March 15, 1966 D. E. ROBINSON ETAL 3,240,665

OFFSET GRATING ASSEMBLIES FOR DEWATERING A PAPER WEB

Original Filed Feb. 6, 1962 2 Sheets-Sheet 1

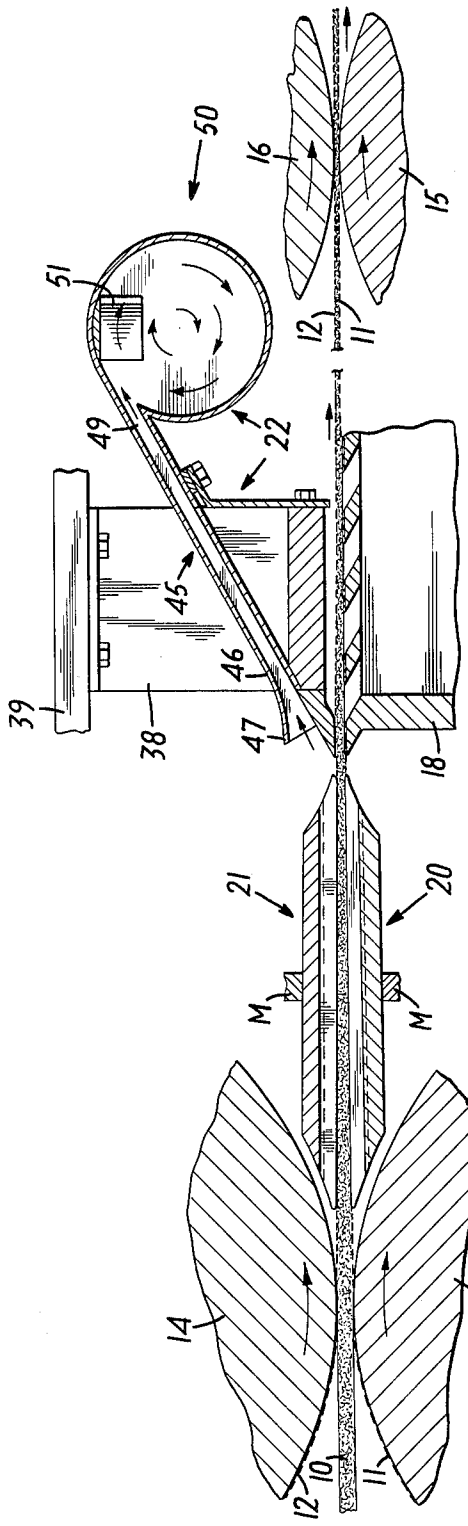


FIG. 1

INVENTORS.
DAVID E. ROBINSON &
JAMES MORAN
BY Brumbaugh, Free, Graves & Donohue
their ATTORNEYS

March 15, 1966 D. E. ROBINSON ETAL 3,240,665

OFFSET GRATING ASSEMBLIES FOR DEWATERING A PAPER WEB

Original Filed Feb. 6, 1962 2 Sheets-Sheet 2

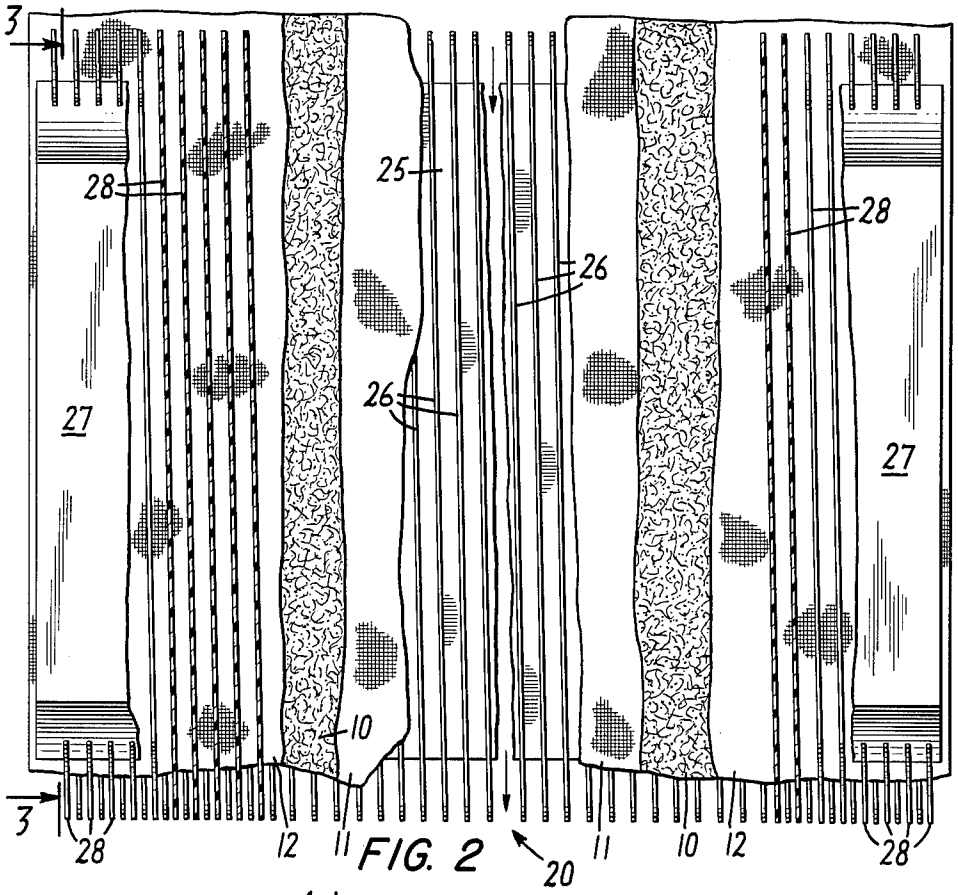


FIG. 2

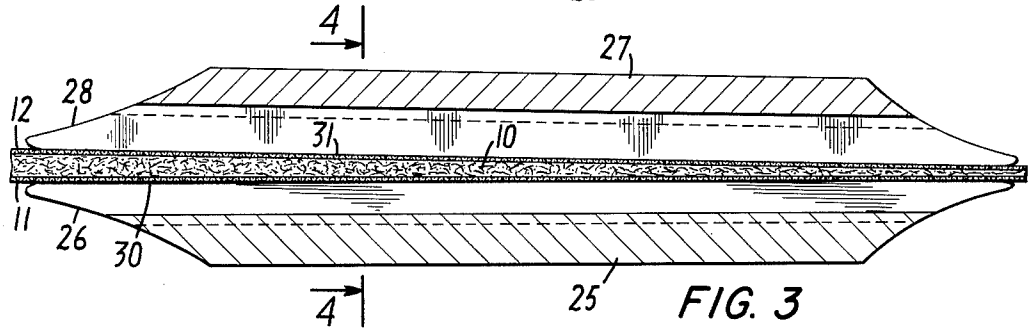


FIG. 3

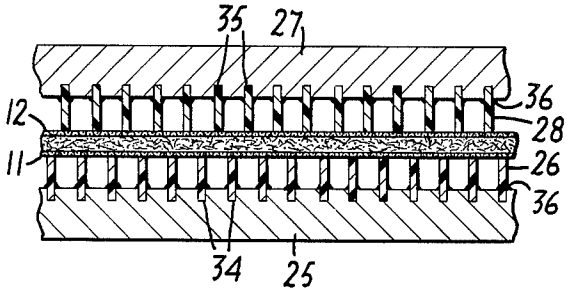


FIG. 4

INVENTORS.
DAVID E. ROBINSON &
JAMES MORAN
BY Brumbaugh, Free, Graves & Donohue
their ATTORNEYS

United States Patent Office 3,240,665 Patented Mar. 15, 1966

3,240,665
OFFSET GRATING ASSEMBLIES FOR DEWATERING A PAPER WEB

David E. Robinson and James Moran, Norwalk, Conn., assignors to Time Incorporated, New York N.Y., a corporation of New York

Original application Feb. 6, 1962, Ser. No. 171,364. Divided and this application Aug. 19, 1963, Ser. No. 303,473

2 Claims. (Cl. 162—303)

This is a division of application Serial No. 171,364, for "Paper-Forming Apparatus and Methods," filed by David E. Robinson on February 6, 1962, now abandoned.

This invention relates to paper forming and, more particularly, to novel and highly effective apparatus including offset grating assemblies for receiving paper stock from a source such as a slice and removing the water from the stock without removing appreciable amounts of clay and fines along with the water and without disrupting the stock as it felts to form a web of paper.

Conventional paper-forming apparatus provides poor control over the rate of water removal from the web of paper stock and permits excessive loss of clay and fines from the stock, and frequent disruption of the web during the critical initial phases of the forming process results.

A principal object of the present invention is to remedy the problems outlined above and to provide improved means for making paper, including paper of the highest quality. More particularly, an object of the invention is to provide means for gently removing large quantities of water from a paper stock substantially immediately after its discharge from a slice and before the stock is subjected to the act of web-disrupting apparatus such as suction boxes.

The objects of the invention are accomplished by providing, in an exemplary embodiment of the invention adapted for use in a paper-forming machine having a pair of opposed permeable belts such as Fourdrinier wires and a pair of grating assemblies for establishing a controlled convergence of the belts or wires over an appreciable length thereof adjacent to the slice, means mounting the grating assemblies with the blades of one of the assemblies lying in planes between adjacent planes of the blades of the other of the assemblies.

An understanding of further particulars of the invention may be obtained from a consideration of the following detailed description of a representative embodiment thereof in conjunction with the accompanying figures in the drawings, of which:

FIGURE 1 is a simplified or somewhat schematic elevational view, partly in section, of a portion of a paper-forming machine constructed in accordance with the invention;

FIGURE 2 is a plan view partly broken away, of a pair of grating assemblies constructed in accordance with the invention and adapted to establish a controlled convergence of a pair of permeable belts in a forming area closely spaced apart from a slice;

FIGURE 3 is a view taken approximately along the line 3—3 of FIGURE 2 and looking in the direction of the arrows; and

FIGURE 4 is a view taken approximately along the line 4—4 of FIGURE 3 and looking in the direction of the arrows.

FIGURE 1 shows a jet of paper stock 10 ejected in the direction indicated by the arrow, preferably at high speed, from a slice (not shown) and directed between a pair of opposed permeable belts such as Fourdrinier wires 11 and 12 respectively trained about a pair of opposed breast rolls 13 and 14. The jet stock is typically thin (0.3 inch, for example, in the vertical dimension of FIG. 1) and

substantially as wide in a direction normal to the plane of the figure as the rolls 13 and 14. The permeable belts or wires 11 and 12 are adapted to permit passage therethrough of water from the jet of stock 10.

The roll 13 forms with a roll 15 mounted in spaced-apart relation thereto a belt or wire path, run, or reach along which the belt or wire 11 is adapted to travel in a direction from the roll 13 to the roll 15. Similarly, the roll 14 forms with a roll 16 mounted in spaced-apart relation thereto a second belt path in which the belt 12 is adapted to move from the roll 14 to the roll 16. The rolls 13, 14, 15, ,and 16 are adapted to rotate, and hence the belts 11 and 12 to move, in the direction indicated by the arrows respectively associated therewith at tangential speeds equal to one another and, preferably, to the speed of the jet of stock 10.

As the stock proceeds through the forming zone or along the path between the rolls 13, 15 and 14, 16, water drains downwardly therefrom under the influence of gravity, passing from the web-contacting side of the belt 10 to the opposite or water-drainage side. Typically, one or more suction boxes such as the suction box 18 are used to accelerate the drainage of water. In conventional paper-forming apparatus, a suction box so employed is likely to withdraw water from the stock so abruptly, even though little suction is applied, that fines and clay— which, owing to the necessarily low consistency of the stock at this stage, have not had an opportunity to become intimately associated with the larger fibers—are withdrawn along the water. A suction box so employed may even rupture the web. Accordingly, one or more belt-converging means such as grating assemblies 20 and 21 may be employed. The grating assemblies 20 and 21 are mounted between rolls 13 and 14 on the one hand and 15 and 16 on the other and preferably as close as possible to the rolls 13 and 14. At a point closely spaced apart from (by a quarter of an inch, for example) and downstream or downwire of the belt-converging grating assemblies 20 and 21, a water-disposal means 22 is mounted. The water-disposal means 22 may but need not be opposed to the suction box 18 as shown.

The grating assemblies 20 and 21 are mounted on mounting means M to establish a gradual and controlled convergence of the belts 11 and 12 between the rolls 13, 14, and 15, 16. The convergence of the belts 11 and 12 is static or independent of the time dimension in that they converge, even when the machine is in operation, after the fashion, for example, of a pair of nonparallel railroad tracks. Further, when the machine is in operation, successive segments of the belts 11 and 12, though not the belts as a whole, converge dynamically, as might, for example, a pair of airplanes. The belt may thus be said to converge quasi-dynamically, and they express water through the belts in the forming zone from their web contacting sides to their opposite or water-draining sides.

The water-disposal means 22 establishes a spiral motion of the expressed water and is adapted to operate substantially completely full of water under a pressure generated automatically in a manner hereinafter described.

The partly-broken-away plan of FIGURE 2 reveals that the grating assembly 20 comprises a mounting member or holding means 25 mounting a plurality of blades 26 for contact with the belt 11. Similarly, the grating assembly 21 comprises a mounting member or holding means 27 mounting a plurality of blades 28 for contact with the belt 12. The blades 26 and 28 may be formed of stainless steel especially where, for example, the belts 11 and 12 are made of nylon. Alternatively, they may be formed of a thermosetting plastic made from fabric or paper impregnated with phenol-formaldehyde resins

and compressed under heat into a permanently solid substance with good structural properties. One such substance is sold by Westinghouse Electric Corporation under the trademark "Micarta."

The blades **26** and **28** may be about 1/16" or less thick in a horizontal direction transverse to the direction of stock flow and are disposed in planes parallel to one another and normal to the portions of the belts **11** and **12** between the rolls **13, 15,** and **14, 16.** The planes of the blades **26** may be equally spaced apart a distance of about 1/4"; the planes of the blades **28** are preferably spaced apart the same distance. Further, in order to prevent shadow marking of the web, the blades **26** and **28** should form a small angle, preferably considerably less than 30°, with the direction of travel of the portions **11** and **12** between the rolls **13, 15,** and **14, 16.** For example, where the blades **26** and **28** are, say, 10" to 24" in length and 1/16" thick, one end may be displaced from the other 1/4" to 9/10" or slightly more in a direction transverse to the direction of motion of the portions of the belts **11** and **12** between the rolls **13, 15,** and **14, 16,** so that an end of one blade barely overlaps the opposite end of an adjacent blade.

FIGURE 3 shows more clearly than FIGURE 1 that the surfaces or edges **30** and **31** of the blades **26** and **28** which contact the belts **11** and **12,** respectively, converge in a direction from the rolls **13** and **14** to the rolls **15** and **16.** In a typical case, the angle of convergence may be 1/4° to 6°. For example, where blades having a length of 10" are employed, the vertical spacing between opposed edges **30** and **31** may be decreased from 0.3" at the upstream end to 0.03" at the downstream end.

As another example, where blades 24" in length are used, the gap between the wires **11** and **12** may converge from .312" at the upstream ends of the blades **26** and **28** to .0.47" at the downstream ends of the blades. The optimum degree of convergence depends to some extent on forming speed and other parameters, as workmen skilled in the art will readily understand.

The edges **30** and **31** may, if desired, be contoured so that the rate of belt convergence is not constant along their length. For example, a slight convexity of the edges **30** and **31** towards the belts **11** and **12** may be desirable in many cases, so that the belts converge somewhat more rapidly in the vicinity of the upstream portion of the blades **26** and **28** than in the vicinity of the downstream portions.

It can be seen from FIGURE 7 that the blades **26** and **28** are adjustably mountable in slots **34** and **35** respectively formed in the holding means **25** and **27** and extending generally longitudinally of but forming a small angle with the portion of the belts **11** and **12** between the rolls **13, 15,** and **14, 16.**

The structure described in the preceding part of the specification is disclosed together with other structure in the co-pending application Serial No. 171,364 referred to above and is claimed in that application and not in the present application.

Our joint invention claimed in the present case is characterized by the location of the plane of each blade **26** or **28** (with the possible exception of the two end blades, each being represented in FIGURE 2 as a blade **28**) between the planes of adjacent blades **28** and **26,** respectively. This offset arrangement of one grating assembly with respect to the other tends to prevent shadow marking of the web, inasmuch as there is no infinitesimal portion of the web which is bounded on opposite sides by a blade edge. Rather, every small portion of the web is free of a blade edge on at least one side, so that drainage of water away from one side or other of the web is always possible.

Thus, there is provided in accordance with the invention novel and highly effective apparatus for receiving paper stock from a source such as a slice and removing the water from the stock without removing appreciable amounts of clay and fines along with the water and without disrupting the stock as it felts to form a web of paper.

Many modifications in form and detail of the representative embodiment of the invention disclosed herein will readily occur to workmen having the ordinary skill of the art.

Accordingly, the invention is to be construed as including all of the modifications which fall within the scope of the appended claims.

We claim:

1. Apparatus for forming paper comprising first and second rolls mounted in spaced-apart relation to each other and defining a first belt path therebetween, third and fourth rolls mounted in spaced-apart relation to each other and defining a second belt path therebetween, said first and second belt paths being closely spaced apart from and generally parallel to each other, a first permeable belt trained about said first and second rolls and having a portion lying in said first path, a second permeable belt trained about said third and fourth rolls and having a portion lying in said second path, means connected to said first and second belts for driving said first belt over said first and second rolls and from said first roll to said second roll in said first path and said second belt over said third and fourth rolls and from said third roll to said fourth roll in said second path, said portions moving generally in the same direction, first belt-converging means, first holding means mounting said first belt-converging means for contact with said first belt between said first and second rolls, second belt-converging means, and second holding means mounting said second belt-converging means for contact with said second belt between said third and fourth rolls, said first and second belt-converging means co-operating with each other to establish a quasi-dynamic convergence of said portions, said belt-converging means including, respectively, first and second pluralities of blades disposed in first and second rows extending across said first and second portions substantially transversely of said direction, each blade extending generally parallel to said direction, said portions being substantially horizontal, and said blades being in substantially parallel and equally-spaced-apart vertical planes, at least some of the planes of the blades of said first row being between adjacent planes of the blades of said second row.

2. Apparatus for forming paper comprising first and second movable permeable belts positioned to move in opposed relation through a forming zone generally in the same direction and to carry therebetween a paper stock, first and second pluralities of blades, each blade of said first plurality of blades having an edge positioned to contact said first belt and each blade of said second plurality of blades having an edge positioned to contact said second belt, and blade-mounting means for effecting a mounting of said blades establishing a convergence of said belts facilitating controlled dewatering of said stock and formation of a paper web, said edges of said first plurality of blades being offset from planes which (a) contain said edges of said second plurality of blades and (b) are normal to said belts.

References Cited by the Examiner

UNITED STATES PATENTS

2,881,676	4/1959	Thomas	162—203
3,149,028	9/1964	Robinson	162—203

FOREIGN PATENTS

89,033	4/1937	Sweden.

DONALL H. SYLVESTER, *Primary Examiner.*