

REPLACED SHEETS		SG
☒	Description	: paged ...1... to paged ...9...
☒	Claim(s)	: paged ...8... to paged ...11...
☒	Drawing(s)	: paged ...12... to paged ...14...
☒	Abstract	: paged ...15... to paged ...16...
DATE OF RECEIPT		

Process and device for the air conditioning of a weaving machine

5 The invention relates to a process for the air conditioning of a weaving machine according to the preamble of claim 1, and to a device for the air conditioning a weaving machine.

10 With the objective of reducing the interruptions of operation of powerful weaving machines, which interruptions result mainly from thread breakages, attempts have been made for a relatively long time to optimize the weaving conditions. Endeavours to achieve this objective just by influencing the space air conditioning of a weaving machine room result in a large volume flow of air, with a large power requirement per machine.

15 However, in connection with dust removal, processes are also known by which the climate directly at the weaving machine is influenced. In a known process of this type, conditioned air is supplied both via ceiling outlets distributed within the room and also through
20 local outlets. In this case, for each machine a local outlet is provided, which exhibits a slot-shaped exit opening at a spacing above the warp. In another known process, the local outlets are disposed below the warps. In both cases, the exit opening extends approximately
25 transversely to the warp over its full width and releases a jet of conditioned air, which jet is directed towards the warp.

30 In a report entitled "Weaving machine dust removal and air conditioning of a weaving machine - a conflict?" (Dr.-Ing. Helmut Weinsdörfer, Dipl.-Ing. Ulrich Stark), presented on the occasion of the 6th Weaving Industry Colloquium (16/17 October 1990) and published by the Institute for Textile and Process Technology, 7306 Denkendorf, Germany, an experimental
35 arrangement is described which exhibits a local outlet of the above type, which outlet is directed vertically from above onto the back shed.

This Sheet Has Been Replaced



In the majority of cases, the air conditioning of the machine using local outlets brings, related to the frequency of thread breakage, a marked improvement as compared with applications in which an influence is exerted on the humidity conditions at the weaving machine only via the space air conditioning. In addition to this, there is also a considerably lower power requirement. However, in order to achieve satisfactory results it is still necessary to generate considerable volume flows of air, and as far as the operating costs are concerned the increased maintenance effort for the cleaning of the local outlets is also significant.

The object of the invention is to provide a process which brings an effective conditioning with a considerable reduction of the air conditioning costs per weaving machine by reduced power requirement and volume flow of air as well as lower water consumption, without creating an impermissible obstruction in visual terms or for accessibility.

The object of the invention is achieved by the measures of the defining clause of claim 1.

In the present context, a piston-type displacement flow is understood as referring to a low-turbulence flow with a distribution which is approximately uniform over its full cross section and approximately equal velocity. In this case, exit velocities between 0.3 and 1.2 m/sec enter into consideration.

The invention is based on the finding that the transport of the moisture by an air jet blown out from a slot-shaped exit opening is of low effectiveness and is therefore uneconomic. What is responsible for this is mainly the relatively high exit velocity which is required for the throughput of the required quantity of air. Investigations demonstrate that in the first instance a considerable part of the conditioning air blown out does not reach the (still noninterwoven) warp threads. Subsequently, a part of this air rebounds at the warp, without being able to give off its humidity. This



means that considerably more conditioned air must be conveyed than comes into action at the warp to achieve the relative humidity aimed at.

5 The displacement flow employed according to the invention permits a quite considerable reduction of the required exit velocity as compared with that from a slot-shaped exit opening, with an equal path to be traversed to reach the warp.

10 By virtue of the displacement flow which is in practice compact but which impinges on the warp at a low velocity, this flow does not rebound, but is mainly deflected. This deflection takes place gently and while preserving the piston-type nature, in order to flow away
15 along the warp threads, mainly in the direction of the warp beam. This gives an optimal utilization of the conditioning air and it becomes possible to influence directly the humidity of the warp threads themselves, in order to condition these for the subsequent processing. With relatively small quantities of air and a low water
20 requirement, optimal humidity is thus created directly at the warp, and the latter is kept to a high degree dust-free. Accordingly, the air conditioning costs may be considerably reduced.

25 As a result of the particular properties of the piston-type displacement flow, only a negligible quantity of surrounding air is set into motion by inductive means. Consequently, virtually no transport of such surrounding air in the direction of the warp is initiated. This is of importance in circumstances in which the relative
30 humidity in the weaving room is considerably below the optimal values and can counteract the positive influence of the conditioning air at the warp.

35 The piston-type displacement flow permits the creation and maintenance, within its cross section, of conditions which are different from those of the surroundings. By designing the cross sectional shape and dimensions, it is accordingly possible to control the climate of each respective zone at a textile machine with



respect to required properties. The entry of entrained matter and dust from the surroundings into this zone is likewise prevented. If this is required, it is accordingly also possible to control at a machine or within the delivery region of the textile material, a plurality of zones, by a respective piston-type displacement flow; in this case, the climatic conditions in these zones can be designed to be different. Accordingly, piston-type displacement flows may be employed with advantage also for the air conditioning of other textile procedures and processes such as for example in carding, in depositing, storage and take-up of the slubbing from the can, in stretching and spinning, as well as in twisting.

The experience gained in the application of the process according to the invention as well as in the operation of the device which is likewise according to the invention has shown that the avoidance of the circulation of surrounding air also has a beneficial effect in the sense of the reduction of the maintenance expenditure, especially with regard to cleaning in the region of the local outlets.

The process according to the invention and the device according to the invention are explained in greater detail hereinbelow with reference to an illustrative embodiment relating to the air conditioning of a weaving machine as well as with reference to the drawing. In the drawings:

Fig. 1 diagrammatically shows the conditions at a weaving machine equipped with a device according to the invention, in the application of an embodiment of the process;

Fig. 2 shows a vertical cross section along line II-II in Fig. 3, through the local outlet of the device according to Fig. 1, which local outlet is shown on an enlarged scale, and

Fig. 3 shows a bottom plan view of the local outlet according to Figs. 1 and 2, partly broken away.



In Fig. 1, reference numeral 2 generally designates a weaving machine having a warp beam 4, thread stop motions 6, a heald frame assembly 8, a slay 10, and a cloth beam 12. The warp threads which pass over a back-rest 14 and which form the warp 16 are designated by 18 and the back shed of the shed adjoining the thread stop motions 6 is indicated at 20.

In the illustrative embodiment shown, a local outlet 22 is disposed above the weaving machine 2 and at a spacing from the warp 16 or the back shed 20, which local outlet is supplied with conditioned air via a line 24 from an air conditioning plant 26. The local outlets of all further weaving machines of the weaving room (not shown) are also connected to the same air conditioning plant 26. The local outlet 22 possesses an exit opening 32 directed downwards towards the warp 16 and extends horizontally over the entire working width of the weaving machine 2; in this case, the exit opening is directed approximately at right angles to the general extent of the warp. The design of the local outlet is evident from Figs. 2 and 3.

As may be inferred from the cross sectional representation of Fig. 2, the local outlet 22 comprises a box 30 of elongate form with uniform rectangular cross section over its longitudinal extent. The box 30 is closed on all sides with the exception of the bottom surface forming the exit opening 32. At the top surface 34 of the box 30 there is provided, approximately at the longitudinal center thereof, a cylindrical connecting piece 36 for connection with the line 24, which connecting piece is connected with the inner space 40 of the box via a circular inlet opening 38 (shown in broken lines in Fig. 3) of the same internal cross section. The bottom surface and the top surface represent the long sides of the rectangular cross sectional shape of the box.

The inner space 40 contains distribution components to distribute uniformly the air flowing in through the inlet opening 38 over the surface of the exit



opening 32 and to generate the displacement flow which is provided according to the invention. These distribution components comprise, seen in the direction of flow, a perforated sheet 42 which extends parallel to the top surface 34, but at a spacing from the latter, over a central longitudinal region and the full width of the inner space 40. The length of the perforated sheet 42 secured by means of bolts 44 to the top surface 34 of the box 30 is greater than the diameter of the inlet opening 38, but smaller than the length of the inner space. Below the perforated sheet 42 there extends, likewise parallel to the top surface 34 over the full width of the inner space 40, a further perforated sheet 46, which is secured to the side walls of the box 30 or is supported in an appropriate manner on the bottom surface. In the longitudinal direction of the inner space 40 the extent of this perforated sheet 46 is restricted to an amount which is somewhat smaller than the diameter of the inlet opening 38. The passage cross section formed by the perforating of the perforated sheets 42 and 46 accounts for preferably between 35 and 45 %, related to the surface area thereof.

There finally follows, as the last distribution component in the inner space 40 of the box, an air-permeable mat 48, for example of an appropriate foam material, which mat is clamped between a peripheral flange 58 of the box and a grid 50. Mat 48 and grid 50 extend over the full length and width of the inner space. The grid 50, which is formed, for example, by a wire grid of relatively large mesh width, is supported on a narrow frame 52, which is provided at the bottom surface of the box. The frame 52 limits the exit opening 32 by the length 54 and the width 56. Preferably, the mat 48 is fitted in the box for example by demountability of the frame 52, so that its accessibility for the purpose of exchange is possible at any time. A foam material with a pressure loss of 15 - 20 Pa at 0.6 m/sec has proved to be suitable for the mat 48.



Together with the distribution components 42, 46 and 48, the box 30 represents an air distributor 60. The described design and arrangement of the distribution components in this box give a stepwise distribution of the air flowing in through the inlet opening 38 into the inner space 40. As a result of the perforated sheet 42, which, also acting as baffle plate, lies opposite the inlet opening, only a part of this air can pass through in the direction of the arrows 62, while the remainder is deflected to opposite sides in the longitudinal direction of the inner space 40 with low pressure loss, without having to overcome an impediment to flow on the further path to the mat 48, i.e. in the direction of the arrows 64. In order to reduce the velocity in the partial stream flowing without deflection in the direction of the arrows 62, this partial stream must still overcome the perforated sheet 46. The partial streams 62 and 64 thus arrive at approximately the same velocity at the mat 48. Besides a further balancing, a fine distribution of the air takes place at the mat 48 and upon passing through the latter a piston-type displacement flow formed of the finest stream lines is created. For the outlet velocity, in the present context a restriction to values of between 0.5 and 0.8 m/sec is appropriate. Thus, the quantities of air may be designed to be different, within certain limits, even in the case of the same dimensions of the air distributor 60.

In operation, the air conditioning plant delivers conditioned air, which emerges from the local outlet 22 (Fig. 1) formed by the air distributor 60, as a piston-type displacement flow 70, e.g. with an outlet velocity of 0.6 m/sec vertically downwards and in this case exhibits a width of for example 300 mm, depending upon the dimension 56. The displacement flow traverses the distance, amounting for example to 0.9 m, to the upper group of warp threads 20' of the shed 20 in compact form, and impinges on said group upstream of the heald frame assembly 8. Upon impinging on said group as well as on



the lower group of warp threads 20'', the air is deflected at least as the major partial stream 72 towards the thread stop motions 6 and flows along the warp threads 18 counter to their direction of delivery. A partial stream 74 flows in the shed region along the corresponding warp threads and flows away downwards between these. In this case, both partial streams of this air create in the environment of the warp 16 a climate which is suitable for the transport and the processing, in that heat and dust are conducted away and the relative humidity is kept at an advantageous value. Since the warp threads 18 are circumcirculated by the stream over a relatively long period of time, a direct moisture take-up also takes place, which has a favorable effect both for the weaving process and also for the water consumption. In particular, this applies to the influence of the partial stream 72, which flows along the warp threads, envelops these and screens them off in relation to the surrounding air.

A spacing of approximately 1.2 m of the local outlet from the warp running therebelow represents an upper limit on economic grounds.

It should be added that below the weaving machine 2, expediently in a manner known per se, a floor opening 80 is provided, via which dust-laden air is transported away.

It has proved to be the case that the arrangement of the local outlet 22 so that the displacement flow 70 impinges on the upper group of warp threads 20' at an acute angle greatly favors the deflection of the same or the formation of a relatively large partial stream 72 and an orientation of the same parallel to the warp threads. Since an effective conditioning of the warp threads 18 can be achieved only over a sufficiently long period of action, this partial stream acts as its own conditioning medium. With the objective of a long period of action of the air streams 70 and 72 respectively, the arrangement of the air outlet 22 so that the stream 70 impinges on



the warp 16 or the back shed 20 directly behind the heald frame assembly 8 is advantageous. On the other hand, in the case of such an arrangement an air build-up takes place at that side of the heald frame assembly which
5 faces the back shed 20, which air build-up assists the deflection of the partial stream 72.

Where the conditioning is also to take place in the region of the front shed or of the gate for the weft thread spools, according to the invention additional
10 outlets similar to the local outlet 22 are to be provided for this purpose, which additional outlets are supplied from the air conditioning plant 26. Just like the local outlet 22, these outlets are also to be provided in the form of elements separate from the weaving machine.

This Sheet Has Been Replaced





Patent claims

1. A process for the air conditioning of a weaving machine, in which there is generated for each weaving machine at a spacing from its warp, at least one conditioning air stream directed towards the latter, wherein the conditioning air is transported in a downwardly directed piston-type displacement flow to the warp threads.
2. The process as claimed in claim 1, wherein the warp threads are conditioned by a partial stream of the displacement flow, which partial stream flows along these.
3. The process as claimed in claim 1, wherein, after deflection, the displacement flow directed onto the back shed is guided along the warp threads in the direction of the side of the warp beam.
4. The process as claimed in one of claims 1, 2 or 3, wherein a maximum outlet velocity of 0.9 m/sec is imparted to the displacement flow.
5. A device for the air conditioning of weaving machines, having at least one local air outlet (22) for each weaving machine (2), which outlet is connected via an inlet opening (38) to an air conditioning plant (26) and is intended to generate an air stream (70) directed downwards into the region of the warp (16), wherein an outlet opening (32) of the air outlet extends transversely to the warp and at a spacing from the latter, an air distributor (60) is connected upstream of the outlet opening, which air distributor exhibits a plurality of flat distribution components (42, 46, 48) which are connected in series in the direction of flow, and wherein the outlet opening exhibits a width of at least 150 mm.
6. The device as claimed in claim 5, wherein the outlet opening (32) of the air outlet is provided at a long side of a box (30), which forms the air distributor (60) and which is approximately rectangular in profile and the cross section of which, parallel to the long





side, approximately corresponds to the cross section of the outlet opening.

5 7. The device as claimed in claim 5 or 6, wherein the distribution components comprise an air-permeable mat (48) and a perforated sheet (46), and wherein a further distribution component (42) disposed opposite the inlet opening (38) is provided as baffle component in the air distributor (60).

10 8. The device as claimed in claim 7, wherein the perforated sheet (46) is disposed, in the direction of flow, upstream of the mat (48) and parallel to the latter and to the outlet opening (32) and the surface extent of the mat is approximately the same as the cross section of the outlet opening.

15 9. The device as claimed in one of the preceding claims, wherein the air distributor exhibits at least one lateral outlet opening.

20 10. Use of a displacement flow outlet as a local outlet for the air conditioning of a textile machine, especially of a weaving machine.

This Sheet Has Been Replaced



Abstract of the disclosure

For each weaving machine, there is generated at a spacing from the warp thereof at least one conditioning air stream directed towards the latter, the conditioning air being transported in a downwardly directed piston-type displacement flow to the warp threads.

(Fig. 1)

This Sheet Has Been Replaced



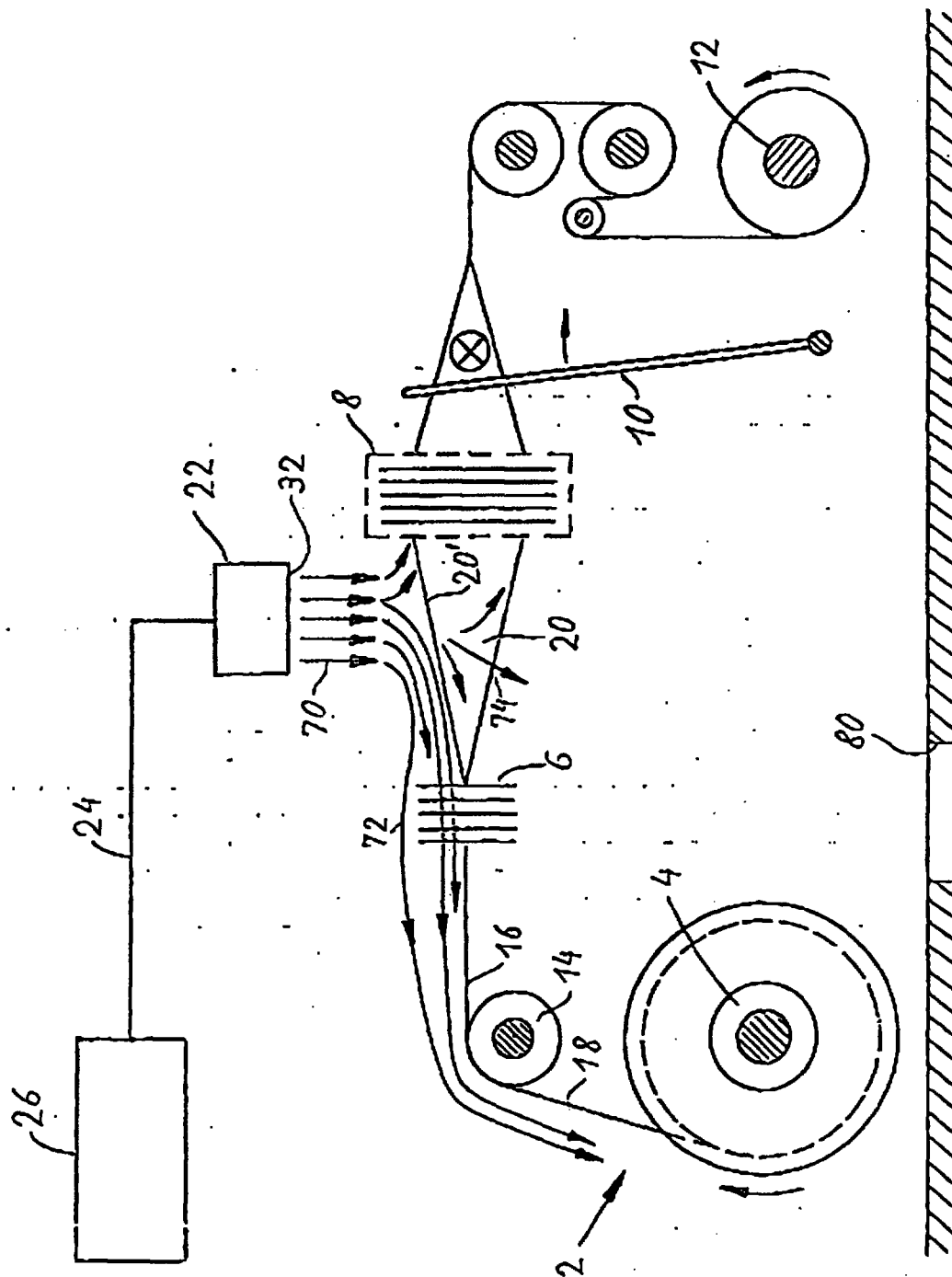
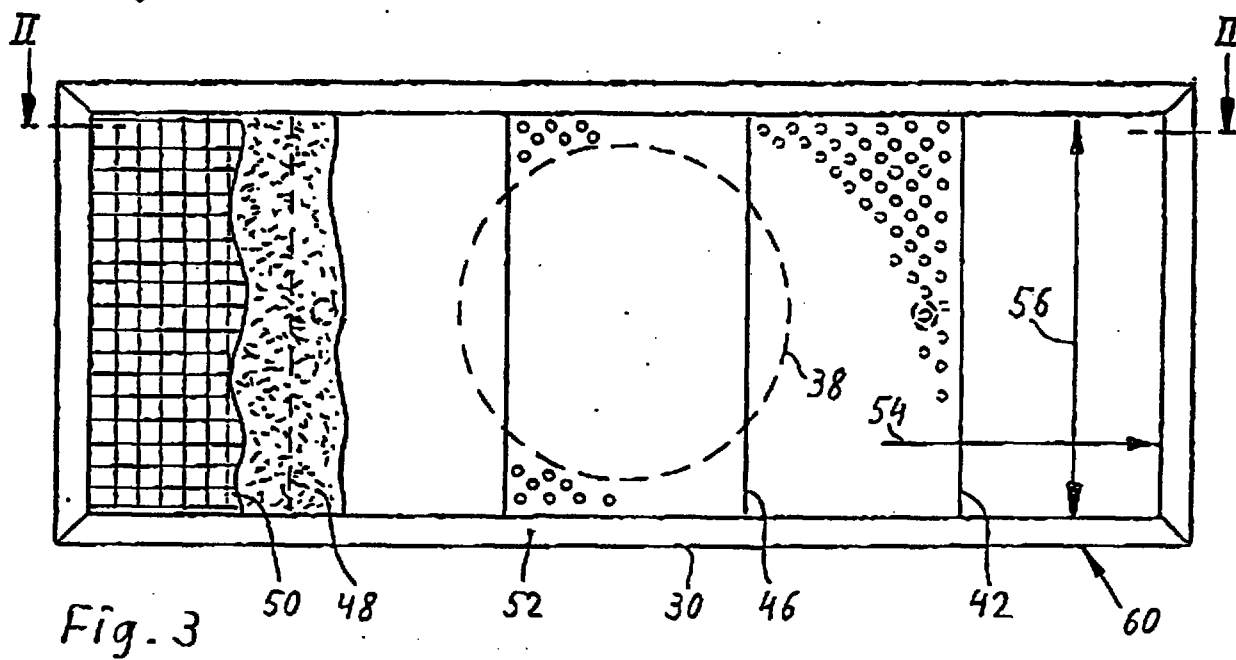
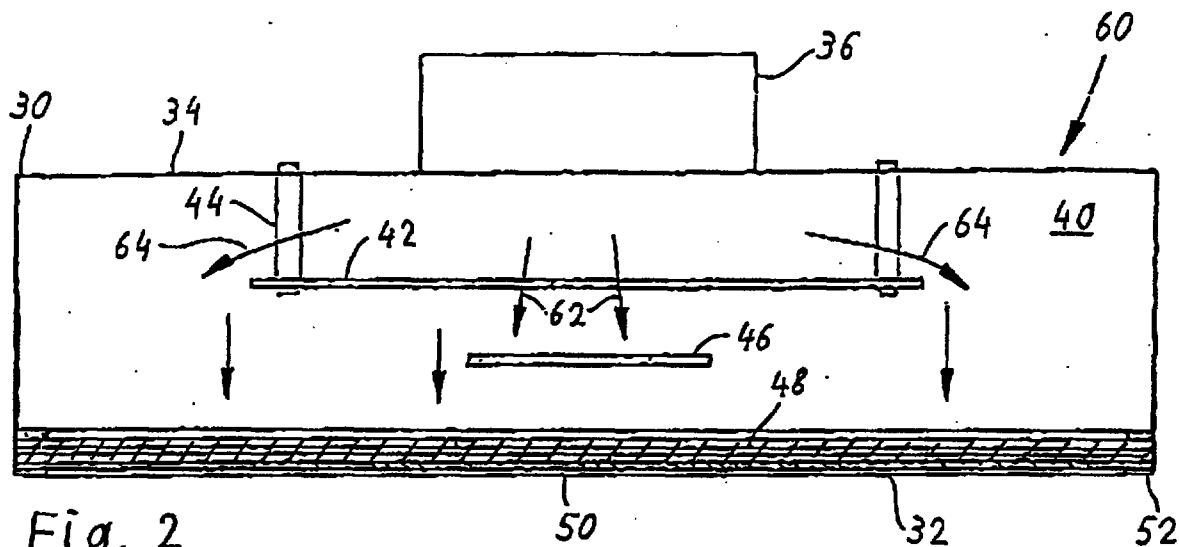


Fig. 1

This Sheet Has Been Replaced





This Sheet Has Been Replaced





REPLACEMENT SHEET

28 SEP 1996

Process and device for the air conditioning of a
weaving machine

The invention relates to a process for the air conditioning of a weaving machine according to the preamble of claim 1, and to a device for the air conditioning a weaving machine.

With the objective of reducing the interruptions of operation of powerful weaving machines, which interruptions result mainly from thread breakages, attempts have been made for a relatively long time to optimize the weaving conditions. Endeavours to achieve this objective just by influencing the space air conditioning of a weaving machine room result in a large volume flow of air, with a large power requirement per machine.

However, in connection with dust removal, processes are also known by which the climate directly at the weaving machine is influenced. In a known process of this type, conditioned air is supplied both via ceiling outlets distributed within the room and also through local outlets. In this case, for each machine a local outlet is provided, which exhibits a slot-shaped exit opening at a spacing above the warp. In another known process, the local outlets are disposed below the warps. In both cases, the exit opening extends approximately transversely to the warp over its full width and releases a jet of conditioned air, which jet is directed towards the warp.

In a report entitled "Weaving machine dust removal and air conditioning of a weaving machine - a conflict?" (Dr.-Ing. Helmut Weinsdörfer, Dipl.-Ing. Ulrich Stark), presented on the occasion of the 6th Weaving Industry Colloquium (16/17 October 1990) and published by the Institute for Textile and Process Technology, 7306 Denkendorf, Germany, an experimental arrangement is described which exhibits a local outlet of the above type, which outlet is directed vertically from above onto the back shed.

REPLACED SHEETS SG

- ☒ Description : paged to paged
☒ Claim(s) : paged to paged
☐ Drawing(s) : paged to paged
☐ Abstract : paged to paged

DATE OF RECEIPT

REPLACEMENT SHEETS SG

- ☒ Description : paged to paged
☒ Claim(s) : paged to paged
☒ Drawing(s) : paged to paged
☒ Abstract : paged to paged

DATE OF RECEIPT 28/9/96

28 SEP 1996

- 2 -

5 In the majority of cases, the air conditioning of the machine using local outlets brings, related to the frequency of thread breakage, a marked improvement as compared with applications in which an influence is exerted on the humidity conditions at the weaving machine only via the space air conditioning. In addition to this, there is also a considerably lower power requirement. However, in order to achieve satisfactory results it is still necessary to generate considerable volume flows of air, and as far as the operating costs are concerned the increased maintenance effort for the cleaning of the local outlets is also significant.

15 The object of the invention is to provide a process which brings an effective conditioning with a considerable reduction of the air conditioning costs per weaving machine by reduced power requirement and volume flow of air as well as lower water consumption, without creating an impermissible obstruction in visual terms or for accessibility.

20 The object of the invention is achieved by the measures of the defining clause of claim 1.

25 In the present context, a piston-type displacement flow is understood as referring to a low-turbulence flow with a distribution which is approximately uniform over its full cross section and approximately equal velocity. In this case, exit velocities between 0.3 and 1.2 m/sec enter into consideration.

30 The invention is based on the finding that the transport of the moisture by an air jet blown out from a slot-shaped exit opening is of low effectiveness and is therefore uneconomic. What is responsible for this is mainly the relatively high exit velocity which is required for the throughput of the required quantity of air. Investigations demonstrate that in the first instance a considerable part of the conditioning air blown out does not reach the (still noninterwoven) warp threads. Subsequently, a part of this air rebounds at the warp, without being able to give off its humidity. This



28 SEP 1996

- 3 -

means that considerably more conditioned air must be conveyed than comes into action at the warp to achieve the relative humidity aimed at.

5 The displacement flow employed according to the invention permits a quite considerable reduction of the required exit velocity as compared with that from a slot-shaped exit opening, with an equal path to be traversed to reach the warp.

10 By virtue of the displacement flow which is in practice compact but which impinges on the warp at a low velocity, this flow does not rebound, but is mainly deflected. This deflection takes place gently and while preserving the piston-type nature, in order to flow away along the warp threads, mainly in the direction of the
15 warp beam. This gives an optimal utilization of the conditioning air and it becomes possible to influence directly the humidity of the warp threads themselves, in order to condition these for the subsequent processing. With relatively small quantities of air and a low water
20 requirement, optimal humidity is thus created directly at the warp, and the latter is kept to a high degree dust-free. Accordingly, the air conditioning costs may be considerably reduced.

25 As a result of the particular properties of the piston-type displacement flow, only a negligible quantity of surrounding air is set into motion by inductive means. Consequently, virtually no transport of such surrounding air in the direction of the warp is initiated. This is of importance in circumstances in which the relative
30 humidity in the weaving room is considerably below the optimal values and can counteract the positive influence of the conditioning air at the warp.

35 The piston-type displacement flow permits the creation and maintenance, within its cross section, of conditions which are different from those of the surroundings. By designing the cross sectional shape and dimensions, it is accordingly possible to control the climate of each respective zone at a textile machine with



respect to required properties. The entry of entrained matter and dust from the surroundings into this zone is likewise prevented. If this is required, it is accordingly also possible to control at a machine or within the delivery region of the textile material, a plurality of zones, by a respective piston-type displacement flow; in this case, the climatic conditions in these zones can be designed to be different. Accordingly, piston-type displacement flows may be employed with advantage also for the air conditioning of other textile procedures and processes such as for example in carding, in depositing, storage and take-up of the slubbing from the can, in stretching and spinning, as well as in twisting.

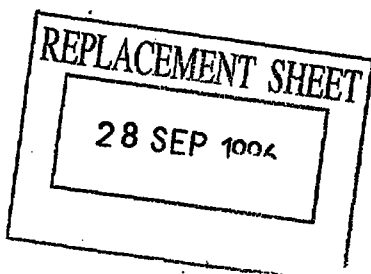
The experience gained in the application of the process according to the invention as well as in the operation of the device which is likewise according to the invention has shown that the avoidance of the circulation of surrounding air also has a beneficial effect in the sense of the reduction of the maintenance expenditure, especially with regard to cleaning in the region of the local outlets.

The process according to the invention and the device according to the invention are explained in greater detail hereinbelow with reference to an illustrative embodiment relating to the air conditioning of a weaving machine as well as with reference to the drawing. In the drawing:

Fig. 1 diagrammatically shows the conditions at a weaving machine equipped with a device according to the invention, in the application of an embodiment of the process;

Fig. 2 shows a vertical cross section along line II-II in Fig. 3, through the local outlet of the device according to Fig. 1, which local outlet is shown on an enlarged scale, and

Fig. 3 shows a bottom plan view of the local outlet according to Figs. 1 and 2, partly broken away.

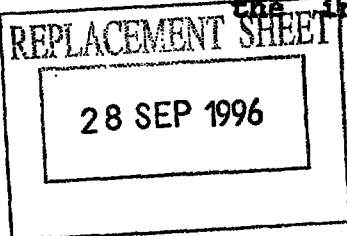


In Fig. 1, reference numeral 2 generally designates a weaving machine having a warp beam 4, thread stop motions 6, a heald frame assembly 8, a slay 10, and a cloth beam 12. The warp threads which pass over a back-rest 14 and which form the warp 16 are designated by 18 and the back shed of the shed adjoining the thread stop motions 6 is indicated at 20.

In the illustrative embodiment shown, a local outlet 22 is disposed above the weaving machine 2 and at a spacing from the warp 16 or the back shed 20, which local outlet is supplied with conditioned air via a line 24 from an air conditioning plant 26. The local outlets of all further weaving machines of the weaving room (not shown) are also connected to the same air conditioning plant 26. The local outlet 22 possesses an exit opening 32 directed downwards towards the warp 16 and extends horizontally over the entire working width of the weaving machine 2; in this case, the exit opening is directed approximately at right angles to the general extent of the warp. The design of the local outlet is evident from Figs. 2 and 3.

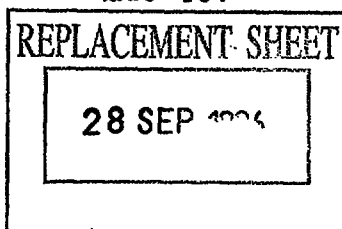
As may be inferred from the cross sectional representation of Fig. 2, the local outlet 22 comprises a box 30 of elongate form with uniform rectangular cross section over its longitudinal extent. The box 30 is closed on all sides with the exception of the bottom surface forming the exit opening 32. At the top surface 34 of the box 30 there is provided, approximately at the longitudinal center thereof, a cylindrical connecting piece 36 for connection with the line 24, which connecting piece is connected with the inner space 40 of the box via a circular inlet opening 38 (shown in broken lines in Fig. 3) of the same internal cross section. The bottom surface and the top surface represent the long sides of the rectangular cross sectional shape of the box.

The inner space 40 contains distribution components to distribute uniformly the air flowing in through the inlet opening 38 over the surface of the exit



opening 32 and to generate the displacement flow which is provided according to the invention. These distribution components comprise, seen in the direction of flow, a perforated sheet 42 which extends parallel to the top surface 34, but at a spacing from the latter, over a central longitudinal region and the full width of the inner space 40. The length of the perforated sheet 42 secured by means of bolts 44 to the top surface 34 of the box 30 is greater than the diameter of the inlet opening 38, but smaller than the length of the inner space. Below the perforated sheet 42 there extends, likewise parallel to the top surface 34 over the full width of the inner space 40, a further perforated sheet 46, which is secured to the side walls of the box 30 or is supported in an appropriate manner on the bottom surface. In the longitudinal direction of the inner space 40 the extent of this perforated sheet 46 is restricted to an amount which is somewhat smaller than the diameter of the inlet opening 38. The passage cross section formed by the perforating of the perforated sheets 42 and 46 accounts for preferably between 35 and 45 %, related to the surface area thereof.

There finally follows, as the last distribution component in the inner space 40 of the box, an air-permeable mat 48, for example of an appropriate foam material, which mat is clamped between a peripheral flange 58 of the box and a grid 50. Mat 48 and grid 50 extend over the full length and width of the inner space. The grid 50, which is formed, for example, by a wire grid of relatively large mesh width, is supported on a narrow frame 52, which is provided at the bottom surface of the box. The frame 52 limits the exit opening 32 by the length 54 and the width 56. Preferably, the mat 48 is fitted in the box for example by demountability of the frame 52, so that its accessibility for the purpose of exchange is possible at any time. A foam material with a pressure loss of 15 - 20 Pa at 0.6 m/sec has proved to be suitable for the mat 48.



This Sheet Has Been Replaced



Together with the distribution components 42, 46 and 48, the box 30 represents an air distributor 60. The described design and arrangement of the distribution components in this box give a stepwise distribution of the air flowing in through the inlet opening 38 into the inner space 40. As a result of the perforated sheet 42, which, also acting as baffle plate, lies opposite the inlet opening, only a part of this air can pass through in the direction of the arrows 62, while the remainder is deflected to opposite sides in the longitudinal direction of the inner space 40 with low pressure loss, without having to overcome an impediment to flow on the further path to the mat 48, i.e. in the direction of the arrows 64. In order to reduce the velocity in the partial stream flowing without deflection in the direction of the arrows 62, this partial stream must still overcome the perforated sheet 46. The partial streams 62 and 64 thus arrive at approximately the same velocity at the mat 48. Besides a further balancing, a fine distribution of the air takes place at the mat 48 and upon passing through the latter a piston-type displacement flow formed of the finest stream lines is created. For the outlet velocity, in the present context a restriction to values of between 0.5 and 0.8 m/sec is appropriate. Thus, the quantities of air may be designed to be different, within certain limits, even in the case of the same dimensions of the air distributor 60.

In operation, the air conditioning plant delivers conditioned air, which emerges from the local outlet 22 (Fig. 1) formed by the air distributor 60, as a piston-type displacement flow 70, e.g. with an outlet velocity of 0.6 m/sec vertically downwards and in this case exhibits a width of for example 300 mm, depending upon the dimension 56. The displacement flow traverses the distance, amounting for example to 0.9 m, to the upper group of warp threads 20' of the shed 20 in compact form, and impinges on said group upstream of the heald frame assembly 8. Upon impinging on said group as well as on

REPLACEMENT SHEET

28 SEP 1996

This Sheet Has Been Replaced



28 SEP 1996

- 8 -

the lower group of warp threads 20'', the air is deflected at least as the major partial stream 72 towards the thread stop motions 6 and flows along the warp threads 18 counter to their direction of delivery. A partial stream 74 74 flows in the shed region along the corresponding warp threads and flows away downwards between these. In this case, both partial streams of this air create in the environment of the warp 16 a climate which is suitable for the transport and the processing, in that heat and dust are conducted away and the relative humidity is kept at an advantageous value. Since the warp threads 18 are circumscribed by the stream over a relatively long period of time, a direct moisture take-up also takes place, which has a favorable effect both for the weaving process and also for the water consumption. In particular, this applies to the influence of the partial stream 72, which flows along the warp threads, envelops these and screens them off in relation to the surrounding air.

A spacing of approximately 1.2 m of the local outlet from the warp running therebelow represents an upper limit on economic grounds.

It should be added that below the weaving machine 2, expediently in a manner known per se, a floor opening 80 is provided, via which dust-laden air is transported away.

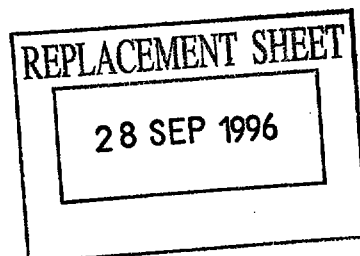
It has proved to be the case that the arrangement of the local outlet 22 so that the displacement flow 70 impinges on the upper group of warp threads 20' at an acute angle greatly favors the deflection of the same or the formation of a relatively large partial stream 72 and an orientation of the same parallel to the warp threads. Since an effective conditioning of the warp threads 18 can be achieved only over a sufficiently long period of action, this partial stream acts as its own conditioning medium. With the objective of a long period of action of the air streams 70 and 72 respectively, the arrangement of the air outlet 22 so that the stream 70 impinges on

This Sheet Has Been Replaced.



the warp 16 or the back shed 20 directly behind the heald frame assembly 8 is advantageous. On the other hand, in the case of such an arrangement an air build-up takes place at that side of the heald frame assembly which
5 faces the back shed 20, which air build-up assists the deflection of the partial stream 72.

Where the conditioning is also to take place in the region of the front shed or of the gate for the weft thread spools, according to the invention additional
10 outlets similar to the local outlet 22 are to be provided for this purpose, which additional outlets are supplied from the air conditioning plant 26. Just like the local outlet 22, these outlets are also to be provided in the form of elements separate from the weaving machine.



This Sheet Has Been Replaced



REPLACEMENT SHEET

28 SEP 1996

- 10 -



Patent claims

1. A process for the air conditioning of a weaving machine, in which there is generated for each weaving machine at a spacing from its warp, at least one conditioning air stream directed towards the latter, wherein the conditioning air is transported in a downwardly directed piston-type displacement flow to the warp threads.
2. The process as claimed in claim 1, wherein the warp threads are conditioned by a partial stream of the displacement flow, which partial stream flows along these.
3. The process as claimed in claim 1, wherein, after deflection, the displacement flow directed onto the back shed is guided along the warp threads in the direction of the side of the warp beam.
4. The process as claimed in one of claims 1, 2 or 3, wherein a maximum outlet velocity of 0.9 m/sec is imparted to the displacement flow.
5. A device for the air conditioning of weaving machines, having at least one local air outlet (22) for each weaving machine (2), which outlet is connected via an inlet opening (38) to an air conditioning plant (26) and is intended to generate an air stream (70) directed downwards into the region of the warp (16), wherein an outlet opening (32) of the air outlet extends transversely to the warp and at a spacing from the latter, an air distributor (60) is connected upstream of the outlet opening, which air distributor exhibits a plurality of flat distribution components (42, 46, 48) which are connected in series in the direction of flow, and wherein the outlet opening exhibits a width of at least 150 mm.
6. The device as claimed in claim 5, wherein the outlet opening (32) of the air outlet is provided at a long side of a box (30), which forms the air distributor (60) and which is approximately rectangular in profile and the cross section of which, parallel to the long

This Sheet Has Been Replaced





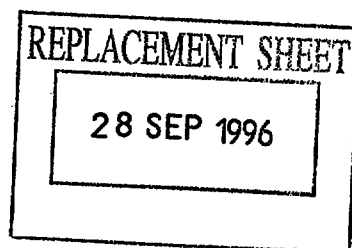
side, approximately corresponds to the cross section of the outlet opening.

7. The device as claimed in claim 5 or 6, wherein the distribution components comprise an air-permeable mat (48) and a perforated sheet (46), and wherein a further distribution component (42) disposed opposite the inlet opening (38) is provided as baffle component in the air distributor (60).

8. The device as claimed in claim 7, wherein the perforated sheet (46) is disposed, in the direction of flow, upstream of the mat (48) and parallel to the latter and to the outlet opening (32) and the surface extent of the mat is approximately the same as the cross section of the outlet opening.

9. The device as claimed in one of the preceding claims, wherein the air distributor exhibits at least one lateral outlet opening.

10. Use of a displacement flow outlet as a local outlet for the air conditioning of a textile machine, especially of a weaving machine.



This Sheet Has Been Replaced

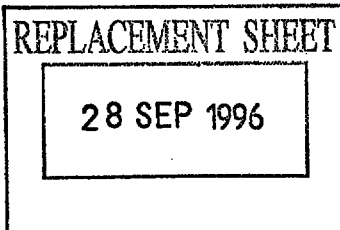


**PROCESS AND DEVICE FOR THE AIR CONDITIONING OF A
WEAVING MACHINE**

Abstract of the disclosure

For each weaving machine, there is generated at a spacing from the warp thereof at least one conditioning air stream directed towards the latter, the conditioning air being transported in a downwardly directed piston-type displacement flow to the warp threads.

(Fig. 1)



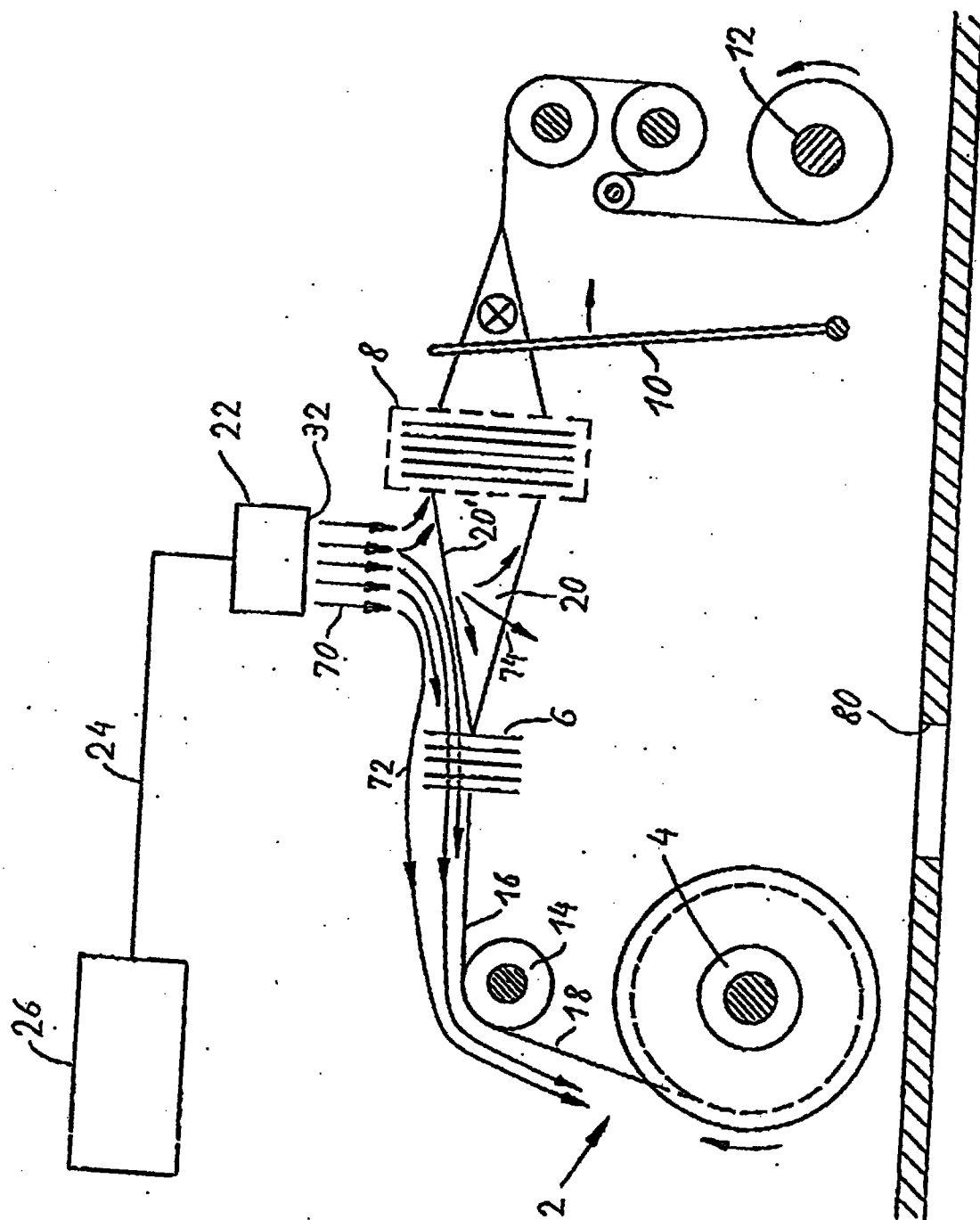
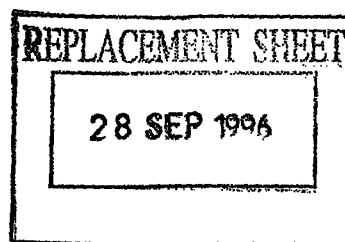
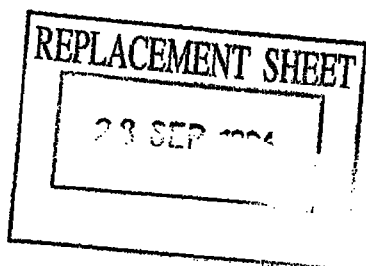
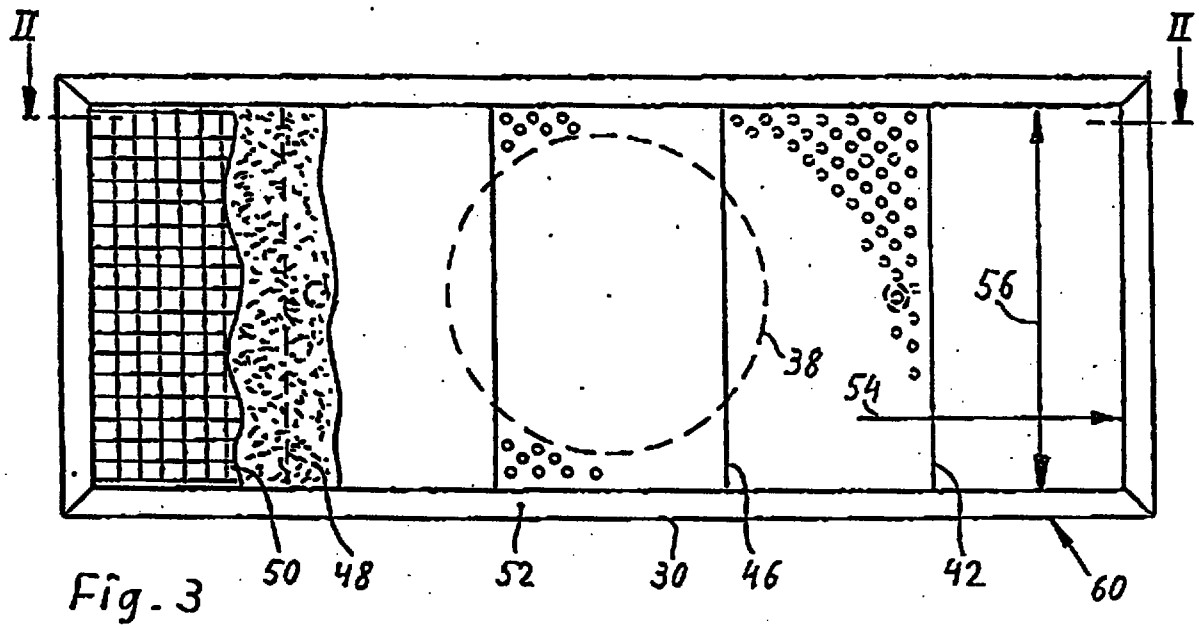
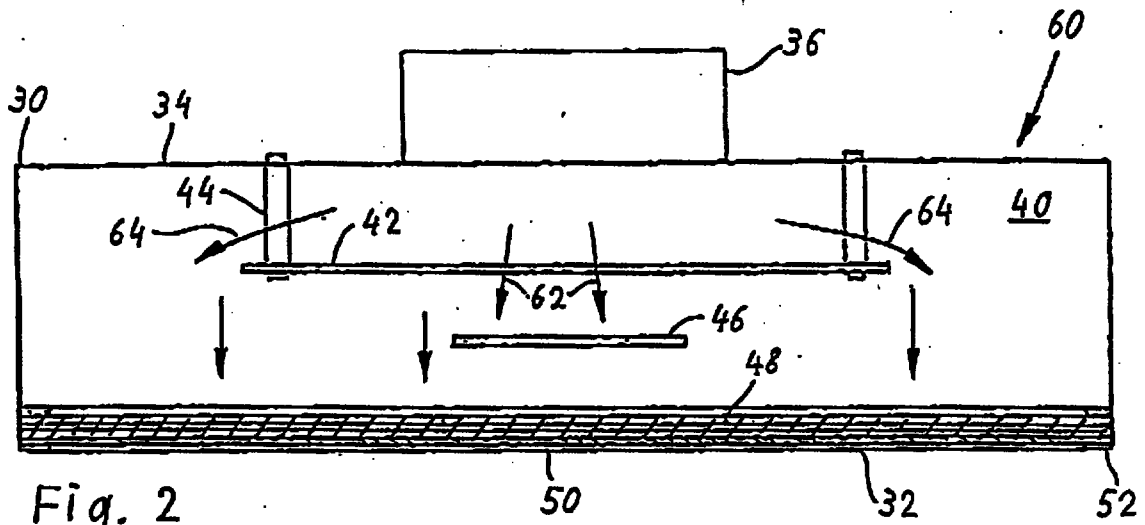


Fig. 1





REPLACEMENT SHEET

28 SEP 1996

20 AUG 1999

- ☒ Description : paged 1... to paged 1...
☒ Claim(s) : paged 2... to paged 2...
☐ Drawing(s) : paged to paged
☐ Abstract : paged to paged

20/8/99
Process and Device of RECEIVING Air Conditioning
of a Weaving Machine

The invention relates to a process for the air conditioning of a weaving machine according to the preamble of Claim 1, and to a device for the air conditioning of a weaving machine.

5 With the objective of reducing the interruptions of operation of powerful weaving machines, which interruptions result mainly from thread breakages, attempts have been made for a relatively long time to optimize the weaving conditions. Endeavours to achieve this objective
10 just by influencing the space air conditioning of a weaving machine room result in a large volume flow of air, with a large power requirement per machine.

 However, in connection with dust removal, processes are also known by which the climate directly at the
15 weaving machine is influenced. In a known process of this type, conditioned air is supplied both via ceiling outlets distributed within the room and also through local outlets. In this case, for each machine a local outlet is provided, which exhibits a slot-shaped exit
20 opening at a spacing above the warp. In another known process, the local outlets are disposed below the weaving edges. In both cases, the exit opening extends approximately transversely to the warp over its full width and releases a jet of conditioned air, which jet is
25 directed towards the warp.

 Local air outlets underneath the weaving machine are also known, for example from the printed documents EP-A1-0 137 056 and DE-B-2 203 900. Both of these air outlets, provided in the floor of the weaving machine
30 room, pursue the objective of blowing out conditioned air into the room, under the machine, at low velocity. To this end they have a large-area exit opening, running transversely with respect to the said machine, and being fitted with an air-permeable, convexly curved distribution component. The air outlet according to the first
35 document is provided, in relation to the weaving machine, in the region underneath the warp. The air outlet according to DE-B-2 203 900 has, connected upstream of the distribution component arranged at the exit opening,

further walls with openings, acting as distribution components.

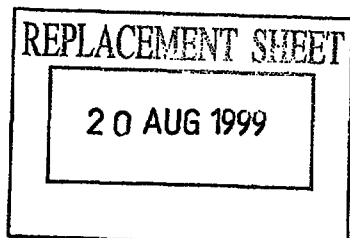
In a report entitled "Weaving machine dust removal and air conditioning of a weaving machine - a conflict?" (Dr.-Ing. Helmut Weinsdörfer, Dipl.-Ing. Ulrich Stark), presented on the occasion of the 6th Weaving Industry Colloquium (16/17 October 1990) and published by the Institute for Textile and Process Technology, 7306 Denkendorf, Germany, an experimental arrangement is described which exhibits a local outlet of the above type, which outlet is directed vertically from above onto the back shed.

In the majority of cases, the air conditioning of the machine using local outlets brings, related to the frequency of thread breakage, a marked improvement as compared with applications in which an influence is exerted on the humidity conditions at the weaving machine only via the space air conditioning. In addition to this, there is also a considerably lower power requirement. However, in order to achieve satisfactory results it is still necessary to generate considerable volume flows of air, and as far as the operating costs are concerned the increased maintenance effort for the cleaning of the local outlets is also significant.

The object of the invention is to provide a process which brings an effective conditioning with a considerable reduction of the air conditioning costs per weaving machine by reduced power requirement and volume flow of air as well as lower water consumption, without creating an impermissible obstruction in visual terms or for accessibility.

The object of the invention is achieved by the measures of the defining clause of Claim 1. Further features of the process are explained in Claims 2-4.

In the present context, a piston-type displacement flow is understood as referring to a low-turbulence flow with a distribution which is approximately uniform over its full cross-section and approximately equal velocity. In this case, exit velocities between 0.3 and



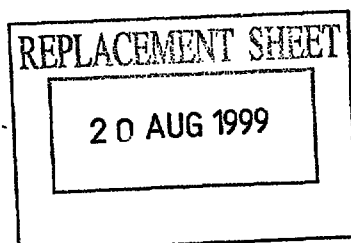
1.2 m/sec enter into consideration.

The invention is based on the finding that the transport of the moisture by an air jet blown out from a slot-shaped exit opening is of low effectiveness and is therefore uneconomic. What is responsible for this is mainly the relatively high exit velocity which is required for the throughput of the required quantity of air. Investigations demonstrate that in the first instance a considerable part of the conditioning air blown out does not reach the (still noninterwoven) warp threads. Subsequently, a part of this air rebounds at the warp, without being able to give off its humidity. This means that considerably more conditioned air must be conveyed than comes into action at the warp to achieve the relative humidity aimed at.

The displacement flow employed according to the invention permits a quite considerable reduction of the required exit velocity as compared with that from a slot-shaped exit opening, with an equal path to be traversed to reach the warp.

By virtue of the displacement flow which is in practice compact but which impinges on the warp at a low velocity, this flow does not rebound, but is mainly deflected. This deflection takes place gently and while preserving the piston-type nature, in order to flow away along the warp threads, mainly in the direction of the warp beam. This gives an optimal utilization of the conditioning air and it becomes possible to influence directly the humidity of the warp threads themselves, in order to condition these for the subsequent processing. With relatively small quantities of air and a low water requirement, optimal humidity is thus created directly at the warp, and the latter is kept to a high degree dust-free. Accordingly, the air conditioning costs may be considerably reduced.

As a result of the particular properties of the piston-type displacement flow, only a negligible quantity of surrounding air is set into motion by inductive means. Consequently, virtually no transport of such surrounding



air in the direction of the warp is initiated. This is of importance in circumstances in which the relative humidity in the weaving room is considerably below the optimal values and can counteract the positive influence of the conditioning air at the warp.

The piston-type displacement flow permits the creation and maintenance, within its cross-section, of conditions which are different from those of the surroundings. By designing the cross-sectional shape and dimensions, it is accordingly possible to control the climate of each respective zone at a textile machine with respect to required properties. The entry of entrained matter and dust from the surroundings into this zone is likewise prevented. If this is required, it is accordingly also possible to control at a machine or within the delivery region of the textile material, a plurality of zones, by a respective piston-type displacement flow; in this case, the climatic conditions in these zones can be designed to be different. Accordingly, piston-type displacement flows may be employed with advantage also for the air conditioning of other textile procedures and processes such as for example in carding, in depositing, storage and take-up of the slubbing from the can, in stretching and spinning, as well as in twisting.

The experience gained in the application of the process according to the invention as well as in the operation of the device which is likewise according to the invention has shown that the avoidance of the circulation of surrounding air also has a beneficial effect in the sense of the reduction of the maintenance expenditure, especially with regard to cleaning in the region of the local outlets.

The device according to the invention is defined in Claim 5. Further features are explained in Claims 6-9. The invention is furthermore defined in Use Claim 10.

The process according to the invention and the device according to the invention are explained in greater detail hereinbelow with reference to an illustrative embodiment relating to the air conditioning of a

REPLACEMENT SHEET

20 AUG 1999

weaving machine as well as with reference to the drawing.
In the drawing:

Fig. 1 diagrammatically shows the conditions at a
weaving machine equipped with a device according
5 to the invention, in the application of an
embodiment of the process;

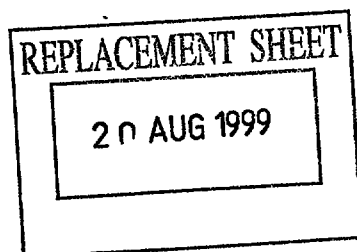
Fig. 2 shows a vertical cross-section along line II-II
in Fig. 3, through the local outlet of the device
according to Fig. 1, which local outlet is shown
10 on an enlarged scale, and

Fig. 3 shows a bottom plan view of the local outlet
according to Figs. 1 and 2, partly broken away.

In Fig. 1, reference numeral 2 generally design-
ates a weaving machine having a warp beam 4, thread stop
15 motions 6, a heald frame assembly 8, a slay 10, and a
cloth beam 12. The warp threads which pass over a back-
rest 14 and which form the warp 16 are designated by 18
and the back shed of the shed adjoining the thread stop
motions 6 is indicated at 20.

20 In the illustrative embodiment shown, a local
outlet 22 is disposed above the weaving machine 2 and at
a spacing from the warp 16 or the back shed 20, which
local outlet is supplied with conditioned air via a
line 24 from an air conditioning plant 26. The local
25 outlets of all further weaving machines of the weaving
room (not shown) are also connected to the same air
conditioning plant 26. The local outlet 22 possesses an
exit opening 32 directed downwards towards the warp 16
and extends horizontally over the entire working width of
30 the weaving machine 2; in this case, the exit opening is
directed approximately at right angles to the general
extent of the warp. The design of the local outlet is
evident from Figs. 2 and 3.

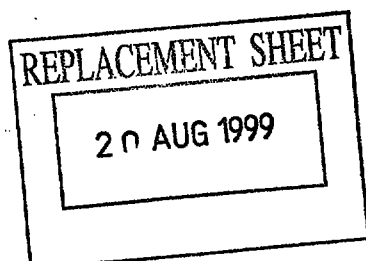
As may be inferred from the cross-sectional
35 representation of Fig. 2, the local outlet 22 comprises
a box 30 of elongate form with uniform rectangular cross-
section over its longitudinal extent. The box 30 is
closed on all sides with the exception of the bottom
surface forming the exit opening 32. At the top sur-



face 34 of the box 30 there is provided, approximately at the longitudinal centre thereof, a cylindrical connecting piece 36 for connection with the line 24, which connecting piece is connected with the inner space 40 of the box
5 via a circular inlet opening 38 (shown in broken lines in Fig- 3) of the same internal cross-section. The bottom surface and the top surface represent the wide sides of the rectangular cross-sectional shape of the box.

The inner space 40 contains distribution components to distribute uniformly the air flowing in through the inlet opening 38 over the surface of the exit opening 32 and to generate the displacement flow which is provided according to the invention. These distribution components comprise, seen in the direction of flow, a
10 perforated sheet 42 which extends parallel to the top surface 34, but at a spacing from the latter, over a central longitudinal region and the full width of the inner space 40. The length of the perforated sheet 42 secured by means of bolts 44 to the top surface 34 of the
15 box 30 is greater than the diameter of the inlet opening 38, but smaller than the length of the inner space. Below the perforated sheet 42 there extends, likewise parallel to the top surface 34 over the full width of the inner space 40, a further perforated sheet 46, which is
20 secured to the side walls of the box 30 or is supported in an appropriate manner on the bottom surface. In the longitudinal direction of the inner space 40 the extent of this perforated sheet 46 is restricted to an amount which is somewhat smaller than the diameter of the inlet
25 opening 38. The passage cross-section formed by the perforating of the perforated sheets 42 and 46 accounts for preferably between 35 and 45 %, related to the surface area thereof.

There finally follows, as the last distribution
35 component in the inner space 40 of the box, an air-permeable mat 48, for example of an appropriate foam material, which mat is clamped between a peripheral flange 58 of the box and a grid 50. Mat 48 and grid 50 extend over the full length and width of the inner space. The grid 50,



which is formed, for example, by a wire grid of relatively large mesh width, is supported on a narrow frame 52, which is provided at the bottom surface of the box. The frame 52 limits the exit opening 32 by the length 54 and the width 56. Preferably, the mat 48 is fitted in the box for example by demountability of the frame 52, so that its accessibility for the purpose of exchange is possible at any time. A foam material with a pressure loss of 15 - 20 Pa at 0.6 m/sec has proved to be suitable for the mat 48.

Together with the distribution components 42, 46, and 48, the box 30 represents an air distributor 60. The described design and arrangement of the distribution components in this box give a stepwise distribution of the air flowing in through the inlet opening 38 into the inner space 40. As a result of the perforated sheet 42, which, also acting as baffle plate, lies opposite the inlet opening, only a part of this air can pass through in the direction of the arrows 62, while the remainder is deflected to opposite sides in the longitudinal direction of the inner space 40 with low pressure loss, without having to overcome an impediment to flow on the further path to the mat 48, i.e. in the direction of the arrows 64. In order to reduce the velocity in the partial stream flowing without deflection in the direction of the arrows 62, this partial stream must still overcome the perforated sheet 46. The partial streams 62 and 64 thus arrive at approximately the same velocity at the mat 48. Besides a further balancing, a fine distribution of the air takes place at the mat 48 and upon passing through the latter a piston-type displacement flow formed of the finest stream lines is created. For the outlet velocity, in the present context a restriction to values of between 0.5 and 0.8 m/sec is appropriate. Thus, the quantities of air may be designed to be different, within certain limits, even in the case of the same dimensions of the air distributor 60.

In operation, the air conditioning plant delivers conditioned air, which emerges from the local outlet 22

REPLACEMENT SHEET

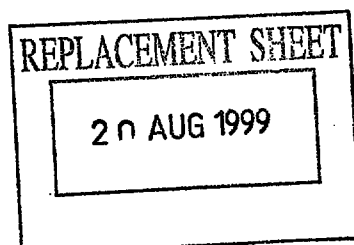
20 AUG 1999

(Fig. 1) formed by the air distributor 60, as a piston-type displacement flow 70, e.g. with an outlet velocity of 0.6 m/sec vertically downwards and in this case exhibits a width of for example 300 mm, depending upon the dimension 56. The displacement flow traverses the distance, amounting for example to 0.9 m, to the upper group of warp threads 20' of the shed 20 in compact form, and impinges on said group upstream of the heald frame assembly 8. Upon impinging on said group as well as on the lower group of warp threads 20'', the air is deflected at least as the major partial stream 72 towards the thread stop motions 6 and flows along the warp threads 18 counter to their direction of delivery. A partial stream 74 flows in the shed region along the corresponding warp threads and flows away downwards between these. In this case, both partial streams of this air create in the environment of the warp 16 a climate which is suitable for the transport and the processing, in that heat and dust are conducted away and the relative humidity is kept at an advantageous value. Since the warp threads 18 are circumcirculated by the stream over a relatively long period of time, a direct moisture take-up also takes place, which has a favourable effect both for the weaving process and also for the water consumption. In particular, this applies to the influence of the partial stream 72, which flows along the warp threads, envelops these and screens them off in relation to the surrounding air.

A spacing of approximately 1.2 m of the local outlet from the warp running therebelow represents an upper limit on economic grounds.

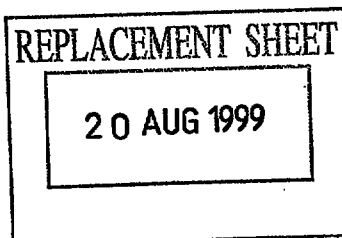
It should be added that below the weaving machine 2, expediently in a manner known per se, a floor opening 80 is provided, via which dust-laden air is transported away.

It has proved to be the case that the arrangement of the local outlet 22 so that the displacement flow 70 impinges on the upper group of warp threads 20' at an acute angle greatly favours the deflection of the same or



the formation of a relatively large partial stream 72 and an orientation of the same parallel to the warp threads. Since an effective conditioning of the warp threads 18 can be achieved only over a sufficiently long period of action, this partial stream acts as its own conditioning medium. With the objective of a long period of action of the air streams 70 and 72 respectively, the arrangement of the air outlet 22 so that the stream 70 impinges on the warp 16 or the back shed 20 directly behind the heald frame assembly 8 is advantageous. On the other hand, in the case of such an arrangement an air build-up takes place at that side of the heald frame assembly which faces the back shed 20, which air build-up assists the deflection of the partial stream 72.

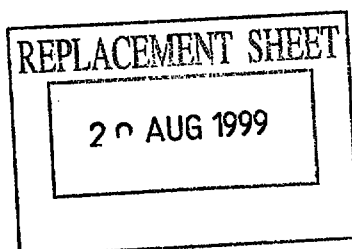
Where the conditioning is also to take place in the region of the front shed or of the gate for the weft thread spools, according to the invention additional outlets similar to the local outlet 22 are to be provided for this purpose, which additional outlets are supplied from the air conditioning plant 26. Just like the local outlet 22, these outlets are also to be provided in the form of elements separate from the weaving machine.





NEW CLAIMS

1. Process for the air conditioning of textile machines, in which there is generated for each textile machine, at a spacing from its textile material, at least one conditioning air stream, directed downwards towards the latter, characterized in that the conditioning air is transported in the form of a piston-type displacement flow to the textile material.
2. Process according to Claim 1, for the air conditioning of weaving machines, in which the conditioning air stream is directed towards the warp, characterized in that the conditioning air is transported by the displacement flow to the warp threads.
3. Process according to Claim 1, characterized in that the warp threads are conditioned by a partial stream of the displacement flow, which partial stream flows along these.
4. Process according to Claim 1, characterized in that, after deflection, the displacement flow directed onto the back shed is guided along the warp threads in the direction of the side of the warp beam.
5. Process according to one of Claims 1, 2 or 3, characterized in that a maximum outlet velocity of 0.9 m/sec is imparted to the displacement flow.
6. Device for the air conditioning of textile machines, with at least one local air outlet (22) for each textile machine (2), which outlet is intended to be connected via an inlet opening (38) to an air conditioning plant (26) and has an air distributor (60) with a plurality of sheet-like distribution components (42, 46, 48) connected in series in the direction of flow, as well as an outlet opening (32) which is intended to be arranged transversely to the textile machine at a spacing from the textile material, characterized in that the outlet opening is intended to be oriented towards the textile material (16), in order, by means of the distribution components, to distribute the air in a piston-like displacement flow over a width of the outlet opening of at least 150 mm.





7. Device according to Claim 6, characterized in that the distribution component (48) which is last in the direction of flow has a pressure loss of 15-20 Pa at 0.6 m/sec.
- 5 8. Device according to Claim 6 or 7, for the air conditioning of weaving machines, with at least one local air outlet (22) for each weaving machine (2), characterized in that the outlet opening (32) is intended to be oriented towards the warp (16).
- 10 9. Device according to one of Claims 6-8, characterized in that the outlet opening (32) of the air outlet (22) is provided at a wide side of a box (30), which forms the air distributor (60) and which is approximately rectangular in profile and the cross-section of which, parallel to the wide side, approximately corresponds to the cross-section of the outlet opening.
- 15 10. Device according to one of Claims 6-9, characterized in that the air distributor (60) has, opposite the inlet opening (38), a distribution component (42) as a baffle component, and in that the distribution component connected upstream of the outlet opening (32) is formed by a perforated sheet (46) and the last distribution component is formed by an air-permeable mat (48).
- 20 11. Device according to Claim 10, characterized in that the perforated sheet (46) and the mat (48) are arranged parallel to the outlet opening (32).
- 25 12. Device according to one of the preceding claims, characterized in that the air distributor exhibits at least one lateral outlet opening.
- 30 13. Use of a local air outlet, which is connected to an air conditioning plant and generates a piston-type displacement flow, for the air conditioning of a textile machine, especially of a weaving machine.

