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(54) Device and method for impregnating fabrics in a treatment liquid, in particular for treatments in liquid ammonia

(57) Device (10) for impregnating fabrics (11) in a treatment liquid (19), comprising a tank (12) associated with impregnation cylinders (15a, 15b, 15c), during use at least partly immersed in the treatment liquid (19) contained in the tank (12). The latter consists of at least two sections (112a, 112b, 112c) communicating with each

other and disposed, during use, on different levels progressively decreasing in the direction of feed of the fabric (11). The device (10) also includes a member to regulate the impregnation time of the fabric (11), making it transit in only one, or only in some, sections (112a, 112b, 112c) of the tank (12), and excluding others.

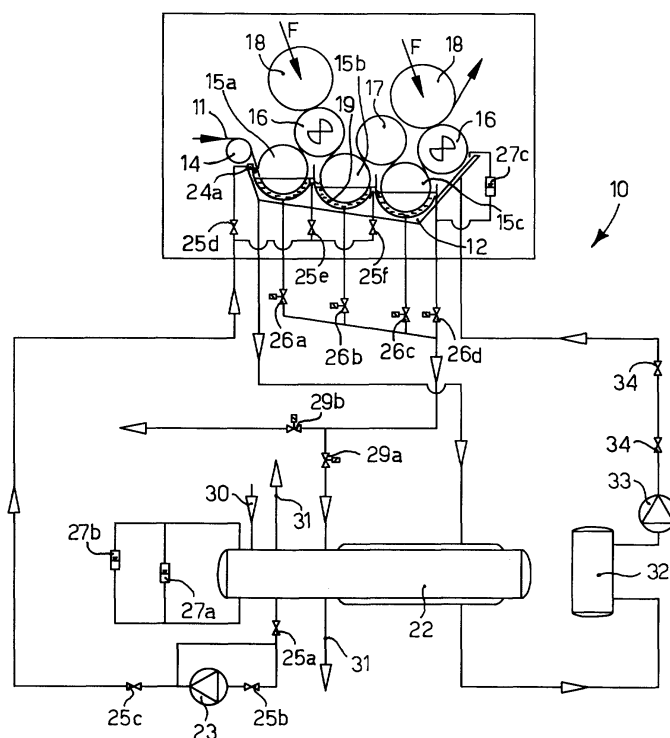


fig.1

Description

FIELD OF THE INVENTION

[0001] The present invention concerns a device and the relative method for impregnating fabrics in a treatment liquid.

[0002] The invention is applied advantageously, although not exclusively, in the continuous treatment of fabrics in anhydrous liquid ammonia (NH_3), in which the impregnation of the fabric is performed by passing it in a tank filled at least partly with liquid ammonia.

BACKGROUND OF THE INVENTION

[0003] In the field of finishing textile materials, it has been known widely and for a long time to subject a fabric to a treatment in liquid ammonia in order to obtain particular effects, both aesthetic and of touch.

[0004] Normally, this treatment is carried out continuously, making the fabric to be treated pass inside a tank containing liquid ammonia, and then sending it in sequence first to a section where a chemical reaction with the ammonia takes place, and then to a section to remove the ammonia from the fabric, performed by means of heating and/or washing in a bath of water.

[0005] One disadvantage of known impregnation devices is that, in general, it is very difficult, if not impossible, to regulate the impregnation times of the fabric in the ammonia according to the type of fabric to be treated and/or the result to be obtained.

[0006] Another disadvantage of known devices is the difficulty of carrying out maintenance and cleaning operations on the impregnation tank, and also the complexity and consequent slowness of the operations to empty the tank of the residual ammonia at the end of or during a pause in the treatment.

[0007] Another disadvantage of known devices is that caused by the difficulty of guaranteeing that the level of liquid ammonia is maintained substantially constant, and/or at a programmed value, during and after the passage of the fabric, and of ensuring a correct restoration of the quantity of liquid ammonia removed by the fabric during its passage.

[0008] Purpose of the invention is to overcome the disadvantages of the state of the art mentioned above, supplying a device for impregnating fabrics in a treatment liquid wherein the impregnation time can be regulated at least according to the fabric to be treated.

[0009] Another purpose is to supply a device for impregnating fabrics wherein the operations to maintain and empty the tank are facilitated, and to restore the level of liquid to a desired value.

[0010] The Applicant has devised and embodied the present invention to overcome the shortcomings of the state of the art and to obtain other advantages.

SUMMARY OF THE INVENTION

[0011] The present invention is set forth and characterized in the main claims, while the dependent claims describe other innovative characteristics of the invention.

[0012] According to a first feature of the present invention, the device for impregnating fabrics in a treatment liquid comprises a tank consisting of at least two sections communicating with each other, which are disposed, in the normal position of use of the tank, on different levels progressively decreasing in the direction of feed of the fabric.

[0013] The two or more sections of the tank are separated from each other by dividing elements, the height of which defines for each section the maximum filling level before the liquid overflows into the adjacent section, located at a lower level.

[0014] In this way, the various sections of the tank can be filled with the treatment liquid, for example liquid ammonia, using a single feed mean communicating with the first section encountered by the fabric, that is, the one located at the highest level, and then progressively filling, by overflow, the other sections too.

[0015] In this way, the constant control of the level in each section is also ensured, since the shape itself of the individual section defines the maximum quantity of liquid that it can contain.

[0016] According to the invention, an impregnation cylinder is associated with each of the sections of the tank, around which the fabric is made to pass at least for the segment it is immersed in the tank.

[0017] Each impregnation cylinder, in the normal condition of use, is at least partly immersed in the relative section of the tank.

[0018] In a first embodiment, in order to regulate the impregnation times of the fabric in the treatment liquid, each cylinder is equipped with an autonomous lifting/lowering movement with respect to the relative section of the tank, so as to be able to be completely removed therefrom when it is desired that the fabric in transit is not immersed in one or more of the relative sections.

[0019] In another solution of the invention, one or more of the sections of the tank are kept empty, while at least one of the others is filled with the treatment liquid; in this way, the impregnation of the fabric can be limited as desired with respect to a situation wherein all the sections of the tank are filled with the liquid.

[0020] In another solution, the tank can be inclined or oriented during the passage of the fabric, so as to put the treatment liquid present in one or more of its sections out of contact with the relative impregnation cylinder.

[0021] All the solutions indicated above allow to regulate and modify the impregnation time of the fabric, for example according to the type and/or result to be obtained, making it transit or impregnating it in only one or only some sections of the tank, and excluding others.

[0022] According to another feature of the invention, the tank is pivoted on one side in order to allow it to be

easily removed, for example for replacement or maintenance or cleaning.

[0023] In another feature of the present invention, the device comprises at least a container suitable to restore, even during use, the level of liquid ammonia present in the impregnation tank. According to the invention, the container is connected to the impregnation tank by means of a hydraulic circuit comprising at least a pump and valve means. The tank also cooperates with at least a level sensor suitable to send measurement signals to a control unit, which is suitable to selectively activate the pump when it becomes necessary to restore a desired level of ammonia inside the tank.

[0024] Moreover, the container is connected to the individual sections of the tank by means of discharge valves that allow to discharge the relative residual liquid inside the container and/or towards abatement and restoration means, so as to allow the possibility of a substantially continuous re-circulation between the tank and the container.

[0025] As already said, the tank can be filled by delivery only in the section of the tank located at the top, that is, the first encountered by the fabric, and the other sections can be filled by means of a progressive overflow from one section to the other. According to a variant, the hydraulic circuit associated with the container is ramified, and the pump is connected by means of a relative branch of the circuit to every section of the tank, which in turn has its own delivery mean which allows it to be filled independently.

[0026] According to another feature of the invention, the device comprises a circuit to heat the impregnation tank and/or the space between the tank and the container. The heating circuit, which can run on diathermic oil or other suitable type, can be selectively activated so as to facilitate the evaporation of the residual ammonia at least in the step of emptying and discharging the ammonia from the tank.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 shows a device for impregnating fabrics in a treatment liquid according to the invention in its entirety;
- fig. 2 shows an enlarged detail of the device in fig. 1;
- fig. 3 is a schematic view of an impregnation tank used in the device in fig. 1 and in the maintenance step.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

[0028] In the attached figures, the reference number 10 denotes in its entirety a device for impregnating a fabric 11 in a treatment liquid 19, which for example can be anhydrous liquid ammonia (NH_3). The invention is however applicable for the treatment of fabrics in any other type of liquid.

[0029] The device 10 comprises at least a tank 12 configured so as to include a plurality of sections, respectively first 112a, second 112b, and third 112c, all contiguous and communicating with each other, separated by dividing elements 13b, 13c which define, at least for the first 112a and the second section 112b, the relative maximum filling level.

[0030] Two walls, respectively inlet 13a and outlet 13d, define the perimeter edges of inlet and outlet of the tank 12. On the outlet wall 13d there is a ridge 20 usable to define the maximum filling level of the third section 112c.

[0031] It comes within the field of the invention that the tank 12 can include only two, or four or more contiguous sections.

[0032] The fabric 11 is accompanied inside the tank 12 by means of an introduction cylinder 14, two drawing cylinders 16 and a plurality of impregnation cylinders, respectively 15a, 15b and 15c, one for each section of the tank 12. There is also a guide cylinder 17 between two adjacent impregnation cylinders 15.

[0033] The impregnation cylinders 15a, 15b, 15c advantageously include a knurled, studded or micro-threaded surface, or with another light surface impression, in order to promote the impregnation with the treatment liquid of the face of the fabric 11 in contact with the cylinder.

[0034] In cooperation with the drawing cylinders 16 there are also squeezing cylinders 18, mobile radially in the direction of the arrows F with respect to the drawing cylinders 16. The function of the squeezing cylinders 18 is to exert an adjustable squeezing action on the fabric 11 emerging from a relative section of the tank 12 in order to dose, on each occasion, the quantity of treatment liquid 19 which remains on the fabric 11 at exit from the tank 12.

[0035] According to the invention, the device 10 is suitable to use only one, or only some of the sections 112a, 112b, 112c of the tank 12, in order to regulate the impregnation times, for example according to the type of fabric 11 being treated, or the desired result.

[0036] This partial use of the tank 12 can be obtained in several ways.

[0037] In a first embodiment, one or more of the impregnation cylinders 15a, 15b, 15c can be raised during the passage of the fabric 11 until they are completely removed from the treatment liquid 19 present in the relative section 112a, 112b, 112c, so that the fabric 11 can transit freely without contacting the liquid and hence without being impregnated therewith.

[0038] In another solution, one or more sections 112a, 112b, 112c can be emptied of the treatment liquid 19,

while one or more of the others are kept full.

[0039] In another solution, the tank 12 can be pivoted at a point 21 (fig. 3) at one end, and be inclined, during the passage of the fabric 11, until the level of treatment liquid 19 of one section, in this case the last 112c, is no longer in contact with the relative impregnation cylinder 15c.

[0040] This last solution can also be adopted in the presence of treatment liquid 19 in all the sections, exploiting the length of the outlet wall 13d which acts as a containing element.

[0041] The use of a tank 12 pivoted at one point 21, and able to oscillate with respect thereto, facilitates its rapid detachment in order to carry out operations of repairs and maintenance on the tank 12 or on parts of it.

[0042] According to the invention, the tank 12 is connected, by means of a hydraulic feed circuit, to a container 22, by means of which, through pump means 23, it is possible to feed the treatment liquid 19 to the tank 12, and possibly make it re-circulate. The container 22 has its own filling mean 30, and a connection pipe 31 to a condenser in order to liquefy the vapors of the liquid, for example ammonia, that are generated inside it during the discharge step.

[0043] The tank 12 can be filled by means of the pump 23, by delivering the liquid only to the first section 112a of the tank 12, by means of a first distributor element 24a, while the other sections 112b and 112c are filled by overflow of the treatment liquid 19 from the first section 112a.

[0044] On the hydraulic circuit that connects the container 22 to said first distributor element 24, there are interception valves 25a, 25b, 25c and 25d present, which are selectively opened during the filling step.

[0045] It is also provided that all three sections 112a, 112b, 112c of the tank 12 can be filled directly from the container 22, by means of a branch of the hydraulic circuit and respective introduction elements, respectively second 24b and third 24c.

[0046] On the lines of feed of the second 112b and third section 112c of the tank 12 there are respective interception valves 25e and 25f which are selectively opened/closed when it is desired to perform a direct feed from the container 22 to these sections, excluding that or those further upstream.

[0047] On the bottom of each section 112a, 112b, 112c there are also discharge means, for example apertures associated with stoppers that can be selectively opened, also automatically, so as to discharge upon command the relative treatment liquid 19, by opening relative discharge valves 26a, 26b, 26c.

[0048] The selective discharge of one or more of the sections 112a, 112b, 112c can be activated when it is desired to regulate the impregnation time of the fabric 11, emptying one or more of the sections and leaving the tank 12 only partly full.

[0049] Apart from the ridge 20 present on the wall 13d there is also an aperture that can be selectively opened, associated with a relative discharge valve 26d, by means

of which it is possible to discharge the treatment liquid 19 which exceeds the correct filling level of the third section 112c, defined by the ridge 20 itself.

[0050] The liquid discharged from the tank 12 by means of the valve 26d can be sent, by opening an interception valve 29a, to the container 22 in order to re-circulate it, or, when re-circulation is no longer possible, to an abatement tank, by opening an interception valve 29b. From the same container 22 the liquid can be sent to an abatement tower by means of the connection pipe 31.

[0051] Two level sensors are associated with the container 22, respectively a minimum level sensor 27a and a maximum level sensor 27b, and another level sensor 27c, a safety sensor, is associated with the tank 12.

[0052] Thanks to this configuration, it is possible to guarantee a continuous control of the need for the treatment liquid during the operating cycles by means of the following operations:

- continuous and constant control of the level inside the container 22, by means of the sensors 27a, 27b, and possible topping-up by means of the filling mean 30;
- continuous control of the level in the tank 12 by means of the overflows;
- control of the liquid discharged from the tank 12 by means of the discharge valves 26a-26d, and control of the fractions sent for re-circulating to the container or to abatement, in a tank or in a tower.

[0053] The device 10 also comprises a heating circuit comprising a container 32 of heating fluid, for example diathermic oil, selectively activated pump means 33, an exchanger and selectively opening interception valves 34. The heating circuit is activated to promote and accelerate the evaporation of the treatment liquid, for example ammonia, at least in the steps when the plant is stopped, for example between one work cycle and the next.

[0054] In another formulation, on the guide cylinder 17 a load cell is mounted, not shown here, the function of which is to detect the value of shrinkage of the fabric 11 during the impregnation step with the treatment liquid, in order, for example, to regulate the drawing tension exerted by the two drawing cylinders 16.

[0055] Modifications and/or additions of parts may be made to the impregnation device 10 as described heretofore, without departing from the field and scope of the present invention.

Claims

1. Device for impregnating fabrics (11) in a treatment liquid (19), comprising a tank (12) associated with impregnation cylinders (15a, 15b, 15c), during use at least partly immersed in the treatment liquid (19) contained in said tank (12), **characterized in that**

- said tank (12) consists of at least two sections (112a, 112b, 112c) communicating with each other and disposed, during use, on different levels progressively decreasing in the direction of feed of the fabric (11), the device (10) also including means to regulate the impregnation time of the fabric (11), making it transit in only one, or only in some, sections (112a, 112b, 112c) of the tank (12) and excluding others.
2. Device as in claim 1, wherein there is at least an impregnation cylinder (15a, 15b, 15c) for each section (112a, 112b, 112c) of said tank (12), **characterized in that** said means to regulate the impregnation time of the fabric (11) comprises means to lift/lower at least one of said impregnation cylinders (15a, 15b, 15c) with respect to the relative section (112a, 112b, 112c), so that said at least one impregnation cylinder (15a, 15b, 15c) is removed therefrom when the fabric in transit is not to be immersed in the relative section.
 3. Device as in claim 1, **characterized in that** said means to regulate the impregnation time of the fabric (11) comprises means (25a, 25e, 25f) to selectively feed one or more of said sections (112a, 112b, 112c), leaving at least the section farthest downstream full.
 4. Device as in claim 1, **characterized in that** said means to regulate the impregnation time of the fabric (11) comprises means to oscillate said tank (12) with respect to a pivoting point (21), so as to prevent contact between the surface of the treatment liquid (19) contained in one or more of said sections (112a, 112b, 112c) and the relative impregnation cylinder (15a, 15b, 15c).
 5. Device as in claim 1, **characterized in that** said at least two sections (112a, 112b, 112c) of said tank (12) are separated from each other by dividing elements (13b, 13c, 20), the height of which defines, for each section, the maximum filling level.
 6. Device as in claim 1, **characterized in that** at least the first (112a) of said sections, that is, the one located highest, includes a distributor element (24a) connected, by means of a hydraulic circuit comprising at least a pump (23) and valve means (25c, 25d), to a container (22) containing the treatment liquid (19).
 7. Device as in claim 6, **characterized in that**, during the filling step of said tank (12), the first (112a) of said sections is filled directly by means of said distributor element (24a), while the other adjacent sections are filled by overflow of the liquid from the section immediately before.
 8. Device as in claim 1, **characterized in that** each of said sections (112a, 112b, 112c) includes its own distributor element (24a, 24b, 24c) connected, by means of a hydraulic circuit comprising at least a pump (23) and valve means (25c, 25d, 25e, 25f) to a container (22) containing the treatment liquid (19).
 9. Device as in claim 6 or claim 8, **characterized in that** said container (22) is associated with sensors of the minimum (27a) and maximum (27b) level, co-operating with a filling means (30) in order to keep the level of liquid inside said container (22) substantially constant.
 10. Device as in claim 6 or claim 8, **characterized in that** each of said sections (112a, 112b, 112c) comprises discharge valve means (26a, 26b, 26c) selectively opening in order to discharge the liquid contained therein into said container (22) and/or towards abatement and restoration means.
 11. Device as in any claim hereinbefore, **characterized in that** it comprises a circuit for heating the impregnation tank (12) and/or the space between the tank (12) and the container (22), said heating circuit comprising at least a container (32) containing a heating fluid, selectively activated pump means (33), means for heating the oil and a hydraulic circuit suitable to make said heating fluid circulate at least in proximity with said tank (12) in order to promote the evaporation of the residual treatment liquid.
 12. Device as in any claim hereinbefore, **characterized in that** said impregnation cylinders (15a, 15b, 15c) include a knurled, studded or micro-threaded surface, or with other surface impression, in order to promote the impregnation with the treatment liquid (19) of the face of the fabric (11) in contact with said cylinder.
 13. Device as in any claim hereinbefore, **characterized in that** it comprises cylinders (16) for drawing the fabric (11) and squeezing cylinders (18) disposed, during use, in contact with said drawing cylinders (16), and radially movable with respect to them in order to exert an adjustable squeezing action on the fabric (11) emerging from impregnation in said tank (12).
 14. Method for impregnating fabrics (11) in a treatment liquid (19), which provides to make said fabric (11) transit in a tank (12) associated with impregnation cylinders (15a, 15b, 15c), during use at least partly immersed in the liquid (19) contained in said tank (12), **characterized in that** it provides to use a tank (12) consisting of at least two sections (112a, 112b, 112c) communicating with each other and disposed, during use, on different levels progressively decreasing in the direction of feed of the fabric (11), and to regulate the impregnation time of the fabric

(11), making it transit or be impregnated only in one, or only in some, sections of the tank (12) and excluding others.

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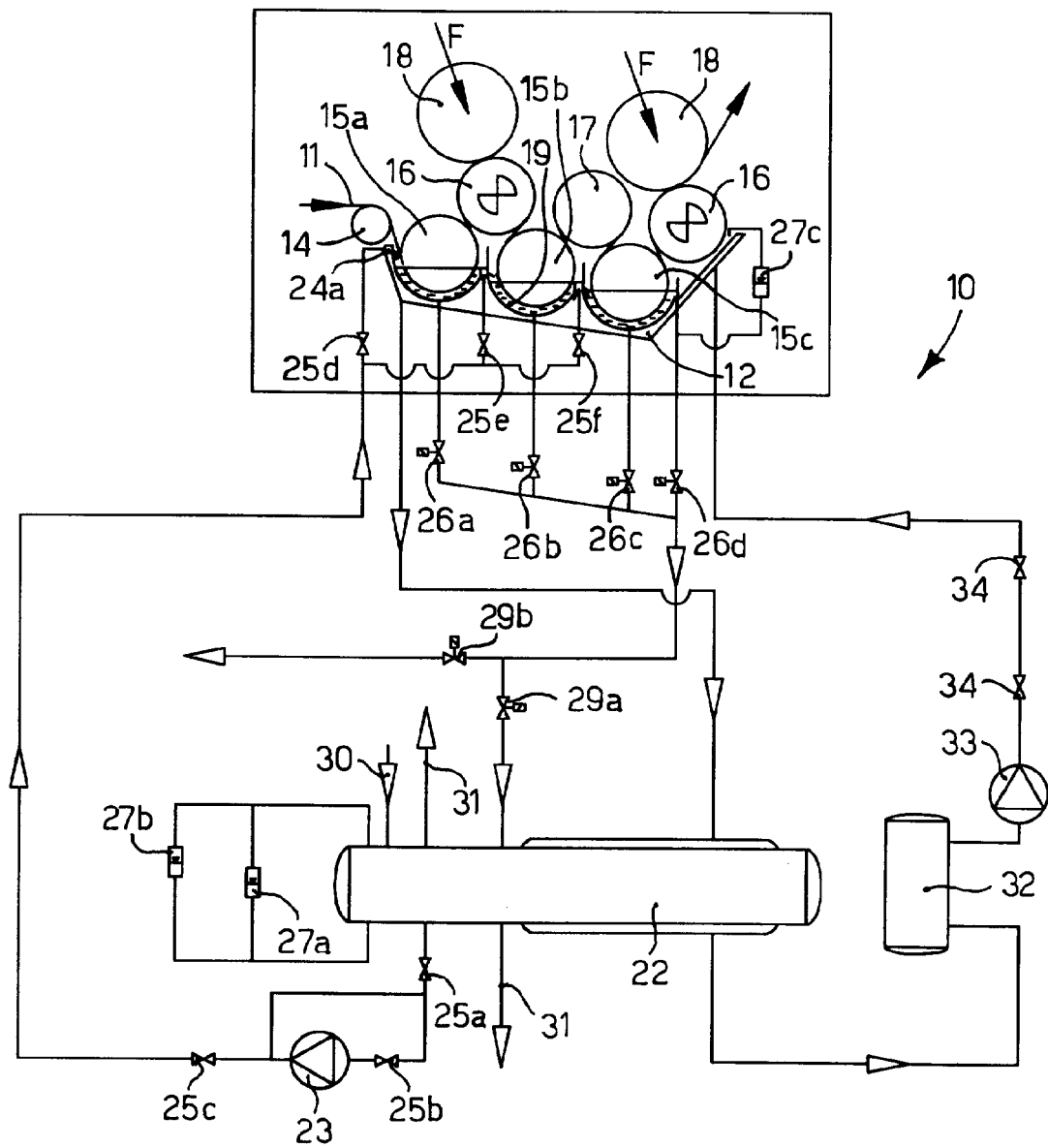


fig.1

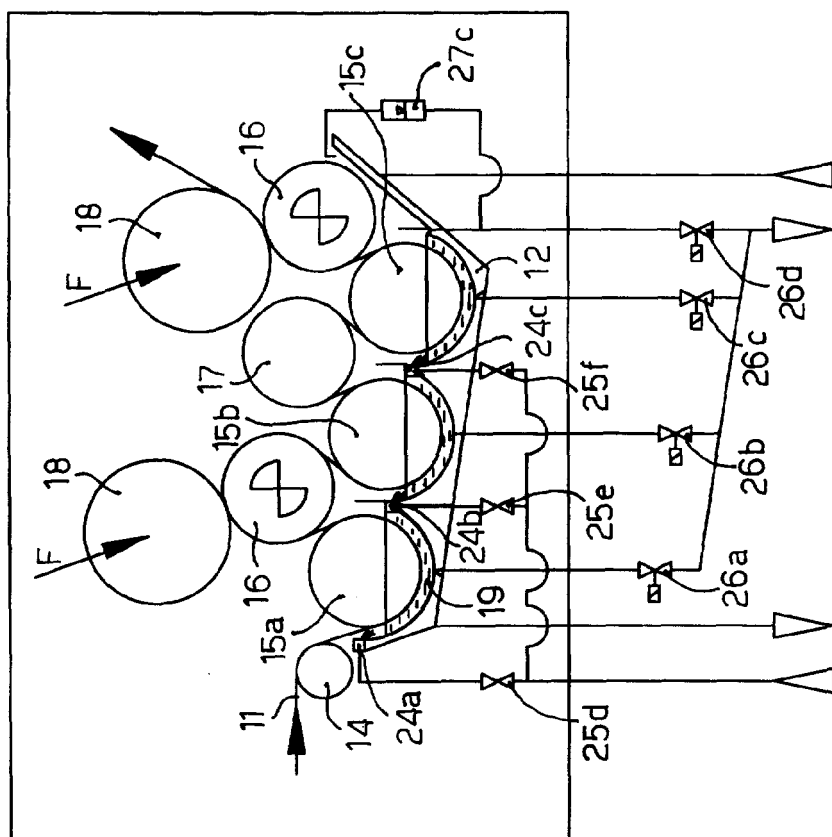


fig. 2

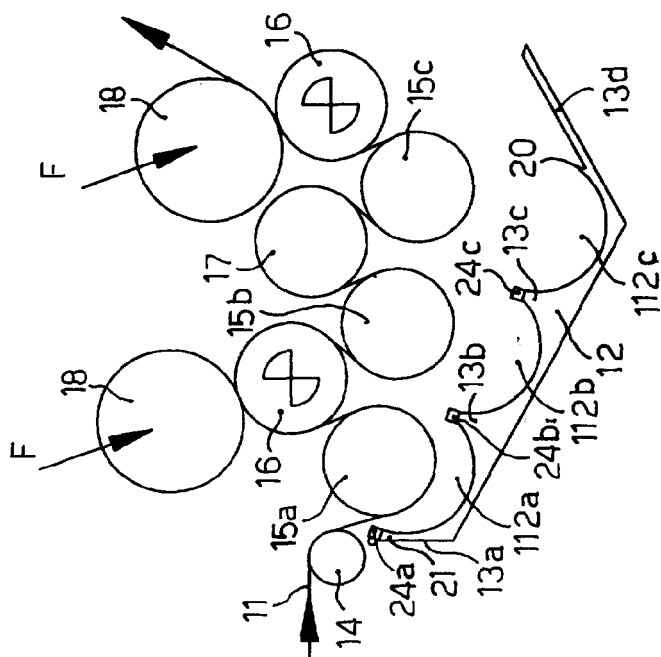


fig. 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 11 1484

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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) D06B
Place of search Munich		Date of completion of the search 31 May 2006	Examiner Bichi, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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