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(54) Paper manufacturing machine and method with a means for eliminating edge trimmings, and mesh for the machine

(57) A method for cutting edge trimmings of a tissue of fibrous material, such as paper or the like, during its production, includes the following steps: feeding a mixture including fibers and a liquid carrier between two moving belts (7,9) which are pressed against each other, at least one of the belts (7) being pervious; arranging on one of the two moving belts at least one substantially impermeable strip (31) which is parallel to the direction of motion of the belts, the pressure of the two belts against each other causing the parting of the fibers at the impermeable strip.

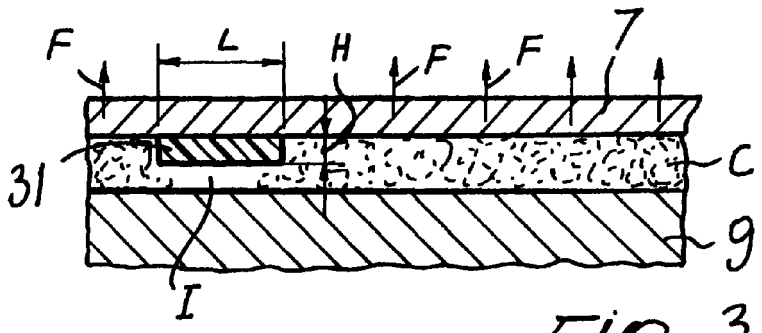

Fig. 3

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Description

[0001] The present invention relates to a machine for the continuous manufacture of a tissue or web of paper or other fibrous material starting from mixtures of fibers and water or other liquid carriers, with a means for eliminating edge trimmings.

[0002] The present invention also relates to a method for eliminating edge trimmings from a paper-like material in web or ribbon form, in a machine for manufacturing it.

[0003] The present invention also relates to a mesh or fabric for use in a machine of the above mentioned type.

[0004] Various kinds of machine are currently used for the continuous production of paper tissues. In the known machines, a mixture of cellulose fibers or the like and water is fed onto a pervious belt or into a gap between two mutually adjacent continuous belts, at least one of which is pervious and is constituted for example by a synthetic fabric. These belts will be called meshes hereinafter.

[0005] In one kind of conventional machine, the mixture of fibers and water is fed into a gap between adjacent guiding rollers on which two meshes are guided. The mixture accordingly forms a thin tissue of water and fibers. By being pressed between the two meshes, and by virtue of the centrifugal force generated in the region in which the two meshes are guided around a roller, the percentage of water in the mixture is reduced from an initial value of approximately 99% to a final value of approximately 50% by weight. The water is drained through the textile structure of the mesh. The resulting tissue of fibers is then passed onto a further belt which is thicker, has high absorption properties and is known as felt. Then the tissue is transferred to a drying means of the thermal type, for example by guiding the tissue on a so-called Yankee cylinder which is internally heated with a suitable heat-conveying fluid, in order to obtain a paper web in output from the unit.

[0006] The longitudinal edges of the tissue formed between the two adjacent meshes are uneven and must be eliminated. Pressurized water nozzles are currently used for this purpose. The nozzles are arranged in a region in which the already partially dehydrated tissue rests on one of the fabrics, while the other surface is free and exposed to the action of the nozzle. The water that cuts the tissue is discharged through the mesh on which the tissue rests.

[0007] In another type of paper-making machine, the mixture of water and fibers is fed between a felt and a mesh. The tissue, partially dehydrated by drainage through the mesh, clings to the felt and is conveyed by it to a heated Yankee cylinder. These machines are known as crescent formers and are used in particular in the manufacture of so-called tissue paper, that is to say, paper adapted to the subsequent production of kitchen paper rolls, napkins, handkerchiefs, toilet paper and the like.

[0008] The longitudinal edge trimmings of the tissue are cut by water-spraying nozzles in this kind of machine as well. The nozzles act on the tissue while it clings to the felt. This entails the drawback that discharge of the water used for cutting is difficult because the felt is practically impermeable to water. Furthermore, the jet of water that reaches the felt causes it to wear rapidly.

[0009] Furthermore, the use of the nozzles entails, in all kinds of machine, drawbacks linked to the delicate nature of these mechanical components, which must operate at high pressures and are therefore subject to frequent maintenance.

[0010] Another drawback inherent in the use of water nozzles for cutting the edge trimmings is the fact that the water ejected by the nozzles increases the water content of the tissue deposited on the felt or on the mesh, having a negative effect on the dying process. In crescent former machines, this entails a further negative effect due to the fact that the water ejected by the nozzles is unable to escape through the felt and therefore impregnates the region of the tissue that lies adjacent to the cut. This limits the maximum speed that can be attained with these machines, since excessive speed would cause centrifuging of the trimmed edges of the tissue, consequently losing fibers and damaging the shape of the edge, with consequent problems in the subsequent steps of crêping, rewinding and processing of the paper. Accordingly, these machines usually cannot exceed 1800 m/min.

[0011] The aim of the present invention is to provide a new method for eliminating longitudinal edge trimmings from paper tissues being formed in continuous machines.

[0012] Another object of the present invention is to provide a machine and corresponding accessories for performing the method.

[0013] More particularly, an object of the present invention is to provide a method and a machine which allow to eliminate edge trimmings from the paper tissue being formed without using nozzles or other mechanical components that are expensive and difficult to maintain, and are therefore more reliable and cheaper.

[0014] Another object of the present invention is to provide a method for eliminating edge trimmings which is particularly suitable for use in machines of the crescent former type, in which the discharge of the water sprayed by conventional cutting nozzles is particularly difficult.

[0015] Another object of the present invention is to provide a new type of mesh for machines for manufacturing paper or other tissues of fibrous material starting from mixtures of fibers and a liquid carrier such as water or the like.

[0016] This aim, these objects and others which will become apparent hereinafter are achieved by a method for cutting edge trimmings of a tissue of fibrous material comprising the following steps:

-- feeding a mixture including fibers and a liquid carrier between two moving belts which are pressed against each other, at least one of the belts being pervious;

-- arranging on one of the two moving belts at least one impermeable strip which is parallel to the direction of motion of the belts, the pressure of the two belts against each other causing the parting of the fibers at the impermeable strip.

[0017] Essentially, the method according to the invention is based on the recognition of the fact that by providing a nondraining region along the mesh of the paper-making machine the fibers contained in the mixture pressed between the mesh and the felt, or between two meshes, tend to migrate due to the hydraulic counterpressure generated in the nondraining region. This produces, between the two belts, a region which has no fibers and in which the paper tissue accordingly does not form. If the nondraining region is obtained by virtue of a longitudinal strip of appropriate size located proximate to the edge of the tissue being formed between the two belts, a cutting line forms at the strip which separates the longitudinal edge trimming from the rest of the tissue being formed.

[0018] The invention also relates to a machine for manufacturing paper comprising: a first pervious moving belt; a second moving belt which cooperates with the first belt, the first belt and the second belt being able to move along respective closed paths which have a common portion along which the two belts are pressed against each other. Characteristically, according to the invention, at least one longitudinal impermeable strip is formed on the first pervious belt; at the strip, the pressure between the two belts produces a parting of the fibers, generating a discontinuity line in the tissue being formed. The first belt can be constituted by a mesh made of synthetic fabric through the stitches of which the liquid of the mixture drains away.

[0019] Further characteristics and advantages will become apparent from the description of preferred but not exclusive embodiments of the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

FIG. 1 is a diagram of a crescent former machine;

FIG. 2 is a schematic enlarged-scale local sectional view, taken along the plane II-II of Fig. 1;

FIG. 3 is an enlarged-scale view of the detail designated by the reference sign III in Fig. 2;

FIGS. 4 and 5 are two further schematic views of paper-making machines to which the invention can be applied;

FIG. 6 is an enlarged-scale sectional view, taken along the plane VI-VI of Fig. 4 or 5; and

FIG. 7 is a plan view of a portion of mesh according to the invention.

[0020] The present invention is applied particularly advantageously in machines of the crescent former type, a diagram of which is shown in Fig. 1. The reference numeral 1 generally designates a container from which the mixture of water and cellulose fibers is dispensed through a longitudinal slit. The mixture is dispensed in a gap between two rollers 3 and 5, around which a mesh 7 and a felt 9 are guided respectively. The mesh 7 is guided not only around the roller 3 but also around additional rollers 11, 12 and 13 as well as around the roller 5, a portion of which is accordingly surrounded both by the felt 9 and by the mesh 7. The mesh 7 advances in the direction indicated by the arrow f7 and the felt advances in the direction indicated by the arrow f9.

[0021] The felt 9 covers a longer path than the fabric 7 which is determined by a series of rollers 15, 16, 17, 18, 19, 21.

[0022] The mixture, fed continuously from the container 1 and constituted by approximately 99% water by weight and 1% cellulose fiber by weight, is pressed in the gap between the rollers 3 and 5 and forms a continuous tissue 10 between the mesh 7 and the felt 9. The guiding of the mesh 7 and of the felt 9, with the tissue interposed between them, around the roller 5 causes the drainage of water through the mesh 7 due to centrifugal force. The discharged water is collected in a tank 23.

[0023] Downstream of the roller 5, the mesh 7 and the felt 9 are caused to mutually diverge, since the roller 13 and the first one of the rollers 15 are mutually spaced. The paper tissue being formed continues to adhere to the surface of the absorbent felt 9 and is conveyed to the cylinder 21, which constitutes, together with a large-diameter cylinder 25 which is known as Yankee cylinder, a rotary press for eliminating by pressing a further fraction of water from the tissue being formed. The tissue is then transferred from the felt 9 to the surface of the Yankee cylinder 25 for the subsequent thermal drying treatment.

[0024] The machine and the process described so far are of a per se known type. In conventional machines of this type, the edge trimmings of the tissue being formed between the felt 9 and the fabric 7 are cut by means of two pressurized water nozzles which are arranged below the felt 9 along the lower portion of its path, below the rollers 15.

[0025] According to the present invention, these nozzles are instead eliminated and replaced with a different cutting system described hereinafter.

[0026] According to the invention, a longitudinal impermeable strip is provided parallel to each edge 7A

(Fig. 7) of the mesh 7 and at a preset distance from the edge and closes the draining region of the fabric over a preset width. The impermeable strip is typically made of a synthetic resin which is applied hot or cold. On meshes made of polyester or other suitable and per se known material it is possible to provide impermeable strips of polyurethane, which are particularly advantageous due to their high adhesion to the mesh and to their considerable elasticity, which makes the mesh resistant to wear.

[0027] In Figs. 2 and 3, the impermeable strip is designated by the reference numeral 31. Fig. 7, which shows a portion of mesh extended flat, illustrates two strips 31 which are parallel to the two longitudinal edges 7A of the mesh. The figs. are not to scale and the dimensions of the felt, of the mesh, of the mixture C and of the strip 31 have been altered for the sake of a clearer graphic presentation.

[0028] As clearly shown in particular by Figs. 2 and 3, in the region where the strip 31 is located the draining action through the mesh 7 is prevented by the impermeable nature of the strip 31, so that while in the adjacent regions the excess water contained in the tissue C formed by the mixture of water and fibers escapes in the direction of the arrows F through the web of the mesh 7, in the region I (Fig. 3) there forms a hydraulic counterpressure, generated by the action of the mesh 7 against the felt 9, which induces the water to flow away toward the longitudinal edges of the strip 31, entraining the fibers of the mixture in this motion. The fibers "migrate" from the region I toward the adjacent regions, so that in the region I between the impermeable strip 31 and the surface of the felt 9 there forms a volume without cellulose fibers which contains practically only water. In this region, the fiber tissue does not form because there are no fibers and this produces a longitudinal cutting line which runs approximately so as to correspond to the extension of the strip 31. This hydraulic effect can also optionally be combined with a mechanical effect due to the fact that the strip 31 protrudes with respect to the surface of the mesh 7 and presses against the surface of the felt 9 to which the tissue C adheres.

[0029] By arranging two impermeable strips 31 at a set distance from the edges 7A of the fabric, a tissue C is produced whose width is equal to the distance between the inner edges of the two strips 31 and has trimmed longitudinal edges.

[0030] By having more than two impermeable longitudinal strips 31 it is possible to provide two or more tissues of paper, already separated and trimmed, on the same machine.

[0031] The dimensions of the strips 31 can vary also according to the type of mixture used. Typically, appreciable results have been obtained with strips 31 which have a width L of approximately 2-7 mm and a height H of approximately 0.5-1.5 mm. Optimum results are achieved with strips approximately 4 mm wide and approximately 1 mm high. These dimensions are different from those of the plastic-coated strips commonly used as reinforcement members in some kinds of mesh. In that case the reinforcement strips are much smaller and are used in large numbers because they must not block the draining region of the mesh.

[0032] The above described edge trimming generation system can also be applied to machines other than the crescent former machines shown in the diagram of Fig. 1. Figs. 4 and 5 show two different diagrams of a paper-making machine. In the diagram of Fig. 4, the mixture of fibers and water is fed by a container, again designated by the reference numeral 1, into a gap formed between two meshes 41, 43 which are guided around two rollers 45, 47. The mixture forms a tissue between the two meshes 41 and 43; the tissue is centrifuged in the region in which the meshes are guided around the roller 47. The water drained through the mesh 41 is discharged into a collection tank 49 which has the same functions as the tank 23. The partially dried tissue is then transferred from the mesh 41 to a felt 51 which conveys it to a thermal drying means, such as a drying section or a Yankee cylinder.

[0033] In the region where it is guided around the roller 47, the mixture that forms the tissue C is enclosed between the two meshes 41 and 43 (see Fig. 6). No drainage effect occurs through the mesh 43, since this is prevented by the presence of the surface of the roller 47, while a drainage effect occurs through the mesh 41 but is hindered at the impermeable strip, again designated by the reference numeral 31. Also in this configuration, two longitudinal cuts form at the two strips 31 applied to the fabric 41.

[0034] The diagram of Fig. 5 is conceptually similar and differs from the diagram of Fig. 4 in the arrangement of the meshes and of the felt. Identical or corresponding parts are designated by the same reference numerals used in Fig. 4.

[0035] Regardless of the structure of the machine, the cutting system according to the present invention can be used whenever, in a region of the path of the tissue being formed in which the tissue is still constituted by a mixture with a high percentage of water with respect to the fiber, the tissue lies between a draining surface constituted by the mesh provided with impermeable strips and a nondraining surface. The nondraining surface can be constituted by a belt-like part which is impervious or scarcely pervious (such as a felt) or by a mesh which rests on an impervious guiding surface (such as the surface of the roller 47 in Figs. 4 and 5).

[0036] In practice, it has been found that the invention achieves the intended aim and objects. The method according to the invention is susceptible of numerous modifications and variations within the scope of the appended claims. All the details may be replaced with technically equivalent elements.

[0037] The materials used, as well as the dimensions, may be any according to the requirements and the state of the art.

Claims

1. A method for cutting edge trimmings of a tissue of fibrous material, such as paper or the like, during production, characterized in that it comprises the following steps:

   -- feeding a mixture which comprises fibers and a liquid carrier between two moving belts which are pressed against each other, at least one of said belts being pervious;

   -- arranging on one of said two moving belts at least one impermeable strip which is parallel to the direction of motion of said belts, the pressure of the two belts against each other causing the parting of the fibers at said impermeable strip.

2. A method according to claim 1, wherein two mutually parallel impermeable strips are provided at the two longitudinal edges of the tissue being formed.

3. A method according to claim 1 or 2, wherein one of said moving belts is a pervious mesh and the other one is a felt, said impermeable strip being provided on the mesh.

4. A method according to claim 1 or 2, wherein said two moving belts are pervious meshes and wherein said two moving belts are guided around a common roller in order to cause the drainage of the liquid through one of said meshes by centrifugal effect.

5. A machine for forming a tissue of fiber-based material starting from a mixture of fibers and a liquid carrier, comprising: a first pervious belt; a second moving belt which cooperates with said first belt, said first belt and said second belt being movable along respective closed paths, said two paths having a common portion along which said two belts are pressed together, characterized in that on said first pervious belt there is at least one longitudinal impermeable strip at which the pressure between the two strips causes a parting of the fibers, generating a discontinuity line in the tissue being formed.

6. A machine according to claim 5, characterized in that said first belt is constituted by a mesh.

7. A machine according to claim 5, characterized in that said second belt is constituted by a felt.

8. A machine according to claim 5, characterized in that said second belt is constituted by a mesh and in that at said common portion of their path the two belts are guided around a common roller, said second belt being in contact with the surface of said roller and said first belt being arranged on the outside of said second belt.

9. A machine according to one or more of claims 5 to 8, characterized in that said impermeable strip is 2 to 7 mm wide and 0.5 to 1.5 mm high.

10. A machine according to claim 9, characterized in that said impermeable strip is approximately 4 mm wide and approximately 1 mm high.

11. A machine according to one or more of claims 5 to 10, characterized in that said first belt has two impermeable strips proximate to its longitudinal edges.

12. A machine according to one or more of claims 5 to 11, characterized in that said first belt has three or more longitudinal impermeable strips for cutting the edge trimmings and for longitudinally dividing the tissue into two or more portions.

13. A pervious belt for a machine for producing a tissue of fiber-based material, characterized in that it comprises at least one impermeable strip which is parallel to the longitudinal edges of said belt, said strip having dimensions which provide a region having no drainage effect.

14. A belt according to claim 13, characterized in that it has two impermeable strips which are parallel to the two respective longitudinal edges.

15. A belt according to claim 13, characterized in that it has three or more impermeable strips which are parallel to the longitudinal edges.

16. A belt according to one or more of claims 13, 14 or 15, characterized in that said impermeable strip or strips have a width between 2 and 7 mm and a height between 0.5 and 1.5 mm.

17. A belt according to claim 16, characterized in that said strip or strips are approximately 4 mm wide and approximately 1 mm high.

18. A belt according to one or more of claims 13 to 17, characterized in that said belt is constituted by a mesh made of a synthetic fabric.

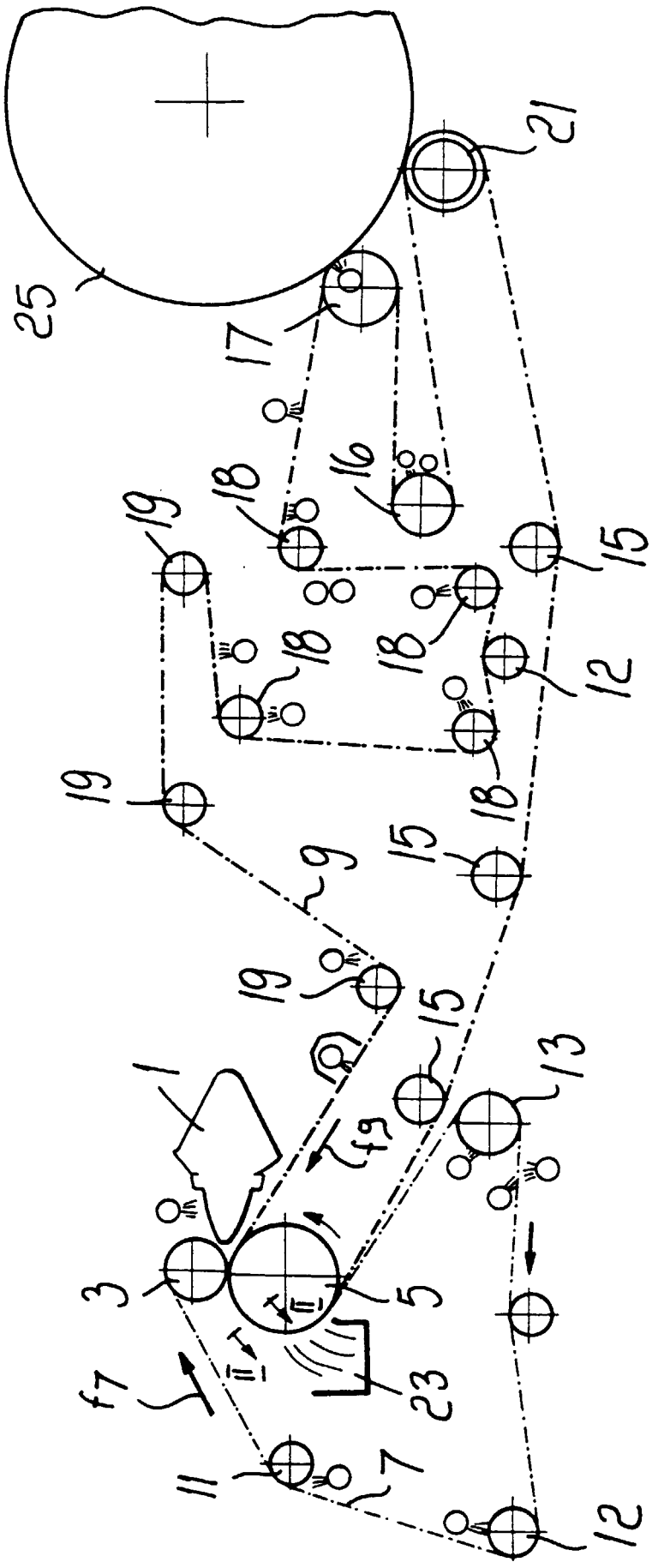

Fig. 1

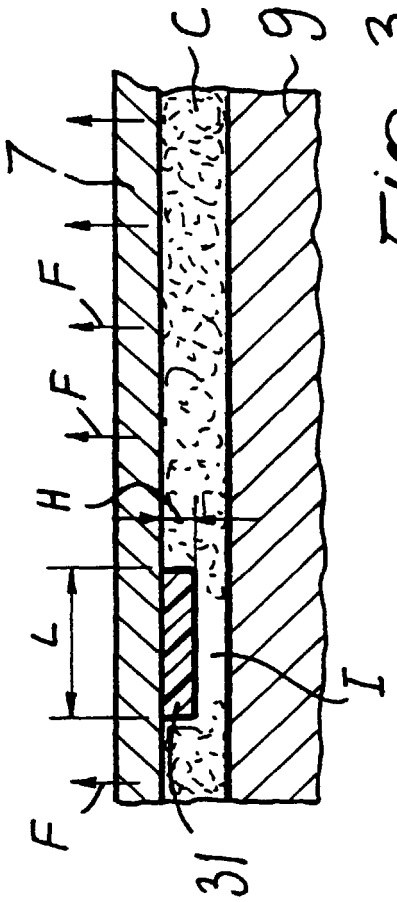

Fig. 3

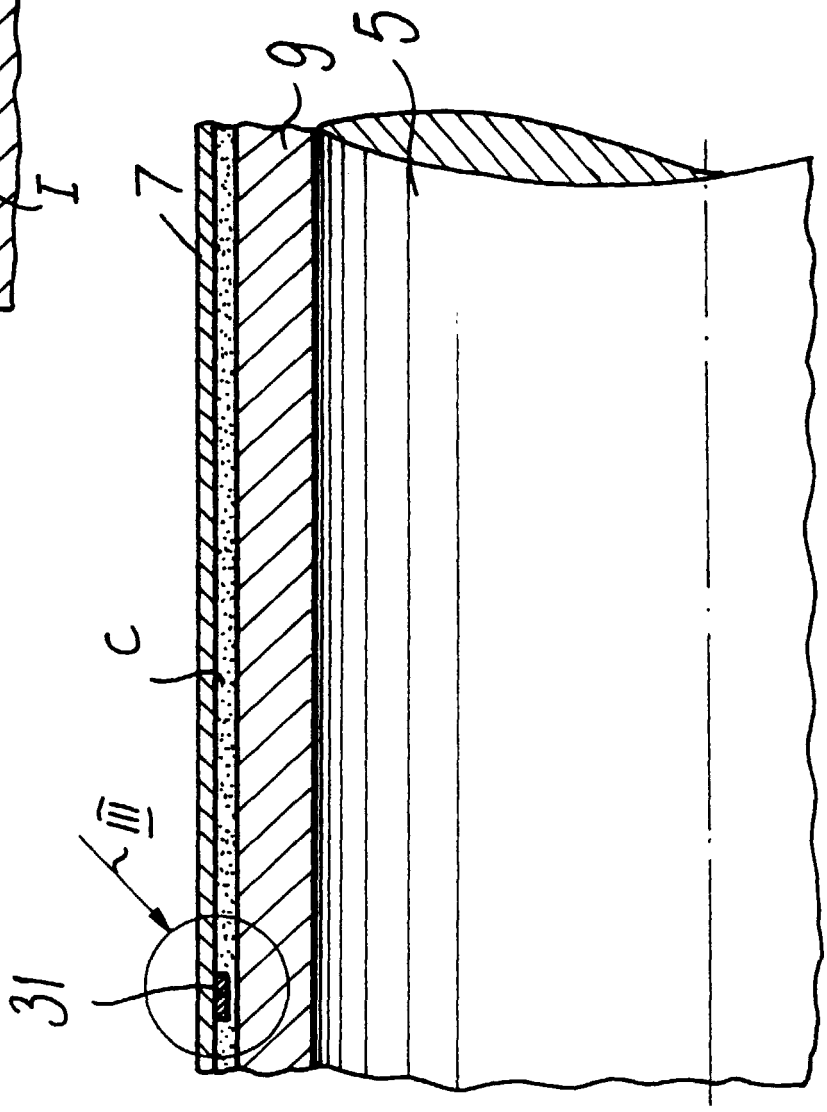

Fig. 2

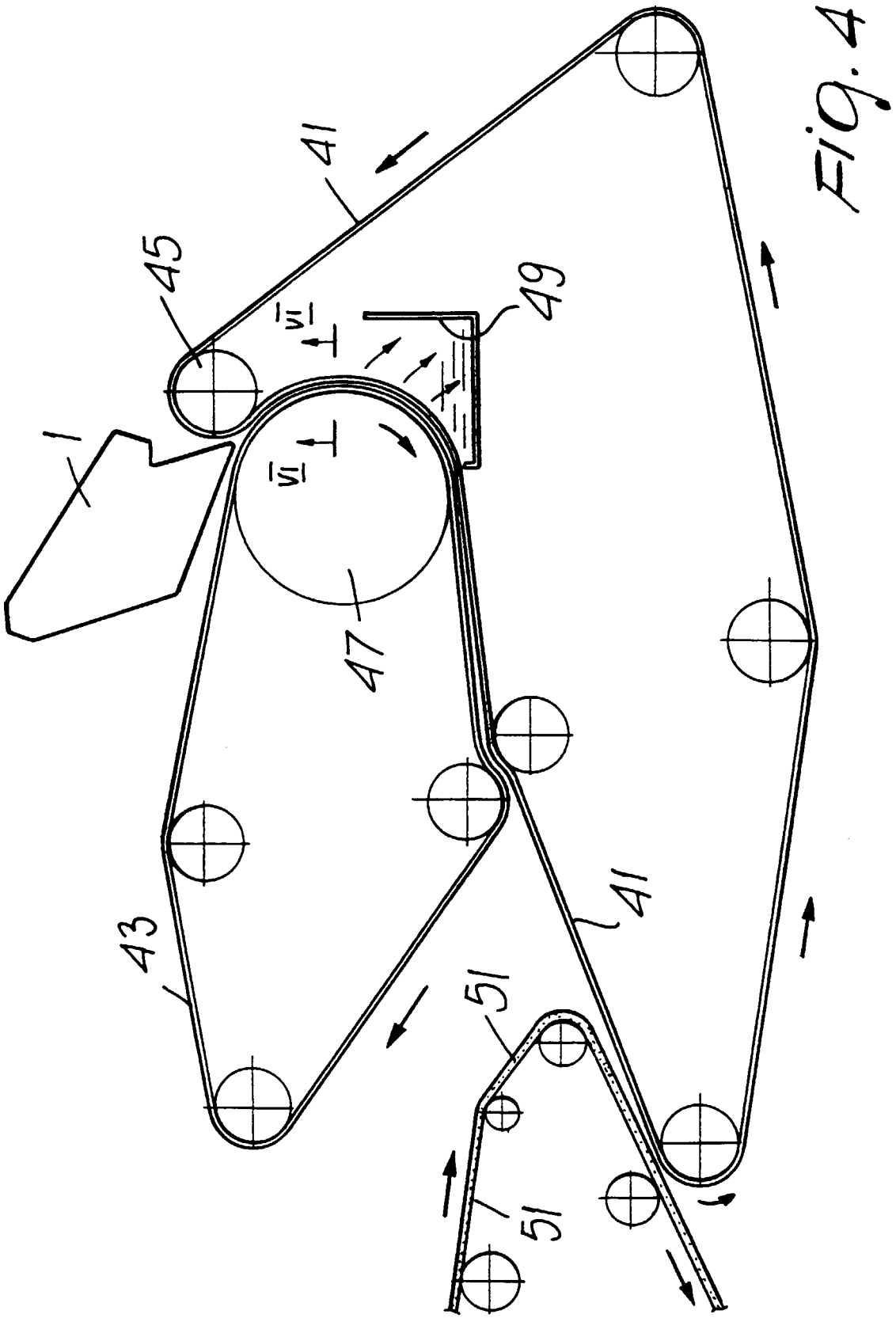

Fig. 4

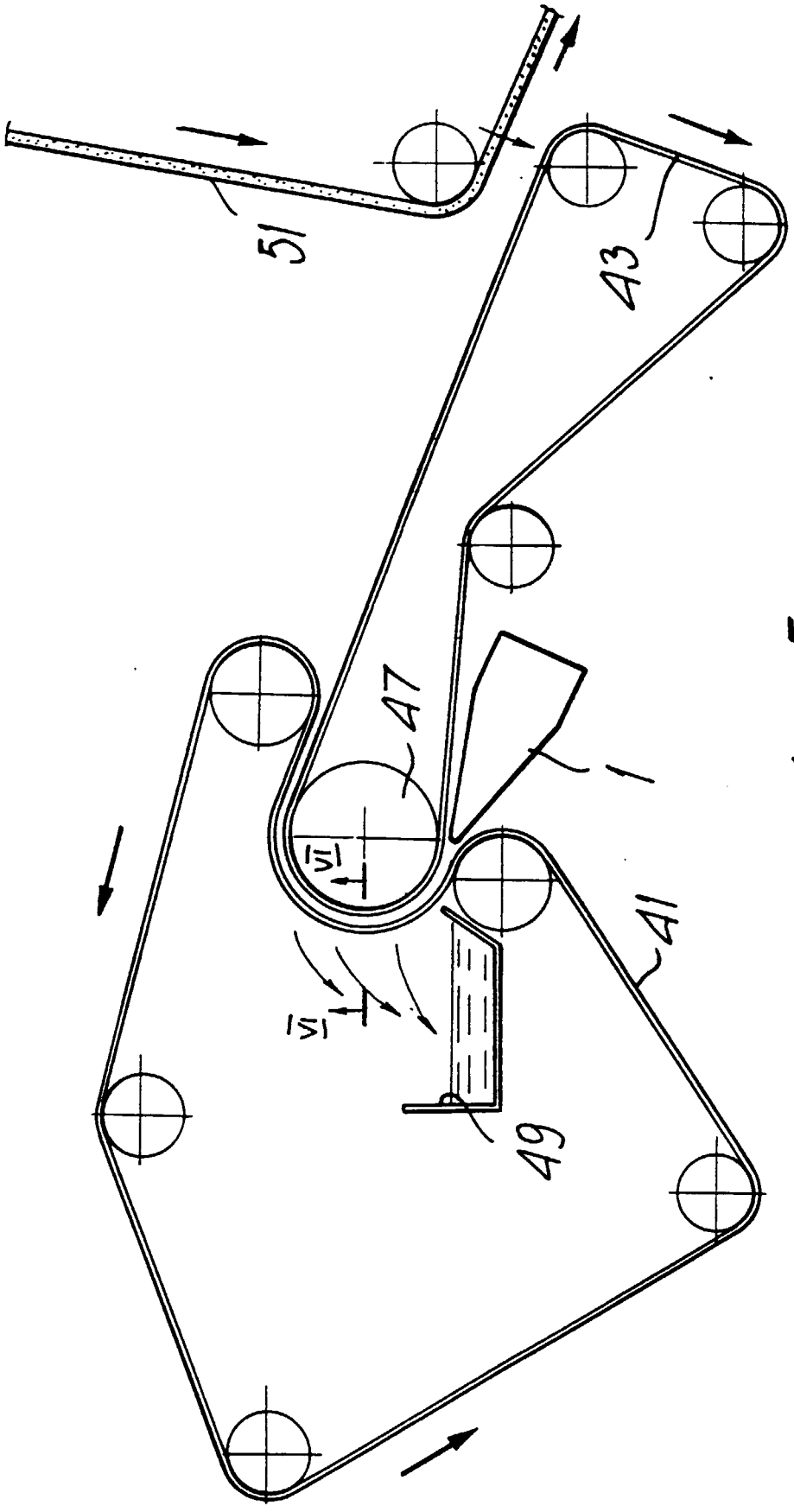

Fig. 5

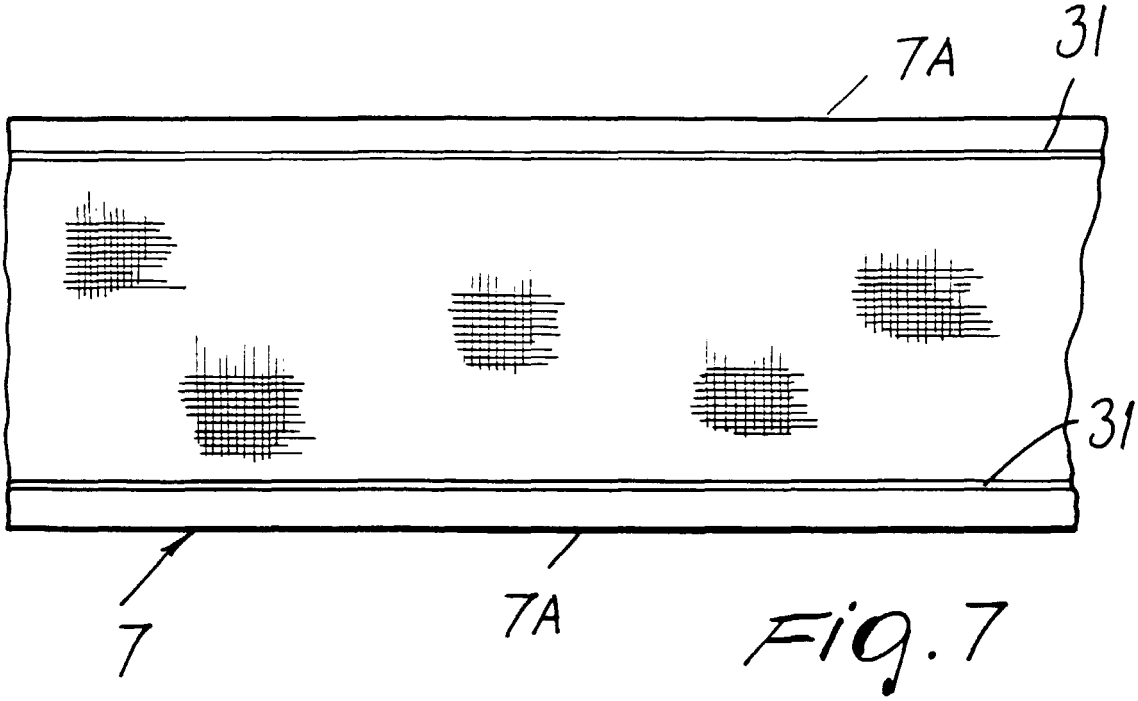

Fig. 7

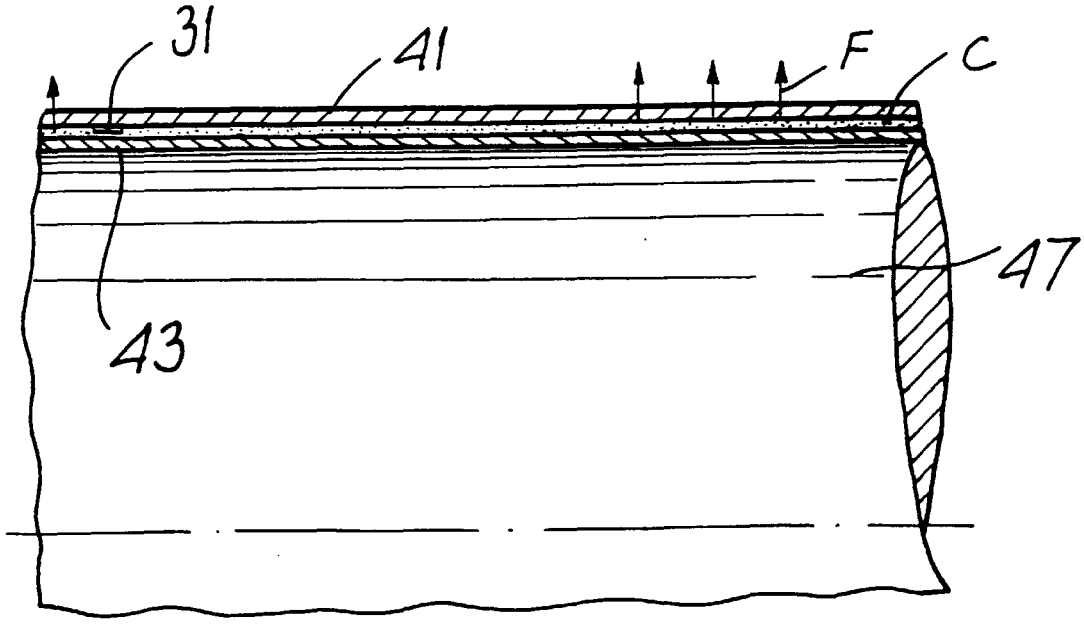

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 99 11 1641 .

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	FR 1 556 210 A (KIMBERLY-CLARK CORPORATION) 7 February 1969 (1969-02-07) * the whole document *	1-3,5-7, 9,11,13, 14,16,18	D21F9/00 D21F1/58

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

D21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 October 1999	De Rijck, F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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08-10-1999

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