United States Patent

Berg et al.

[15] **3,668,787**

[45] **June 13, 1972**

[54] VENTILATING DEVICE FOR A MULTICYLINDER DRIER

[72] Inventors: **Nils-Christian Berg**, Turuku; **Mauri Aatos Soininen**, Naantali, both of Finland

[73] Assignee: **Valmet Oy**, Helsinki, Finland

[22] Filed: **Sept. 1, 1970**

[21] Appl. No.: **68,684**

[52] **U.S. Cl.** **34/111**, 34/116

[51] **Int. Cl.** **F26b 11/02**

[58] **Field of Search** 34/111, 116, 117, 123

[56] **References Cited**

UNITED STATES PATENTS

3,110,575 11/1963 Justus 34/111

3,376,653 4/1968 Daane 34/111

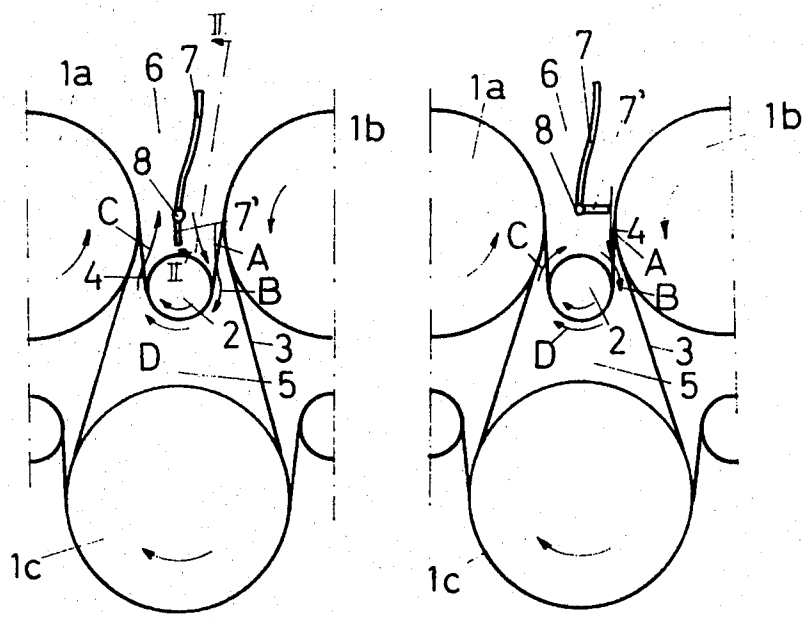
Primary Examiner—Carroll B. Dority, Jr.

Attorney—Richards and Geier

[57] **ABSTRACT**

A device is used for ventilating a pocket of a multicylinder drier. The pocket consists of a felt guided by a felt roll. A partition extends transversely to the felt and is located opposite the felt roll belonging to the pocket. The invention is particularly characterized in that the marginal part of the partition pointing toward the felt roll consists of sections each of which has its own adjusting device so that a gap of desired width for the flow of air may be produced between the surface of the felt roll and the edge of the section.

6 Claims, 8 Drawing Figures



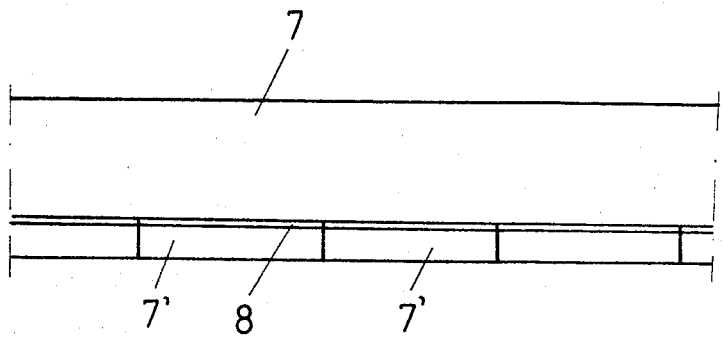


Fig. 2

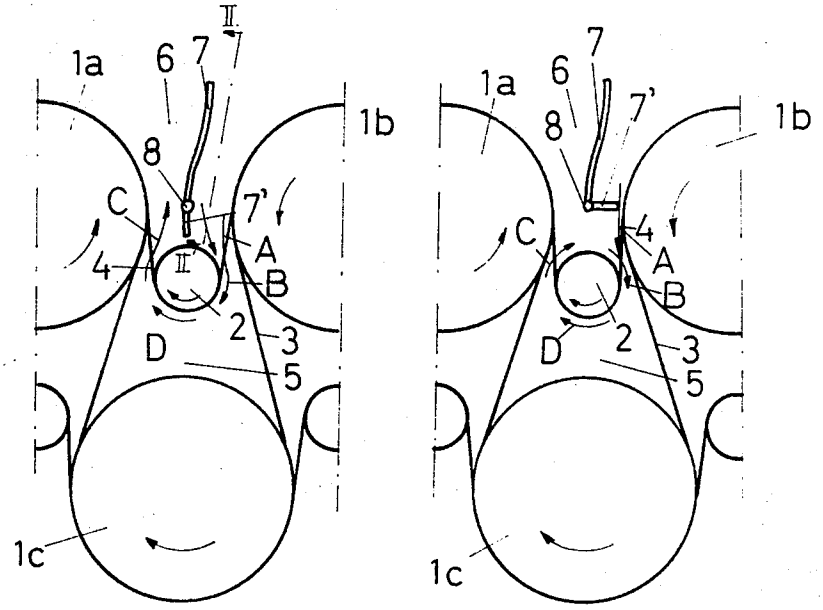


Fig. 1

INVENTORS
NILS-CHRISTIAN BERG
MAURI AATOS SOININEN

Richard J. Gallo

ATTORNEY

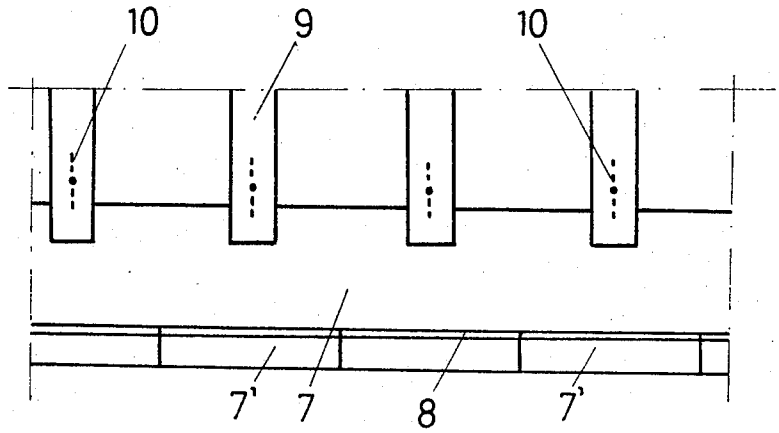


Fig.4

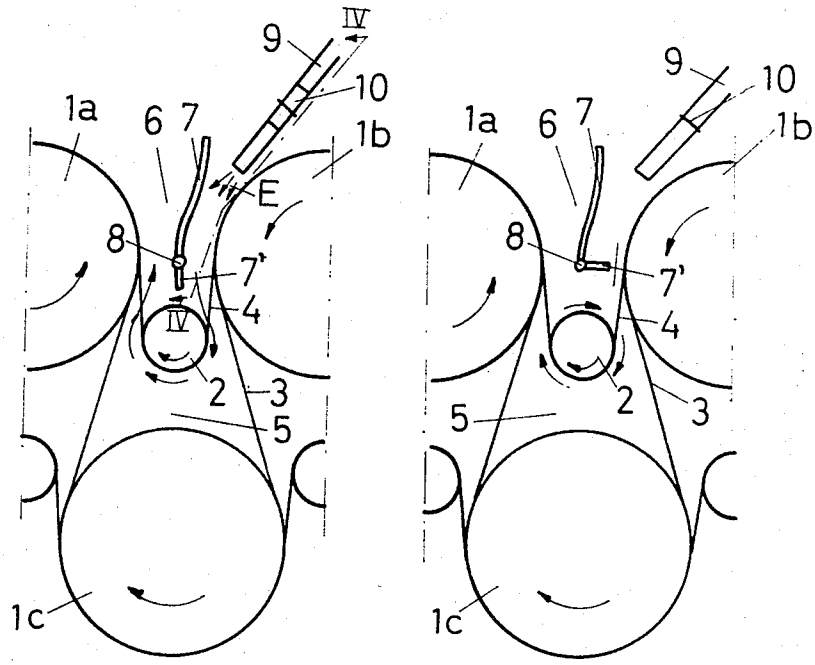


Fig.3

INVENTORS
NILS-CHRISTIAN BERG
MAURI AATOS SOININEN

Richards & Geier

ATTORNEYS

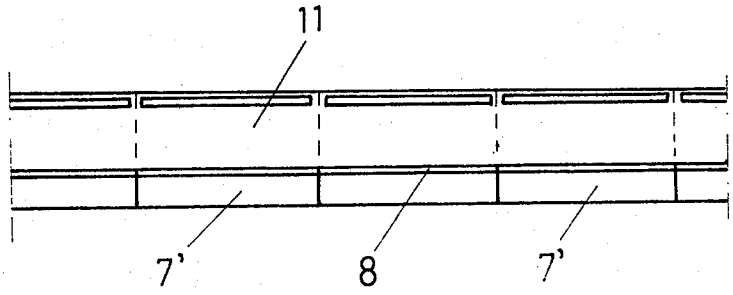


Fig. 6

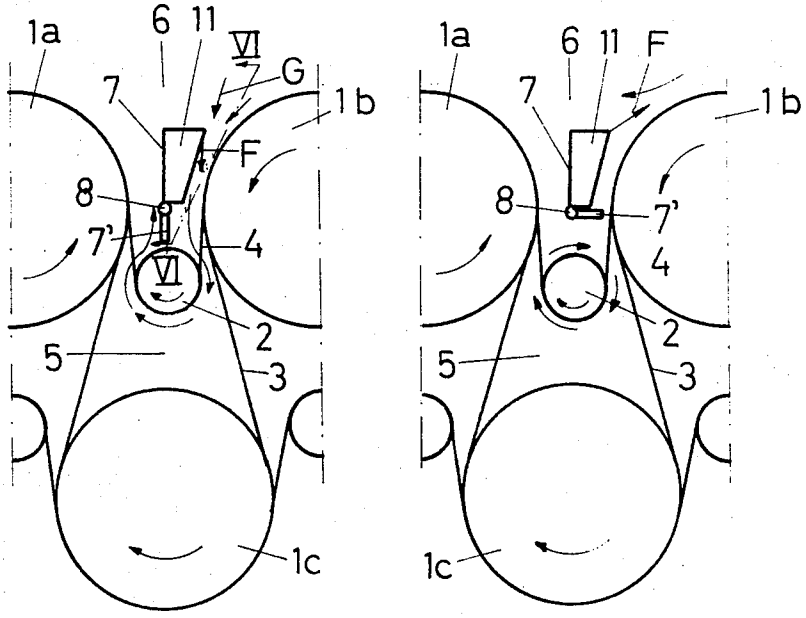


Fig. 5

INVENTORS
NILS-CHRISTIAN BERG
MAURI AATOS SOININEN

Richards & Geier

ATTORNEYS

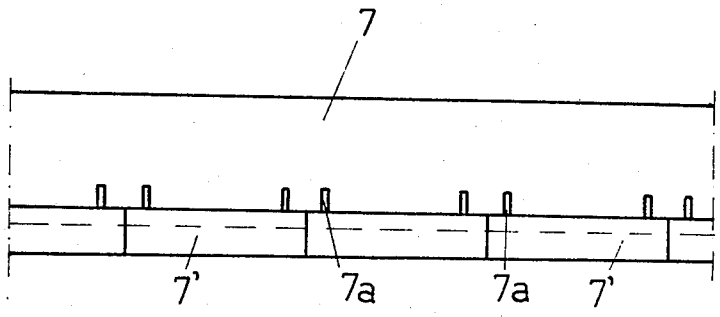


Fig.8

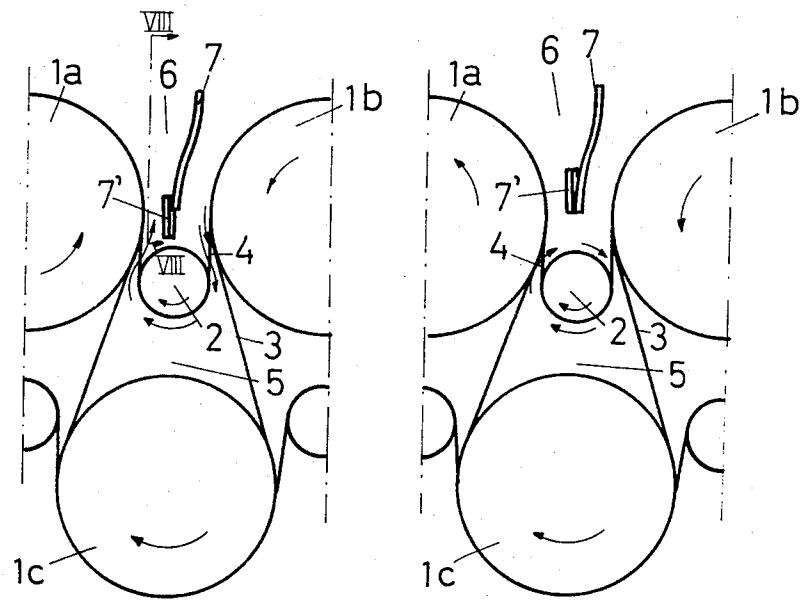


Fig.7

INVENTORS
NILS-CHRISTIAN BERG
MAURI AATOS SOININEN

Richards & Geier

ATTORNEYS

VENTILATING DEVICE FOR A MULTICYLINDER DRIER

The present invention concerns a device for ventilation of a pocket in a multicylinder drier provided with felts permeable to air, which pocket consists of a space open at its end and confined by a felt guided by a felt roll, by two freely travelling web runs and by the surface of the drying cylinder between them, the device consisting of a partition transversal to the felt and placed opposite to the felt roll belonging to the pocket on the outside of the pocket between two drying cylinders, one edge of the partition extending close to the surface of the felt roll and said partition dividing the space between the drying cylinders into two parts from one of which an air current induced by the running of the machine flows in the direction into the pocket and into the other of which air flows from the direction of the pocket.

It is known in previous art that ventilation is poor in the pockets of a multicylinder drier, which pockets are found under the upper cylinders and above the lower cylinders, and which fact results in lowered drying efficiency of the machine and in non-uniform moisture profile of the web which is being dried because as a rule the humidity of the air in the pockets is higher in the center of the pocket than at its ends. The drying felt has previously been impermeable to air. Nowadays the use of a drying felt permeable to air, a so-called drying wire, has been increasingly adopted. It is to be noted that then currents passing through the drying felt are produced by the rotating parts of the machine and by the moving drying felt, which are directed on one hand from the spaces surrounding the pockets into the pockets and on the other hand from the pockets into the spaces surrounding them. As a consequence, the ventilation of the pocket is considerably improved, whereby the drying efficiency of the machine and the uniformity of drying are increased. It is obvious that the air flows passing through the felt are greater accordingly as the speed of operation of the machine is higher. It is furthermore known in previous art to place in the space outside the pockets additional devices which are used by means of various blowing actions to boost the flow through the felt or by means of which the state of the air passing through the felt is so controlled that the uniformity of moisture content of the web in the cross-machine direction improves. It has been observed that in fast-running driers the flow from the spaces surrounding the pockets through the wire into the pockets as a rule is a multiple of the drying air flow which is available for additional devices improving the ventilation. For this reason in fast machines the possibilities of influencing both the state and quantity of the air flowing into the pockets decrease with increasing operating speed. Quite often, in addition, the air flow into the pockets has such high magnitude that its increase is in fact detrimental.

The observation may also be made that all the air flowing into the pocket is not fresh air arriving from the surroundings but that part of it is air which circulates around the roll, without in actual fact contributing in any way to the ventilation of the pocket. This circulation, which is useless from the viewpoint of ventilation, constitutes a very remarkable fraction of the total flow into the pocket.

It has further been found by measurements that if in the space outside the pocket, opposite to the felt roll, an appropriately shaped partition is placed, which extends close to the surface of the felt roll, the flow into the pocket is not substantially changed from the situation prevailing in the absence of such a partition. The air flow has in fact even been noted to increase thanks to the partition. It is then important, in order that the ventilation of the pocket might improve, that the air flow circulating around the felt roll cannot reenter the pocket, instead of which only fresh air from one side of the partition from above the felt roll can flow into the pocket. It is not possible, however, with the aid of the partition to influence the operation so as to achieve a uniform moisture profile of the web.

The object of the present invention is to accomplish for the drier a device by the aid of which good ventilation of the pockets can be achieved and by means of which the moisture profile of the web can be influenced, utilizing the observations

described above. The invention is characterized in that opposite to the felt roll, outside the pocket, between two drying cylinders has been placed a partition with its marginal part pointing towards the felt roll consisting of sections placed in continuation of each other in the cross-machine direction, each section individually being provided with regulating devices for such adjustment that it is possible to produce between the surface of the felt roll and the section (the edge) a gap of desired magnitude, through which the air can flow in the direction of rotation of the felt roll from one side of the partition to the other. The sections of the edge portion of the partition pointing towards the felt roll may be turnably attached to the partition. Also, the partition in its entirety or at least its marginal part closest to the felt roll may consist of sections transversal to the felt which have been arranged to be movable radially with reference to the surface of the felt roll, like shutters. It is advantageous to place on the side of the partition from which flow into the pocket takes place, a fresh-air-introducing nozzle with closing device corresponding to each section in the marginal portion of the partition, the closing device of which has been arranged to operate so that when the free edge of the section of the partition is in its position closest to the felt roll the closing device is open and thus causes flow, while it is closed in the position in which the gap between the section and the felt roll is largest.

It is advantageous if the partition consists of an air feed box which has as its continuation a marginal portion provided with sections, and if in the slice nozzle there is an adjustable nozzle corresponding to each section, which supplies air into that space between the partition and a drying cylinder from which flow into the pocket takes place and the nozzle-closing devices have been arranged to operate so that when the section is in its position pointing towards the felt roll the nozzle is open and air flows from it in a direction parallel to the section towards the felt roll, while when the section is in the position in which the gap between it and the felt roll is open the air flow is directed against the drying cylinder. Between the sections in the margin of the partition pointing towards the felt roll there may be partitions running in the web direction, which mainly serve the purpose of preventing flows in the direction across the web in the space between the partition and drying cylinder from which air flows towards the pocket. The said partition may consist of an air curtain.

Since in a device according to the invention opposite to the felt roll belonging to the pocket, outside the pocket, there has been placed a partition transversal to the felt and extending close to the surface of the felt roll, the edge of this partition pointing towards the felt roll having sections lying side by side and each of which is individually adjustable so that the gap between the section and the felt roll can be made to have desired magnitude, it is possible to control the flow into the pocket at the points desired so that the moisture profile of the web will be uniform.

The invention is described in closer detail with reference to the embodiment examples presented in the attached drawings.

In the drawings,

FIG. 1 presents schematically part of a multicylinder drier according to the invention, in elevational view.

FIG. 2 shows an element belonging to the multicylinder drier according to FIG. 1, viewed from the direction indicated by the line II—II in FIG. 1.

FIG. 3 presents a multicylinder drier according to another embodiment of the invention, in elevational view.

FIG. 4 shows an element belonging to the multicylinder drier according to FIG. 3, viewed in the direction indicated by the line IV—IV in FIG. 3.

FIG. 5 presents a multicylinder drier according to a third embodiment of the invention, in elevational view.

FIG. 6 shows an element belonging to the multicylinder drier according to FIG. 5, viewed in the direction indicated by the line VI—VI in FIG. 5.

FIG. 7 presents a multicylinder drier according to a fourth embodiment of the invention, in elevational view.

FIG. 8 shows an element belonging to the machine according to FIG. 7, viewed in the direction indicated by the line VIII—VIII in FIG. 7.

To a multicylinder drier belong the drying cylinders in the upper row (in FIGS. 1, 3, 5 and 7 of the drawing only two drying cylinders 1*a* and 1*b* shown) and the drying cylinders in the lower row, of which in the drawing only one cylinder 1*c* has been shown. In the spaces between the drying cylinders in the upper row of the multicylinder drier there is always one felt roll 2, and between the drying cylinders in the lower row, correspondingly also one felt roll. The drying felt 4 is carried from the drying cylinder 1*b* in the upper row over the felt roll 2 to the drying cylinder 1*b* in the same row. The drying felt travels from a drying cylinder in the lower row in analogous manner to another drying cylinder. The web which is being dried, 3, passes as even previously from the drying cylinder 1*b* in the upper row to the drying cylinder 1*c* in the lower row and hence further to the drying cylinder 1*a* in the upper row. For this reason in the multicylinder drier pockets 5 with open ends are formed, as before. Arrows in the figures indicate the directions of rotation of the drying cylinders 1*a*, 1*b* and 1*c* and of the felt roll 2.

In the multicylinder drier shown in FIG. 1 there has been placed outside the pocket and in the space 6 between two drying cylinders 1*a* and 1*b* a partition 7 according to the invention transversely to the felt, the marginal portion of this partition which points towards the felt roll 2 consisting of sections 7′ located side by side in the direction across the felt, which have been attached to the partition 7 by hinges 8 and each of which can individually turn about its hinge. Each section has been connected for the purpose of turning to an adjusting device of its own, not shown in the drawings. When the said sections form a direct continuation of the partition 7, they extend quite close to the felt roll. This position of the partition is illustrated by the left part of FIG. 1. In this case, when the machine is running, the air entering the pocket 5 through the felt comes in its entirety from the space on the right side of the partition 7 in the direction of arrows A and B. As a consequence, no whorl encircling the felt roll 2 can be formed. Opposite to a section in such position the air in the pocket 5 is dry because as a rule air arriving in the direction of arrows A and B is dry compared to the air escaping from the pocket in the direction of arrow C, return of this air, at least its immediate return, into the pocket 5 being prevented as a result of the position of the section 7′. If one of the sections is in the upturned position, which is illustrated by the right half of FIG. 1, a gap is formed between this section and the surface of the felt roll. As a result, a whorl is formed opposite to the section around the felt roll 2, which is indicated by the arrows B, D and C. In this case only part of the air entering the pocket 5 is dry air, namely that arriving in the direction of arrow A. Since furthermore, in this position, the section throttles the total flow of air into the pocket, the humidity of the air in the part of the pocket corresponding to the section in question will be higher than the humidity in the parts governed by sections which have not been turned up. It is thus seen that one may achieve in the pocket 5 alternating dryer and more humid zones and thus exert an influence on the rate of drying with the aim of attaining as uniform final drying of the web in the cross-machine direction as possible.

The multicylinder drier presented in FIGS. 3 and 4 differs from that shown in FIGS. 1 and 2 only in that it comprises a nozzle arrangement, and corresponding parts have been denoted with the same reference numerals in said figures. The said nozzle arrangement merely serves the purpose of boosting the action of the machine. The nozzle unit has been placed in the space between the partition 7 and the drying cylinder 1b, and it has been connected with an air header unit for supplying fresh air into the said space. In the said nozzle unit there is for each section 7′ on the margin of the partition 7 a corresponding nozzle 9 provided with a closing device, a flap, 10. The flap 10 of each nozzle 9 has been connected to cooperate with its own section 7′ so that their operation is as follows.

The closing device, the flap, 10 of each nozzle has been connected with the respective section 7′ by means of some devices known in themselves, not depicted in the drawing, so that the flap is in its opened position when the section 7′ is closest to the felt roll and prevents circulation around the roll, in which instance fresh air flows in the direction of arrows E at the point governed by the section in question into the space between the partition 7 and the drying cylinder 1*b* and thence into the pocket 5, as has been shown in the left part of FIG. 3, whereas the flap 10 is closed when the section 7′ is in a position such that a gap is formed between it and the felt roll, which permits formation of a whorl encircling the felt roll; this situation is illustrated by the right half of FIG. 3. It is seen that in this manner drier and more humid zones can be produced in the pocket, with the result that uniform drying of the web in the cross-machine direction is achieved.

In FIGS. 5 and 6 a multicylinder drier has been presented which differs from the multicylinder drier shown in FIGS. 1 and 2 only in that the partition 7 has been shaped to constitute a blow box 11, into which air is supplied with the aid of blowers and of a pipe system, and corresponding parts in said figures are indicated by identical reference numerals. In said blow box 11 there is for each section 7′ in the marginal part of the partition a corresponding nozzle slit, from which air is discharged into the space between the partition 7 and the drying cylinder 1*b*, the direction of air flow depending on the position in which the section 7′ is. When the section 7′ is in a position such that only a narrow gap remains between the section 7′ and the surface of the felt roll, that is in the position shown in the left part of FIG. 5, then the air flow is directed as arrow F indicates towards the felt roll and introduces fresh air into the space between the partition 7 and the drying cylinder 1*b* and also permits flow of air from the surroundings in the direction of arrows G into said space, in addition to which it may perhaps even increase the said flow by its injector effect. If the section 7′ in the marginal part of the partition is in its upturned position, as in the right half of FIG. 5, whereby there remains between the section 7′ and the surface of the felt roll 2 a gap which permits circulation around the felt roll 2, an air curtain is directed across the space between the partition 7 and the drying cylinder 1*b*, as the arrow F indicates. In this case the flow of air from the surroundings into said space is inhibited or at least impeded. It is thus seen that in the pocket 5 zones with various moisture contents can be produced. By appropriate regulation of the sections, uniform drying in the cross-machine direction of the web which is being dried is achieved. The multicylinder drier presented in FIGS. 7 and 8 differs from the multicylinder drier shown in FIGS. 1 and 2 only in that the sections 7′ in the marginal strip of the partition 7 are adjustable in different manner, and corresponding parts in said figures have been denoted with identical reference numerals. The sections 7′ have been arranged to be displaceable in guides 7a on the partition 7 in the vertical direction of the partition. Each section 7′ has been connected in some manner known in itself with adjusting devices in order that the sections might be individually adjustable so that a gap of desired magnitude is achieved between the section and the surface of the felt roll. The action is similar to that of the machine presented in FIGS. 1 and 2. This multicylinder drier, too, can be provided with devices such as have been presented in FIGS. 3, 4 and 5, 6.

The invention is by no means confined merely to the embodiments presented in the foregoing, and it can be varied in numerous different ways within the scope of the invention.

We claim:

1. Device for ventilating a pocket (5) of a multicylinder drier provided with drying felts permeable to air, which pocket is defined by a felt (4) guided by a felt roll (2), by two freely travelling web portions (3) and by the surface of the drying cylinder (10) between them and is open at its ends, this device consisting of a partition (7) transversal to the felt and placed opposite to the felt roll (2) belonging to the pocket (5), outside the pocket (5) between two drying cylinders (1*a*, 1*b*)

and one edge of which extends close to the surface of the felt roll (2), said partition (7) dividing the space between the drying cylinders into two parts from one of which an air flow induced by the running machine flows in the direction towards the pocket and into the other of which air flows in the direction away from the pocket, characterized in that the marginal part of said partition (7) pointing towards the felt roll consists of sections (7') forming each others' continuations in the direction across the felt and each of which has been provided with individual adjusting devices for such adjustment that between the surface of the felt roll (2) and the edge of the section (7') a gap of desired width can be produced, through which air may flow in the direction of rotation of the felt roll (2) from one side to the other of the partition.

2. Device according to claim 1, characterized in that the sections (7') constituting the marginal part of the partition pointing towards the felt roll (2) are turnably attached to the partition (7).

3. Device according to claim 1, characterized in that the partition in its entirety or at least its marginal part closest to the felt roll (2) consists of sections (7') transversal to the felt (4) which are movable in radial direction with reference to the surface of the felt roll (2), like shutters.

4. Device according to claim 1, characterized in that on the side of the partition (7) from which flow into the pocket (5) takes place there has been placed corresponding to each section (7') of the partition a nozzle (9) introducing fresh air and provided with a closing device (10), its closing device being arranged to operate so that when the free edge of the section (7') is in its position closest to the surface of the felt roll (2) the closing device (10) is open, while it is closed when the section (7') is in the position in which the gap between the section (7') and the felt roll (2) is at its largest.

5. Device according to claim 2, characterized in that the partition consists of an air supply box under pressure and having a nozzle slit at each turnable section (7') in the marginal part of the partition which supplies air flow into the space between the partition and the drying cylinder from which flow into the pocket (5) takes place, and the sections (7') constituting the marginal part of the partition being arranged to operate so that when a section (7') is in its position pointing towards the felt roll (2) the nozzle is open and air flows from it parallel to the section towards the felt roll (2), but when the section (7') is in its upturned position, in which the gap between it and the felt roll (2) is open, the air flow is directed against the drying cylinder (1*b*).

6. Device according to claim 1, including means forming an air curtain between said partition and one of said drying cylinders.

* * * * *