared to those used in traditional presses with suction rollers. As a result, water is efficiently removed with a lower compression of the layer of cellulose fibers.

[0010] In this way a better compromise is achieved between the two conflicting requirements: pressing the layer of cellulose fibers is thus subjected to pressure for a longer time. In this way, efficient dewatering is possible with relatively low specific pressures, compared to those used in traditional presses with suction rollers. As a result, water is efficiently removed with a lower compression of the layer of cellulose fibers.

er of cellulose fibers as little as possible and mechanically removing as much water as possible before starting heating the cellulose web.

[0011] However, the shoe presses, although efficient as regards energy consumption and final quality of the cellulose web, have significant drawbacks, among which the following.

[0012] The structure of a shoe press is very complex and requires a much higher initial investment compared to that of other systems for pressing the cellulose web. In fact, the shoe press requires a central support shaft, onto which the hydrostatic pad (shoe) is mounted, as well as a system for moving the hydrostatic shoe and a system for supplying pressurized oil to the hydrostatic shoe, including a hydraulic control unit.

[0013] The cylindrical sleeve is subject to stresses and cyclical deformations, and in particular to repeated bending due to the concave shape it has in the area of contact with the shoe. For this reason, the sleeve shall be often replaced, with consequent down times. Replacing the cylindrical sleeves requires specialized workforce.

[0014] A need therefore exists to provide a machine and a method for wet manufacturing of paper, which achieve better results in terms of energy consumption and quality of the final product.

SUMMARY OF THE INVENTION

[0015] The invention is defined by the features of claim 1. Only those embodiments that show all these features fall within the scope of claim 1 and describe the present invention. According to a first aspect, a machine for wet manufacturing of tissue paper is disclosed, comprising a Yankee cylinder having a cylindrical surface and rotating around a rotation axis. Detaching members for detaching a cellulose web, such as scraping blades or doctor blades, can co-act with the outer cylindrical surface of the Yankee cylinder. Air hoods can be provided around the Yankee cylinder. The machine further comprises a continuous flexible member, typically a felt, comprising a first surface suitable to receive a layer of cellulose pulp, containing cellulose fibers and water. A guide roller is also provided, around which the continuous flexible member is driven, with a second surface thereof in contact with the first guide roller. The position of the guide roller relative to the Yankee cylinder is such that the first surface of the continuous flexible member is spaced from the Yankee cylinder so that, in the area of contact with the guide roller, a layer of cellulose pulp adhering to the first surface of the continuous flexible member is spaced from the Yankee cylinder, i.e. it is not in contact therewith.

[0016] The guide roller is suitable to dewater the layer of cellulose pulp through the continuous flexible member. The guide roller can be configured, for example, as a suction roller.

[0017] The machine further comprises a first pressure roller, around which the continuous flexible member is driven, arranged downstream of the guide roller with re-

spect to a feeding direction of the layer of cellulose pulp. The pressure roller is in contact with the second surface of the continuous flexible member, i.e. the surface opposite to that on which the layer of cellulose pulp is applied.

5 The first pressure roller and the Yankee cylinder define a first pressure nip, inside which the continuous flexible member is pressed, by means of the first pressure roller, against the cylindrical surface of the Yankee cylinder, the layer of cellulose pulp being positioned between the cylindrical surface of the Yankee cylinder and the continuous flexible member.

10 **[0018]** The first pressure roller is adapted to dewater the layer of cellulose pulp through the continuous flexible member. For example, the first pressure roller can configure, together with the cylindrical surface of the Yankee cylinder, a so-called press with dead holes.

15 **[0019]** In general, the guide roller and the first pressure roller have outer cylindrical surfaces adapted to absorb water from the layer of cellulose pulp through the continuous flexible member.

20 **[0020]** Therefore, contrary to the cylindrical sleeves of the shoe presses of the prior art, the pressure roller of the machine disclosed herein absorbs water inside the cylindrical skirt.

25 **[0021]** Contrary to what occurs with the shoe presses, the structure of the pressure roller is particularly simple and requires low maintenance.

[0022] In practice, the machine configured in this way allows efficient dewatering by means of mechanical systems before the layer of cellulose pulp is heated and dried through the thermal energy supplied by the Yankee cylinder and the air hoods. Dewatering is done with simple and economical means, easy to maintain and control, contrary to what occurs with the prior art shoe presses. Furthermore, preliminary removal of water through the guide roller, wherein the layer of cellulose pulp is not pressed, allows to have a paper layer of greater thickness with respect to that obtained with the prior art machines, given the same saving in drying energy.

30 **[0023]** In fact, the guide roller removes part of the water in a mechanical and/or hydraulic and/or pneumatic manner, without pressing, thus making the subsequent removal by pressing more efficient, so that the layer of cellulose pulp can have higher dry content than that obtained with the traditional machines, given the same thickness.

35 **[0024]** In some embodiments, the guide roller comprises an outer cylindrical skirt provided with a plurality of through holes connecting an outer surface of the guide roller and an inner suction chamber of the guide roller.

40 The suction chamber can extend, for example, for a portion of the circumferential extension of the suction roll and is in a stationary position with respect to the axis of the guide roller, so as to generate a suction area through the through holes of the cylindrical skirt. The suction area is fixed with respect to the path of the continuous flexible member and is provided along the arc of contact between the cylindrical skirt and the continuous flexible member. In this way, the suction chamber draws water from the

layer of cellulose pulp through the continuous flexible member (felt) and the water accumulates in the holes of the cylindrical skirt. Due to the centrifugal force, the water is then ejected from the holes that, due to the continuous rotation of the cylindrical skirt, move away from the suction area.

[0025] Also the first pressure roller can be a suction roller similar to the guide roller. However, in order to simplify the overall structure of the machine and also to reduce the energy consumption, in some embodiments the first pressure roller can be a pressure roller with dead holes. The pressure roller with dead holes may have a cylindrical skirt coated with an elastically yielding material, for example a layer of rubber, polyurethane or the like. The coating layer may be provided with dead holes, i.e. not through holes, connecting it to the outer surface of the pressure roller. Due to the pressure between the pressure roller and the Yankee cylinder, between which the felt - or other continuous flexible member to which the layer of cellulose pulp adheres - passes, the water is transferred from the layer of cellulose pulp to the dead holes passing through the felt or other continuous flexible member. Due to the centrifugal force, the water is then ejected from the dead holes downstream of the point where the continuous flexible member (felt) moves away from the pressure roller.

[0026] In some embodiments, the machine may also comprise a second pressure roller, provided along the path of the continuous flexible member (felt) and downstream of the first pressure roller. The continuous flexible member is driven around the second pressure roller and is pressed thereby against the cylindrical surface of the Yankee cylinder, defining a second pressure nip.

[0027] In some embodiments, the second pressure roller has the same structure as the first pressure roller. For example, both the first pressure roller and the second pressure roller can have dead holes. In other embodiments, the first pressure roller and the second pressure roller have different configurations. For example, the first pressure roller is a suction roller, similar to the guide roller, and the second pressure roller is a roller with dead holes.

[0028] In some embodiments, the machine comprises a heating device adapted to act on the continuous flexible member to increase the temperature of the layer of cellulose pulp and thus to reduce the viscosity of water contained in the cellulose pulp. This allows increasing the efficiency of the step of pressing the cellulose pulp between the pressure roller and the Yankee cylinder, and consequently to increase the dry content after the pressure nip defined between the pressure roller and the Yankee cylinder. In particular, the heating device is arranged between the guide roller and the first pressure roller.

[0029] The particular position of the heating device, in combination with the guide roller and the first pressure roller, is particularly advantageous for better drying the cellulose pulp. In fact, the presence of the guide roller allows removing a certain amount of water contained in

the cellulose pulp, preventing it from being absorbed by the felt. The heating downstream of the guide roller allows a greater heating of the cellulose pulp compared to the prior art machines, namely as the felt, through the guide roller, has been deprived of a certain percentage of water. Moreover, as the part of felt contained between the guide roller and the first pressure roller contains less water, the heating device is able to transmit more energy to the layer of cellulose pulp.

[0030] Conveniently, the heating device can face the first surface of the continuous flexible member carrying the layer of cellulose pulp.

[0031] Conveniently, the heating device is a steam heating device and/or an electrical heating device and/or an infrared heating device and/or a microwave heating device, or any other heating device.

[0032] Conveniently, the heating device comprises a steam box adapted to blow steam directly onto the continuous flexible member carrying the layer of cellulose pulp. Alternatively, the heating device can comprise a thermal radiation plate facing the continuous flexible member carrying the layer of cellulose pulp.

[0033] Conveniently, the heating device comprises an air suction module arranged preferably at the opposite side of the continuous flexible member and facing it, useful for removing humid air in the vicinity of the heating device.

[0034] The machine can also comprise a further heating device, similar to the heating device described above and arranged directly upstream of the guide roller, in order to increase the temperature of the layer of cellulose pulp.

[0035] The machine can also comprise a forming wire, suitable to receive the layer of cellulose pulp from a head-box, and adapted to transfer, directly or indirectly, the layer of cellulose pulp to the continuous flexible member. The guide roller and the heating device are arranged downstream of the area of separation of the forming wire from the continuous flexible member.

[0036] According to a further aspect, a method is disclosed for removing water from a layer of cellulose pulp containing water and cellulose fibers. The invention is defined by the features of claim 17. Only those embodiments that show all these features fall within the scope of claim 17 and describe the present invention. In embodiments described herein, the method comprises the following steps:

forming a layer of cellulose pulp comprising water and cellulose fibers on a first surface of a continuous flexible member;
driving the continuous flexible member around a guide roller, the continuous flexible member having a second surface in contact with the guide roller, and removing water from the layer of cellulose pulp through the continuous flexible member by means of the guide roller;
downstream of the guide roller, feeding the layer of

cellulose pulp in a first pressure nip defined by a Yankee cylinder and by a first pressure roller, around which the continuous flexible member is driven with the second surface in contact with the first pressure roller, and removing water from the layer of cellulose pulp through the continuous flexible member by means of the first pressure roller.

[0037] The method can comprise a further step of feeding the layer of cellulose pulp in a second pressure nip defined by the Yankee cylinder and by a second pressure roller, around which the continuous flexible member is driven with the second surface in contact with the second pressure roller, and removing water from the layer of cellulose pulp through the continuous flexible member by means of the first pressure roller.

[0038] The method can further comprise a drying step through heating of the layer of cellulose pulp between the guide of the continuous flexible member around a guide roller and the first pressure nip. Preferably, the drying step through heating occurs through heating generated by means of steam emitted onto said layer of cellulose pulp, or through thermal radiation.

[0039] The method can also comprise a further drying step through heating of the layer of cellulose pulp upstream of the guide roller.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040] The invention will be better understood by following the description and the accompanying drawing, which shows a non-limiting example of embodiment of the invention. More in particular, in the drawing:

Fig. 1 is a diagram of a first embodiment of a machine according to the invention;
 Fig. 2 is a schematic enlargement of the action area of the suction guide roller;
 Fig. 3 is a schematic enlargement of the first pressure nip of the machine of Fig. 1;
 Fig. 4 is a diagram of a further embodiment of a machine according to the invention;
 Fig. 5 is a diagram of a portion of the machine according to the invention, different than the cases of Figs. 1 and 4, wherein the difference consists in a heating device inserted between the guide roller and the first pressure roller.

DETAILED DESCRIPTION OF AN EMBODIMENT

[0041] The detailed description below of example embodiments is made with reference to the attached drawing. The same reference numbers in different figures identify equal or similar elements. Moreover, the drawings are not necessarily to scale. The detailed description below does not limit the invention. The protective scope of the present invention is defined by the attached claims.

[0042] In the description, the reference to "an embod-

iment", "the embodiment" or "some embodiments" means that a particular feature, structure or element described with reference to an embodiment is comprised in at least one embodiment of the described object. The sentences "in an embodiment" or "in the embodiment" or "in some embodiments" in the description do not therefore necessarily refer to the same embodiment or embodiments. The particular features, structures or elements can be furthermore combined in any adequate way in one or more embodiments.

[0043] With initial reference to Fig. 1, in an embodiment the machine for tissue paper wet manufacturing, indicated as a whole with number 10, comprises a headbox 11 arranged in front of a forming area defined between a forming wire 15 and a continuous flexible member 17, for example a felt. The continuous flexible member 17, herein simply called "felt", is driven around a forming roller 19, around which also the forming wire 15 is driven.

[0044] The forming wire 15 follows a closed path defined by means of guide rollers 21, 22, 23, 24, as well as by means of the forming roller 19. The felt 17 follows a closed path defined by means of guide rollers 25, 26, 27, 28, the forming roller 19, a guide roller 31 and a first pressure roller 33, described below in greater detail.

[0045] The machine 10 further comprises a Yankee cylinder 35, around which air hoods 37 are arranged. The Yankee cylinder 35 rotates around a rotation axis 35A thereof, and has an outer cylindrical surface 35S. The path of the felt 17 passes through a pressure nip 34 defined between the outer cylindrical surface 35S of the Yankee cylinder 35 and the pressure roller 33, which is pressed against the cylindrical surface 35S.

[0046] With the Yankee cylinder 35 a scraping blade or doctor blade 38 co-acts, which detaches a tissue paper ply V at the exit of the Yankee cylinder 35, after it has been dried.

[0047] The headbox 11 feeds a pulp or water suspension of cellulose fibers to the nip or forming space between the felt 17 and the wire 15. The cellulose suspension or pulp comprises, for example, approximately 99.8% of water and 0.2% of solid matter, in particular cellulose fibers. Part of the water is removed, i.e. drained, through the forming wire 15, so that at the exit of the area in which the forming wire 15 and the felt 17 are in mutual contact, i.e. in the area of the guide roller 24, on the felt 17 there is a layer of cellulose pulp having approximately 6% of solid content. This layer of cellulose fibers remains adhering to the outer surface 17A of the felt 17 and is conveyed by the felt 17 towards the Yankee cylinder 35.

[0048] The layer of cellulose pulp, indicated by the letter S, is transported by the felt 17 along the path defined by it, driven around the guide roller 31 and the pressure roller 33, with which the felt 17 is in contact by means of the inner surface 17B thereof, opposite to the outer surface 17A, to which the layer of cellulose pulp S adheres. As it will be described below, the guide roller 31 and the pressure roller 33 are configured to remove water from the layer of cellulose pulp S before it is transferred from

the felt 17 to the outer cylindrical surface 35S of the Yankee cylinder 35.

[0049] In a known manner, during the contact with the Yankee cylinder 35, the layer of cellulose pulp S is dried thanks to the heat provided by the Yankee cylinder 35 through the cylindrical wall thereof, and to the hot air supplied by the air hoods 37. Consequently, the layer of cellulose pulp S, which arrives to the Yankee cylinder 35 with a water percentage of more than 50%, is dried forming the ply or web V; the web V, after having been detached from the Yankee cylinder 35 through a scraping blade or a doctor blade 38, is fed to a winder, not shown, to form a reel.

[0050] The guide roller 31 can have a structure adapted to remove a fraction of the water contained in the layer of cellulose pulp S which adheres to the felt 17, driven around the guide roller 31 and in contact with said roller through the inner surface 17B.

[0051] An embodiment of the guide roller 31 is schematically illustrated in the enlargement of Fig. 2. In this embodiment, the guide roller 31 comprises a rotating outer cylindrical skirt 39 and a stationary inner core 41. An annular volume 43 is defined between the cylindrical skirt 39, rotating around a rotation axis 31A, and the stationary core 41. The annular volume 43 can be subdivided into two portions 43.1 and 43.2. The two portions 43.1 and 43.2 can be defined by stationary separating walls 45, mounted on the inner core 41. The portion 43.2 can be connected to a suction line, schematically indicated with number 49. The suction duct can be arranged at any one or both the ends of the guide roller 31. In this way, a suction chamber is defined between the separating walls 45.

[0052] The cylindrical skirt 39 can be provided with a plurality of through holes 51, which can be uniformly distributed over the entire extension of the cylindrical skirt 39. In this way, the through holes 51 connect the outer cylindrical surface of the guide roller 31 to the suction chamber 43.2 in the area comprised between the walls 45. A suction effect is thus generated in this area through the through holes 51 and through the felt 17. Due to this suction, the water contained in the layer of cellulose pulp S is sucked inside the through holes 51. When, following the rotation of the guide roller 31, the through holes 51 pass beyond the suction area defined between the walls 45, there is no more suction and, therefore, the centrifugal force causes the removal of the water accumulated in the through holes 51. The separating walls 45 are positioned relative to the path of the felt 17 such that the suction effect ends at the point, or downstream of the point, where the felt 17 moves away from the outer cylindrical surface of the guide roller 31, so that the water in the through holes 51 is removed from the roller 31 due to the centrifugal force, and does not return in the felt 17.

[0053] By means of this mechanism, a part of the water contained in the layer of cellulose pulp S is removed before the layer reaches the pressure nip 34 defined between the pressure roller 33 and the Yankee cylinder 35.

[0054] In the nip 34, the layer of cellulose pulp S is pressed between the outer surface 35S of the Yankee cylinder 35 and the felt 17 due to the pressure exerted by the pressure roller 33 against the Yankee cylinder 35. The structure of the pressure roller 33 can be the same as the structure of the guide roller 31, so that the water contained in the layer of cellulose pulp S is collected in the through holes of the rotating cylindrical skirt and then removed due to centrifugal effect.

[0055] In other preferred embodiments, the pressure roller 33 may have the structure shown in greater detail in the enlargement of Fig. 3. This structure is typical of a so-called blind-drilled press. It consists of a roller with heads, cylindrical skirt and support pins (not shown). On the cylindrical skirt 33.1, a layer of an elastic material 33.2 is applied, for example rubber or polyurethane. The layer of elastic material 33.2 is provided with a plurality of dead holes 57. In the area where the inner surface 17B of the felt 17 is in contact with the outer cylindrical surface of the pressure roller 33, the layer of cellulose pulp S and the felt 17 are pressed so that a part of the water contained in the layer of cellulose pulp S passes through the felt 17 and penetrates, through pressure, into the dead holes 57. In the area downstream of where the felt 17 is detached from the cylindrical surface of the pressure roller 33, the water collected in the dead holes 57 is removed through centrifugal force. In this way a part of water is removed from the layer of cellulose pulp S.

[0056] In some embodiments the combined effect of the suction guide roller 31 and the pressure roller 33 decreases the wet content in the layer of cellulose pulp S to about 42-43%, applying linear pressures in the pressure nip 34 in the order of 90-100 kN/m. The thickness of the cellulose web V that can be obtained is in the order of 95-100 μm for ten sheets, according to the standard TAPPI - T 580 *Thickness (caliper) of towel, tissue, napkin and facial products*. It should be understood that the numerical values of the applied linear pressures and the thicknesses are given just by way of non-limiting example. This applies, in general, to all the numerical values mentioned in the present description, unless otherwise specified.

[0057] Thanks to the combination of the pressure roller 33 and the suction guide roller 31, where the water is removed without compression and without pressing the layer of cellulose pulp S, an effective dewatering is achieved, i.e. a substantial reduction of wet in the layer of cellulose pulp S before starting drying by thermal effect around the Yankee cylinder 35. Dewatering occurs without excessive reduction in the thickness of the resulting layer of cellulose fibers, thanks to the fact that part of the water is removed without compression and without pressing the layer of cellulose pulp S.

[0058] Fig. 4 shows a second embodiment of a machine according to the invention. The same numbers indicate the same or equivalent parts to those of Fig. 1, which will be not described again. The main difference between the embodiment of Fig. 1 and that of Fig. 4 is

that the latter has a second pressure roller 61 downstream of the pressure roller 33. The felt 17 is driven around an intermediate roller 64 provided along the closed path defined by the felt 17, between the first pressure roller 33 and the second pressure roller 61. The second pressure roller 61 defines a second pressure nip 63 between the pressure roller 61 and the outer cylindrical surface 35S of the Yankee cylinder 35.

[0059] In some embodiments, the second pressure roller can be provided with the suction structure as described with reference to the guide roller 31. In preferred embodiments, the second pressure roller 61 has a structure with dead holes, like the structure of the first pressure roller 33 described above (Fig. 3).

[0060] In the embodiment of Fig. 4, the water content of the layer of cellulose pulp S is reduced in three subsequent steps: due to the suction through the guide roller 31, due to the pressing in the first pressure nip 34 through the first pressure roller 33, and due to the pressing in the second pressure nip 63 through the second pressure roller 61.

[0061] With the configuration of Fig. 4 it is possible to have, before the drying step on the Yankee cylinder, a wet content inside the layer of cellulose pulp S lower than the content that can be obtained in the embodiment of Fig. 1, even if with a slightly greater pressing of the layer of cellulose pulp S and therefore with a slight reduction in the final thickness thereof. For example, with linear pressures in the order of 90-100 kN/m in the pressure nips 34 and 63, it is possible to obtain a solid content in the order of 44-45% in the layer of cellulose pulp S at the exit of the second pressure nip 63, and a paper thickness in the order of 93-95 μm for ten sheets, according to the standard TAPPI - T 580 *Thickness (caliper) of towel, tissue, napkin and facial products*. As indicated above, the numerical values are given just by way of non-limiting example.

[0062] Conveniently, in Fig. 5 a further machine according to the invention is shown, which is a variant of the examples of Figs. 1 and 4 and comprises a heating device 40 adapted to act on the continuous flexible member 17 (the felt) in order to increase the temperature of the layer of cellulose pulp and, consequently, to reduce the viscosity of the water contained in the cellulose pulp. This allows increasing the efficiency of the step of pressing the cellulose pulp between the pressure roller and the Yankee cylinder, and consequently to increase the dry content after the pressure nip defined between the pressure roller and the Yankee cylinder.

[0063] In particular, the heating device 40 is arranged between the guide roller 31 and the first pressure roller 33, and faces the first surface 17A of the felt 17, i.e. the surface carrying the layer of cellulose pulp S.

[0064] From an operative point of view, it is important that the heating device 40 is not too close to (and never overlapping) the guide roller 31 or the first pressure roller 33, i.e. that it is not arranged on the circumference of these rollers. In fact, the rotation of the two rollers 31 and

33 causes the dispersion in air of fragments of a cellulose pulp. If the heating device 40 overlaps one of the two rollers 31 or 33, or is arranged on the circumference thereof, the fragments of cellulose pulp tend to deposit on the heating device, forming thereon a pulp layer which would reduce the heating capacity thereof.

[0065] According to a preferred embodiment, the device 40 heats through steam. In this example, the device is a known steambox, which emits saturated, preferably dry or superheated steam on the cellulose pulp S present on the felt 17, thus contributing to the drying thereof.

[0066] The steam used to supply the steambox can arrive, through a duct 40A, from a heat recovery unit (not shown in the figures) generating steam, using for example the fumes of the hood 37. In practice, this recovery unit generates high pressure steam to feed the Yankee cylinder, and, with a reduction in pressure, supplies the steambox of the device 40 through the duct 40A. In a further embodiment, the heat recovery unit can generate low pressure steam just for the steambox.

[0067] According to other embodiments, the heating device 40 can be of the type exploiting electricity (joule effect), for example an electrical resistance or an induction plate, or generating infrared rays, such as infrared lamps or panels, or of the microwave type.

[0068] In this example, the heating device 40 also comprises a suction module 40B, arranged opposite to the steambox with respect to the felt 17 and close to this latter, so as to suck humid air in the area. The sucked air is removed through a duct, not shown in the figures.

[0069] It is clearly apparent that the use of the heating device 40, between the guide roller 31 and the first pressure roller 33, is particularly effective for increasing the drying of the cellulose pulp. The guide roller 33 allows removing the water contained in the cellulose pulp, which is not absorbed by the felt. Consequently, the heating device 40 is able to transmit more energy to the layer of cellulose pulp, and therefore to perform an optimal drying.

[0070] Thanks to the combined effect of the suction roller 31 and the first pressure roller 33, thanks to the heating device 40, the dry content in the cellulose pulp S is increased by a value comprised least between 2.8% and 3.5% compared to the embodiments described above.

[0071] In order to further increase the temperature of the layer of cellulose pulp S, in this example a further heating device 40' is provided, similar to the heating device 40 described above and arranged immediately upstream of the guide roller. In this case again, it can be of the steam type or of the type exploiting electricity, such as an electrical resistance or an induction plate, or generating infrared rays, such as infrared lamps or panels, or of the microwave type. It can also comprise a further suction module 40'. In this case again, it is important that the further heating device 40' is not too close to (and never overlapping) the guide roller 31, i.e. that it is not arranged on the circumference of the roller.

[0072] While the particular embodiments of the invention described above have been shown in the drawing and described integrally in the description above with features and characteristics relating to different exemplary embodiments, those skilled in the art will understand the modifications, changes and omissions are possible without however departing from the innovative learning, the principles and the concepts described above and the advantages of the object described in the attached claims.

[0073] For example, at least one or both of the rollers 33, 61 can be without perforations and have a smooth cylindrical surface.

Claims

1. A machine (10) for wet manufacturing of tissue paper, comprising in combination:

a Yankee cylinder (35) comprising a cylindrical side surface (35S), rotating around an axis (35A) thereof;

a continuous flexible member (17) comprising a first surface (17A) suitable to receive a layer of cellulose pulp (S), comprising cellulose fibers and water, and a second surface (17B), opposite to the first surface (17A);

a first guide suction roller (31), around which the continuous flexible member (17) is driven; wherein the second surface (17B) of the continuous flexible member (17) is in contact with the first guide suction roller (31); wherein, in the area guided around said roller (31), the first surface (17A) of the continuous flexible member (17) is spaced from the Yankee cylinder (35); and wherein the first guide suction roller (31) is suitable to remove water from the layer of cellulose pulp (S) through the continuous flexible member (17);

a press formed by a first blind-drilled pressure roller (33) around which the continuous flexible member (17) is driven, arranged downstream of the first guide suction roller (31) with respect to a feeding direction of the layer of cellulose pulp (S); wherein the first pressure roller (33) and the Yankee cylinder (35) define a first pressure nip (34), inside which the continuous flexible member (17) is pressed by means of the first pressure roller (33) against the cylindrical surface (35S) of the Yankee cylinder (35); and wherein the first pressure roller (33) is suitable to remove water from the layer of cellulose pulp (S) through the continuous flexible member (17);

a heating device (40) adapted to act on said continuous flexible member (17) and arranged between said first guide suction roller (31) and said first pressure roller (33).

2. The machine (10) of claim 1, wherein the first guide suction guide roller (31) comprises an outer cylindrical skirt (39) provided with a plurality of through holes (51) connecting an outer surface of the guide roller and an inner suction chamber (43.2) of the guide roller (31).
3. The machine (10) of claim 2, wherein the suction chamber (43.2) extends for a portion of the circumferential extension of the first guide suction roller (31) and is arranged in a stationary position with respect to the rotation axis (31A) of the guide roller (31), so as to generate a suction area through the through holes (51) of the cylindrical skirt (39), the suction area being fixed with respect to the path of the continuous flexible member.
4. The machine (10) of claim 3, wherein the suction chamber (43.2) is arranged in an area of the first guide suction roller (31) that is in contact with the continuous flexible member (17), so as to generate suction of water contained in the layer of cellulose pulp (S), through the flexible member (17) in the through holes.
5. The machine (10) of claim 4, wherein inside the cylindrical skirt (39) an annular volume (43) is arranged, fluidly connected to the through holes (51), the annular volume (43) being subdivided into said suction chamber (43.2) and a non-suction area (43.1), so that water is temporarily sucked in the through holes (51) when they pass in front of the suction chamber (43.2) and is removed from the through holes (51) due to the centrifugal effect when the through holes pass along the non-suction area (43.1) of the annular volume (43).
6. The machine (10) of one or more of the previous claims, further comprising a second pressure roller (61), around which the continuous flexible member (17) is driven; wherein the second pressure roller (61) and the Yankee cylinder (35) define a second pressure nip (63), inside which the continuous flexible member (17) is pressed by means of the second pressure roller (61) against the cylindrical surface (35S) of the Yankee cylinder (35); and wherein the second pressure roller (61) is adapted to remove water from the layer of cellulose pulp (S) through the continuous flexible member (17).
7. The machine (10) of claim 6, wherein the second pressure roller (61) has the same structure as the first pressure roller; or wherein the second pressure roller has a different structure than the first pressure roller, and in particular said second pressure roller having a blind-drilled configuration or a through holes configuration.

8. The machine (10) of one or more of the previous claims, wherein said heating device faces said first surface (17A) carrying the layer of cellulose pulp (S).
9. The machine (10) of one or more of the previous claims, wherein said heating device is a steam heating device and/or an infrared heating device and/or a microwave heating device and/or an electrical heating device, for instance a device for heating through resistance and/or electrical induction.
10. The machine (10) of one or more of the previous claims, wherein said heating device comprises a steam box adapted to blow steam directly onto said continuous flexible member (17) carrying the layer of cellulose pulp (S).
11. The machine (10) of one or more of the previous claims, wherein said heating device comprises a thermal radiation plate facing said continuous flexible member (17) carrying the layer of cellulose pulp (S).
12. The machine (10) of one or more of the previous claims, further comprising a forming wire (15), adapted to receive the layer of cellulose pulp (S) from a headbox (11), and configured to transfer, directly or indirectly, the layer of cellulose pulp (S) to the continuous flexible member (17).
13. The machine (10) of one or more of the previous claims, comprising a forming wire (15), driven around a forming drum (19), around which also said continuous flexible member (17) is driven, to form, between the continuous flexible member (17) and the forming wire (15), a volume for receiving cellulose pulp from a headbox.
14. The machine (10) of claim 12 or 13, wherein said guide roller (31) and said heating device (40) are arranged downstream of the area where said forming wire (15) is separated from said continuous flexible member (17).
15. The machine (10) of one or more of the previous claims, wherein said heating device comprises an air suction module arranged preferably at opposite side from the continuous flexible member and facing it.
16. The machine (10) according to one or more of the previous claims, comprising a further heating device (40') arranged immediately upstream of the first guide suction roller (31).
17. A method for removing water from a layer of cellulose pulp (S) comprising water and cellulose fibers, the method comprising the following steps:

forming a layer of cellulose pulp (S) comprising water and cellulose fibers on a first surface (17A) of a continuous flexible member (17);
 feeding the layer of cellulose pulp (S) towards a Yankee cylinder (35);
 driving the continuous flexible member (17) around a first guide suction roller (31), the continuous flexible member (17) having a second surface (17B) in contact with the first guide suction roller (31), and removing water from the layer of cellulose pulp (S) through the continuous flexible member (17) by means of the first guide suction roller (31), with no contact between the layer of cellulose pulp (S) and the Yankee cylinder (35);
 downstream of the first guide suction roller (31), feeding the layer of cellulose pulp (S) in a first pressure nip (34) defined by the Yankee cylinder (35) and by a first blind-drilled pressure roller (33) around which the continuous flexible member (17) is driven with the second surface (17B) in contact with the first pressure roller (33), and removing water from the layer of cellulose pulp (S) through the continuous flexible member (17) by means of the first pressure roller (33);
 and further comprising a drying step through heating of said layer of cellulose pulp (S) between the area where the continuous flexible member (17) is driven around the first guide suction roller (31) and said first pressure nip (34).

18. The method of claim 17, further comprising the following step: downstream of the first pressure roller (33), feeding the layer of cellulose pulp (S) in a second pressure nip (63) defined by the Yankee cylinder (35) and by a second pressure roller (61), around which the continuous flexible member (17) is driven with the second surface (17B) in contact with the second pressure roller (61), and removing water from the layer of cellulose pulp (S) through the continuous flexible member (17) by means of the second pressure roller (61).
19. The method of claim 17 or 18, wherein said drying step occurs through heating generated by means of steam emitted onto said layer of cellulose pulp (S), or through thermal radiation.

19. The method of claim 17 or 18, wherein said drying step occurs through heating generated by means of steam emitted onto said layer of cellulose pulp (S), or through thermal radiation.

50 Patentansprüche

1. Maschine (10) zur Nass-Herstellung von Tissue-Papier mit, in Kombination:
 einem Yankee-Zylinder (35) mit einer zylindrischen Seitenfläche (35S), die um seine Achse (35A) dreht,
 einem kontinuierlichen flexiblen Element (17)

- mit einer ersten Fläche (17A), die geeignet ist, um eine Schicht von Zellulose-Pulpe (S) aufzunehmen, die Zellulosefasern und Wasser enthält, und einer zweiten Fläche (17B), die der ersten Fläche (17A) gegenüberliegt, einer Ansaug-Führungswalze (31), um die das kontinuierliche flexible Element (17) angetrieben wird, wobei die zweite Fläche (17B) des kontinuierlichen flexiblen Elements (17) in Kontakt mit der ersten Ansaug-Führungswalze (31) ist, wobei in dem Bereich, der um die Walze (31) geführt ist, die erste Fläche (17A) des kontinuierlichen flexiblen Elements (17) von dem Yankee-Zylinder (35) beabstandet ist und wobei die erste Ansaug-Führungswalze (31) geeignet ist, um Wasser aus der Zellulose-Pulpe (S) durch das kontinuierliche flexible Element (17) zu entfernen, einer Presse, die durch eine Sackloch-Druckwalze (33) gebildet wird, um die das kontinuierliche flexible Element (17) getrieben wird, die stromab der ersten Ansaug-Führungswalze (31) mit Bezug auf eine Förderrichtung der Schicht der Zellulose-Pulpe (S) angeordnet ist, wobei die erste Druckwalze (33) und der Yankee-Zylinder (35) einen ersten Druckspalt (34) definieren, innerhalb dessen das kontinuierliche flexible Element (17) mittels der ersten Druckwalze (33) gegen die zylindrische Fläche (35S) des Yankee-Zylinders (35) gepresst wird, und wobei die erste Druckwalze (33) geeignet ist, um Wasser aus der Schicht der Zellulose-Pulpe (S) durch das kontinuierliche flexible Element (17) zu entfernen, einer Heizvorrichtung (40), die ausgebildet ist, um auf das kontinuierliche flexible Element (17) einzuwirken und die zwischen der ersten Ansaug-Führungswalze (31) und der ersten Druckwalze (33) angeordnet ist.
2. Maschine (10) nach Anspruch 1, wobei die erste Ansaug-Führungswalze (31) eine äußere zylindrische Schürze (39) aufweist, die mit einer Anzahl von Durchgangslöchern (51) versehen ist, die eine äußere Fläche der Führungswalze und eine innere Ansaugkammer (43.2) der Führungswalze (31) verbinden.
 3. Maschine (10) nach Anspruch 2, wobei die Ansaugkammer (43.2) sich zu einem Teil der umfänglichen Ausdehnung der ersten Ansaug-Führungswalze (31) erstreckt und in einer stationären Position mit Bezug auf die Drehachse (31A) der Führungswalze (31) angeordnet ist, um so einen Ansaugbereich durch die Durchgangslöcher (51) der zylindrischen Schürze (39) zu bilden, wobei der Ansaugbereich mit Bezug auf den Weg des kontinuierlichen flexiblen Elements fixiert ist.
 4. Maschine (10) nach Anspruch 3, wobei die Ansaugkammer (43.2) in einem Bereich der ersten Ansaug-Führungswalze (31) angeordnet ist, der in Kontakt mit dem kontinuierlichen flexiblen Element (17) steht, um so ein Ansaugen von Wasser zu erzeugen, das in der Schicht der Zellulose-Pulpe (S) enthalten ist, durch das flexible Element (17) in den Durchgangslöchern.
 5. Maschine (10) nach Anspruch 4, wobei innerhalb der zylindrischen Schürze (39) ein ringförmiges Volumen (43) angeordnet ist, das fluidmäßig mit den Durchgangslöchern (51) verbunden ist, wobei das ringförmige Volumen (43) in die Ansaugkammer (43.2) und einen Nicht-Ansaugbereich (43.1) unterteilt ist, sodass Wasser zeitweilig in die Durchgangslöcher (51) gesaugt wird, wenn sie die Vorderseite der Ansaugkammer (43.2) passieren, und aus den Durchgangslöchern (51) aufgrund des Zentrifugaleffekts entfernt werden, wenn die Durchgangslöcher entlang des Nicht-Ansaugbereichs (43.1) des ringförmigen Volumens (43) passieren.
 6. Maschine (10) nach einem oder mehreren der vorstehenden Ansprüche mit ferner einer zweiten Druckwalze (61), um die das kontinuierliche flexible Element (17) getrieben wird, wobei die zweite Druckwalze (61) und der Yankee-Zylinder (35) einen zweiten Druckspalt (63) definieren, innerhalb dessen das kontinuierliche flexible Element (17) mittels der zweiten Druckwalze (61) gegen die zylindrische Fläche (35S) des Yankee-Zylinders (35) gepresst wird, und wobei die zweite Druckwalze (61) ausgebildet ist, um Wasser aus der Zellulose-Pulpe (S) durch das kontinuierliche flexible Element (17) zu entfernen.
 7. Maschine (10) nach Anspruch 6, wobei die zweite Druckwalze (61) die gleiche Struktur wie die erste Druckwalze hat oder wobei die zweite Druckwalze eine unterschiedliche Struktur zu der ersten Druckwalze aufweist und insbesondere die zweite Druckwalze eine Sackloch-Struktur aufweist oder eine Durchgangsloch-Konfiguration.
 8. Maschine (10) nach einem oder mehreren der vorstehenden Ansprüche, wobei die Heizvorrichtung zu der ersten Fläche (17A) gerichtet ist, die die Schicht der Zellulose-Pulpe (S) trägt.
 9. Maschine (10) nach einem oder mehreren der vorstehenden Ansprüche, wobei die Heizvorrichtung eine Dampf-Heizvorrichtung und/oder eine Infrarot-Heizvorrichtung und/oder eine Mikrowellen-Heizvorrichtung und/oder eine elektrische Heizvorrichtung ist, beispielsweise eine Vorrichtung zum Heizen durch Widerstand und/oder elektrische Induktion.
 10. Maschine (10) nach einem oder mehreren der vor-

stehenden Ansprüche, wobei die Heizvorrichtung eine Dampfkammer aufweist, die ausgebildet ist, um Dampf direkt auf das kontinuierliche flexible Element (17) zu blasen, das die Schicht der Zellulose-Pulpe (S) trägt.

11. Maschine (10) nach einem oder mehreren der vorstehenden Ansprüche, wobei die Heizvorrichtung eine Platte zur thermischen Strahlung aufweist, die auf das kontinuierliche flexible Element (17), die die Schicht der Zellulose-Pulpe (S) trägt, gerichtet ist. 5
 12. Maschine (10) nach einem oder mehreren der vorstehenden Ansprüche mit ferner einem Formdraht (15), der ausgebildet ist, um die Schicht der Zellulose-Pulpe (S) aus einem Stoffkasten (11) aufzunehmen, und ausgebildet ist, um direkt oder indirekt die Schicht der Zellulose-Pulpe auf das kontinuierliche flexible Element (17) zu übertragen. 10
 13. Maschine (10) nach einem oder mehreren der vorstehenden Ansprüche mit einem Formdraht (15), der um eine Formtrommel (19) getrieben wird, um die auch das kontinuierliche flexible Element (17) getrieben wird, um zwischen dem kontinuierlichen flexiblen Element (17) und dem Formdraht (15) ein Volumen zur Aufnahme von Zellulose-Pulpe aus einem Stoffkasten zu bilden. 15
 14. Maschine (10) nach Anspruch 12 oder 13 wobei die Führungswalze (31) und die Heizvorrichtung (40) stromab des Bereichs angeordnet sind, wo der Formdraht (15) von dem kontinuierlichen flexiblen Element (17) getrennt ist. 20
 15. Maschine (10) nach einem oder mehreren der vorstehenden Ansprüche, wobei die Heizvorrichtung ein Luft-Ansaugmodul aufweist, das vorzugsweise an einer gegenüberliegenden Seite von dem kontinuierlichen flexiblen Element angeordnet ist und zu ihm gerichtet ist. 25
 16. Maschine (10) nach einem oder mehreren der vorstehenden Ansprüche mit einer weiteren Heizvorrichtung (40') die direkt stromauf der ersten Ansaug-Führungswalze (31) angeordnet ist. 30
 17. Verfahren zum Entfernen von Wasser aus einer Schicht von Zellulose-Pulpe (S), die Wasser und Zellulosefasern enthält, wobei das Verfahren die folgenden Schritte aufweist: 35
- Bilden einer Schicht von Zellulose-Pulpe (S), die Wasser und Zellulosefasern enthält, auf einer ersten Fläche (17A) eines kontinuierlichen flexiblen Elements (17), 40
- Fördern der Schicht der Zellulose-Pulpe (S) zu einem Yankee-Zylinder (35), 45

Antreiben des kontinuierlichen flexiblen Elements (17) um eine erste Ansaug-Führungswalze (31),
wobei das kontinuierliche flexible Element (17) eine zweite Fläche (17B) in Kontakt mit der ersten Ansaug-Führungswalze (31) aufweist, und Entfernen von Wasser aus der Schicht der Zellulose-Pulpe (S) durch das kontinuierliche flexible Element (17) mittels der ersten Ansaug-Führungswalze (31) ohne Kontakt zwischen der Schicht der Zellulose-Pulpe (S) und dem Yankee-Zylinder (35), Fördern der Schicht der Zellulose-Pulpe (S) stromab der ersten Ansaug-Führungswalze (31) in einen ersten Druckspalt (34), der durch den Yankee-Zylinder (35) und durch eine erste Sackloch-Druckwalze (33) gebildet wird, um die das kontinuierliche flexible Element (17) getrieben wird, wobei die zweite Fläche (17B) in Kontakt mit der ersten Druckwalze (33) steht, und Entfernen von Wasser aus der Schicht der Zellulose-Pulpe (S) durch das flexible Element (17) mittels der ersten Druckwalze (33),
und mit ferner einem Trocknungsschritt durch Heizen der Schicht der Zellulose-Pulpe (S) zwischen dem Bereich, in dem das kontinuierliche flexible Element (17) um die erste Ansaug-Führungswalze (31) geführt ist, und dem ersten Druckspalt (34) .

18. Verfahren nach Anspruch 17 mit ferner dem folgenden Schritt:
Fördern der Schicht der Zellulose-Pulpe (S) stromab der ersten Druckwalze (33) in einen zweiten Druckspalt (63), der durch den Yankee-Zylinder (35) und eine zweite Druckwalze (61) gebildet wird, um die das kontinuierliche flexible Element (17) getrieben wird, wobei die zweite Fläche (17B) in Kontakt mit der zweiten Druckwalze (61) steht, und Entfernen von Wasser aus der Zellulose-Pulpe (S) durch das kontinuierliche flexible Element (17) mittels der zweiten Druckwalze (61). 35
19. Verfahren nach Anspruch 17 oder 18, wobei der Trocknungsschritt durch Heizen auftritt, das mittels Dampf erzeugt wird, das auf die Schicht der Zellulose-Pulpe (S) emittiert wird, oder durch thermische Strahlung. 40

Revendications

1. Une machine (10) pour la fabrication à l'état humide de papier absorbant, comprenant, en combinaison

un cylindre sécheur (35) comprenant une surface latérale cylindrique (35S), tournant autour de son axe (35A), 55

- un organe flexible continu (17) comprenant une première surface (17A) apte à recevoir une couche de pulpe de cellulose (S) comprenant des fibres de cellulose et de l'eau, et une deuxième surface (17B) opposée à la première surface (17A),
 un premier rouleau de guidage d'aspiration (31) autour duquel l'organe flexible continu (17) est entraîné en rotation ; la deuxième surface (17B) de l'organe flexible continu (17) étant en contact avec le premier rouleau de guidage d'aspiration (31) ; la première surface (17A) de l'organe flexible continu (17) étant espacée du cylindre sécheur (35) dans la zone guidée autour dudit rouleau (31) ; et le premier rouleau de guidage d'aspiration (31) étant apte à retirer de l'eau de la couche de pulpe de cellulose (S) à travers l'organe flexible continu (17) ;
 une presse formée par un rouleau de pression à trous borgnes (33) autour duquel l'organe flexible continu (17) est entraîné en rotation, agencée en aval du premier rouleau de guidage d'aspiration (31) par rapport à une direction d'avancement de la couche de pulpe de cellulose (S) ; le premier rouleau de pression (33) et le cylindre sécheur (35) formant une première zone de pression (34) à l'intérieur de laquelle l'organe flexible continu (17) est pressé au moyen du premier rouleau de pression (33) contre la surface cylindrique (35S) du cylindre sécheur (35) et dans lequel le premier rouleau de pression (33) est apte à retirer de l'eau de la couche de pulpe de cellulose (S) à travers l'organe flexible continu (17) ;
 un dispositif de chauffage (40) apte à agir sur ledit organe flexible continu (17) et agencé entre ledit premier rouleau de guidage d'aspiration (31) et ledit premier rouleau de pression (33).
2. La machine (10) selon la revendication 1, dans laquelle le premier rouleau de guidage d'aspiration (31) comprend une jupe cylindrique externe (39) pourvue d'une pluralité de trous traversants (51) reliant une surface externe du rouleau de guidage et une chambre d'aspiration interne (43.2) du rouleau de guidage (31).
 3. La machine (10) selon la revendication 2, dans laquelle la chambre d'aspiration (43.2) s'étend sur une portion de l'extension circonférentielle du premier rouleau de guidage d'aspiration (31) et est agencée dans une position stationnaire par rapport à l'axe de rotation (31A) du rouleau de guidage (31), de façon à créer une zone d'aspiration à travers les trous traversants (51) de la jupe cylindrique (39), la zone d'aspiration étant fixe par rapport au chemin de l'organe flexible continu.
 4. La machine (10) selon la revendication 3, dans laquelle la chambre d'aspiration (43.2) est agencée dans une zone du rouleau de guidage d'aspiration (31) qui est en contact avec l'organe flexible continu (17), de façon à créer une aspiration de l'eau contenue dans la couche de pulpe de cellulose (S), à travers l'organe flexible (17) par les trous traversants.
 5. La machine (10) selon la revendication 4, dans laquelle, à l'intérieur de la jupe cylindrique (39), un volume annulaire (43) est agencé, connecté de manière fluide aux trous traversants (51), le volume annulaire (43) étant subdivisé en ladite chambre d'aspiration (43.2) et une zone de non aspiration (43.1), de sorte que de l'eau soit temporairement aspirée dans les trous traversants (51) quand ils passent en face de la chambre d'aspiration (43.2) et soit retirée des trous traversants (51) en raison de l'effet de centrifugation lorsque les trous traversants passent le long de la zone de non aspiration (43.1) du volume annulaire (43).
 6. La machine (10) selon l'une ou plusieurs des revendications précédentes, comprenant en outre une deuxième rouleau de pression (61), autour duquel l'organe flexible continu (71) est entraîné en rotation ; dans lequel le deuxième rouleau de pression (61) et le cylindre sécheur (35) forment une deuxième zone de pression (63), à l'intérieur duquel l'organe flexible continu (17) est pressé au moyens du deuxième rouleau de pression (61) contre la surface cylindrique (35S) du cylindre sécheur (35) ; et dans lequel le deuxième rouleau de pression (61) est apte à retirer de l'eau de la couche de pulpe de cellulose (S) à travers l'organe flexible continu (17).
 7. La machine (10) selon la revendication 6, dans laquelle le deuxième rouleau de pression (61) a la même structure que le premier rouleau de pression ; ou dans lequel le deuxième rouleau de pression a une structure différente de celle du premier rouleau de pression et en particulier ledit deuxième rouleau de pression ayant une configuration à trous borgnes ou une configuration à trous traversants.
 8. La machine (10) selon l'une ou plusieurs des revendications précédentes, dans laquelle ledit dispositif de chauffage fait face à ladite première surface (17A) portant la couche de pulpe de cellulose (S).
 9. La machine (10) selon l'une ou plusieurs des revendications précédentes, dans laquelle ledit dispositif de chauffage est un dispositif de chauffage à la vapeur et/ou un dispositif de chauffage à infrarouges et/ou un dispositif de chauffage à micro-ondes et/ou un dispositif de chauffage électrique, par exemple un dispositif pour chauffer à l'aide d'une résistance et/ou par induction électrique.

10. La machine selon l'une ou plusieurs des revendications précédentes, dans laquelle ledit dispositif de chauffage comprend une boîte à vapeur apte à souffler de la vapeur directement sur ledit organe flexible continu (17) portant la couche de pulpe de cellulose (S). 5
11. La machine (10) selon l'une ou plusieurs des revendications précédentes, dans laquelle ledit dispositif de chauffage comprend une plaque de radiation thermique faisant face audit organe flexible continu (17) portant la couche de pulpe de cellulose (S). 10
12. La machine (10) selon l'une ou plusieurs des revendications précédentes comprenant en outre une toile de formation (15) apte à recevoir la couche de pulpe de cellulose (S) d'une caisse d'arrivée (11) et configurée pour transférer directement ou indirectement, la couche de pulpe de cellulose (S) à l'organe flexible continu (17). 15 20
13. La machine (10) selon l'une ou plusieurs des revendications précédentes, comprenant une toile de formation (15), entraînée en rotation autour d'un tambour de formation (19), autour duquel ledit organe flexible continu (17) est aussi entraîné en rotation, pour former, entre l'organe flexible continu (17) et la toile de formation (15), un volume pour recevoir de la pulpe de cellulose provenant d'une caisse d'arrivée. 25 30
14. La machine (10) selon la revendication 12 ou 13, dans laquelle ledit rouleau de guidage (31) et ledit dispositif de chauffage (40) sont agencés en aval de la zone où ladite toile de formation (15) est séparée dudit organe flexible continu (17). 35
15. La machine (10) selon l'une ou plusieurs des revendications précédentes, dans laquelle ledit dispositif de chauffage comprend un module d'aspiration d'air agencé de préférence du côté opposé à l'organe flexible continu et lui faisant face. 40
16. La machine (10) selon l'une ou plusieurs des revendications précédentes, comprenant un autre dispositif de chauffage (40') agencé immédiatement en amont du premier rouleau de guidage d'aspiration (31). 45
17. Un procédé pour retirer de l'eau d'une couche de pulpe de cellulose (S) comprenant de l'eau et des fibres de cellulose, ce procédé comprenant les étapes suivantes consistant à : 50
- former une couche de pulpe de cellulose (S) comprenant de l'eau et des fibres de cellulose sur une première surface (17A) d'un organe flexible continu (17) ; 55
- faire avancer la couche de pulpe de cellulose (S) vers un cylindre sécheur (35) ;
- entraîner en rotation l'organe flexible continu (17) autour d'un premier rouleau de guidage d'aspiration (31),
- l'organe flexible continu (17) ayant une deuxième surface (17B) en contact avec le premier rouleau de guidage d'aspiration (31) et
- retirer de l'eau de la couche de pulpe de cellulose (S) à travers l'organe flexible continu (17) au moyen du premier rouleau de guidage d'aspiration (31), sans contact entre la couche de pulpe de cellulose (S) et le cylindre sécheur (35) ;
- en aval du premier rouleau de guidage d'aspiration (31), faire avancer la couche de pulpe de cellulose (S) dans une première zone de pression (34) formée par le cylindre sécheur (35) et un premier rouleau de pression à trous borgnes (33) autour duquel l'organe flexible continu (17) est entraîné en rotation avec la deuxième surface (17B) en contact avec le premier rouleau de pression (33), et retirer de l'eau de la couche de pulpe de cellulose (S) à travers l'organe flexible continu (17) au moyen du premier rouleau de pression (33) ;
- et comprenant en outre une étape de séchage par chauffage de ladite couche de pulpe de cellulose (S) entre la zone où l'organe flexible continu (17) est entraîné en rotation autour du premier rouleau de guidage d'aspiration (31) et ladite première zone de pression (34).
18. Le procédé selon la revendication 17, comprenant en outre l'étape suivante consistant à : en aval du premier rouleau de pression (33), faire avancer la couche de pulpe de cellulose (S) dans une deuxième zone de pression (63) formée par le cylindre sécheur (35) et par une deuxième rouleau de pression (61), autour duquel l'organe flexible continu (17) est entraîné en rotation avec la deuxième surface (17B) en contact avec le deuxième rouleau de pression (61), et retirer de l'eau de la couche de pulpe de cellulose (S) à travers l'organe flexible continu (17) au moyen dudit deuxième rouleau de pression (61).
19. Le procédé selon la revendication 17 ou 18, dans lequel ladite étape de séchage s'effectue à l'aide d'un chauffage obtenu au moyen de vapeur émise sur ladite couche de pulpe de cellulose (S), ou par radiation thermique.

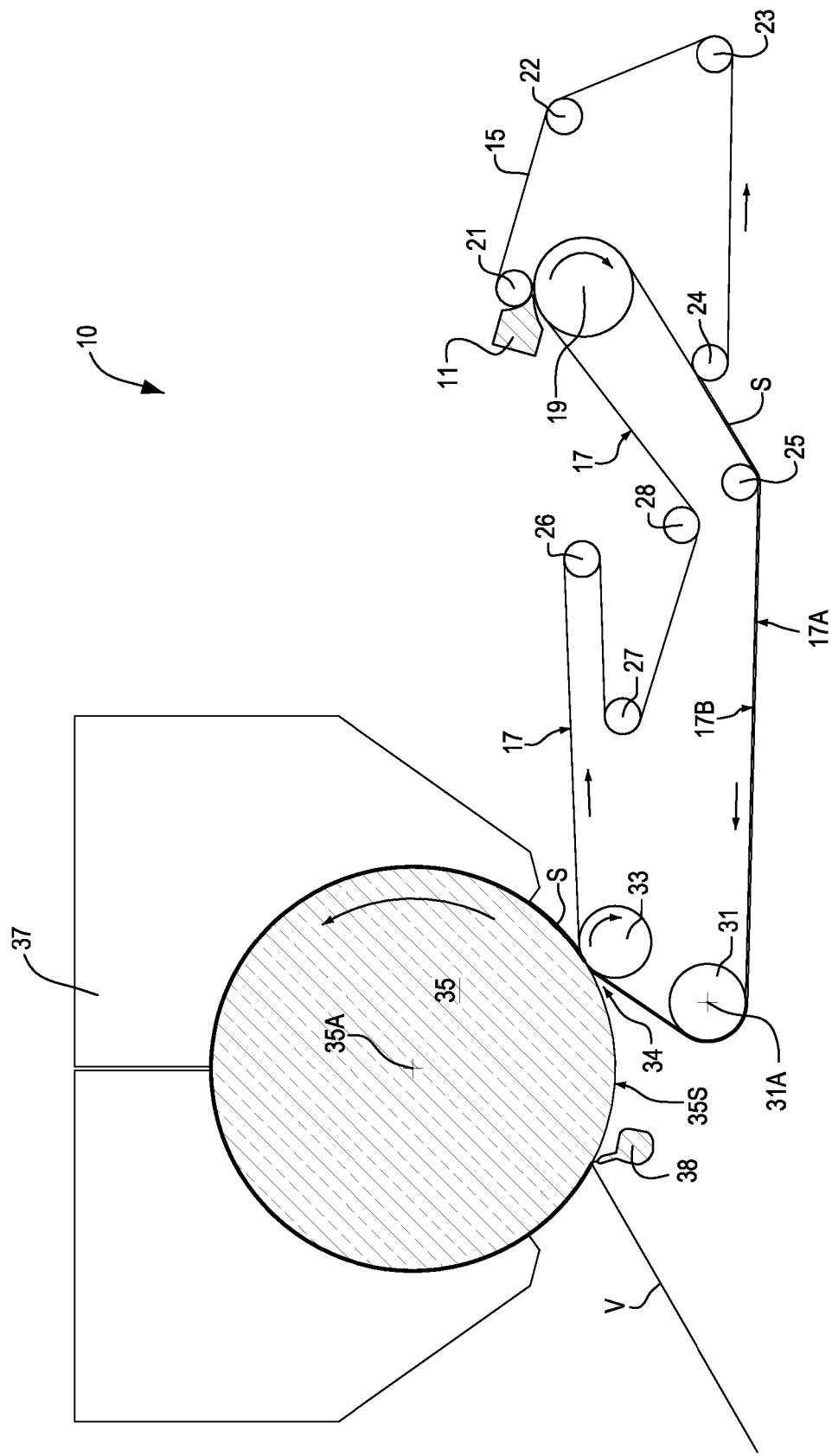


Fig.1

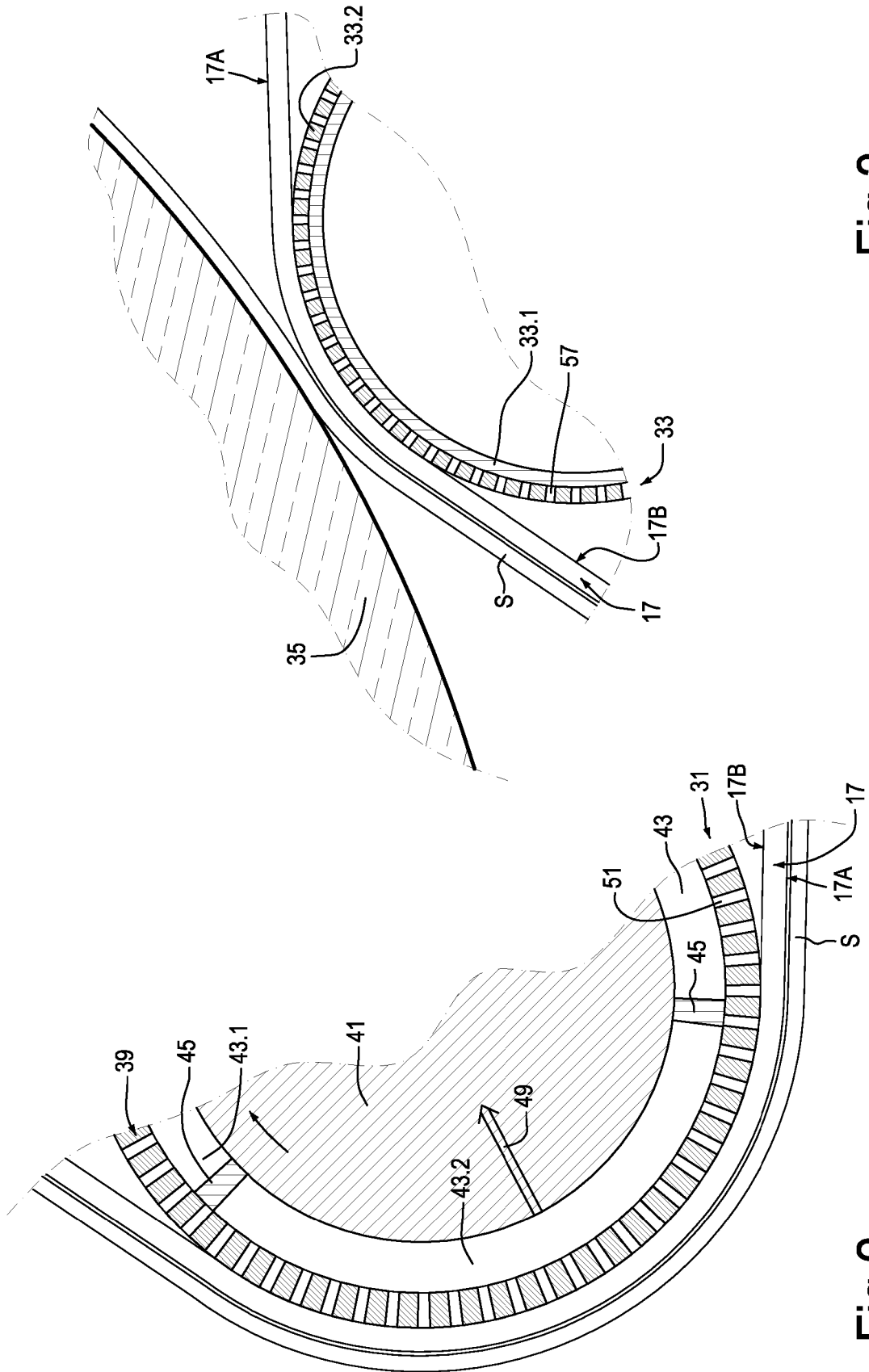


Fig.3

Fig.2

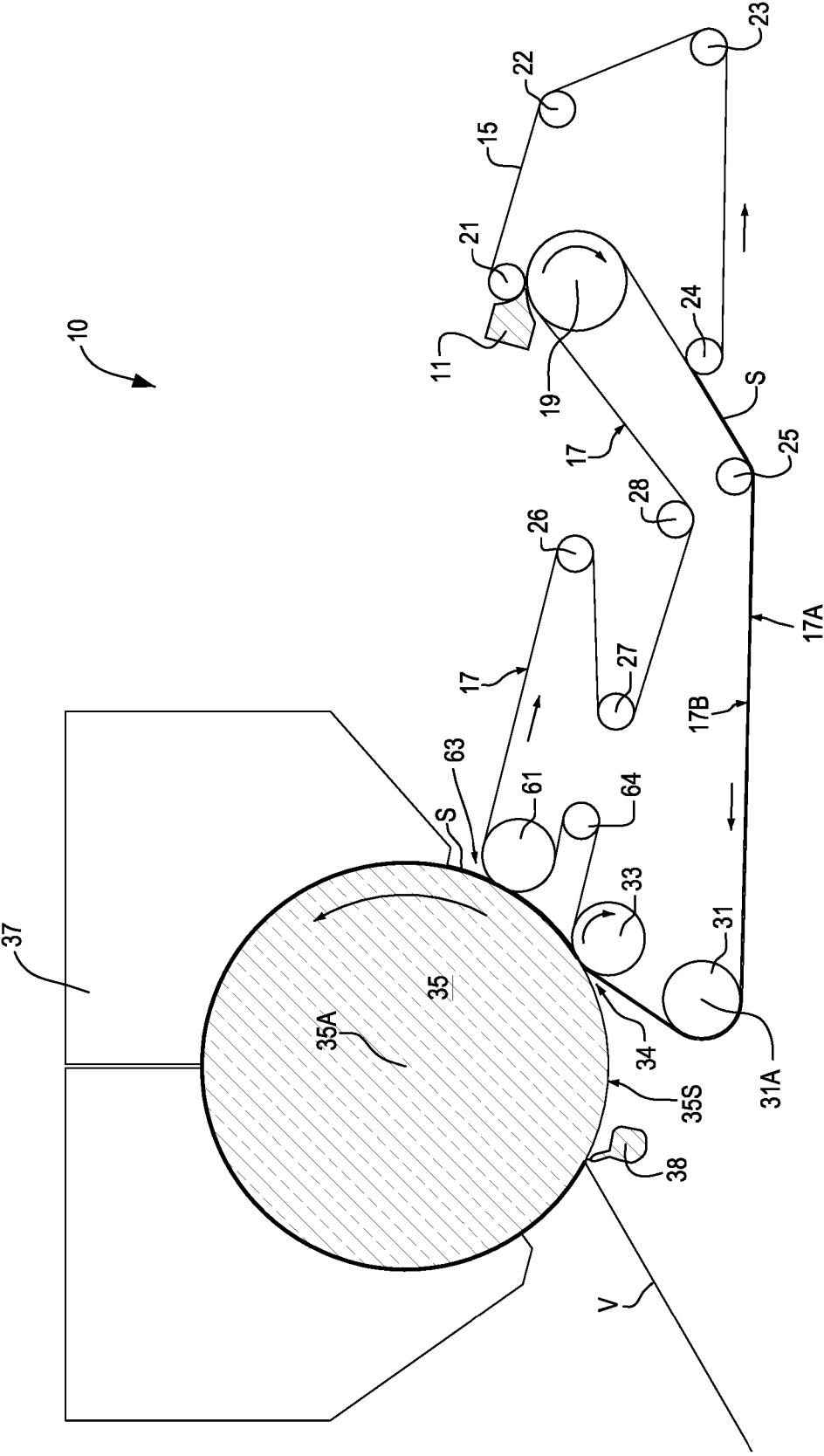
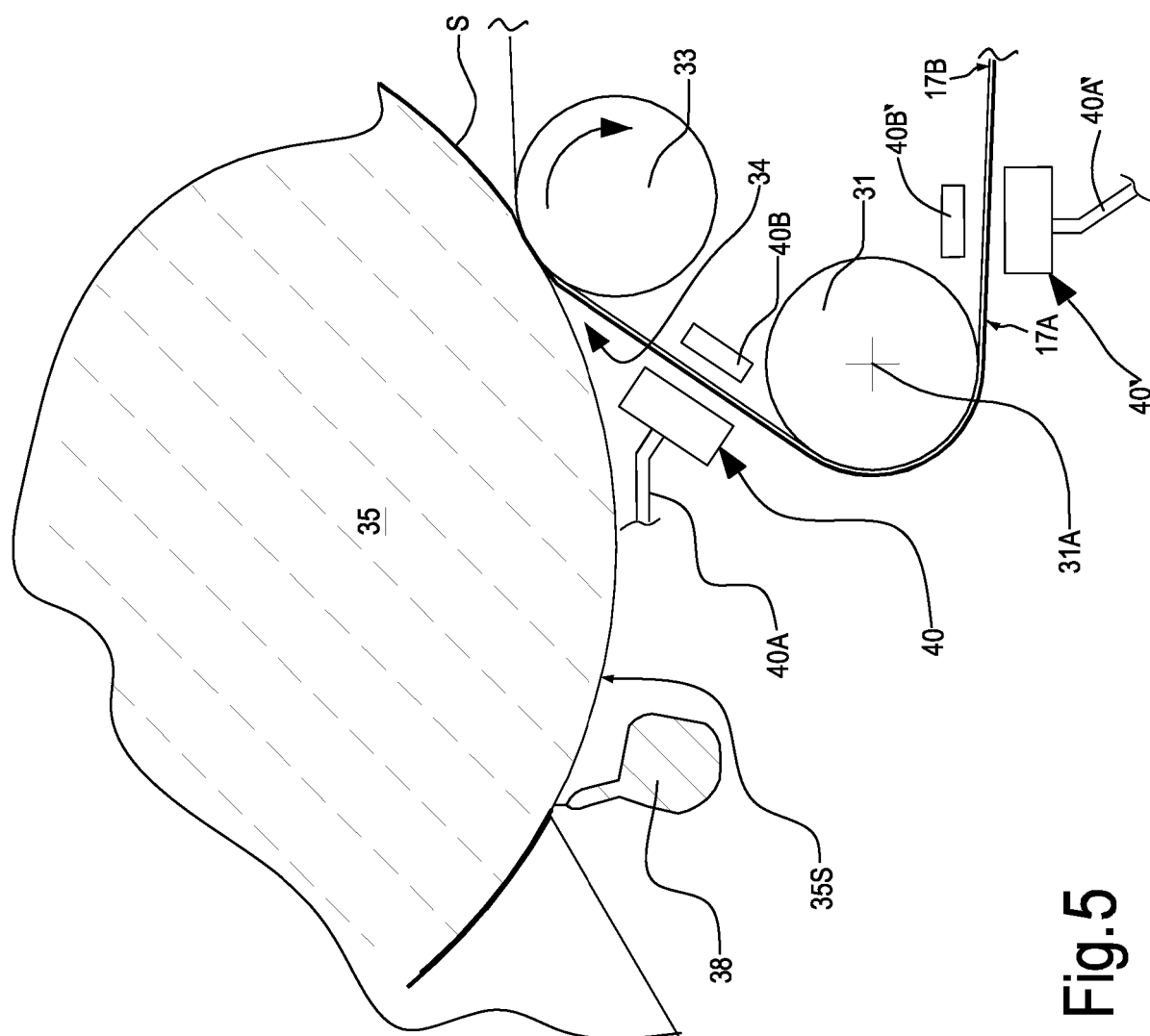


Fig.4



REFERENCES CITED IN THE DESCRIPTION

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