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(54) THROUGH AIR DRYER

DURCHLUFTTROCKNER

SÉCHEUR À L'AIR TRAVERSANT

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Description

Technical Field of the Invention

[0001] The present invention relates to the field of tissue paper production by means of systems with through air drying (TAD) type sections.

[0002] In more detail, the invention relates to a drying section which includes a single TAD hood arranged above a certain number of drums, for example 3 or 5. More in particular, the invention relates to a TAD drying hood provided with an adjustable air flow profiling device located in the TAD hood.

Background art

[0003] It is known that TAD systems are based on drying a wet sheet of paper by passing hot air through the sheet and a sheet support canvas carried by one or more drying drums, such that the hot air removes the water contained in the paper.

[0004] It is also known that one of the main problems of the TAD sections is the maintenance of a good uniformity of the transverse moisture profile of the paper produced.

[0005] In fact, the hot air flow is affected by the permeability of both the sheet and the support canvas. Where the paper and canvas are drier, the permeability increases, whereby preferential hot air passage zones can be created, thereby locally increasing the drying. Where there is more moisture, the permeability is lower, less hot air passes through and the drying effect is reduced.

[0006] In order to improve the uniformity of the moisture profile, flow profiling devices are known, called "profiling dampers" placed in the outlet zone and which allow to vary and control the outflow of the hot humid air produced by the passage through the drums and the paper.

[0007] A known type of system also involves the use of dampers called "sliding dampers" which allow to vary the features of the air flow downstream of the drum.

[0008] By way of example, known profiling systems are described by WO2006020300 which includes a single drum placed inside an air treatment system structured so as to make hot air flow inside the drum, where the air flows are kept divided by disks which create bulkheads.

[0009] Downstream of the drums, the individual flows are then controlled by the baffles or profiling dampers.

[0010] The known single-drum systems have some drawbacks, in particular in relation to structural complexity, and therefore the cost of the drums used, and the energy efficiency of the paper drying system, due to the path followed by the sheet of paper through the hood.

[0011] From US2005204580 it is known an apparatus for conditioning a support fabric of a web to be dried in a papermaking machine comprising parallel drums permeable to the passage of air, which are arranged to be partially wrapped in succession by the inlet sheet and to be passed through by the entering air flowing through cylindrical surface portions of the drums.

Object of the Invention

[0012] A first object of the present invention is therefore to improve the efficiency of the paper drying process, reducing the complexity of the drums used.

[0013] A further object of the invention is to be able to locally vary the pressure drop of the drying air flow in the TAD hood, so as to be able to correct any deviations from the moisture profile uniformity of the paper.

Summary of the invention

[0014] These objects have been achieved by obtaining a TAD drying hood according to at least one of the appended claims, provided with at least two drums defining a serpentine shaped path for the sheet of paper to be dried. According to the invention, deviators are also provided at the outlet of the hood, crossed by independent air flows passing through a defined number of independent and externally controllable adjustable channels known as dampers.

[0015] A first advantage of the invention consists in the smaller size and constructional complexity of the single drum with the same length of the paper section in contact with the drums.

[0016] A second advantage consists in the possibility of separating the through air flows of the drums.

[0017] A further advantage consists in the serpentine shape of the path followed by the paper in contact with the drums which allows a more efficient drying action of the hot air flow crossing the paper layer, due to the fact that in the system of the invention the air flow always crosses the thickness of the paper in the same direction, but the paper follows a path which leads it to curve first in one direction and then in the other. This alternating curving allows to "open" or alternately stretch the fibres located on the upper layer and, then, on the lower layer of the sheet. The air flow therefore reaches the fibres more effectively (and efficiently) throughout the thickness.

[0018] A further advantage is that the efficiency of the TAD hood is improved because the use of the serpentine shaped path through a plurality of drums allows to increase the length of the stretch of paper actually affected by the hot through air flow and to obtain a longer length of passing through the hood without having to create large drums, very complex and expensive to make and characterized by a lower efficiency due to the greater influence of the on-board disturbance effects.

[0019] A further advantage is that the profiling device of the invention provided with baffles or adjustable profiling dampers allows to adjust air flows and therefore the moisture profile along the width of the paper acting on the dampers of the profiling device from the outside.

[0020] An even further advantage is that the adjustable baffles, in combination with the presence of flow separa-

tors both in and out of the drums, guarantee the possibility of adjusting the hot air flows both in the feed direction of the sheet and along the width of the sheet itself.

[0021] A further advantage consists in the possibility to automatically adjust the moisture profile by installing in-line quality control systems (QCS) and controlled actuators on the dampers, for example electro-pneumatic.

List of Drawings

[0022] These and other advantages will be better understood by those skilled in the art from the description below and the accompanying drawings, given as non-limiting example, in which:

- fig. 1 schematically shows a direct one-hood drying air treatment system according to the invention
- fig. 2 and 2a respectively show a side view and a front view of a hood TAD according to the invention;
- fig. 3 shows a view from above of the hood of fig. 2;
- fig.4 shows a detail of the adjustments of the profiling device. Detailed

Description

[0023] With reference to the attached drawings, a through air drying hood (TAD) for drying continuous sheets of paper 6, for example paper of the tissue type, is described.

[0024] With reference to figure 1, the hood TAD comprises an inlet section 1 of a drying hot air flow intended to pass through the sheet 6, coming from an air treatment apparatus AS of the type known per se and generally comprising a pipe 20 for the passage of hot air produced by a hot air source, for example a burner 21, which may be provided with one or more devices 22 to improve the uniformity of the air flow, consisting for example of mixing chambers.

[0025] Equivalently, also depending on the application conditions, the hot air source may be a steam battery or other suitable system, for example electric or cogeneration.

[0026] With reference to figure 2, the hood further comprises an inlet 5 of a continuous sheet 6 of paper to be dried which, according to the invention, is passed, in coupling to a support canvas 26, following a serpentine shaped path through at least two cylindrical drying drums.

[0027] In the preferred embodiment disclosed, three drums 3, 4, 5 are provided located downstream of the inlet 1 of the drying air flow, preferably comprised between at least two sealing rollers 16, 17 arranged upstream and downstream of said drums in the feed direction of the sheet 6.

[0028] Advantageously, compared to the use of two drying drums, the use of 3 drums allows to extend a serpentine of a more articulated shape and greater exposure length of the paper to the hot air flow.

[0029] The drums 3, 4, 5 are permeable to the passage of air, for example perforated cylinders, and are arranged inside the hood TAD parallel to each other and with the rotation axis orthogonal to the inlet direction of the hot air flow, indicated with ascending undulating arrows in figure 2.

[0030] With this arrangement, the drums are each crossed by the air flow entering through a first cylindrical surface passage portion 12 of a drum and exiting the opposite cylindrical surface portion 13 of the drum.

[0031] Depending on the direction of the air flow, i.e., from the bottom upwards or vice versa, the first cylindrical passage portion wrapped by the sheet 6 may be at the bottom or top of the drums.

[0032] Advantageously, since the drums are wrapped by the sheet 6 at alternately opposite cylindrical portions 12, 13 of adjacent drums, the sheet follows a serpentine shaped path between the inlet 5 and the outlet 14.

[0033] Therefore, since the air flow always passes through the thickness of the paper in the same direction, but the paper follows a path which leads it to curve first in one direction and then in the other, the alternating bending of the sheet wrapped on the drums allows to "open" or alternately stretch the fibres placed on the upper layer and on the lower layer of the sheet, with the consequence that the air flow reaches the fibres more effectively through the entire thickness of the sheet.

[0034] In the example described, the drums have parallel axes offset vertically, but it is understood that they can be arranged in line according to application needs. Downstream of the drums 3-5, the hood TAD is lastly provided with an outlet section 8 of the drying air flow.

[0035] Preferably, in order to adjust the air flow which passes through the sheet, the outlet section 8 comprises an air flow profiling device 9 by means of passage channels 10 adjusted by corresponding baffles 11, for example a plurality of individually movable baffles controllable also from the outside of the hood which, in a preferred embodiment, are arranged to adjust the air flow both along the feed direction of the sheet and in the axial extension direction of the drums. Advantageously, with this solution the effect of limiting the mixing of the flows caused by the rotation of the drums which normally have different degrees of moisture after passing through the paper is obtained: the paper in the inlet side of the drum has a lower degree of dryness (for example of 20%-25%); proceeding towards the outlet, the degree of dryness gradually increases until reaching the desired values (for example 60%-85%, depending on the overall energy balances of the machine).

[0036] The hood may further comprise second flow separators 19 arranged downstream of the drums arranged to define at least two separate air passage sectors 24 in the outlet section 8.

[0037] Advantageously, the separators 19 allow air flows with different degrees of moisture to be kept separate, so as to allow a more effective management of the air flows possibly to be re-circulated and, in part, elimi-

nated from the air treatment circuit.

[0038] In greater detail, with reference to figure 2, two or more air inlet zones 27 are provided, preferably separated by one or more inlet separators 18, for example sheet metal sheets, arranged upstream of the drums 3-5. Preferably, there can be as many inlet zones as drums.

[0039] The incoming air flows in the zones 27 therefore pass through the drums and reach the sectors 24 defined by the upper separators or bulkheads 19 after passing through the controlled baffles 11.

[0040] Advantageously, the baffles 11 in the different zones or sectors 24 are independently adjustable with a multiplicity of baffles 11 independently controlled and shown with circles in fig. 3.

[0041] Advantageously, as better illustrated in figure 4, the individually movable baffles 11 are controllable from the outside by means of control devices preferably consisting of rods 25 acting on a kinematic mechanism 28 (one rod and one kinematic mechanism for each baffle): advancing or retracting the rod, so that the baffle 11 rotates on the axis 29 thereof, opening or closing the air passage. In different implementation examples, the movement of the rod may be manual or automatic.

[0042] Advantageously, it can be included that the rods 25 emerge from the upper hood laterally to be accessible by an operator and can be adjusted from the outside even with the system in operation.

[0043] In use, the baffles 11 are suitably adjusted to compensate for the formation of preferential flows whose presence would cause problems of moisture uniformity in the paper produced along the width of the sheet.

[0044] The present invention has been described according to preferred embodiments, but it is understood that equivalent variants can be conceived as long as they fall within the scope of the claims.

Claims

1. Through air drier, comprising

an inlet (5) of a continuous sheet (6) of paper to be dried,
an inlet section (1) of a drying hot air flow intended to pass through the sheet (6),
a distribution of at least two cylindrical drying drums (3, 4, 5) located downstream of the inlet (1) of the drying air flow, permeable to the passage of air, parallel to each other and with the rotation axis orthogonal to the inlet direction of the hot air flow, arranged so as to each be passed through by the entering air flow through a first cylindrical surface passage portion (12) and exiting a second cylindrical surface passage portion (13),
said drums (3, 4, 5) being arranged to be partially wrapped in succession by the inlet sheet (6),
an outlet section (8) of the drying air flow downstream of the drums (3, 4, 5),
an outlet (14) of the dried sheet (6).

characterized in that said drums (3, 4, 5) are arranged to be partially wrapped on a first lower or upper cylindrical portion (12) of a first drum and on a second respectively upper or lower cylindrical portion (13) of a second drum adjacent to said first drum and to guide the inlet sheet along a serpentine shaped path,

2. Through air drier according to claim 1, comprising an air flow profiling device (9) by means of passage channels (10) adjusted by corresponding baffles (11), arranged downstream of the drums (3, 4, 5).

3. Through air drier according to claim 2, wherein said profiling device comprises a plurality of individually movable baffles controllable from the outside of the hood by means of control members (25, 28, 29), in order to adjust the air flow.

4. Through air drier according to one of the preceding claims 2-3, wherein said control members comprise a rod (25) acting on a kinematic mechanism (28), so that the baffle (11) rotates on an axis (29) thereof, opening or closing the air passage.

5. Through air drier according to one of the preceding claims 2-4, wherein said control members comprise automatic actuation means.

6. Through air drier according to one of the preceding claims 2-5, wherein said profiling device comprises a plurality of baffles arranged to adjust the air flow along the feed direction of the sheet and/or in the axial extension direction of the drums (3, 4).

7. Through air drier according to one of the preceding claims 2-6, comprising at least two sealing rollers (16, 17) arranged upstream and downstream of said drums.

8. Through air drier according to one of the preceding claims, comprising flow separators (18) arranged upstream of the drums (3, 4, 5).

9. Through air drier according to one of the preceding claims, comprising flow separators (19) arranged downstream of the drums (3, 4, 5) to define at least two separate air passage sectors (24) in the outlet section (8) of the hood.

10. Through air drier according to one of the preceding claims, comprising three drying drums arranged to be alternately wrapped in succession on first and second opposite cylindrical portions (12, 13) of the adjacent drums.

11. Through air drier according to one of the preceding claims, comprising five drying drums arranged to be alternately wrapped in succession on first and second opposite cylindrical portions (12, 13).

Patentansprüche

1. Durchlufttrockner, umfassend

einen Einlass (5) eines zu trocknenden Endlosblatts (6) Papier.
einen Einlassabschnitt (1) eines Trocknungsheißluftstroms, der durch das Blatt (6) gehen soll,
eine Verteilung aus mindestens zwei zylindrischen Trocknungstrommeln (3, 4, 5), die sich stromabwärts des Einlasses (1) des Trocknungsluftstroms befinden, die für den Durchgang von Luft durchlässig sind, parallel zueinander sind und deren Drehachse orthogonal zu der Einlassrichtung des Heißluftstroms liegt, so angeordnet, dass sie jeweils durchströmt werden, indem der Luftstrom durch ein erstes zylindrisches Oberflächendurchgangsteil (12) eintritt und ein zweites zylindrisches Oberflächendurchgangsteil (13) austritt,
wobei die Trommeln (3, 4, 5) so angeordnet sind, dass sie der Reihe nach teilweise von dem Einlassblatt (6) umhüllt sind,
einen Auslassabschnitt (8) des Trocknungsluftstroms stromabwärts der Trommeln (3, 4, 5),
einen Auslass (14) für das getrocknete Blatt (6),
dadurch gekennzeichnet, dass die Trommeln (3, 4, 5) so angeordnet sind, dass sie an einem ersten unteren oder oberen zylindrischen Teil (12) einer ersten Trommel und an einem zweiten oberen beziehungsweise unteren zylindrischen Teil (13) einer zweiten Trommel neben der ersten Trommel umhüllt sind und das Einlassblatt entlang eines serpentinenförmigen Pfads führen.

2. Durchlufttrockner nach Anspruch 1, der eine Luftstromprofiliervorrichtung (9) mittels Durchgangskanälen (10) umfasst, die durch entsprechende Leitbleche (11) eingestellt werden, die stromabwärts der Trommeln (3, 4, 5) angeordnet sind.

3. Durchlufttrockner nach Anspruch 2, wobei die Profiliervorrichtung mehrere einzelne bewegliche Leitbleche umfasst, die von der Außenseite der Haube mit Hilfe von Steuerelementen (25, 28, 29) steuerbar sind, um den Luftstrom einzustellen.

4. Durchlufttrockner nach einem der vorstehenden Ansprüche 2-3, wobei die Steuerelemente eine Stange (25) umfassen, die auf einen kinematischen Mechanismus (28) wirkt, sodass sich das Leitblech (11) auf seiner Achse (29) dreht, wodurch der Luftdurchgang geöffnet oder geschlossen wird.

5. Durchlufttrockner nach einem der vorstehenden Ansprüche 2-4, wobei die Steuerelemente automatische Betätigungselemente umfassen.

6. Durchlufttrockner nach einem der vorstehenden Ansprüche 2-5, wobei die Profiliervorrrichtung mehrere Leitbleche umfasst, die angeordnet sind, um den Luftstrom entlang der Zufuhrrichtung des Blatts und/oder in der axialen Erstreckungsrichtung der Trommeln (3, 4) einzustellen.

7. Durchlufttrockner nach einem der vorstehenden Ansprüche 2-6, der mindestens zwei Dichtungswalzen (16, 17) umfasst, die stromaufwärts und stromabwärts der Trommeln angeordnet sind.

8. Durchlufttrockner nach einem der vorstehenden Ansprüche, der Strömungstrenner (18) umfasst, die stromaufwärts der Trommeln (3, 4, 5) angeordnet sind.

9. Durchlufttrockner nach einem der vorstehenden Ansprüche, der Strömungstrenner (19) umfasst, die stromabwärts der Trommeln (3, 4, 5) angeordnet sind, um mindestens zwei separate Luftdurchgangssektoren (24) in dem Auslassabschnitt (8) der Haube zu bilden.

10. Durchlufttrockner nach einem der vorstehenden Ansprüche, der drei Trocknungstrommeln umfasst, die angeordnet sind, um der Reihe nach abwechselnd an einem ersten und zweiten gegenüberliegenden zylindrischen Teil (12, 13) der benachbarten Trommeln umhüllt zu werden.

11. Durchlufttrockner nach einem der vorstehenden Ansprüche, der fünf Trocknungstrommeln umfasst, die angeordnet sind, um der Reihe nach abwechselnd an einem ersten und zweiten gegenüberliegenden zylindrischen Teil (12, 13) umhüllt zu werden.

Revendications

1. Séchoir à air traversant, comprenant

une entrée (5) d'une feuille (6) continue de papier devant être séchée ;
une section d'entrée (1) d'un flux d'air chaud de séchage conçu pour passer à travers la feuille (6),
une distribution d'au moins deux tambours de séchage cylindriques (3, 4, 5) situés en aval de l'entrée (1) du flux d'air de séchage, perméables

au passage d'air, parallèles l'un à l'autre et à l'axe de rotation orthogonal à la direction d'entrée du flux d'air chaud, conçus de manière à être chacun traversés par le flux d'air entrant par le biais d'une première partie de passage de surface cylindrique (12) et sortant d'une deuxième partie de passage de surface cylindrique (13), lesdits tambours (3, 4, 5) étant conçus pour être partiellement enveloppés en succession par la feuille (6) d'entrée,
une section de sortie (8) du flux d'air de séchage en aval des tambours (3, 4, 5),
une sortie (14) de la feuille (6) séchée,
caractérisé en ce que lesdits tambours (3, 4, 5) sont agencés pour être partiellement enveloppés sur une première partie cylindrique inférieure ou supérieure (12) d'un premier tambour et sur une deuxième partie cylindrique respectivement supérieure ou inférieure (13) d'un deuxième tambour adjacent audit premier tambour et pour guider la feuille d'entrée le long d'un trajet en forme de serpentin.

2. Séchoir à air traversant selon la revendication 1, comprenant un dispositif de profilage de flux d'air (9) au moyen de canaux de passage (10) ajustés par des déflecteurs (11) correspondants, agencés en aval des tambours (3, 4, 5).

3. Séchoir à air traversant selon la revendication 2, dans lequel ledit dispositif de profilage comprend une pluralité de déflecteurs mobiles individuellement pouvant être commandés à partir de l'extérieur de la hotte au moyen d'éléments de commande (25, 28, 29), afin d'ajuster le flux d'air.

4. Séchoir à air traversant selon l'une des revendications précédentes 2-3, dans lequel lesdits éléments de commande comprennent une tige (25) agissant sur un mécanisme cinématique (28), de sorte que le déflecteur (11) tourne sur un axe (29) de celui-ci, ouvrant ou fermant le passage d'air.

5. Séchoir à air traversant selon l'une des revendications précédentes 2-4, dans lequel lesdits éléments de commande comprennent des moyens d'actionnement automatique.

6. Séchoir à air traversant selon l'une des revendications précédentes 2-5, dans lequel ledit dispositif de profilage comprend une pluralité de déflecteurs agencés pour ajuster le flux d'air le long de la direction d'alimentation de la feuille et/ou dans la direction d'extension axiale des tambours (3, 4).

7. Séchoir à air traversant selon l'une des revendications précédentes 2-6, comprenant au moins deux rouleaux d'étanchéité (16, 17) agencés en amont ou en aval desdits tambours.

8. Séchoir à air traversant selon l'une des revendications précédentes, comprenant des séparateurs de flux (18) agencés en amont des tambours (3, 4, 5).

9. Séchoir à air traversant selon l'une des revendications précédentes, comprenant des séparateurs de flux (19) agencés en aval des tambours (3, 4, 5) pour définir au moins deux secteurs de passage d'air distincts (24) dans la section de sortie (8) de la hotte.

10. Séchoir à air traversant selon l'une des revendications précédentes, comprenant trois tambours de séchage agencés pour être enveloppés en alternance en succession sur des première et deuxième parties cylindriques opposées (12, 13) des tambours adjacents.

11. Séchoir à air traversant selon l'une des revendications précédentes, comprenant cinq tambours de séchage agencés pour être enveloppés en alternance en succession sur des première et deuxième parties cylindriques opposées (12, 13).

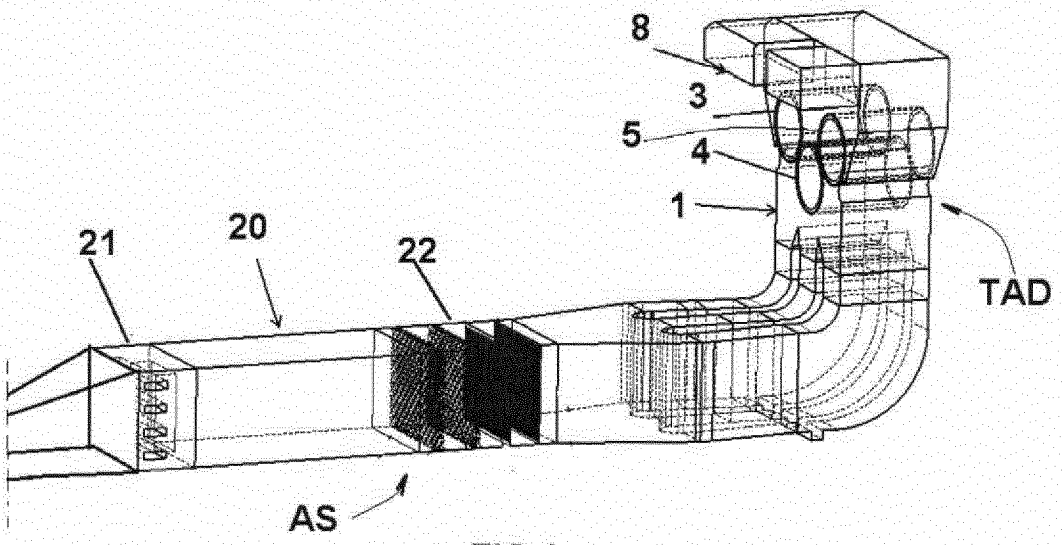
8
3
5
4
1
21
20
22
TAD
AS

FIG.1

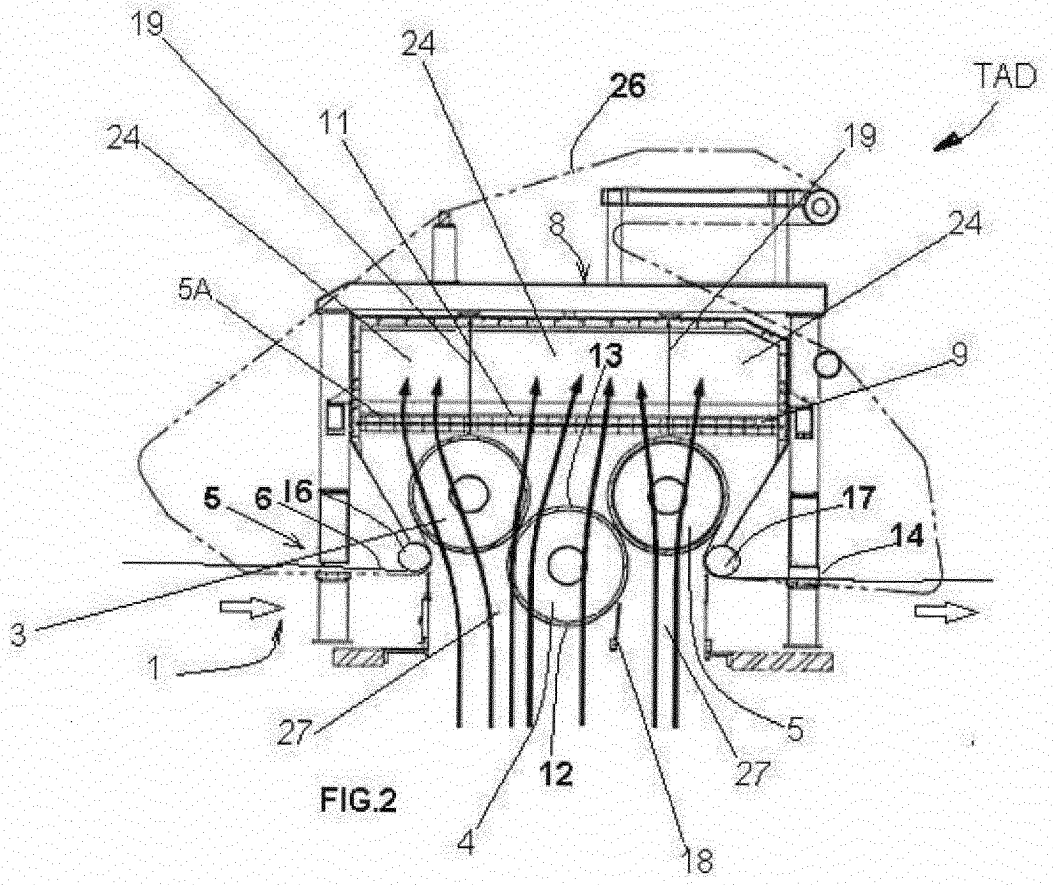
19
24
26
TAD
11
24
19
8
24
5A
13
9
5
6
16
17
14
3
1
27
5
12
27
4
18

FIG.2

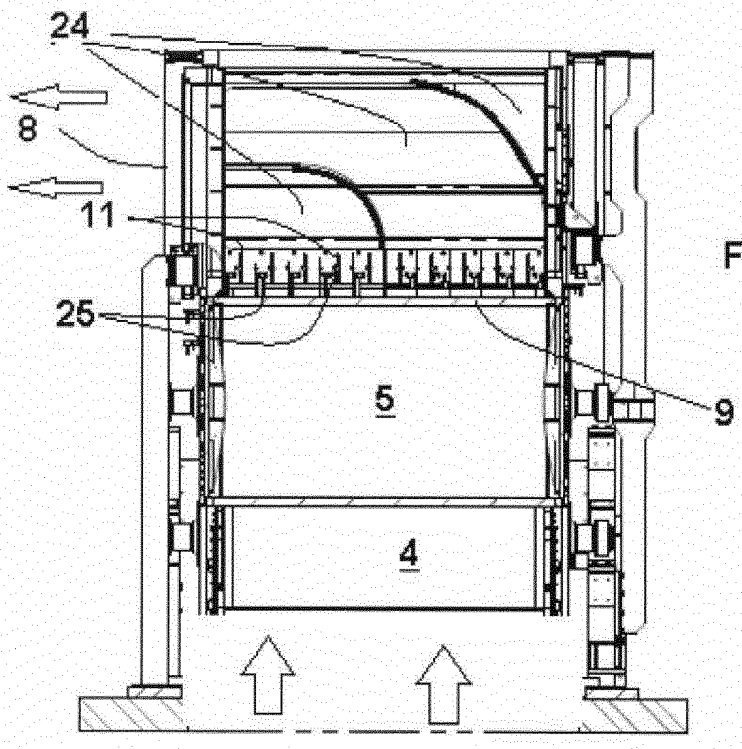

FIG.2a

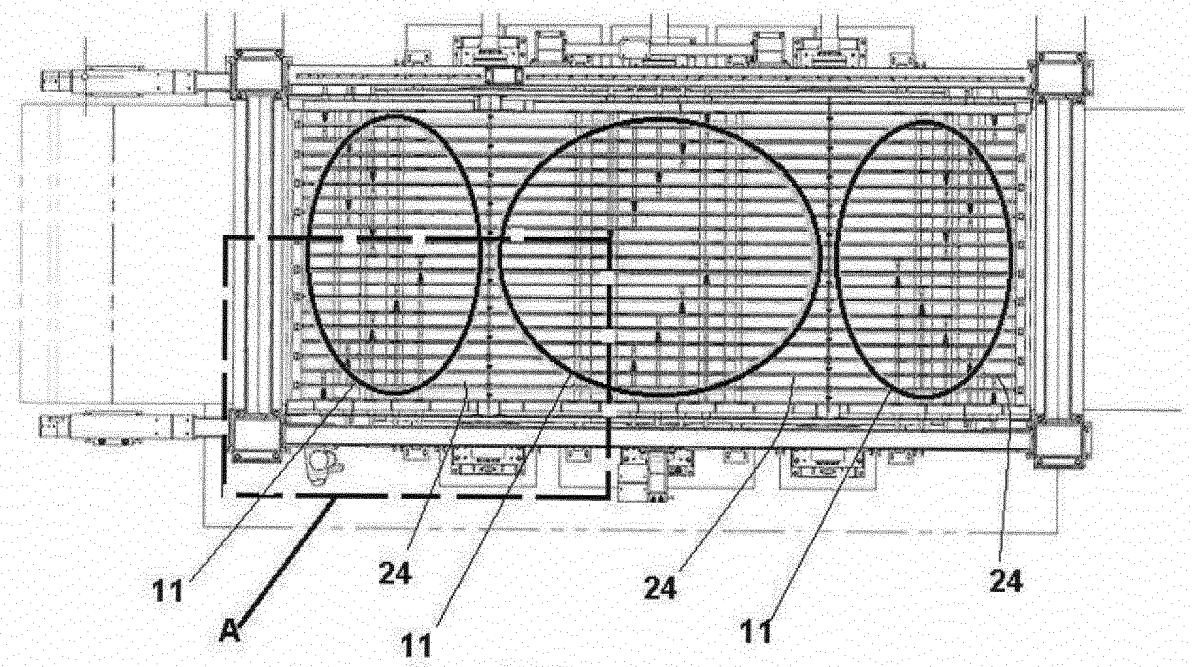

FIG.3

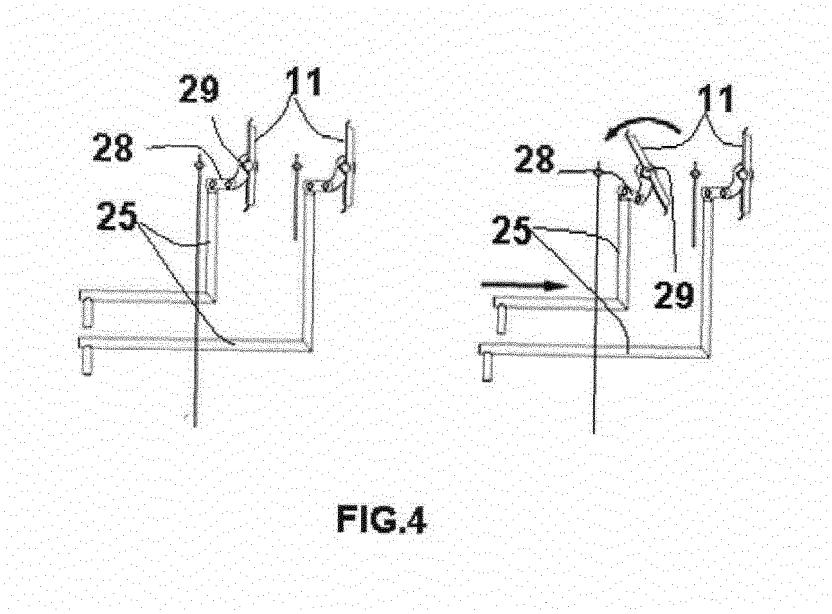

FIG.4

REFERENCES CITED IN THE DESCRIPTION

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