(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 February 2015 (19.02.2015)

WIPO | PCT

(10) International Publication Number
WO 2015/022705 A1

(51) International Patent Classification:
D21F 1/34 (2006.01) *D06C 7/02* (2006.01)

(21) International Application Number:
PCT/IN2014/000525

(22) International Filing Date:
13 August 2014 (13.08.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2686/MUM/2013 16 August 2013 (16.08.2013) IN

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to the identity of the inventor (Rule 4.17(i))*

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) **Title**: FLUID TREATMENT UNIT FOR FABRICS, CELLULOSIC AND THE LIKE MATERIAL AS WELL AS FLUID TREATMENT METHOD

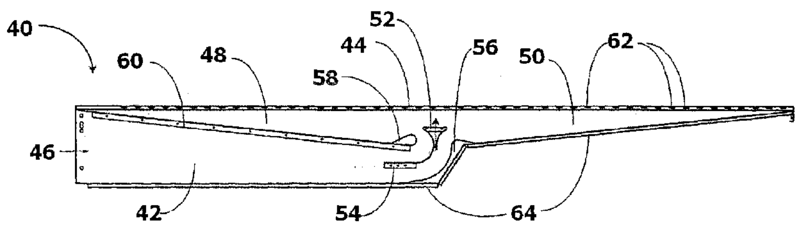

Fig.1

(57) **Abstract**: The invention pertains to a fluid treatment unit for fabric, cellulosic and the like material (12) comprising at least one manifold (38, 40) for blowing fluid onto the surface of the fabric, cellulosic or the like material (12) which is continuously guided past at least one manifold, said manifold (38, 40) comprising a manifold housing (64), a port which is provided on one side of the manifold (38, 40), a nozzle plate (44) having at least one outlet opening (62) through which the fluid is blown onto the said fabric, cellulosic and the like material (12) and a duct for guiding the fluid from the said port (46) to the said nozzle plate (44). The present invention also provides a method for continuous and uniform fluid treatment of the fabric.

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FORM-2

THE PATENT ACT, 1970

(39 OF 1970)

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THE PATENT RULES, 2003

COMPLETE SPECIFICATION

[SECTION 10; RULE 13]

"FLUID TREATMENT UNIT FOR FABRIC, CELLULOSIC AND THE LIKE MATERIAL AS WELL AS FLUID TREATMENT METHOD"

THE FOLLOWING COMPLETE SPECIFICATION PARTICULARLY DESCRIBES THE INVENTION AND THE MANNER IN WHICH IT IS TO BE PERFORMED:

FIELD OF THE INVENTION

This invention relates to a fluid treatment unit for fabric, cellulosic and the like material including a manifold for such a fluid treatment unit as well as a fluid treatment method.

PRIOR ART

Stenters and similar equipment like hot flues, relax driers or belt driers are used for hot air treatment of fabrics, especially for drying, heat setting or the so-called finishing in relatively broad textile or paper fabric.

In doing so, the fabric to be treated is continuously guided through the so-called fields or chambers using a suitable transport system, which chains in case of stenters which have holding fixtures for the two edges of the product and with screen belts in case of relax driers, where the fabric is subjected to hot air (also known as process air) in order to dry the fabric and to heat-set by heating to a certain temperature or to enable certain chemical reactions during the so-called finishing.

For this purpose, the hot air that is typically heated up to temperatures of 220°C is applied using many nozzles to one or both sides of the fabric which is continuously guided past the nozzles. In the process, it is important to maintain a uniform outlet distribution of the hot air stream as far as possible so that the result of the treatment is uniform across the entire width of the fabric.

The hot air is distributed using the so-called nozzles which are arranged above and / or below the fabric and to which the pre-heated hot air is supplied using at least one blower.

In addition, various state of the art designs are also known where the upper nozzle and the lower nozzle can be supplied using separate blowers. For certain applications, nozzles that act only from above or from below are intended.

The nozzle fingers, which are mirror symmetrically designed, discharge the hot air via a nozzle plate, which is facing the fabric, using a number of equidistant holes that act as hot air nozzles.

The cross-section and geometry of the holes can be different. Alternatively, the hot air can also be discharged via one or several elongated slots.

In general, several nozzles that are restricted by using housing walls in the paper plane direction are arranged one behind the other in the transportation direction of the fabric, referred to as *longitudinal direction* below, i.e., at right angles to the paper plane. The direction at right angles to the transportation direction of the fabric is referred to as *transverse direction* below.

The individual nozzles are arranged in the longitudinal direction with a space such that there are gaps through which the "used" hot air can flow back to an exhaust chamber. The hot air is heated here, for e.g., using a forced-air burner, which is an example of a hot air treatment setup using a direct heating system. Alternatively, indirect heating systems, like e.g. stream or oil circulation heating systems, can be used.

The heated air from chamber is then mostly re-fed to the inlet of the blower. A part of the process air, in which substances (for e.g. water, finishing chemicals or residual solutions from the spinning process and fabric pre-treatment), that evaporate or sublimate from the fabric, get accumulated and which also contain the combustion gases of the forced-air burner in case of direct heating systems, is removed from circulation air via an exhaust pipe using an exhaust fan (s).

The hot air feed from the (front) side into the nozzles has proven itself in case of this hot air treatment system because there are many advantages for the design and maintenance of the system.

The disadvantage of this design is a flow-related effect which causes the hot air stream from the nozzle to be inclined in the (air) flow direction, i.e. nozzle end and not at right angle to the fabric plane. The angle of inclination is a result of the arc cosine of the ratio-sum of the air outlet cross section area to the air-inlet cross-section area of a nozzle. The result of this is that the air striking the fabric is not deflected uniformly to the right and left in the transverse direction but more air flows to the right in direction of the nozzle end than in the opposite direction. This means that there is more process air at higher flow speed in the area of the fabric edge which is in the direction of the nozzle end than in the opposite area. This resulting difference in heat transfer results in an unacceptable different fabric wastage in the edge area, both during drying as well as during the setting and finishing processes (the so-called right/left non-uniformity).

Different state of the art approaches are known to prevent this:

In one approach, so-called “stumbling edges” are used, which ensure a roughly perpendicular air deflection from the nozzle openings, square in this case, through vortex formation and thus ensure a uniform discharge onto the fabric. However, the aerodynamic losses of this approach due to the vortex formation taken into account and the unfavorable restriction factor caused by the use of square nozzle cross-sections, are relatively high.

In another approach, the nozzles are staggered for obtaining a perpendicular air discharge, i.e., the nozzles are provided with a compensation angle with respect to the vertical plane using a zigzag-shaped design of the nozzle wall, which compensates the discharge angle as accurately as possible in case of the "straight" non-staggered nozzles. This approach however is significantly more complex in terms of production and results in additional aerodynamic losses due to the slightly zigzag shaped nozzle wall that is folded.

The problem of the non-uniform treatment of the fabric described here, as is generally known for e.g. in small laboratory stenters, can be basically prevented by supplying the air to the nozzle at the *centre* with respect to the transverse direction and by tapering the nozzle from the centre to both the sides, which typical resembles the dome shape of a chimney.

In case of such a flow configuration, the hot air is likewise not discharged vertically from the individual nozzles everywhere. In fact, there is a slightly diverging angular distribution to both the sides.

However, this angular distribution behaves roughly mirror symmetrical to the centre, which at least results in a uniform and, in many cases, even a better result of the treatment in practice compared to a completely vertical air discharge.

The design of such an air feed from the centre would however be very complex to implement in case of many known hot air treatment systems on an industrial standard.

The ease of maintaining the nozzles would be significantly reduced especially by supplying the air from the centre in the design in question with the usual lateral hot-air feed, the nozzles are mounted such that they can be moved in the transverse direction for maintenance purposes and can be easily removed from the side opposite to the air feed for maintenance and cleaning purposes. An adequately pressure-tight connection to the feed channel can be implemented using a simple flange with gaskets in the area of plane against which the nozzles are pressed with a pre-load in the assembled condition.

In case of the central feeding in question using a separate common air feed channel for all the nozzles supplied by one blower, such a convenient and lateral option for removing the nozzles using a virtually automatic flanging at the feed channel, would only be very complex to implement, if at all possible.

In addition, the height of the treatment chamber would also have to be increased in general to accommodate a central hot-air feed channel.

In such, there is a need in the art for a fluid treatment unit that is of simple construction as well as a low design cost. It is therefore an object of the present invention to develop a fluid treatment unit which is aerodynamically efficient and is economical.

OBJECT OF THE INVENTION

The objective of this invention is to develop a fluid treatment unit of simple construction for treatment of fabric, cellulosic or the like material comprising at least one manifold for blowing the fluid onto the fabric, cellulosic or the like material.

Another object of the present invention is to develop a fluid treatment unit with low design cost and which is aerodynamically efficient as per the description mentioned herein below.

Yet another object of the present invention is to provide a fluid treatment unit which does not pose any disadvantages as compared to a conventional nozzle in terms of maintenance and assembly space requirements.

A further object of the present invention is to provide a fluid treatment method with low design cost and which is aerodynamically efficient, in which a symmetric fluid distribution can be obtained with good treatment results.

SUMMARY OF THE INVENTION

Fluid treatment unit for a fabric, cellulosic or the like material (12), having at least one manifold (38, 40) for blowing the fluid onto the fabric, cellulosic or the like material (12) which is continuously guided past at least one manifold (38, 40), wherein at least one manifold (38, 40) comprises:

a manifold housing (64);

a port (46) which is provided on one side of the manifold (38, 40);

a nozzle plate (44) having atleast one outlet opening (62) through which the fluid is blown onto the said fabric, cellulosic or the like material (12); and

a duct for guiding the fluid from the said port (46) to the said nozzle plate (44),

characterised by the fact that

the said duct has a central feed channel (42) which guides the fluid from the said port (46) to a central area of the manifold (38, 40) as well as two distribution channels (48, 50) and at least one flow guide in the said central area to uniformly distribute the fluid across the said nozzle plate (44) that extends on both sides of the central area and that are fed from the said central feed channel (42).

Typically, the central feed channel (42) with the manifold (38, 40) is designed as an integral unit.

Typically, the height of the two distribution channels (48, 50) tapers to the sides and that the central feed channel (42) and one of the distribution channels (48) are separated by a common wall (60) in at least a part of the area.

Typically, the central feed channel (42) has a taper towards the centre that is complementary to the profile of the adjacent distribution channel (48).

Typically, an initial flow guide (54) is provided in the first transition area between the central feed channel (42) and the distribution channels (48, 50), which divides the stream of fluid into two partial streams for the two distribution channels (48, 50) and deflects it by about 90°.

Typically, a second flow guide (52) is provided in a second transition area which connects to the first transition area and protrudes into the two distribution channels (48, 50), which basically guides the two partial streams symmetrically in the direction of the two distribution channels (48, 50).

Typically, the second flow guide (52) is provided with a passage for supplying fluid to the outlet openings (62) that are located directly in the centre and to which the flow is otherwise partly affected.

Typically, an additional flow guide (58) is provided at one front end of the said wall (60) between the said central feed channel (42) and the adjacent distribution channel (48).

Typically, the nozzle plate (44) has many oval, circular, rectangular or slot-shaped outlet openings (62).

Typically, the walls of the said outlet openings (62) can be arranged normally to the surface of the nozzle plate (44) or longitudinally at an angle to this and wherein the outlet openings (62) can be arranged in one or several rows, with or without offset to each other.

Typically, the nozzle plate (44) has at least one narrow slot as outlet opening (62) which extends across a large part of the transverse length of the manifold.

Typically, rows of several manifolds (38, 40) are provided on both sides of the fabric, cellulosic or the like material (12) to be treated, between which spaces are provided for discharging the fluid blown out through the outlet openings (62), wherein the respective rows of manifolds (38, 40) are staggered on both sides with respect to each other in such a manner that the spaces and outlet openings (62) are at least partially opposite to each other.

Typically, manifold (38, 40) for use in a fluid treatment unit, characterized by the fact that it is designed according to claims 1 to 12.

Typically, fluid is continuously blown onto the surface of the fabric, cellulosic or like material (12) which is continuously guided past at least one manifold (38, 40) having a nozzle plate (44),

characterised by the steps

a) guiding a stream of fluid through the manifold (38, 40) from one side into a central area;

b) basically dividing the stream of fluid into two partial streams; and

c) distributing the two partial streams to the nozzle plate (44) on both sides of the central area.

DESCRIPTION OF THE INVENTION

The fluid treatment unit especially hot air treatment unit for textile fabrics and the method for treatment of fabrics as per the present invention will now be described with reference to the accompanying drawings wherein same numerals are used to denote the same parts. However, the said drawings only illustrate the invention and in no way limit the invention.

In the accompanying drawings:

Fig. 1: shows a perspective view of the manifold according to one of the embodiment as described in the invention;

Fig. 2: shows a perspective view of the fluid treatment unit according to one of the preferable embodiment of the invention with two manifolds and a qualitative illustration of the resulting flow pattern;

Fig. 3: shows an expanded view of the central part of the said manifold as shown in Fig.1.

The following are the details of the main components of the blower manifold assembly in accordance with the invention, which are used with reference to Figure1 to Figure 5:

12	=	fabric, cellulosic or the like material
22	=	delivery end
38, 40	=	manifold
42	=	central feed channel
44	=	nozzle plate
46	=	port
48	=	left distribution channel
50	=	right distribution channel
54	=	stream divider plate
56	=	initial flow guide
52	=	second flow guide
58	=	additional flow guide
60	=	wall
62	=	outlet openings

64 = manifold housing

As per the invention, the fluid treatment unit has a port (46) for entry of fluid, especially hot air, a central feed channel (42) which guides the hot air from the port to a central area of the manifold (38, 40), as well as two distribution channels (48, 50) that extend on both sides of the central area and are fed by the central feed channel (42) and which distributes and blows the hot air on the fabric (12) via the nozzle plate (44).

By guiding the hot air initially to a central area and then, from there, to both the sides within a manifold (38, 40), a symmetrical flow pattern is finally generated which in turn produces a uniform treatment result on both sides. In addition, a certain amount of transverse stretching of the fabric, cellulosic or the like material (12) (the so-called width-stretching) is required by the resulting flow pattern that is slightly divergent, which for e.g. is advantageous for drying stretched fabric in a relax dryer.

The term "centre" or central area does not necessarily have to mean the exact geometric centre of the manifold (38, 40) in the transverse direction but should include certain part of the central area of the manifold (38, 40). It is rather the geometric centre of the fabric (12) guided through the system in the transverse direction which is relevant for a uniform treatment result.

Due to the fact that the central fed channel (42) is part of the manifold (38, 40) and that the hot air can be fed from the side, the manifold (38, 40) design of the invention does not pose any disadvantages compared to a conventional nozzle in terms of maintenance and assembly space requirements. Since individual corrective measures for the discharge angle such as stumbling edges and staggering of the manifold (38, 40) can be avoided and the central fed channel (42) is simple in design and is aerodynamically advantageous to implement, excellent aerodynamics can be achieved with little effort, which reduces the manufacturing cost of the assembly as well as the energy consumption of the system.

In an advantageous design of the invention, the central feed channel (42) is shown as an integral unit with the manifold (38, 40).

The two distribution channels (48, 50) preferably taper towards the sides and the central feed channel (42) and at least one of the distribution channel (42) are separated by a common wall (60) at least in a partial section.

In addition, the central feed channel (42) preferably has a taper that is complementary to the profile of the adjacent distribution channel (48). Through this design, the central feed channel (42) can be implemented with minimum design effort, wherein the maximum assembly height of the manifold (38, 40) can remain unchanged.

As an alternative to the staggering of the central feed channel (42) with a distribution channel (48) as described above, the central feed channel (42) can also be designed as a separate pipe provided the central feed channel (42) and the manifold (38, 40) can be removed from the system as a common unit.

An initial flow guide (52) is preferably provided in the first transition area between the central feed channel (42) and the distribution channels (48, 50), which divides the hot air stream into two partial streams for the two distribution channels (48, 50) and deflects it by about 90°.

In addition, a second flow guide (52) is preferably provided in a second transition area which connects to the first transition area and protrudes into the two distribution channels (48, 50), which basically guides the two partial streams symmetrically in the direction of the two distribution channels (48, 50).

In order to ensure an adequate supply of air to the outlet openings (62) that are located in the central area, the second flow guide (52) can be provided with a passage for supplying hot air to the outlet openings (62) that are located directly in the centre and to which the flow is otherwise partly affected.

The nozzle plate (44) can be designed differently, it can especially include many oval, circular, rectangular or slot-shaped outlet openings (62), wherein the walls of the outlet openings (62) can be arranged normally to the surface of the fabric (12) or at an angle to this surface and wherein the outlet openings (62) can be arranged in one row or in several rows, arranged with or without offset to each other.

As an alternate to individual outlet openings (62) arranged in rows, the nozzle plate (44) may also have at least one narrow slot as outlet opening (62) which extends across a large part of the transverse length of the manifold (38, 40).

In a preferred design of the invention, rows of several manifolds (38, 40) are proposed on both sides of the fabric (12) to be treated, between which spaces are provided for discharging the air blown out through the outlet openings (62), wherein the respective rows of manifolds (38, 40) are staggered on both sides with respect to each other in such a manner that the spaces and air outlet openings (62) are at least opposite to each other.

In addition, a method is proposed for addressing the task of hot-air treatment of the fabric (12) mentioned at the beginning, in which hot air is continuously blown onto the surface of the fabric (12) which is guided past at least one manifold (38, 40) having a nozzle plate (44). the method consists of the following steps:

a) guiding a hot-air stream through the manifold (38, 40) from one side into a central area,

b) Basically dividing the hot air stream into two partial streams and

c) Distributing the two partial streams to the nozzle plate (44) on both sides of the central area.

A manifold (40) as per the invention has a nozzle plate (44) according to figure 1 through which the hot air is blown onto a fabric (12) (not shown in figure 1), above the manifold (40) in this case. This takes place using outlet openings (62) that are equidistantly arranged and which are designed in the nozzle plate (44) using circular holes. Below the flat nozzle plate (44), the manifold (40) is separated from the surrounding area by a manifold housing (64).

The hot air or process air is fed into the manifold (40) through a port (46).

The hot air that is fed is first guided to a central area of the manifold (40), with reference to the transverse section, via a central feed channel (42). From there, the air stream is basically divided into two parts which flow into two distribution channels (48, 50) that are arranged on both sides of the centre. These distribution channels (48, 50) are immediately adjacent to the nozzle plate (44) such that the hot air can be discharged through the outlet openings (62) and blown onto to the fabric (12) located above it.

The two distribution channels (48, 50) are closed at the end. In addition, the height and thus the cross-sectional area of the distribution channels (48, 50) reduce in the outward direction. This geometry is technically calculated such that approximately the same amount of air is discharged from all the outlet openings (62), regardless of their distance from the centre.

Figure 2 shows a perspective view of a fluid treatment, especially hot air treatment unit according to one of the preferable embodiment of the invention with one upper manifold (38) and one lower manifold (40), in which the flow pattern to be adjusted as per the invention is also indicated by using arrows schematically and qualitatively. The fabric (12) to be treated is in turn located between the two manifolds (38, 40). As can be seen, the air is not discharged from the nozzle plates (44) of the two manifolds (38, 40) at right angles to the nozzle plate (44) but at a specific angle, which depends on the ratio of the sum of the air outlet cross-sections to the air inlet cross-section in the manifold (38, 40).

In this case, the flow pattern is symmetric to the centre of the manifold (38, 40) with a slightly diverging flow pattern caused by feeding the hot air at the centre of the distribution channels (48, 50), which ultimately results in a uniform treatment result. The diverging angle results in a flow component from inside to the outside for a part of the hot air that is discharged from the manifolds (38, 40), which is more advantageous in terms of treating stretch fabrics (12) compared to a continuous vertical flow pattern, because it causes a certain spreading effect on the fabric(12).

With reference to figure 1 once again, the guiding of hot air inside the manifold (40) is explained below in more detail.

As mentioned before, the hot air is fed via a port (46) into the manifolds (38, 40) from one side. This configuration makes it easy to remove the manifolds (38, 40) for maintenance purposes. For removing, the manifolds (38, 40) can be removed (in the drawing) to the right side by using a guide rail (not shown) through a maintenance access on the side of the stenter range, wherein the port (42) is automatically separated from the hot air feed. While re-inserting the manifold (40), the port (42) is pressed with a pre-load against the hot air feed at the end of the displacement path such that an adequately air-tight connection is guaranteed.

The hot air flowing in through the port (46) is guided to the central area of the manifolds (38, 40) via the central feed channel (42). This central feed channel (42) narrows down complementary to the widening of the distribution channel (48), with which the central feed channel (42) shares a wall (60). This design of the central feed channel (42) saves material and the overall assembly height of the manifold (40) is also not increased. By tapering the central feed channel (42) towards the central area, the hot air is still accelerated as desired.

The air stream is divided into two partial streams that are approximately equal by stream divider plate (54) shortly before the end of the central feed channel (42). The two parts of the stream are then deflected by approximately 90° using an approximately 90° bend in the stream divider plate (54) and a corresponding bend in the initial flow guide (56) provided on the manifold housing (64), such that the two parts of the stream initially flow onto the nozzle plate (44) more or less perpendicularly. A second flow guide (52) which is connected to the first stream divider plate (54), then deflects in each case one component of the two stream parts to the left or right, such that most part of the hot air streams at least flow to the left and right distribution channel (48, 50).

In order to achieve a laminar flow deflection from the centre to the two sides as far as possible, an additional flow guide (58) is provided at one front end of the common wall (60) between the central feed channel (42) and the left distribution channel (48). The said additional flow guide (58) is approximately located on the manifold housing (64).

Second flow guide (52) slightly affects the flow to some of the outlet openings (62) of nozzle plate (44), that is, the outlet openings (62) that are located at the centre. This is compensated by the fact that the second flow guide (52) has a passage through which the air can pass in the direction indicated by the dashed arrow and can flow into the manifold (40) area in question.

If the manifold (40) width that affects the flow needs to be adjusted to the actual width of the fabric (12), this can be easily implemented as part of this invention by using flow flaps at the desired positions in the distribution channels (48, 50) which prevent air flow in the peripheral areas of the distribution channels (48, 50), in addition to the generally known solutions where the outer manifold outlet openings (62) are closed using a slider or something similar.

WE CLAIM:

1. Fluid treatment unit for a fabric, cellulosic or the like material (12), having at least one manifold (38, 40) for blowing the fluid onto the fabric, cellulosic or the like material (12) which is continuously guided past at least one manifold (38, 40), wherein at least one manifold (38, 40) comprises:

a manifold housing (64);
a port (46) which is provided on one side of the manifold (38, 40);

a nozzle plate (44) having atleast one outlet opening (62) through which the fluid is blown onto the said fabric, cellulosic or the like material (12); and

a duct for guiding the fluid from the said port (46) to the said nozzle plate (44),

characterised by the fact that

the said duct has a central feed channel (42) which guides the fluid from the said port (46) to a central area of the manifold (38, 40) as well as two distribution channels (48, 50) and at least one flow guide in the said central area to uniformly distribute the fluid across the said nozzle plate (44) that extends on both sides of the central area and that are fed from the said central feed channel (42).

2. Fluid treatment unit as claimed in claim 1, characterised by the fact that the central feed channel (42) with the manifold (38, 40) is designed as an integral unit.

3. Fluid treatment unit as claimed in claim 2, characterised by the fact that the height of the two distribution channels (48, 50) tapers to the sides and that the central feed channel (42) and one of the distribution channels (48) are separated by a common wall (60) in at least a part of the area.

4. Fluid treatment unit as claimed in claim 3, characterised by the fact that the central feed channel (42) has a taper towards the centre that is complementary to the profile of the adjacent distribution channel (48).

5. Fluid treatment unit as claimed in claims 1to 4, characterised by the fact that an initial flow guide (54) is provided in the first transition area between the central feed channel (42) and the distribution channels (48, 50), which divides the stream of fluid into two partial streams for the two distribution channels (48, 50) and deflects it by about 90°.

6. Fluid treatment unit as claimed in claim 5, characterised by the fact that a second flow guide (52) is provided in a second transition area which connects to the first transition area and protrudes into the two distribution channels (48, 50), which basically guides the two partial streams symmetrically in the direction of the two distribution channels (48, 50).

7. Fluid treatment unit as claimed in claim 6, characterised by the fact that the second flow guide (52) is provided with a passage for supplying fluid to the outlet openings (62) that are located directly in the centre and to which the flow is otherwise partly affected.

8. Flow treatment unit as claimed in Claims 1 to 4, characterized by the fact that an additional flow guide (58) is provided at one front end of the said wall (60) between the said central feed channel (42) and the adjacent distribution channel (48).

9. Fluid treatment unit as claimed in claims 1 to 7, characterised by the fact that the nozzle plate (44) has many oval, circular, rectangular or slot-shaped outlet openings (62).

10. Fluid treatment unit as claimed in claims 1 to 8, characterized by the fact that the walls of the said outlet openings (62) can be arranged normally to the surface of the nozzle plate (44) or longitudinally at an angle to this and wherein the outlet openings (62) can be arranged in one or several rows, with or without offset to each other.

11. Fluid treatment unit as claimed in claims 1to 8, characterised by the fact that the nozzle plate (44) has at least one narrow slot as outlet opening (62) which extends across a large part of the transverse length of the manifold.

12. Fluid treatment unit as claimed in claims 1 to 9, characterised by the fact that rows of several manifolds (38, 40) are provided on both sides of the fabric, cellulosic or the like material (12) to be treated, between which spaces are provided for discharging the fluid blown out through the outlet openings (62), wherein the respective rows of manifolds (38, 40) are staggered on both sides with respect to each other in such a manner that the spaces and outlet openings (62) are at least partially opposite to each other.

13. Manifold (38, 40) for use in a fluid treatment unit, characterized by the fact that it is designed according to claims 1 to 12.

14. A method for fluid treatment of a fabric, cellulosic or like material (12) where fluid is continuously blown onto the surface of the fabric, cellulosic or like material (12) which is continuously guided past at least one manifold (38, 40) having a nozzle plate (44),

characterised by the steps

d) guiding a stream of fluid through the manifold (38, 40) from one side into a central area;

e) basically dividing the stream of fluid into two partial streams; and

f) distributing the two partial streams to the nozzle plate (44) on both sides of the central area.

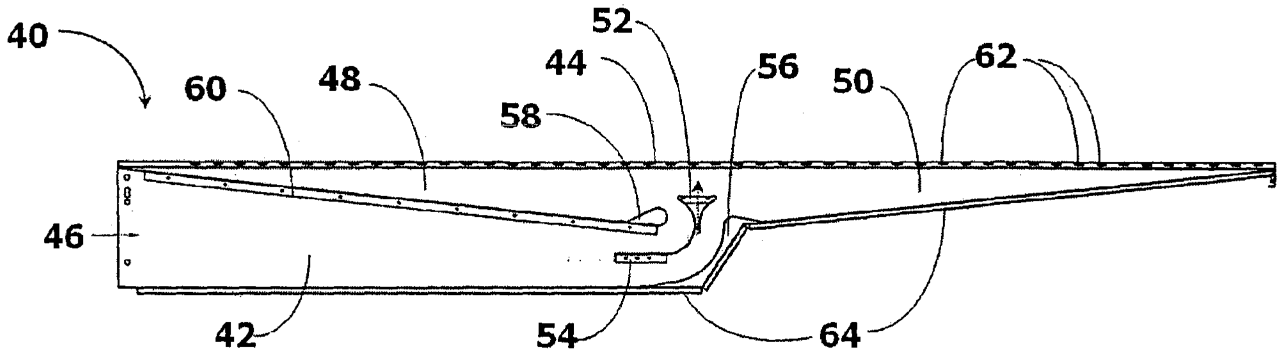
40
60
48
58
44
52
56
50
62
46
42
54
64

Fig.1

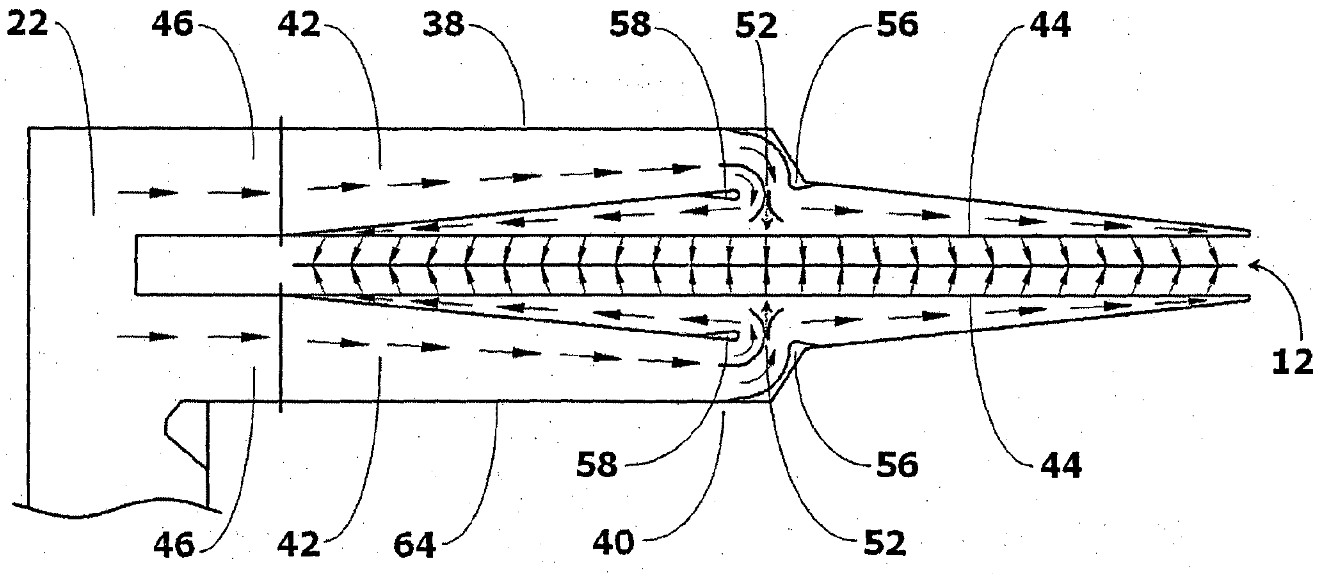
22
46
42
38
58
52
56
44
12
58
56
44
46
42
64
40
52

Fig.2

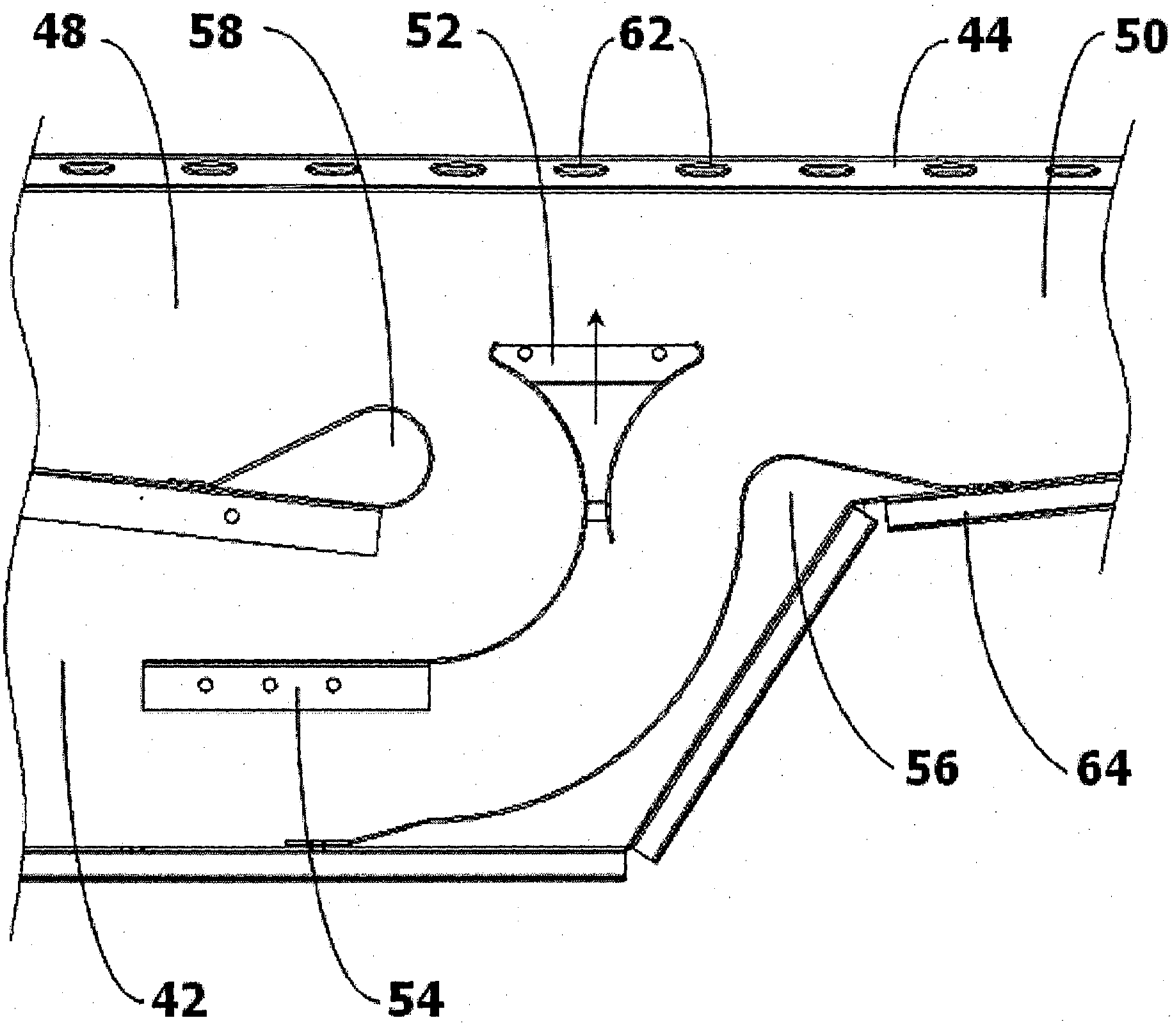

Fig.3

INTERNATIONAL SEARCH REPORT

International application No
PCT/IN2014/000525

A. CLASSIFICATION OF SUBJECT MATTER
INV. D21F1/34 D06C7/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D21F D06C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 03/038364 A1 (IM HO-KWUN [KR]) 8 May 2003 (2003-05-08) page 12, line 28 - page 14, line 14; figure 2	1-14
A	US 4 586 268 A (FLEISSNER HEINZ [CH]) 6 May 1986 (1986-05-06) column 9, line 27 - column 10, line 26; figure 2	1,14

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 January 2015	02/02/2015

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IN2014/000525

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03038364 A1	08-05-2003	KR 20010104408 A	26-11-2001
		WO 03038364 A1	08-05-2003
US 4586268 A	06-05-1986	US 4586268 A	06-05-1986
		US 4638572 A	27-01-1987
		US 4674197 A	23-06-1987