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(54) **Roll**

Walze

Rouleau

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(73) Proprietor: **Voith Paper Patent GmbH**
89522 Heidenheim (DE)

(72) Inventors:
• **Reichel, Walter**
D-86407 Mering (DE)

• **Weinzettl, Michael**
A-2632 Wimpassing (AT)

(74) Representative: **Kunze, Klaus et al**
Voith Paper Patent GmbH
St. Pöltener Strasse 43
89522 Heidenheim (DE)

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EP 1 103 654 B1

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Description

[0001] The present invention relates to a roll, in particular to improvements in roll covers, applicable to all industrial rolls, but in particular to rolls used in the press-section or forming section of paper, pulp and board making machines.

[0002] It is known to use two adjacent rolls in paper machines and the like to provide a press-nip to dewater paper during its production. This usually involves feeding the paper between the two rolls and effectively squeezing the water out into an accompanying press felt or felts.

[0003] It is known to replace at least one of the plain rolls by a suction roll comprising a drilled shell and a suction box which is connected to a vacuum system and which pulls water through the drilled shell hence providing an easier escape route for the water pressed out of the paper. However, most of the expressed water must still travel laterally to reach a drilled hole. Also, there is a limit to the pressure that can be applied by a hollow perforated shell, therefore there is a reduced amount of water expressed in comparison to a plain roll. Furthermore, suction rolls are also prone to stress fatigue and can cause shadow marking on the paper.

[0004] To overcome this solid grooved rolls were developed, in which a continuous groove is cut spirally in the roll cover, the groove providing an easily accessible escape route for expressed water. The helically-cut grooves are typically 2.5 mm (0.1 inch) in depth, 0.5 mm (0.02 inch) wide on 3.2 mm (0.125 inch) centers (ie 8 grooves per inch). The maximum lateral distance for water travel in the grooved press is, therefore, only 1.3 mm (0.05 inch), as compared to typical figures of 5 mm and 20 mm, respectively, for the suction and plain presses.

[0005] A grooved roll is usually solid and a higher pressure can be applied at the nip in comparison to a suction roll, therefore more water can be expressed. However, the roll covers must be very hard to maintain groove integrity, and this can lead to damage of the paper.

[0006] In a blind drilled roll, the roll is drilled with small closely spaced holes. These holes self clear/empty by the action of the centrifugal force. Because of the greater void volume in comparison to a grooved roll, there is a lower risk of the holes closing, hence the blind-drilled hole can be a softer roll than that of a grooved-roll and therefore create less damage to the paper. However due to the nip pressure, air and water are forced into the blind-drilled hole and in order to prevent a stress fracture line from developing in the rolls, the blind-drilled holes do not have a constant depth but have a variety of different depths. This has the drawback that varying back pressures can occur resulting in shadow marking of the sheet and a working of the press-felt which reduces its longevity, especially in the presence of abrasive fillings such as calcium carbonate.

[0007] It is known to provide a combination of suction holes, blind-drilled holes and grooves in a polyurethane cover of a suction roll. The suction holes are through

bores extending all the way through the cover and mating with respective shell perforations. It is known to provide each through-bore with a diameter of 3mm which is equal to the diameter of the shell perforation. The blind-drilled holes are bored into the land area between the suction holes and have a diameter of 2.2 mm. The grooves are cut into the surface in order to further boost the open area. The smaller diameter of the blind-drilled holes in comparison to that of the suction holes has prevailed because of the danger of causing the remaining land areas to be lacking in substance. Despite its inherent toughness, polyurethane will break-off the roller surface if there is insufficient material present. The difference in diameter between the two types of holes creates a further pressure difference in addition to that provided due to the varying depths between the different depth of blind-drilled holes and now also the suction holes which increases the incidence of shadow marking of the paper and also working of the felt as described hereinabove. In order to try to reduce the incidence of shadow marking it is essential to increase the open area of the roll from 40% to 50% in order to reduce the hydraulic pressure in the pressure nip. This then reduces the stability of the holes and grooves in the more open roll cover surface resulting in a higher incidence of breakdown of polyurethane around the holes and grooves.

[0008] A roll according to the preamble of claim 1 is known from US-A-4 366 025.

[0009] It is an object of the present invention to provide a roll which overcomes or alleviates the above described disadvantages of the known rolls.

[0010] The object is solved by a roll comprising the features of claim 1.

[0011] In accordance with an embodiment of the present invention there is provided a roll cover for a roll, comprising an outwardly presented work-contacting surface which has an even distribution of bores of equal cross-sectional area.

[0012] This has the advantage that the equal distribution coupled with the equal diameter evens the pressure distribution and thereby reduces the incidence of shadow marking. Furthermore, the equality of the distribution and of the cross sectional area allows the reduction in the hydraulic pressure at the press-nip allowing the open area in the surface to be reduced yielding an improvement in the surface integrity.

[0013] Preferably the bores comprise blind holes and a continuous circumferential groove extends helically in and about the roll cover surface and cuts through each of the blind bores. This has the advantage that the blind-drilled holes serve as temporary pressure relief vessels at the mid point of the nip when water is being expressed and the grooves provide additional open area for the water to thereby further improve the pressure distribution and thereby more readily compensate for bores of different depths with a consequent reduction in the incidence of shadow marking. Allowing the provision of different depths of grooves improves the integrity of the structure

of the cover because of the further consequential reduction in hydraulic pressure leading to a further reduction in open area and increase in the surface integrity

[0014] In accordance with the present invention there is provided a roll cover for a roll, comprising an outwardly presented work contacting surface in which is provided a plurality of through bores and a plurality of blind-drilled holes, the cross-sectional area of each through bore being the same as that of each blind-drilled hole.

[0015] The equal surface area of the through-bores in comparison to the blind-bores improves pressure distribution as described with subsequent improvement of surface integrity.

[0016] A continuous circumferential groove is provided in said work surface. This provides an additional path for the expressed water.

[0017] Said groove connects the through bores.

[0018] Preferably, said groove connects the blind-bores and/or through bores. This has the advantage that the groove provides an additional channel for expressed water and thereby helps equalize pressure between the different depth of bores allowing the blind-bores to have a variety of depths and thereby reduce the occurrence of stress fractures. In known systems the grooves did not cut through, or pass by a substantially number of the different bores. -

[0019] Preferably, the groove extends helically about the work surface. By this means the groove can provide a more constant or continuous pressure relief channel and connect a larger number of bores.

[0020] Preferably, the groove has a semi-circular base. This has the advantage that it reduces frictional resistance to water flow therein.

[0021] Preferably there is an even distribution of through bores and/or of blind-drilled holes. The even distribution further enhancing said pressure distribution, which is more preferably improved if each through bore is surrounded by an even distribution of blind-drilled holes and more preferably each through bore is not immediately adjacent another through bore.

[0022] The roll cover is provided on a perforated hollow shell. This allows drainage to the interior of the shell.

[0023] The through bores in the cover are aligned with a respective shell perforation to provide a suction hole in the roll.

[0024] Preferably, the cross-sectional area of each shell perforations is greater than the cross-sectional area of each through bore. This allows the through bore to be reduced in diameter so as to be equal in size to the traditionally smaller blind-bores. This allowing a reduction in the surface open area with the advantages described above, whilst allowing the suction pressure to be maintained via the larger shell perforation which is enhanced by the reduced channel through the through bore.

[0025] In a preferred embodiment suction means is provided within the shell to draw water through the suction holes.

[0026] Preferably, the suction means is an internal foil

within the suction roll the activation of which produces a suction pressure with the suction holes. This has the advantage of being a simple means of providing a suction pressure without the expense of providing and running a vacuum box or fan.

[0027] Preferably, the foil is fixed and is located opposite the press-nip of the roll. This has the advantage that the press-nip can activate the foil allowing the suction pressure to be created adjacent the press-nip and thereby remove water flowing laterally from the nip.

[0028] Preferably, activation means is provided in the roll to activate the foil. This can be provided on the roll, if the foil is fixed with respect to the roll, or it can be fixed with regard to the roll if the foil rotates with the roll.

[0029] In accordance with an embodiment of the present invention there is provided a suction roll comprising a perforated hollow drum and a foil within the drum whose activation creates a suction pressure at the perforations.

[0030] Preferably, the suction roll further comprises a suction roll cover provided with through bores each of which connects with a respective shell perforation to provide suction holes in the roll.

[0031] Preferably, the cover also comprises a plurality of blind-drilled holes and/or grooves.

[0032] By way of example only, specific embodiments of the invention will now be described, with reference to the accompanying drawings, in which:-

Fig. 1 is a partial schematic view illustrating the outer surface of the roll cover constructed in accordance with a first embodiment of the present invention;

Fig. 2 is a partial section through the roll cover of Fig. 1;

Fig. 3 is a partial schematic view illustrating the outer surface of the roll cover constructed in accordance with a second embodiment of the present invention;

Fig. 4 is a partial section through the roll cover of Fig. 3;

Fig. 5 shows schematically the distribution of suction holes in relation to the blind-drilled holes for the embodiment of Figs. 3 and 4 (the grooves have been omitted for the sake of clarity);

Fig. 6 is a diagrammatic longitudinal sectional view of a roll provided with the roller cover of Figs. 3 and 4; and

Figs. 7 and 8 are diagrammatic representations of the suction roll of Figs. 3 and 4 illustrating a variation of the means providing a vacuum source.

[0033] In a first embodiment of the present invention illustrated in Figs. 1 and 2, a roll comprises a solid metal

drum or shell 2 clad in a polyurethane shell cover 4. The thickness of the cover is 21 mm and its outermost surface is provided with an equal distribution of blind-drilled holes 6 each having a diameter of 2.4 mm. The blind-drilled holes have a plurality of depths namely, 5, 6 and 6.5 mm. The blind-drilled holes 6 are interconnected by a circumferential groove 8 cut through each blind-drilled hole 6 and which groove 8 extends helically about the roll cover surface. The grooves have a semi-circular base to reduce frictional resistance to water flow along them.

[0034] In the second embodiment illustrated in Fig. 3 and 4, the roll of the first embodiment is modified in that the solid metal shell 2 comprises a plurality of equally distributed perforations 10 each having a diameter of 3 mm. The cover is modified in that several of the blind-drilled holes are replaced by an equal distribution of through bores 12 each having a diameter of 2.4 mm and connecting with a respective perforation 10 to form a suction hole 14. Each suction hole 14 is separated from an adjacent suction hole 14 by the interposition of a blind-drilled hole 6, such that each suction hole 14 is completely surrounded by an even distribution of blind drilled holes 6 as best illustrated in Fig. 5.

[0035] The hollow interior of the suction roll is provided with a standard suction box (not illustrated) to provide a vacuum at the suction holes 14. Alternatively the suction roll could be provided with a source of vacuum as illustrated in Fig. 6 which shows a diagrammatic cross-section of a roller 16, which comprises a cylindrical roller sleeve 4, end caps 18 and trunnions 20, 22. Trunnion 20 is solid and serves only as a rotational bearing for the roller 16. Trunnion 22 however has an axial bore 24 which extends along an axial shaft 26 of the roller, and the wall of the shaft 26 is pierced by a plurality of apertures 28 which connect the interior of the bore 24 with the internal volume of the roller 16. A suction device, such as a pump or fan is connected to the bore 24, so as to draw air, and entrained water from the surface of the roller 16, and thus from any wet material resting thereon, through the suction holes 14 and apertures 28.

[0036] In a third embodiment of the invention as illustrated in Figs. 7 and 8, the suction roll of the second embodiment is modified in that instead of creating a vacuum by means of a suction box or trunnion 24, an artificial vacuum is created by means of a fixed foil 30 in the interior of the suction roll 16. Referring to Fig. 7 paper 42 supported on press felt 34 passes between suction roll 16 and top roll 32 in order to express water from the paper. As the roll 16 rotates the press-nip 36 created between the rolls activates the foil to produce a positive pressure pulse 38 and a negative pressure pulse 40 and thereby creates a vacuum to draw water into the interior of the roll 16 via the suction holes 14.

Claims

1. A roll comprising a hollow shell (2) with perforations

(10) and a roll cover (4), wherein the roll cover (4) is provided on the perforated hollow shell (2), the roll cover (4) comprising an outwardly presented work contacting surface in which is provided a plurality of through bores (12) extending through said roll cover (4) and being aligned with respective shell perforations (10) to provide suction holes (14) in the roll, the work contacting surface further comprises a plurality of blind-drilled holes (6), the cross-sectional area of each through bore (12) being the same as that of each blind-drilled hole (6), **characterized in that** said work surface comprises a continuous circumferential groove (8) which connects the through bores (12).

2. A roll as claimed in claim 1, wherein said groove (8) in addition connects said blind-drilled holes (6).

3. A roll as claimed in claim 1 or 2, wherein said groove (8) extends helically about the work surface.

4. A roll as claimed in claim 1, 2 or 3 wherein the groove (8) has a semi-circular base.

5. A roll as claimed in any one of the preceding claims wherein there is an even distribution of through bores (12) and/or of blind-drilled holes (6).

6. A roll as claimed in any one of the preceding claims wherein each through bore (12) is surrounded by an even distribution of blind-drilled holes (6).

7. A roll as claimed in any one of the preceding claims wherein each through bore (12) is not immediately adjacent another through bore (12).

8. A roll as claimed in any one of the preceding claims, wherein the cross-sectional area of each shell perforation (10) is greater than the cross-sectional area of each through bore (12).

9. A roll as claimed in any one of the preceding claims, wherein suction means is provided within the shell (2) to draw water through the suction holes (14).

10. A roll as claimed in claim 9, wherein the suction means is an internal foil within the suction roll the activation of which produces a suction pressure with the suction holes (14).

11. A roll as claimed in claim 10, wherein in use, the foil is fixed and is located opposite the press-nip of the roll.

12. A roll as claimed in claim 10 or 11, wherein, activation means is provided in the roll to activate the foil.

13. A roll as claimed in any one of the preceding claims,

wherein the bores comprise blind bores of a variety of depths.

Patentansprüche

1. Walze mit einem hohlen Mantel (2) mit Perforationen (10) und einer Walzenabdeckung (4), wobei die Walzenabdeckung (4) auf dem perforierten hohlen Mantel (2) vorgesehen ist und eine nach außen weisende Arbeitskontaktfläche umfasst, in der mehrere Durchgangsbohrungen (12) vorgesehen sind, die sich durch die Walzenabdeckung (4) erstrecken und auf jeweilige Mantelperforationen (10) ausgerichtet sind, um Sauglöcher (14) in der Walze bereitzustellen, wobei die Arbeitskontaktfläche weiterhin mehrere gebohrte Sacklöcher (6) umfasst, wobei die Querschnittsfläche jeder Durchgangsbohrung (12) der jedes gebohrten Sacklochs (6) entspricht, **dadurch gekennzeichnet, dass** die Arbeitsfläche eine kontinuierliche Umfangsnut (8) umfasst, die die Durchgangsbohrungen (12) verbindet. 5
2. Walze nach Anspruch 1, bei der die Nut (8) darüber hinaus die gebohrten Sacklöcher (6) verbindet. 10
3. Walze nach Anspruch 1 oder 2, bei der sich die Nut (8) schraubenförmig um die Arbeitsfläche herum erstreckt. 15
4. Walze nach Anspruch 1, 2 oder 3, bei der die Nut (8) eine halbkreisförmige Basis aufweist. 20
5. Walze nach einem der vorhergehenden Ansprüche, bei der eine gleichmäßige Verteilung der Durchgangsbohrungen (12) und/oder der gebohrten Sacklöcher (6) vorgesehen ist. 25
6. Walze nach einem der vorhergehenden Ansprüche, bei der jede Durchgangsbohrung (12) von einer gleichmäßigen Verteilung von gebohrten Sacklöchern (6) umgeben ist. 30
7. Walze nach einem der vorhergehenden Ansprüche, bei der sich jede Durchgangsbohrung (12) nicht unmittelbar neben einer anderen Durchgangsbohrung (12) befindet. 35
8. Walze nach einem der vorhergehenden Ansprüche, bei der die Querschnittsfläche jeder Mantelperforation (10) größer ist als die Querschnittsfläche jeder Durchgangsbohrung (12). 40
9. Walze nach einem der vorhergehenden Ansprüche, bei der ein Saugmittel in dem Mantel (2) vorgesehen ist, um Wasser durch die Sauglöcher (14) zu saugen. 45
10. Walze nach Anspruch 9, bei der das Saugmittel eine 50

innere Folie in der Saugwalze ist, deren Aktivierung einen Saugdruck in den Sauglöchern (14) erzeugt.

11. Walze nach Anspruch 10, bei der die Folie im Gebrauch festgelegt ist und sich gegenüber dem Pressspalt der Walze befindet. 5
12. Walze nach Anspruch 10 oder 11, bei der in der Walze ein Aktivierungsmittel zur Aktivierung der Folie vorgesehen ist. 10
13. Walze nach einem der vorhergehenden Ansprüche, bei der die Bohrungen Sackbohrungen mit den verschiedensten Tiefen umfassen. 15

Revendications

1. Rouleau comprenant une coque creuse (2) avec des perforations (10) et un recouvrement de rouleau (4), le recouvrement de rouleau (4) étant prévu sur la coque creuse perforée (2), le recouvrement de rouleau (4) comprenant une surface de contact de travail tournée vers l'extérieur dans laquelle est prévue une pluralité d'alésages traversants (12) s'étendant à travers ledit recouvrement de rouleau (4) et étant alignée avec les perforations respectives (10) de la coque pour fournir des trous d'aspiration (14) dans le rouleau, la surface de contact de travail comprenant en outre une pluralité de trous borgnes (6), la surface en section transversale de chaque alésage traversant (12) étant la même que celle de chaque trou borgne (6), **caractérisé en ce que** ladite surface de travail comprend une gorge circonférentielle continue (8) qui relie les alésages traversants (12). 20
2. Rouleau selon la revendication 1, dans lequel ladite gorge (8) relie en outre lesdits trous borgnes (6). 25
3. Rouleau selon la revendication 1 ou 2, dans lequel ladite gorge (8) s'étend en forme d'hélice autour de la surface de travail. 30
4. Rouleau selon la revendication 1, 2, ou 3, dans lequel la gorge (8) a une base semi-circulaire. 35
5. Rouleau selon l'une quelconque des revendications précédentes, dans lequel il y a une répartition uniforme des alésages traversants (12) et/ou des trous borgnes (6). 40
6. Rouleau selon l'une quelconque des revendications précédentes, dans lequel chaque alésage traversant (12) est entouré par une répartition uniforme de trous borgnes (6). 45
7. Rouleau selon l'une quelconque des revendications précédentes, dans lequel chaque alésage traversant 50

(12) n'est pas directement adjacent à un autre alésage traversant (12).

8. Rouleau selon l'une quelconque des revendications précédentes, dans lequel la surface en section transversale de chaque perforation (10) de la coque est supérieure à la surface en section transversale de chaque alésage traversant (12). 5
9. Rouleau selon l'une quelconque des revendications précédentes, dans lequel un moyen d'aspiration est prévu dans la coque (2) pour aspirer de l'eau à travers les trous d'aspiration (14). 10
10. Rouleau selon la revendication 9, dans lequel le moyen d'aspiration est un film interne dans le rouleau d'aspiration, dont l'activation produit une pression d'aspiration avec les trous d'aspiration (14). 15
11. Rouleau selon la revendication 10, dans lequel, en fonctionnement, le film est fixe et est situé en face de la ligne de pressage du rouleau. 20
12. Rouleau selon la revendication 10 ou 11, dans lequel un moyen d'activation est prévu dans le rouleau pour activer le film. 25
13. Rouleau selon l'une quelconque des revendications précédentes, dans lequel les alésages comprennent des alésages borgnes ayant des profondeurs différentes. 30

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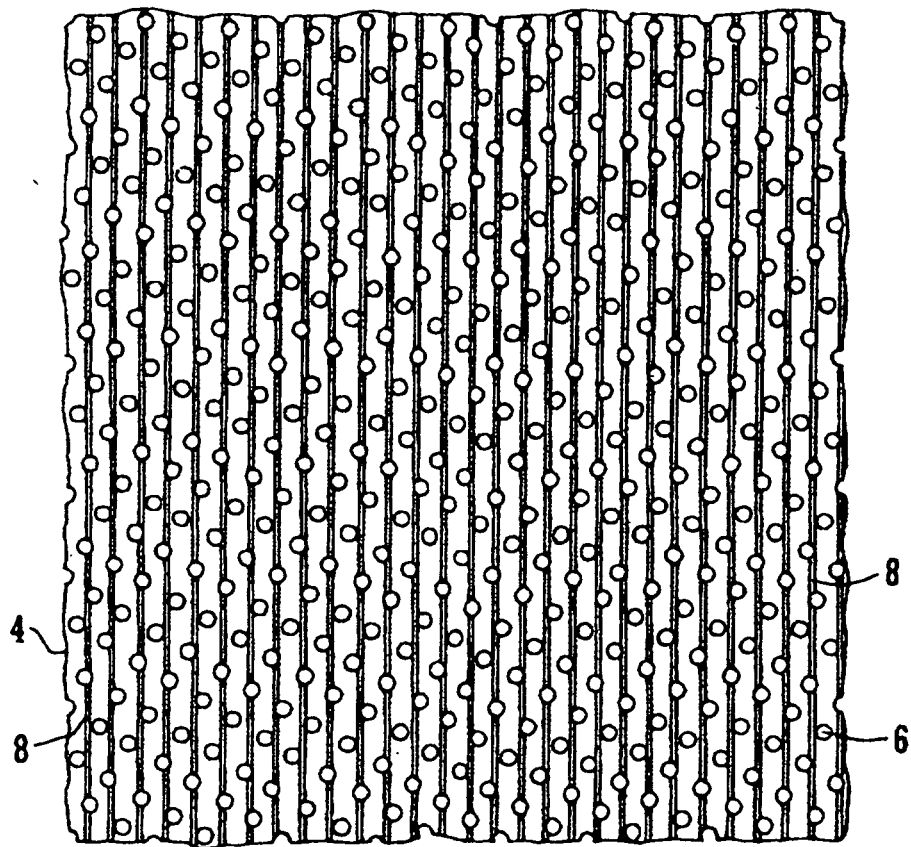


FIG. 1

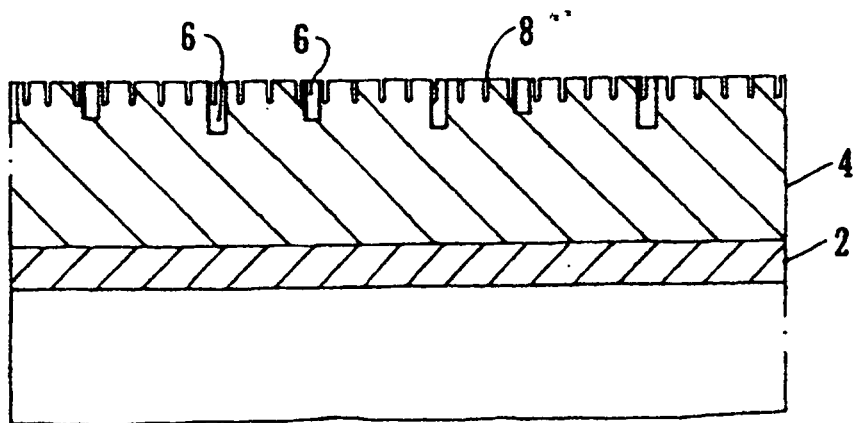


FIG. 2

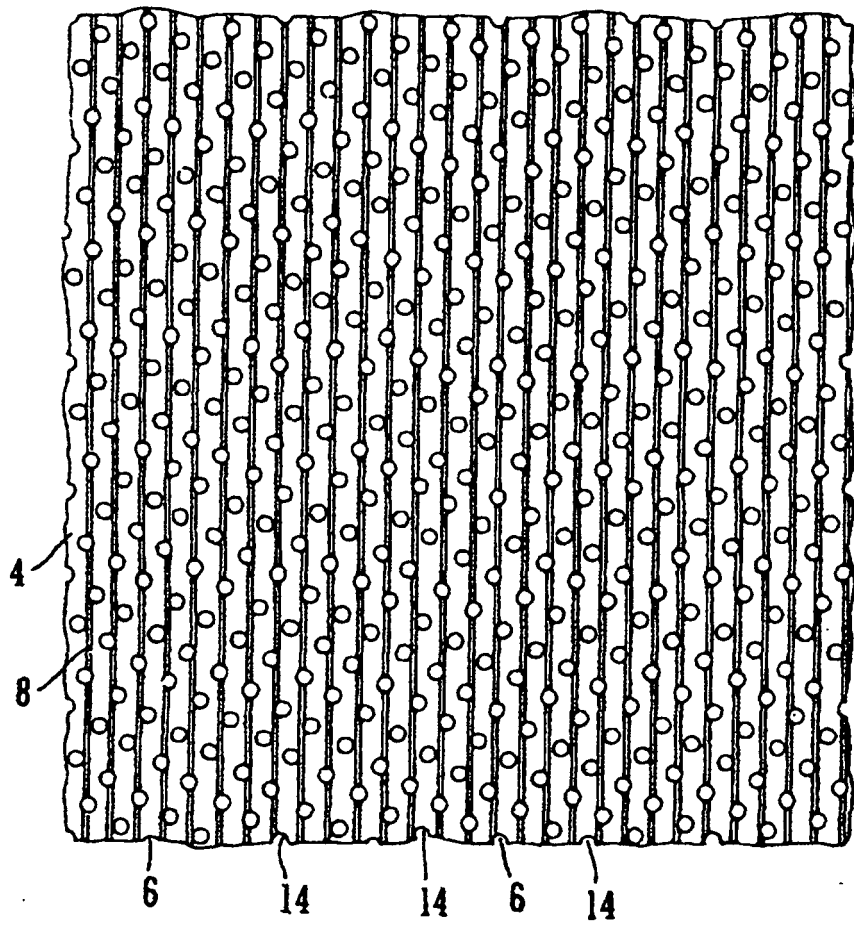


FIG. 3

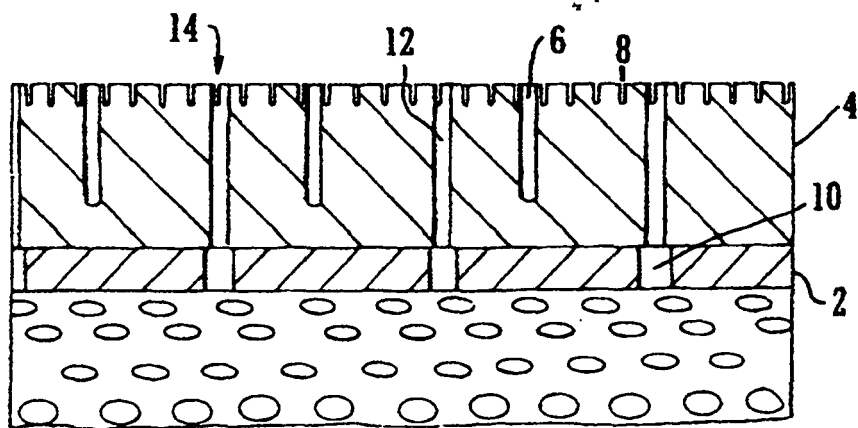


FIG. 4

