APPLARATUS FOR MAKING PAPER OR PAPER BOARD OR SIMILAR FIBROUS PRODUCT

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Application June 10, 1957, Serial No. 664,808
Claims priority, application Great Britain June 12, 1956
4 Claims. (Cl. 92—39)

This invention relates to apparatus for making paper or paperboard or similar fibrous product from wet pulp delivered to a travelling carrier band, or to formed pulp carried by said band, said apparatus being of the kind comprising a permeable member adapted to be arranged above the band to move therewith for squeezing the unformed pulp against the band to assist in separating water from the pulp, and for removing separated water which flows through said member.

The squeezing of the watery pulp by the apparatus above referred to brings about a restriction in the free flow of the watery pulp on the carrier band, or formed pulp, and so results in the build up of a turbulent pond or pool of pulp extending rearwardly from the position where the squeezing action commences, the rearward extent of said pond depending on the speed of movement of the carrier band.

The turbulence of the pond causes agitation of the solid content of the pulp and so tends to orient the fibres in all directions and at the same time flows them towards the permeable member whereby the water passes there-through so as to form or felt the pulp on said member.

The present invention particularly relates to apparatus of the above general kind in which the permeable member in co-operation with the band is arranged to provide a tapering gap into which the watery pulp is carried and that constitutes a restriction in the free flow of the pulp.

In such apparatus, the afore said turbulent pond extends from the forward end of the wedge shaped gap rearwardly and the distance it extends rearwardly depends on the speed of the carrier band.

For example, if the band is running fast, then the pond may only be an inch or even less in length rearwardly and in this case formation starts to take place on the permeable member for a substantially similar length. If, however, the carrier band is running say, at 200 feet per minute or less, then the pond may extend rearwardly for two or three feet, and then formation will start to take place on a considerably greater length of the permeable member. It will be appreciated that if the pond is short in extent, it is similarly small in height, but if the pond is long then its height is greater so that the pulp flows towards the permeable member throughout a greater length.

The object of the present invention is to provide improved apparatus for restricting the flow of watery pulp on a travelling carrier band and thus building up a turbulent pond thereof.

According to a feature of the present invention a permeable surface adapted to co-operate with a travelling carrier band to provide therewith a tapering gap that constitutes a restriction in the free flow of the watery pulp, passes around a permeable roller arranged adjacent said carrier band, whereby a portion of the periphery of the roller in cooperation with the band constitutes the tapering gap in which a turbulent pond of pulp may build up and thereby form on said permeable member.

Preferably the roller around which the permeable member passes is of large diameter so that in cooperation with the carrier band, it provides a reasonable sized forming area for the turbulent pond of pulp.

Preferably, also, the permeable member comprises an endless wire band having a lower run arranged adjacent the carrier band.

If desired, a sloping chute may be arranged across the upper surface of the lower run of the endless wire band beyond the roller whereby water passing through said lower run, due to its momentum, flows up said chute to a channel and is removed.

Alternatively or in addition, a suction box, or suction chute, may be arranged across the upper surface of said lower run beyond the large diameter roller whereby water passing through said run may be drawn up into said box or chute and removed.

The roller may include a suction member adapted to draw water through the perforations.

The roller may be of cellular construction, that is to say its surface may comprise a plurality of transverse and peripheral strips whereby a number of polygonal cells are provided.

If desired the transverse strips may be arranged at an angle to the radius of the roller, whereby they act, due to rotation of the roller, to pick up water passing into the cells, and filing it towards the chute.

Forms of apparatus in accordance with the present invention will now be described with reference to the accompanying drawings in which:

Fig. 1 is an elevation showing apparatus for de-watering a single layer of pulp; this may constitute the first de-watering device in a multi-ply machine.

Fig. 2 is a fragmentary end view to a larger scale than Fig. 1 of one form of roller for providing the upper surface of the tapering gap.

Fig. 3 is a view taken from the left-hand side of Fig. 2, showing part of a wire cloth covering there-on removed.

Figs. 4 and 5 are views similar to Figs. 2 and 3, illustrating modifications.

Figs. 6 and 7 are also views similar to Figs. 2 and 3 illustrating another construction of roller.

Fig. 8 is a view corresponding to Fig. 1 but showing modifications to the apparatus.

The apparatus comprises legs 1 secured to the ground carrying uprights 2 adapted to support an overhead framework 3.

A breast roll 4 is rotatably mounted on the legs 1 and a main travelling carrier band 5 is trained around said breast roll 4, and other rollers not shown, so as to provide a substantially horizontal upper run 6. and 8 are support rollers for said upper run 6.

The upper framework 3 carries by means of rotatable bearings a permeable member in the form of an endless wire band 9, whose lower stretch 10 runs substantially parallel with the said upper run 6. Thus said permeable member 9 is trained around rollers 11 to 17, the latter being perforated. The roller 17 functions as an oncoming directing roll positioned so that it presses the lower stretch 10 of the upper permeable wire 9 down against the upper stretch 6 of the carrier band 5. By this means the quadrant of the roller from the 6 o'clock position to the 9 o'clock position lies above the stretch 6, and therein which formation starts to take place is provided by the periphery of the roller 17 contained within said quadrant in cooperation with the portion of the upper stretch 6 that it overlies.

As will be seen in the drawing, the roller 17 is of comparatively large diameter so as to provide a reasonable sized forming area (tapering gap) in cooperation with the upper stretch 6. A sloping chute or waterway
such as 19 is arranged beyond the perforated roller so that, in operation, water passing through the periphery of the roller flows up the slice into the channel 20.

The above described apparatus is suitable for manufacturing a single-ply board and works in the following manner. A layer of watery pulp is fed from a head box 21 onto the carrier band 6 whereupon it is carried into the above described tapering gap indicated by the numeral 22. At the position where the upper wire is nipped against the band 6 (i.e., 6 o'clock) the free flow of the pulp is restricted so that it builds up as a turbulent pond 23 in the tapering gap 22. This turbulence agitates the solid content in the pulp and orientates the fibres in all directions, and flows them towards the upper wire. Water from the pond 23 passes through the upper wire through the perforations in the roller 17, up the slice 19 into the channel 20, and the fibres in the pulp start to felt or felt on said wire. Some water from the pulp drains downwardly and hence formation also takes place on the carrier band 6.

As the pulp passes clear of the converging end of the tapering gap 22, due to the lower stretch 19 and the upper stretch 6 being squeezed together, water continues to pass upwardly through said stretch 10 and this water also flows up the slice 19 into the channel 20 for removal.

It is thought that in a high speed machine water that passes through the permeable member is held in the perforations of the roller and is subsequently flung clear of said roller after it has turned past the nip, i.e., the narrow end of the wedge-shaped gap.

Instead of using a perforated roller, a cellular roller may be used and one form thereof is illustrated in Figs. 2 and 3. This consists of an imperforate drum 24 having transverse and peripheral strips, 25A, 25B respectively, say, an inch or two in depth radially, the strips being arranged about two inches apart both transversely and peripherally so as to provide a roller whose periphery comprises a number of rectangular cells 26 about 2" x 2" square by 2" deep. The periphery of the roller is preferably covered with a wire covering 27, as shown. In this case water passing through the permeable wire flows into the cells and is carried thereby beyond the nip (6 o'clock position) whereupon it is flung centrifugally towards the waterway 19. In order to enhance the carrying and flinging effect of the cells, the transverse strips 25A may be arranged at an angle to the radius of the roller so that the cells act to scoop the water passing through the wire and fling it towards the waterway 19. This angular arrangement of the transverse strips is shown in Figs. 4 and 5, and the latter also shows another variation in which the peripheral strips 25B are replaced by a continuous spiral strip 25C.

In a still further form illustrated in Figs. 6 and 7 a wire covering is shown wound around a perforate drum 34, said covering comprising strips 35 set edge-on in slotted transverse ribs 36. If desired the roller 17 may comprise a skeleton structure, i.e., a drum having circularly ends with transverse bars joining them together, this skeleton roller may have a wire or similar cloth covering. This skeleton type of roller is not illustrated in the drawings.

In using the above described apparatus for dewatering a second or subsequent layer of pulp i.e., a layer of pulp delivered on to a layer already formed carried by a travelling band, the operation is similar except that the pond 23 may be of larger dimensions since nearly all the water from the second or subsequent layer will constitute the pond, only a small quantity being absorbed by the underlying formed layer. Thus it may be advantageous to provide a larger roller 17 for said second or subsequent layer in order to provide a larger area in which formation may start (tapering gap).

Modifications of the invention particularly useful in operation on a slower running machine, e.g., 200 ft. per minute or below are illustrated in Fig. 8. Thus a suction box 28 may be provided inside the large diameter roller 17 since in this case the speed of the travelling carrier band may not impart sufficient momentum to the pulp to cause the water to flow up the surface of a waterway 19. Thus water is drawn through the upper wire into the suction box 28. The box may extend throughout a portion of the lower half of the roller 17 and it may consist of a plurality of sections 29, 30, 31 operating under different degrees of vacuum, e.g., a higher degree of vacuum may be desirable at the nip (section 31) than in the pond (section 29) so that as formation progresses, and hence water has to be drawn through the already formed fibres, a greater degree of vacuum is exerted on the pond.

In another modification for a slow running machine (200 ft. per minute)—see also Fig. 8—a suction box 32 is provided beyond the large diameter roller either in place of or in addition to the waterway 19. This operates on the pulp after it has passed the nip. The said suction box 32 may be located before or beyond the waterway 19 when the two mechanisms are used together, and in an alternative a suction box may be used that comprises a waterway 33 at the other end. Thus said end is sloped and is sloped a short distance up the slope so that water flowing up the sloping face passes into or is drawn into the slot.

Instead of providing a plain slice such as 19, said slice may be suctionized.

Reference has hereinafore been made to the roller 17 being of comparatively large diameter and it is to be understood that this means the dimensions of the roller are sufficient to provide a reasonable sized forming area (tapering gap) for the turbulent pond commensurate with the speed of the machine and nature and consistency of the pulp to be dewatered. It should be mentioned that the nature and consistency of the pulp alters the characteristics of the turbulent pond. For example heavily beaten stock, which does not readily part with its water, may provide a higher and longer pond than pulp that part with their water easily.

For example in a high speed machine where the pond is, say, two inches in extent a roller of five inches diameter would probably suffice. When however a machine is running slowly and the pond extends, say, for two feet, then a roller up to three feet in diameter may be desirable. It might be assumed that a four foot pond would require at least a four foot diameter roller, but this is not so because the height of the pond does not increase directly in proportion to its length and so a good portion of a four foot roller would remain unused and clearly it is not desirable to use an unnecessarily large roller because of increased costs occasioned thereby.

It is of course desirable to provide a roller that is suitable for all speeds of travel of carrier band and all consistencies and nature of stock so that any individual machine may be readily adapted for different conditions, and the most suitable dimensions for this purpose appears to be a roller of about 3 feet diameter.

In some instances it has been found advantageous to provide an enclosed space beyond the roller 17 extending up to the waterway 19 as by this means the operation of suction can be more accurately controlled.

Although it is hereinafore stated that the roller 17 squeezes the upper wire 16 and the carrier band 6, it is to be understood that this may only be so when the machine is in operation. For example, if a pulp containing 98% water and 2% solids has its water content reduced to 96% when it reaches the nip and the layer consisting of 96% water is, say ¼" thick, then the roller 17 may be set so as to provide a ¾" gap. It is thought that in practice the travelling carrier band gives under the influence of the pulp when the machine is in operation.

I claim as my invention:

1. Apparatus for making fibrous webs from a watery
pulp comprising, a traveling permeable carrier band having a horizontal upper run for the pulp, a looped upper forming wire having a horizontal lower run for conduction with the said upper run, a permeable oncoming roller for the forming wire arranged to maintain the lower run thrusting against the carrier band and to provide a wedge-shaped entry to the horizontal runs, said entry being defined by the periphery of the roller in cooperation with the said upper run, means for delivering watery pulp to said entry, and an inclined waterway in the loop of the upper forming wire downstream from the roller for receiving and removing water passing from the pulp through the periphery of the roller.

2. Apparatus for making fibrous webs from a watery pulp comprising, a looped traveling permeable carrier means having a first run for the pulp, a forming wire having a second run opposite to said first run, a permeable oncoming roller for the forming wire in the loop thereof positioned to urge said second run firmly against said carrier means and to provide a wedge-shaped entry having an outlet of restricted depth to said opposite runs, said entry being defined by the periphery of said roller in cooperation with said first run, means for delivering watery pulp to said entry, and means for receiving and removing water passing from the pulp through the periphery of the roller.

3. Apparatus for making fibrous webs from a watery pulp comprising, a looped traveling permeable carrier band having a first run for the pulp, means for delivering watery pulp to said carrier band, a looped forming wire having a second run parallel to said first run, an oncoming roller for said forming wire in the loop thereof, a sloping chute in the loop of the forming wire positioned across the upper surface of said second run of said forming wire beyond said roller, the surface of said roller comprising a plurality of cells formed by transverse and peripheral strips in said roller, said transverse strips being arranged at an angle to the radius of the roller to pick up water passing into said cells when the roller is rotated and to fling it towards said chute, said roller being positioned to urge said second run firmly against said carrier means and to provide therewith a tapering gap that constitutes a restriction to the free flow of watery pulp along said carrier means so that a turbulent pond of pulp is built up in said gap, water from said pond flowing into said permeable cellular roller and being transmitted therethrough to said chute.

4. Apparatus for making fibrous webs from a watery pulp comprising a looped travelling permeable carrier means having a first run for the pulp, an upper looped forming wire having a second run parallel to said first run, an oncoming roller for the forming wire in the loop thereof, said roller being positioned to urge said second run firmly against said carrier means and to provide there with a tapering gap that constitutes a restriction to the free flow of watery pulp along said carrier means so that a turbulent pond of pulp is built up in said gap, a water removal chute in the loop of the forming wire downstream from the oncoming roller, a plurality of polygonal cells at the surface of said oncoming roller formed by transverse and peripheral strips of said surface, said cells constituting means for receiving water from the pond at the gap and for flinging said water to said chute for upwards removal.

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