April 14, 1959 G. H. SHELDON 2,881,673

DEWATERING IN THE MANUFACTURE OF PAPER AND BOARD

Filed May 8, 1957 3 Sheets-Sheet 1

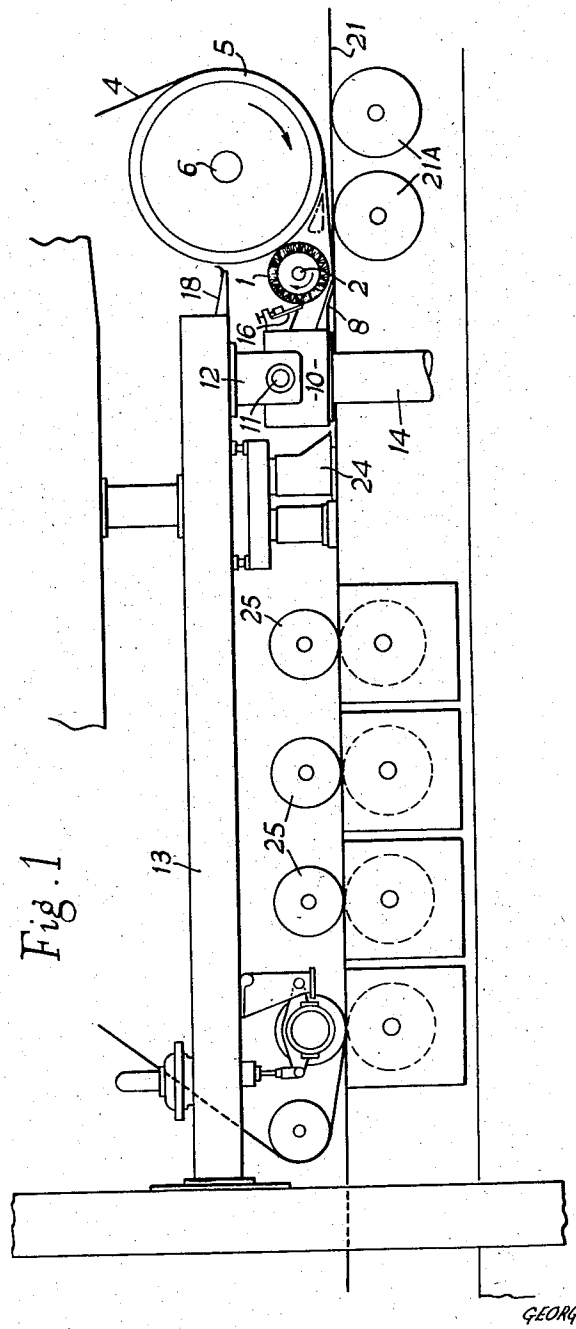

Fig. 1

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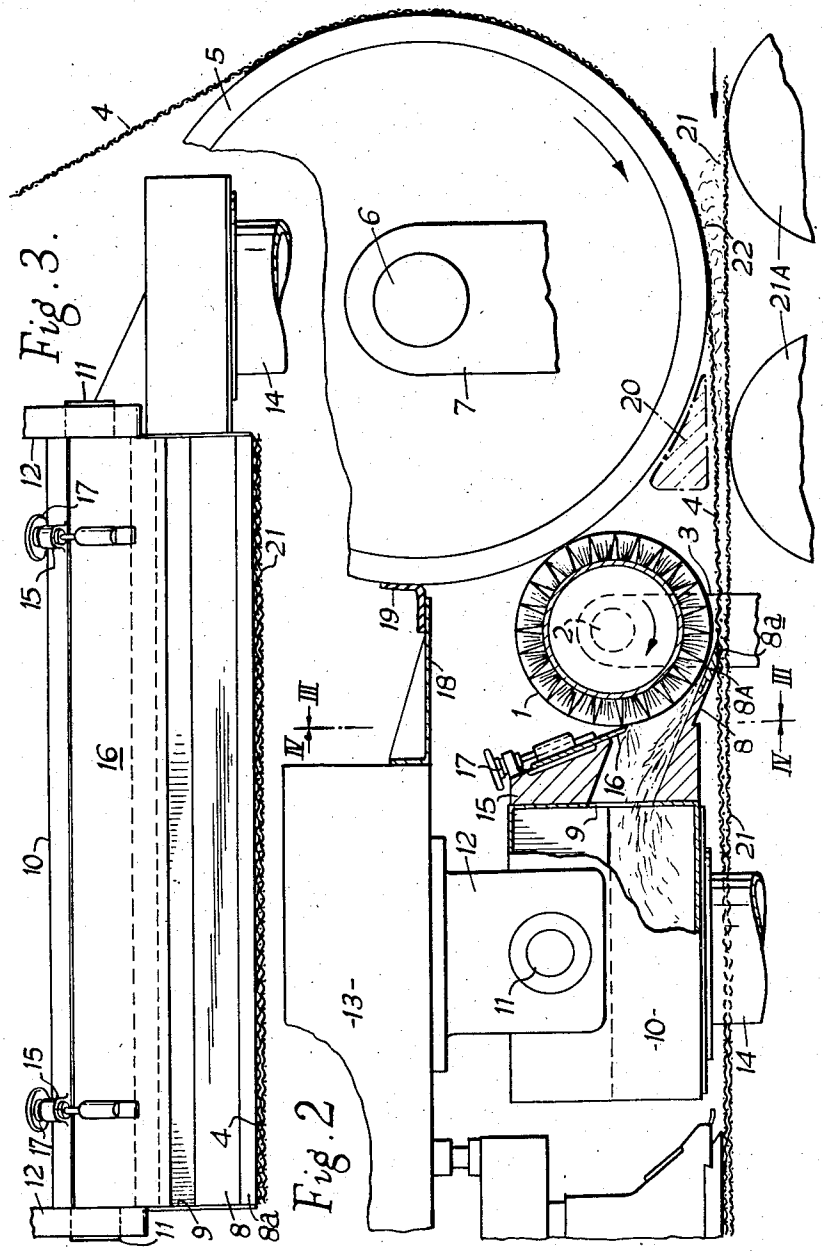

Fig. 3.

Fig. 2

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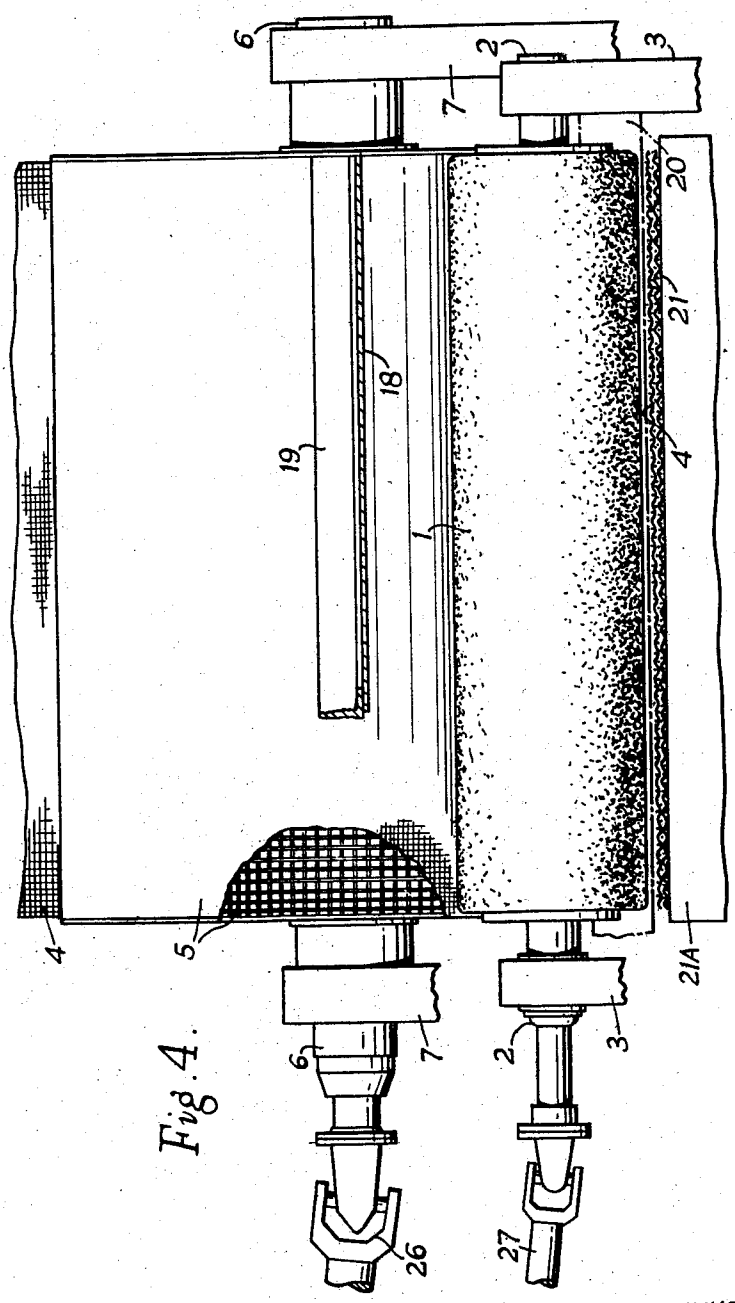

Fig. 4.

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2,881,673

DEWATERING IN THE MANUFACTURE OF PAPER AND BOARD

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Application May 8, 1957, Serial No. 657,942

Claims priority, application Great Britain May 12, 1956

10 Claims. (Cl. 92—39)

The present invention concerns the dewatering of dilute aqueous stock for formation of fibrous webs therefrom in the manufacture of paper, paper board and similar fibrous products.

In the manufacture of paper and similar fibrous webs the forming or formed web may be overlaid by an upper water-permeable surface traveling in contact with said web as it is carried along a moving carrier band, or a formed layer of stock on said band, resulting in water passing up through said upper permeable surface.

It is an object of this invention to provide improved means to facilitate removal from the top side of said upper permeable surface of water passing therethrough.

More particularly it is an object of the invention to facilitate removal of water passing upwardly through a top forming wire in a method of dewatering in which web formation occurs at least partially in an upward direction.

Another object of the invention is to provide means assisting in the removing of water through such a top forming wire, under the influence of momentum developed in stock entering a convergent gap between said top wire and a bottom wire onto which an open top layer of stock is delivered or onto a previously formed layer on said bottom wire.

The present invention achieves the foregoing objects by traversing a bristled surface above the top forming wire or other upper permeable surface to sweep water discharging therethrough into a drainage system.

The bristled surface is preferably in the form of a rotary brush touching or stationed in close proximity to the upper side of said top forming wire or the like.

The brush is preferably disposed adjacent a water collecting means which together with the brush conveniently extends across the full width of the member. A deflector having an edge closely adjacent to or actually in contact with the brush is preferably arranged to divert water from the rotating surface of the brush towards the collecting means.

The invention will be described further, by way of example, with reference to the accompanying drawings, wherein:

Figure 1 is a diagrammatic side elevation of a dewatering unit adapted for upward removal of water and upward formation of fibers on the underside of a top forming wire which is mounted above the carrier band of a Fourdrinier paper making machine,

Figure 2 is an enlarged view of the rotary brush and associated inclined waterway and deflector, and

Figures 3 and 4 are views looking in the directions of arrows III—III and IV—IV in Figure 2 respectively.

In the arrangement shown the rotary brush **1** has its horizontal axle **2** mounted in bearings **3** above a top forming wire **4**, with its periphery in close proximity to or touching the upper side of said top forming wire **4**.

The brush **1** is positioned immediately following a roll **5**, preferably one having, as shown, a perforated or

cellular surface around which the upper forming wire **4** is trained; said roll **5** has its axle **6** journalled in bearings **7** and disposed horizontally and parallel to the axle **2** of brush **1**. The brush **1** may be adjustably mounted so as to be capable of being positioned to rotate just in contact with the roll **5** and slightly above the upper side of the forming wire **4**. The direction of rotation of the brush **1** is the same as that of the roll **5**, and it therefore travels in the same direction as the forming wire **4**. The rate of rotation of the brush is such that its peripheral speed is in excess of that of the linear or surface speed of the wire **4**. The portion of brush **1** which is adjacent roll **5** therefore moves in a peripherally opposed direction as compared with the roll, and where the brush **1** makes contact with the roll **5** it has the effect of cleaning the roll surface. In a slow running paper making machine the linear speed of the forming wire **4** may be in the region of 400 feet per minute, whereas in the case of a high speed machine the wire **4** may run in the region of 1000 feet per minute; in both cases the brush **1** may have a peripheral speed of say 1500 feet per minute. The ratio between wire and brush speeds is, however, best determined by trail; it will be found that a high brush speed is advantageous.

Following the brush **1**, that is, downstream thereof is an inclined waterway **8** in the form of a guide plate or ductor having a horizontal surface portion disposed with its lower end in contact with the upper side of the forming wire **4**, said waterway **8** extending below but not quite touching the brush **1**. The edge **8***a* of the waterway **8** is renewable. The angle of inclination of this waterway **8** relative to the wire may be, for instance, between 20° and 30°.

The upper end of the waterway **8** terminates in contact with the lower edge of an aperture **9** in a transverse conduit **10** extending the full width of the wire **4**. The conduit **10** is conveniently mounted on trunnions **11** in bearings **12** suspended from part of the machine frame **13** by which also the bearings **3** and **7** are supported, the lower wall of the conduit **10** being disposed somewhat above the upper side of the wire **4**. The conduit **10**, which may be open at the top or closed in, as shown, is provided with a suitable drain pipe **14** for discharging water collected in said conduit.

Above the waterway **8**, and mounted in bracket means **15** on the side of the conduit **10**, is a deflector **16** preferably carried, as shown, on two (or more) screw adjustment devices **17**, so that the lower edge of the deflector **16** may be brought towards or away from the surface of the brush **1** surface; the deflector **16** by lightly contacting the brush bristles prevents them from carrying over an excessive amount of water. The lateral ends of the waterway **8** are preferably closed by side walls or fences. The space between the roll **5** and the conduit **10**, within which space the brush **1** is stationed, is preferably covered, as shown, by a roof **18** to shield against splashing water, the roof edge **18** carrying a flexible rubber or like strip **19** lightly bearing on roll **5** to remove surplus water.

The deflector **16** may be tipped with or at least partially formed of glass or ceramic material or rust resistant metal such as stainless steel; similar materials may be used for the renewable waterway edge **8***a*.

For reducing turbulence and improving the extractive action of the brush **1** (there is appreciable suction on the uprising lower side of roll **5**) a roughly triangular-section cross bar **20** may be mounted in a space of generally triangular section defined by the slightly downwardly inclining upper side of forming wire **4** and by the uprising side of roll **5**.

In a high speed machine the sweeping action of the

brush augments the influence of momentum in the stock carried forward by the wire **21**, whereas in a slow speed ried forward by the wire **21**, whereas in a slow speed machine this momentum effect may be small and water removal is then largely dependent on the brush.

The brush **1** may be assisted in its action by surrounding it with a suction box or by otherwise associating a suction device with it.

The brush bristles are preferably composed of nylon or a similar fairly flexible material; to provide a sweeping action; on a brush of about 10 inches diameter the bristles may be about 2 inches long, but the material and characteristics of the bristles is preferably determined by trial.

The waterway or doctor **8** serves a dual purpose. That is, it not only constitutes a surface over which white water is swept by brush **1**, but it constitutes also a pressing element serving to constrain the forming wire **4** to move above the main wire carrier band **21** of the machine—such as a so-called Fourdrinier wire. By suitably disposing the roll **5** the downcoming side thereof trains the top forming wire **4** so that the portion of wire **4** between roll **5** and the waterway **8** forms with the top horizontal run of carrier band **21**, a tapering gap **22**, with the waterway **8** at the convergent end thereof. The tapering gap **22** is bounded above and below by forming wires **4** and **21** respectively and laterally by side deckles (not shown) and thus provides a space wherein a turbulent pond of stock is created, formation of fibrous layers upwards and downwards simultaneously being effected as water from the stock passes through the advancing wires **4** and **21**. Downstream of the wire-pressing waterway **8** an inverted suction box **24** may be provided, as shown in Figure 1, followed by press roll assembles **25** and other devices customarily employed at the wet press end of a paper making machine; these further devices cause the layers forming on wires **4** and **21** to interlock to produce a unitary, so-called single-ply web. In the manufacture of a multiply web, the layer of fibers forming beneath wire **4** is pressed into interlocking relation with a previously formed web carried on the main band or wire **21**; in such a case and particularly where several additional layers are formed, dewatering is effected mainly in an upward direction by the passage of water through top forming wire **4**. The roll **5** is driven from a suitable power source through coupling means **26** so as to run synchronously with forming wires **4** and **21** and the brush **1** is separately driven at a higher speed from a suitable power source through coupling means **27**.

I claim:

1. In the method of making a paper web which comprises introducing an open top layer of dilute aqueous stock between a top forming wire and a web on a bottom forming wire, advancing the forming wires with the web and stock therebetween, discharging water from the stock through the top forming wire to form a web on the under face of said top forming wire, and pressing the two wires toward each other to squeeze the web on said under face into interlocked unitary relation with the web on the bottom forming wire, the improvement of continuously traversing bristles above the top forming wire to sweep water discharging therethrough away from the top forming wire, and removing water from the bristles before the bristles again traverse the top forming ware.

2. In the method of making a fibrous web which comprises advancing opposed forming surfaces in the same direction along converging paths to form therebetween a gap of diminishing height, introducing a layer of stock into said gap, maintaining the thickness of said layer less than the width of the entrance mouth of said gap, moving the stock with the surfaces through the gap, and applying mechanical pressure to the stock between the surfaces at the convergent end of said gap, the improvement of removing water from the stock through said upper surface partly under the influence of momentum built up in the water by the traveling stock in the gap and partly by the sweeping action of a rotating brush stationed in close proximity to the top side of said upper forming surface downstream of the divergent end of said gap and rotating in the direction of the advancing forming surfaces with a higher peripheral speed than the linear speed of said forming surfaces and forming the stock on said opposed forming surfaces into a unitary web.

3. In a machine for forming fibrous web material from watery pulp including opposed looped forming wires having active runs defining a forming gap therebetween, a pulp feed device for feeding a layer of watery pulp into said gap to be formed into a web on said wires, and a doctor in the loop of one wire at the downstream end of said gap acting on the active run of said one wire and defining a waterway for removal of water expressed through said one wire, the improvement of a rotatable brush in the loop of said one wire upstream from said doctor and arranged to sweep water from said one wire over said waterway to assist in separation of water from said one wire, and a deflector on the ascending side of the rotatable brush coacting with the bristles of the brush to decrease amounts of water carried by the bristles to the descending side of the brush.

4. In a paper making machine which comprises a looped bottom forming wire having a top active run, a looped top forming wire having a bottom active run overlying said top active run, a roll in the loop of said top wire directing said active bottom run thereof, and a slice in the loop of said top wire pressing said active under run thereof toward the bottom wire downstream from said roll, the improvement of a rotary brush in the loop of said top wire between said roll and slice having bristles radiating therefrom to sweep water from said active run of the top wire over said slice, and means coacting with said bristles to minimize rewetting of the top wire with water from the bristles.

5. In a web forming machine wherein a web is formed between upper and lower traveling looped forming wires and a doctor in the loop of the top wire acts on the bottom active run thereof and receives water thereover to separate water from the top wire, the improvement of a rotating brush in the loop of the top wire immediately in advance of said doctor and acting on said top wire to sweep water therefrom over said doctor, and baffle means to decrease water carryover by said bristles.

6. In a dewatering apparatus for forming fibrous webs including a main forming wire having an active upper run, a plurality of stock inlets at longitudinally spaced intervals along the length of said upper run to supply stock thereto, a top wire for each inlet having an active bottom run starting adjacent each inlet and converging with the main forming wire downstream from the inlet to provide stock forming gaps of progressively decreasing height, means for driving all of said wires so that their active runs travel in the same direction, doctors within the loops of each top wire pressing the active runs thereof against the stock between the wires to squeeze the stock, said doctors having inclined top surfaces disposed at an angle relative to the bottom runs of the top wires and adapted to receive a flow of white water thereover, the improvement of rotating brushes mounted upstream of said doctors acting on white water expressed through the bottom runs of said top wires to sweep said water over the inclined top surfaces of said doctors and cooperate with the momentum built up in the stock by the advancing wires to dewater the stock.

7. In a web making machine including a looped bottom forming wire having an active upper run adapted to form a web, a looped top forming wire having an active under run overlying said upper run and coacting therewith to define a stock receiving gap, means for feeding a layer of aqueous stock into the leading end of said gap having less thickness than the width of said leading end, means for driving the wires to advance the stock along said gap

while dewatering the stock upwardly through the under run of the top wire to deposit a layer of fibers on the under surface of said under run, water removing means in the loop of the top wire receiving water from the under run of the top wire, and means for pressing the layer of fibers on the under face of the active under run of the top wire against the web on the upper run of the bottom wire to interlock the layer and web, the improvement of a bristle-equipped member mounted in the loop of the top wire in close proximity to the active under run thereof, and means for traversing said bristle-equipped member in the same direction as but at greater speed than the top wire to sweep water from the top wire to said water removing means.

8. In a paper making machine including an elongated looped main forming wire having a top active run, a looped top forming wire having an active bottom run overlying the top run of the main wire, a guide roller in the loop of the top wire spaced above the active top run of the bottom wire to direct the top wire in spaced relation over the bottom wire, a downwardly inclined waterway in the loop of the top wire acting thereon downstream from said guide roller to provide an inclined bottom run on the top wire converging toward the top run of the bottom run, a stock inlet for introducing stock into the gap between the top run of the bottom wire and the converging run of the top wire to create a hydraulic head of stock in said gap, said inclined waterway applying mechanical pressure to the stock between the wires at the converging end of said gap, means for driving said wires to advance the top run of the bottom wire and the bottom run of the top wire in the same direction at a speed sufficient to impart momentum to the white water in the stock for carrying said white water over the waterway and above the bottom run of the top wire, a drain trough in the loop of said top wire coacting with the waterway to receive white water therefrom, squeeze roll assemblies having rolls in the loops of the respective wires downstream from said waterway to squeeze the paper stock between the wires, and suction slices cooperating with said squeeze roll assemblies in the loop of the top wire to remove the white water squeezed from the web

by said assemblies, the improvement of a rotatable brush above the inclined bottom run of said top wire upstream of and adjacent the lower end of said waterway, means for driving said brush to sweep white water over said waterway from said top wire, and a deflector contacting the uprising side of said brush to remove excess water therefrom.

9. In a paper making apparatus having a top wire, a trough in the loop of said top wire spanning the bottom run thereof, a flat scraper tiltably mounted adjacent said trough having an active bottom edge engaging the upper face of said bottom run of the wire and an upper edge discharging into said trough, and means for adjusting said scraper to vary the degree of inclination thereof, the improvement of a rotating brush situated in close proximity to the bottom run of said top wire and adjacent said scraper for sweeping water thereover into said trough, and deflecting water from the brush before it approaches the top wire.

10. In a paper making machine wherein a web is formed from aqueous stock between upper and lower traveling perforate looped bands, and doctor means are arranged within said upper looped band to carry and remove water expressed upwardly from said aqueous stock during said formation, the improvement of a rotating brush located upstream of said doctor and a drain system located downstream of said doctor so that water passing through said upper traveling band is swept up said doctor surface by said rotating brush into said drain system.

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