Feb. 14, 1967 KARL-HERMAN GISTRÉN 3,303,575

PUMPING ROLLER

Filed March 17, 1965 2 Sheets-Sheet 1

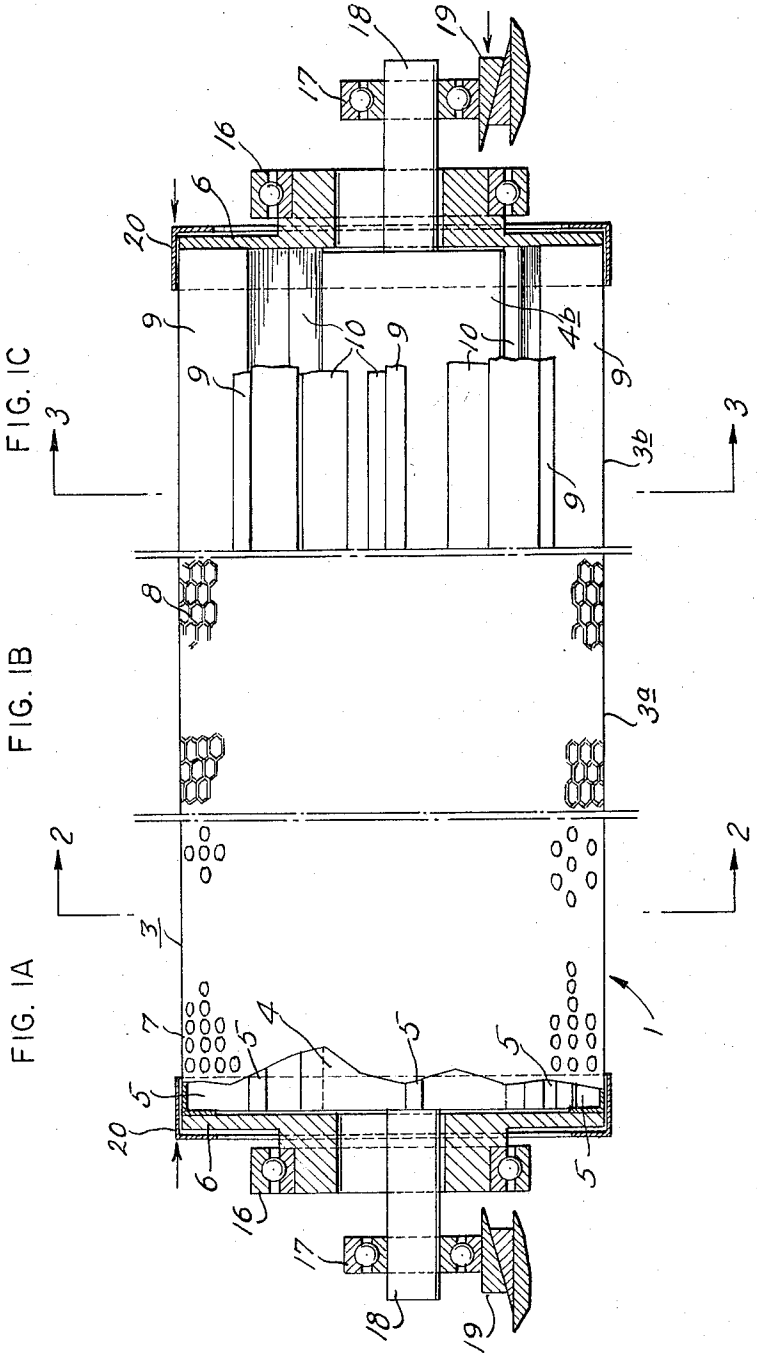

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FIG. 2

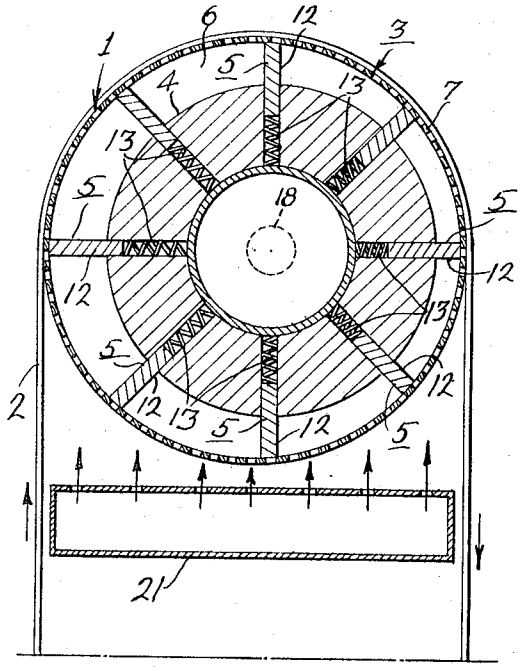


FIG. 3.

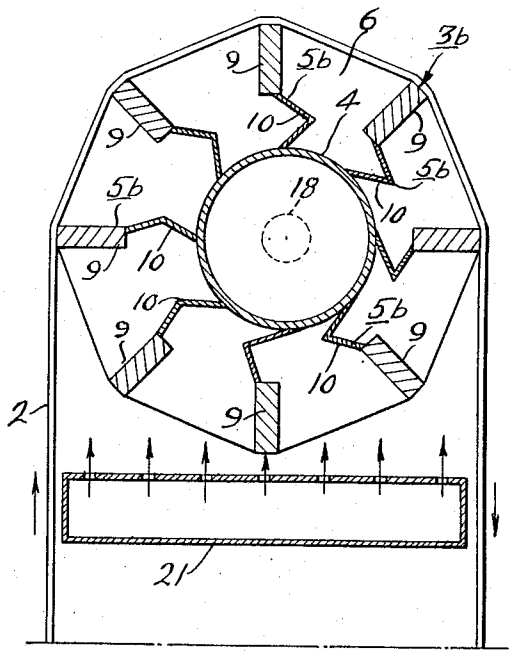


FIG. 4.

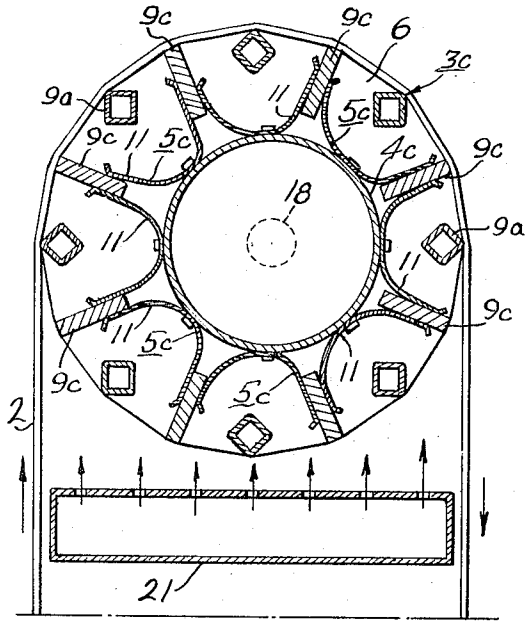
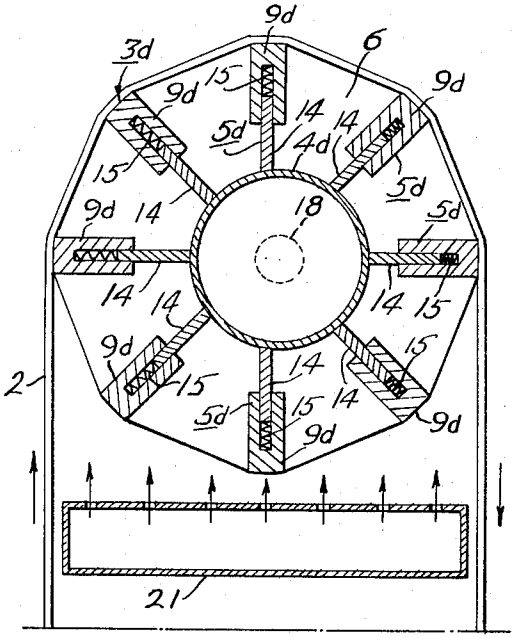


FIG. 5.



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3,303,575

PUMPING ROLLER

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13 Claims. (Cl. 34—115)

The present invention relates to a rotatable roller for a web-like material to be used in treatment plants to pump gaseous medium through, and/or to create a pressure difference over, the web-like material, and in connection therewith to exhaust water and/or impurities from the material. A forced blowing or pumping of medium through a web is used, as an example, in drying the felts in a paper machine in order to increase the evaporation capacity of the machine, and to afford correction, as needed, of the so-called moisture profile, i.e., the variation of the moisture content across the web material.

One conventional roller construction for such blowing is the so-called Madeleine roller in which air is supplied to the roller axially at the two ends of the roller from a separate device, whereby chambers located in the roller distribute the air across the width of the roller for blowing air through the material being conducted over the roller. As this blowing of air requires a relatively high pressure, difficult sealing problems will occur at the points where the air is supplied from the stationary plant to the rotating roller. This requires that rollers of the above-mentioned kind, in order to function effectively, be complicated and thus expensive. Furthermore, it is difficult to distribute the air evenly and to conduct the air to the middle of the roller, which difficulties increase with greater speed of the machine and greater width of the roller. Finally, the stationary supply device always requires extra space and the connection between this device and the rollers will detract from the desired accessibility to the machine.

The present invention relates to a construction, wherein the roller itself during its rotation creates the pressure and the air quantity required for gaining the desired blowing effect. The roller can be said to work as an eccentric pump and has thus a pressure side, from which the air compressed during the rotation of the roller is pressed out through the felt, and a suction side, where the air, evenly distributed over the whole width of the roller, is supplied radially to the roller. This means that the problem of distributing the air to the roller has been minimized. Furtherfore, this construction has the advantage that the roller itself functions as the air supply, and therefore neither a blower nor a duct system for the air supply is needed.

Furthermore, it may be mentioned that the air quantity which the roller can deliver, is directly proportional to the speed of revolution. An increased speed of revolution of a paper machine, for instance, means an increased water quantity in the felt during the manufacture of a certain kind of paper and thus an increased need for air blowing. By using apparatus according to the invention, increased blowing is automatically obtained, which, on the other hand, is not possible in hitherto known constructions without expensive special arrangements. The above-mentioned advantages only refer to such cases, where it is a question of blowing air from the rotating roller through the web-like material being conducted over the roller. Nothing prevents, however, the construction from being used in the reverse case, i.e., with sub-pressure in the part of the roller engaged by the web-like material. By this arrangement, a sucking-off of dust from the web or only an adherence of the web to the roller may be obtained. Furthermore, a part of

the air supplied to the prior conventional blowing roller is lost owing to the fact that the blowing takes place also on the part of the roller, which is not covered by the material.

The invention, which has as its object the elimination of the drawbacks of earlier known constructions mentioned above, is characterized in that the roller consists of an outer rotor, over which the web-like material is conducted, and an inner, possibly stationary rotor supported in bearings eccentrically to the outer rotor, and a number of extensible partitions arranged substantially radially between the outer and the inner rotor, for example, being made of flexible material or being telescopically mounted.

The outer rotor being part of the invention may consist of a cylindrical shell, provided with perforations or being made of a so-called sandwich or honeycomb panel composed by edged metal ribbons; comprising a number of substantially radially arranged longitudinal members such as rods or plates clamped between two end wall plates; or finally being made with an outer shell of the above-mentioned kind in combination with radially arranged rods or plates.

In a similar manner the extensible partitions between the outer and the inner rotor may be made in several different ways within the scope of the invention. Thus, a suitable embodiment of the invention is characterized in that the partitions between the outer and the inner rotor are fastened to both said elements and in that the radial and tangential relative movement between said rotors is made possible by the flexibility and/or elasticity of the partitions. According to another embodiment, the radial and/or tangential relative movement between the outer and the inner rotor is made possible by a sliding telescoping movement of the same. Furthermore, the partitions may be toggle joint-shaped and pivotally fastened to the outer and the inner rotor. They may also comprise elements of resilient material fastened to the inner rotor, which elements with their free end by spring pressure bear against substantially radial longitudinal members such as rods or plates on the outer rotor, whereby the radial relative movement between the rotors is made possible by means of a sliding telescoping movement of the resilient element against said members and the tangential relative movement by means of the elasticity of said element.

A further embodiment is characterized in that the extensible partitions between the outer and the inner rotor consist of radially displaceable elements supported for telescoping movement in bearings in the inner rotor, which elements with spring pressure are pressed against the inner shell surface of the outer rotor and which during the rotation of the roller, slide against said surface. The partitions according to still another embodiment consist of radially displaceable elements supported for telescoping movement in bearings in the outer rotor, which elements with spring pressure are pressed against the inner rotor and which during the rotation of the roller, slide against same.

In order to make possible a variation of the capacity with respect to the air flow and pressure created by the invention, the inner rotor may be supported in the bearings so that the eccentricity of the same can be varied. This can be desirable in, for instance, paper machines, when during the manufacture of various paper qualities, different moisture content in the felt is obtained and accordingly different requirements of air blowing through the felt.

An advantageous embodiment of the invention is characterized in that the outer rotor at its ends is equipped with axially displaceable shielding elements for the part

of the length of the rotor not being covered by the web material. By this embodiment, such a sealing is obtained that the air quantity delivered by the invention object takes the desired way through the web-like material. The embodiment can also be utilized to shield partially the web-like material in order to correct the above-mentioned moisture profile. To increase still the possibility of such a correction the roller may be combined with a duct for the supply or exhaust of air to or from the roller, which duct is arranged in confronting relation to the part of the periphery of the roller not covered by the web-like material. Thereby, the duct can be divided into two or more channels for the supply of air of different condition. In the last-mentioned case, it may be suitable to divide the roller in a number of sections by insertion of partitioning walls disposed perpendicularly to the axis of the roller.

The invention will now be more fully described with reference to the accompanying drawing showing a rotatable roller according to the invention in alternative embodiments, wherein:

FIG. 1A is a longitudinal view in plan with portions broken away of the left-hand end of a roller according to a first embodiment of the invention;

FIG. 1B is a plan view of the central portion of a roller according to a second embodiment of the invention;

FIG. 1C is a plan view similar to FIG. 1A of the right-hand end of a roller according to a third embodiment of the invention;

FIG. 2 is a sectional view taken on the line 2—2 of FIG. 1A;

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 1C; and

FIGS. 4 and 5 are views similar to FIGS. 2 and 3 of other embodiments of the invention.

In the drawing, and particularly the embodiment shown in FIGS. 1A and 2, 1 designates a rotatable roller for a web-like material. The roller 1 consists of an outer rotor 3, over which the web-like material 2 is conducted, an inner rotor 4, and a number of extensible partitions 5 arranged substantially radially between the outer and the inner rotor. The outer rotor consists of a cylindrical, perforated shell 7 clamped between two end wall plates 6. The partitions 5 comprise displaceable elements 12 supported in the inner rotor and projecting radially into sliding engagement with the shell 7 of rotor 3. These elements are pressed by means of springs 13 against the inner shell surface. In FIG. 1, a bearing device 16 supports the outer rotor 3 and a corresponding bearing device 17 supports the stub shaft 18 of the inner rotor 4. To make possible a variation of the eccentricity of the inner rotor, the bearing device 17 is displaceable by means of a device 19 consisting of, for instance, a wedge element. An axially displaceable shielding element 20 preferably covers the part of the length of the rotor not covered by the web-like material. A duct 21 supplies or exhausts air to or from the roller 1, which duct confronts the part of the periphery of the roller not covered by the web-like material 2.

In FIG. 1B, the outer rotor 3*a* consists of a so-called sandwich or honeycomb panel 8 composed of edged meal ribbons.

In FIGS. 1C and 3, the rotor 3*b* is made of a number of longitudinal members such as rods or plates 9 arranged substantially radially and being clamped between two end wall plates 6. The extensible partitions 5*b* are made up of plates 9 and flexible material as a toggle joint-shaped element 10 and pivotally fastened to the plates 9 and the inner cylindrical rotor 4*b*.

FIG. 4 shows an embodiment wherein the outer rotor 3*c* consists of longitudinal members such as rods 9*a* and plates 9*c* between end plates 6. The extensible partitions 5*c* consist of elements 11 of resilient material mounted on an inner rotor 4*c*, which elements at their free end by spring pressure bear against the radial plates 9*c* of the outer rotor 3*c*. The rod members 9*c* support the web between the plate members 9*c*. The resilient flexibility of the elements 11 permits the relative circumferential or tangential movement of the inner and outer rotors, and the telescoping joint of the plates 9*c* between adjacent elements 11 permits the relative radial movement.

In FIG. 5, the extensible partition arrangement is reversed from that shown in FIG. 2. In this embodiment, the inner rotor 4*d* may be fixed and the radial partitions 5*d* may travel therearound. The partitions comprise displaceable elements 14 mounted for radial telescoping engagement in the longitudinal plate members 9*d* of the rotor 3*d*, and spring elements 15 adapted to bias the elements 14 radially into sliding engagement with the fixed inner rotor 4*d*.

In each of the aforedescribed embodiments, the rotor end plates and the supporting bearing structure are substantially identical and the same reference characters have been applied to corresponding parts.

In operation of the illustrated embodiments, the travel of the web 2 causes the outer rotor to revolve, rotating the partition elements circumferentially within the annular space between the rotors. As the partition elements are carried circumferentially, they are retracted and extended in accordance with the eccentricity of the inner and outer rotors. As shown in FIGS. 2–5, the partitions are fully extended at the point where the web 2 first engages the outer rotor, and are fully retracted where the web first disengages the rotor. The retractive movement of the partition effects a pumping action causing air to be exhausted through the web from the compartments between the partitions. It is apparent that reversal of the eccentricity or reversal of the direction of rotation will effect a pumping action which sucks air into the compartments through the web. When reversed, the air flow through the duct 21 is reversed to assist in the exhaust of any dust removed from the web by the sucking action, and to render the operation more efficient.

While particular embodiments of the invention have been illustrated and/or described, other changes and modifications may be made therein and thereto without departing from the invention, as defined in the appended claims.

What I claim is:

1. A rotatable roller for a web-like material characterized in that the roller consists of an outer rotor, over which the web-like material is conducted, an inner rotor eccentrically supported in relation to the outer rotor, a number of extensible partitions arranged substantially radially between the outer and the inner rotor, and means to effect rotation of said partitions, said partitions defining pumping compartments which are extended and retracted as the roller rotates thereby pumping air through the web-like material.

2. A device according to claim 1 wherein said outer rotor comprises two end wall plates and a cylindrical, perforated shell being clamped between said end wall plates.

3. A device according to claim 2 wherein said perforated shell consists of a so-called sandwich or honeycomb panel composed by edged metal ribbons.

4. A device according to claim 2 characterized in that the extensible partitions between the outer and the inner rotor consists of radially displaceable elements supported for telescoping movement in the inner rotor, and spring means to press said elements against the inner shell surface of the outer rotor and which during the rotation of the roller may slide against said surface.

5. A device according to claim 1 wherein said outer rotor comprises two end wall plates and a number of substantially radially arranged longitudinal members clamped between said end wall plates.

6. A device according to claim 1 characterized in that the extensible partitions between the outer and inner rotors comprise elements of flexible material fastened to both said rotors, radial and tangential relative movement be-

tween said rotors being afforded by the flexibility of the partitions.

7. A device according to claim 6 characterized in that the flexible elements are toggle joint-shaped and pivotally fastened to the outer and the inner rotor.

8. A device according to claim 1 wherein said partitions comprise telescoping elements mounted in one of said rotors and slidable on the other of said rotors, radial and tangential relative movement between the outer and the inner rotor being afforded by the telescoping and sliding movements respectively of the partitions.

9. A device according to claim 1 wherein said extensible partitions comprise substantially radial plates on one of said rotors, and elements of resilient flexible material fastened to the other rotor, and at their free ends bearing against the plates, whereby radial relative movement between the rotors is afforded by means of telescoping sliding movement of the resilient elements with said plates and tangential relative movement is afforded by means of the resilient flexibility of said elements.

10. A device according to claim 1 including bearing means supporting said rotors and means to adjust said bearing means to vary the eccentricity of the rotors.

11. A device according to claim 10 wherein said outer

rotor is mounted for rotation about a fixed axis, and said adjusting means operates to displace the axis of said inner rotor.

12. A device according to claim 1 including axially displaceable shielding elements circumscribing said outer rotor at its ends and extending axially inward for the part of the length of the rotor not covered by the web-like material.

13. A device according to claim 1 including a duct located in confronting relation to the part of the periphery of the roller not covered by the web-like material, said duct being operable to supply air to the roller or to exhaust air from the roller to assist the pumping action through the web.

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