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SUCTION CYLINDER MOLD FOR PAPER MAKING MACHINES

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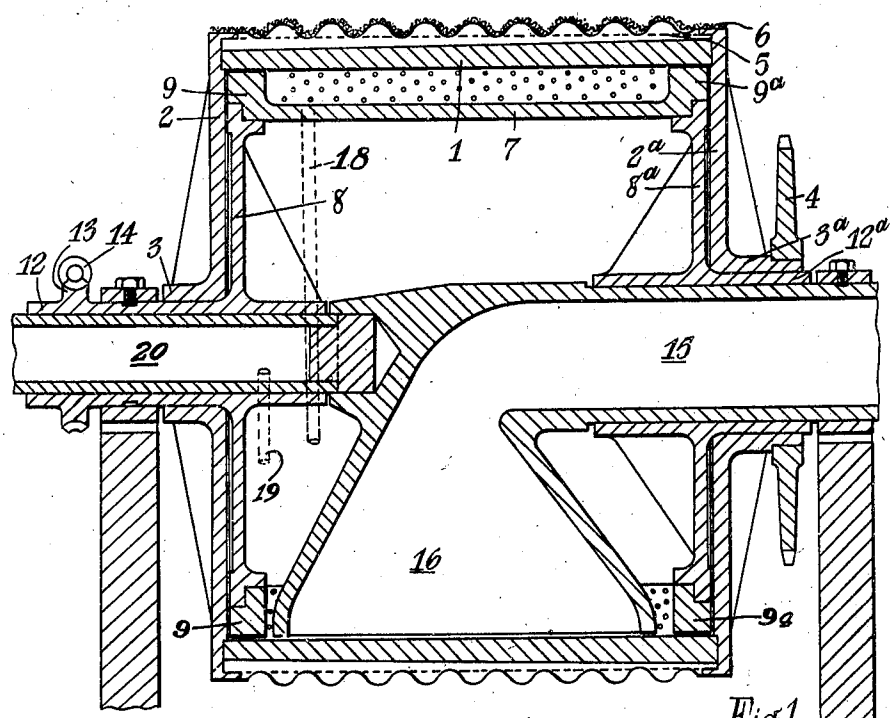


Fig. 1

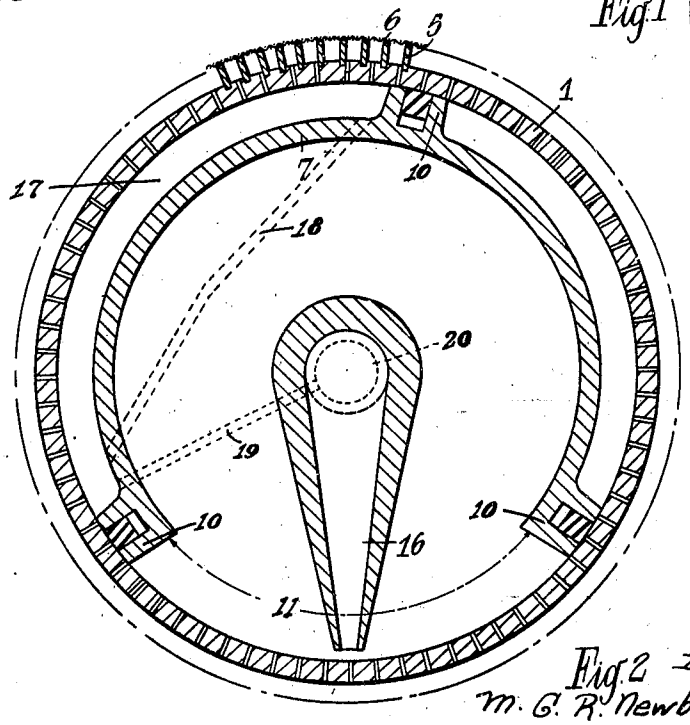


Fig. 2

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SUCTION CYLINDER MOLD FOR PAPER-MAKING MACHINES

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1 Claim. (Cl. 92—43)

This invention relates to the production of felted fibrous material in sheet form and more particularly felted cellulosic fibrous material of the character employed in forming paper, paper pulp and the like.

The object of the invention is to provide a new and improved apparatus for the production of such material of the kind including a rotatable foraminous member adapted to be partially submerged in a body of fibrous pulp and, in association with the foraminous member, means for applying suction to a predetermined area of the pulp which is aspirated against the surface of the foraminous member, the suction operating to remove water therefrom.

In known apparatus of the above kind both a water suction chamber and an air suction chamber are employed. The object of the water suction chamber is to draw the fibre against the submerged outer surface of the foraminous member where the fibre is retained to form the sheet, and the water that carried the fibre is separated from it by passing through the foraminous member and subsequently out of the machine. The air suction chamber operates to withdraw the water and consolidate the deposited material after it has passed the water suction area, that is to say, when the fibrous sheet has emerged from the stuff tank. Under normal conditions the sheet is required in as dry and consolidated a condition as possible, and the two main essentials for the air suction chamber are thus time and the highest degree of suction obtainable. The water suction chamber, however, rarely works above a suction value of 25 cm. of mercury, for above this vacuum the increase in thickness of deposit is slow and not worth the pumping expense, while the texture of the sheet on its outer side is not satisfactory. Hence, when using a common air and water suction chamber where the vacuum is equal for both forming and drying, the air drying portion is usually adversely controlled by the conditions obtaining in the water suction portion.

In general a coarse or fast stuff will build up rapidly and with a low water suction, while a slow stuff builds up slowly and by clogging the web and the foraminous member builds up a high suction without producing proportions to increase in the thickness of the sheet. There is thus a maximum and probably uneconomic thickness which can be produced by any particular stuff with existing construction of apparatus, which can only be governed by variations in speed. The invention is directed to the provision of means whereby the limitation set by existing apparatus may be overcome.

According to the invention, within the foraminous member there is provided a normally stationary member capable of adjustment by rotation about the axis of rotation of the foraminous member and consisting of a segment of a cylinder spaced a convenient distance from the inner surface of the cylinder forming part of the foraminous member, furnished with flanges presenting bearing surfaces to the interior of the foraminous member and constituting partitions dividing the space between the segment and the cylinder forming part of the foraminous member into convenient sized compartments, one at least of which is connected to means for aspirating air through the material deposited on the foraminous member to effect its de-watering and that within the cylinder segment there is provided a hollow central shaft from which a suction channel descends to a point close to the inner surface of the foraminous member, such suction channel being designed to be connected with a pump adapted to cause the pulp in which the foraminous member is submerged to be sucked against the foraminous member and thus become deposited thereon, the segment of a cylinder being capable of rotation about the hollow central shaft to adjust the area of the foraminous member which is subjected to suction, to secure the deposition on it of the fibrous pulp, and to vary the area of the deposited pulp to effect its dewatering before being carried into the position where the de-watered material will be brought into position against a compartment communicating with the atmosphere or a source of air pressure to assist in the removal of the deposited material from the foraminous member.

The foraminous member may consist of a hollow cylinder suitably mounted upon end plates which constitute the bearings upon which it revolves on an inner stationary member. The inner surfaces of the end plates are machined to receive the stationary members, while the outer surfaces are axially slotted at convenient distances around its periphery to receive strips of metal or the like, which project radially and carry the sieve. These radial strips are conveniently retained in their axial position by the end plates, and both the slots and the strips are tapered axially to facilitate the tightening up of the sieve which is preferably of metal gauze.

These strips, which are interchangeable, may have either a straight exterior edge for the production of flat sheeting, a corrugated exterior

edge to produce corrugated sheeting, or other desired profiles. Holes are provided between the slots in the wall of the cylinder to enable the sieve to be submitted to the various conditions required and which are produced by the foraminous member revolving over the chambers of the stationary inner member.

The normally stationary member consists of a segment of a cylinder spaced at a convenient distance from the inner surface of the cylinder forming part of the foraminous member, and is flanged at its extremities to present a bearing surface to the interior of the foraminous member. The annular chamber so formed is subdivided into three or, if desired, four convenient sized compartments by axial partitions extending to the inner side of the foraminous member.

This cylinder segment is mounted on a hollow central shaft from which a suction channel descends vertically until close to the inner surface of the foraminous member. It is upon the hollow shaft that the bearings of the end plates of the foraminous member rotate.

These three compartments provided by the normally stationary member, together with the continuously revolving foraminous member, constitute the aspirating suction chamber which is submerged in the stuff supply tank, the air drying and consolidating chamber and the normal air pressure chamber. In some cases a fourth chamber supplied with super pressure air is desirable, and this would be situated between the consolidating chamber and the normal air pressure chamber.

The aspiration in the suction chamber is operated by a centrifugal pump or the like drawing the water in which the fibrous material was suspended through the sieve and thence out of the machine by way of the vertical suction channel and the hollow central shaft. The web so formed is carried by the revolving foraminous member out of the stuff tank and across the first axial partition of the stationary member to the air drying and consolidating chamber that is maintained at a suitable sub-atmospheric pressure by means of a vacuum pump or the like. Evacuation of water which would accumulate in this chamber is effected by a gravitational by-pass pipe extending between the higher and the lower two extremities of the chamber and by arranging a suction pipe at the bottom of the lower extremity of the chamber. Continuing its rotation, the foraminous member carrying its now partially dried web passes over the second axial partition of the stationary member to the atmospheric pressure chamber, where the web is carried away from the foraminous support to the consolidating rolls.

The third axial partition forms the separator between the atmospheric pressure chamber and the aspirating suction chamber. When varying causes, such as fragility of the web or excessive adhesion of the web to the foraminous member, necessitate assistance for its removal, a small super pressure chamber supplied with compressed air is introduced between the consolidating and atmospheric pressure chambers.

For rotating the adjustable stationary member about the shaft in order to vary the area to which suction is applied to the immersed portion of the foraminous support, any suitable means may be provided. Thus, for instance, a projecting part of the hollow shaft extending through the bearing on one of the end plates of the rotating foraminous support may be formed with a worm gear meshing with a worm on a spindle provided with a hand wheel.

The invention will be described further in detail and by way of example with reference to the accompanying drawing, in which:

Figure 1 is a view in sectional elevation of a rotatable foraminous member on a plane containing the axis of rotation thereof, and

Figure 2 is a view in section on a plane at right angles to the plane of section of Figure 1.

In the drawing, 1 is a foraminous hollow cylinder secured to end plates 2 and 2*a* formed with trunnions 3 and 3*a* on the latter of which is shown secured a toothed wheel 4 whereby it may be rotated.

About the cylinder and in slots in the end plates there are arranged a plurality of strips 5 which function as a support for a metal wire gauze 6.

These strips as may be seen are tapered axially to facilitate the tightening up of the metal wire gauze. The strips are interchangeable and may have straight exterior edges for the production of plain sheeting or corrugated exterior edges to produce corrugated sheeting.

Within the cylinder in question there is provided an adjustable segmental cylinder comprising a member 7 constituting the peripheral walls thereof and end plates 8, 8*a*.

The segmental cylinder is at each end furnished with flanges 9 and 9*a* to present a bearing surface to the interior of the foraminous cylinder and the generally annular chamber between the inner and outer cylinders is subdivided in effect into three compartments by radial partitions 10. The wall, however, of the inner cylinder is cut away at the position indicated by 11.

This cylinder is integral with hollow trunnions or stub shafts 12 and 12*a* and it is upon these that the trunnions of the outer foraminous member rotate.

One of the trunnions or stub shafts of the segmental cylindrical member is furnished with a worm wheel 13 in engagement with a worm 14 by which it may be rotated within limits about its axis in order that the area of aspirated pulp subjected to suction beneath the body of the pulp may be varied as desired.

Secured within the inner chamber there is arranged a tubular shaft 15 from which a suction channel 16 descends vertically, the end of it being brought close to the inner surface of the foraminous member, the tubular shaft being arranged in communication with a pump.

In order to permit the escape of water from the suction space 17 intervening between two adjacent radial partitions, whatever may be the position into which the member 7 has been rotated relative to the channel 16, there are provided a gravitational by-pass pipe or pipes 18 extending from one side to the other of the air suction space which is in communication by way of the pipe 19 with the pipe 20.

With the above-described arrangement, if the foraminous support is revolved at a constant speed in a constant stuff, assuming that the water suction is constant, a sheet will be delivered of a constant thickness. For example, let it be supposed that the sheet is 50% too thick, then by increasing the speed by 50% or more the right thickness will be secured, the drying time will be cut down, and delivery will be increased. If, on the other hand, the speed is left constant and the adjustable stationary member is displaced in the same direction as that in which the foraminous support revolves, for instance through an

arc representing 33⅓% or more of the length of the suction chamber, then the time of submersion in the stuff tank is reduced in the required proportion. With such an arrangement the end of the suction chamber remote from the first felting may be raised above the stuff level but no air leak can take place here on account of the sheet formed on the revolving foraminous support when that portion was previously submerged. If desirable the stuff level may be reduced by a weir on the stuff tank although this is not essential.

Having now arranged to produce a wet web of the best economic thickness and at a constant speed, multiples of this thickness can be produced by a series of similar machines situated in line with, but higher and behind, each preceding machine, so that the web produced by each machine lies upon that produced by the preceding machine, thereby partially consolidating the webs together by suction.

Alternatively, with such a bank of machines all revolving at the same rate, an ultimate composite web could be produced of different thicknesses of different or the same fibre by adjusting the individual aspirating suction chambers. In certain instances it may be desirable to employ a construction in which the previously mentioned adjustable stationary member consists of a permanently fixed vertical suction channel and hollow horizontal shaft, while the air drying and consolidating chamber, together with the atmospheric air pressure chamber, are constructed as a saddle member pivoting upon the fixed hollow shaft, the saddle being displaceable by means similar to those previously described. By maintaining the suction channel in the vertical position the minimum of dead water is left in the aspirating suction chamber.

The adjustment of the stationary member may be effected either when the machine is running or when it is stationary.

Similarly a reduction in the aspirating suction chamber may be effected by constructing the saddle member of two sections separated in the vertical axial plane by a mechanical device capable of widening or narrowing the space between them, and so altering the arc subtending the suction area or by other like mechanical devices.

At this point it may be mentioned that so-called suction rollers have been used in connection with apparatus of the kind in which a web of fibrous pulp is deposited upon a flexible carrier the suction roller being employed for extracting water from the material so deposited, and that in apparatus of the general type to which the invention relates, that is to say of the kind including a rotatable foraminous member adapted to be partially submerged in a body of fibrous pulp and, in association with the foraminous member, means for applying suction to a predetermined area of the pulp which is aspirated against the surface of the foraminous member, the suction operating to remove water therefrom, means has been provided for varying the area of a foraminous member actually immersed in or in contact with the body of fibrous pulp, and which is subjected to suction in order to cause the fibrous component to be deposited on the foraminous member.

I claim:

Apparatus for the production of felted fibrous material in sheet form comprising an outer hollow cylinder having a foraminous peripheral wall secured to end plates formed with hollow trunnions, a tubular shaft extending through one of said trunnions and terminating within a drum in a suction channel descending substantially downward, the open end of which suction channel is adjacent to the foraminous wall, the said tubular shaft being designed to be connected with a pump by which the liquid component of the fibrous pulp may be aspirated through the foraminous wall and the fibrous component of the pulp directly deposited thereon, a segmental cylinder within the drum comprising a member constituting the peripheral walls thereof and flanges on the segmental cylinder at each end presenting a bearing surface to the interior of the outer cylinder having a foraminous peripheral wall, partition members extending radially from the segmental cylinder to the foraminous peripheral wall of the hollow cylinder and dividing the space between the inner and outer cylinders into a plurality of chambers each of which is a segment of an annulus, trunnions on the end plate of the inner segmental cylinder rotatable within the hollow trunnions of the outer cylinder and on the tubular shaft at one end and at the other end on a tubular member adapted to be connected to an air pump for securing a further extraction of water and thus the drying of the deposited fibrous material and furnished with at least one connection extending from it to one of the chambers between the outer cylinder and the inner segmental cylinder.

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