Jan. 20, 1942. W. C. NASH 2,270,465

PAPERMAKING MACHINERY

Filed Jan. 11, 1939 2 Sheets-Sheet 1

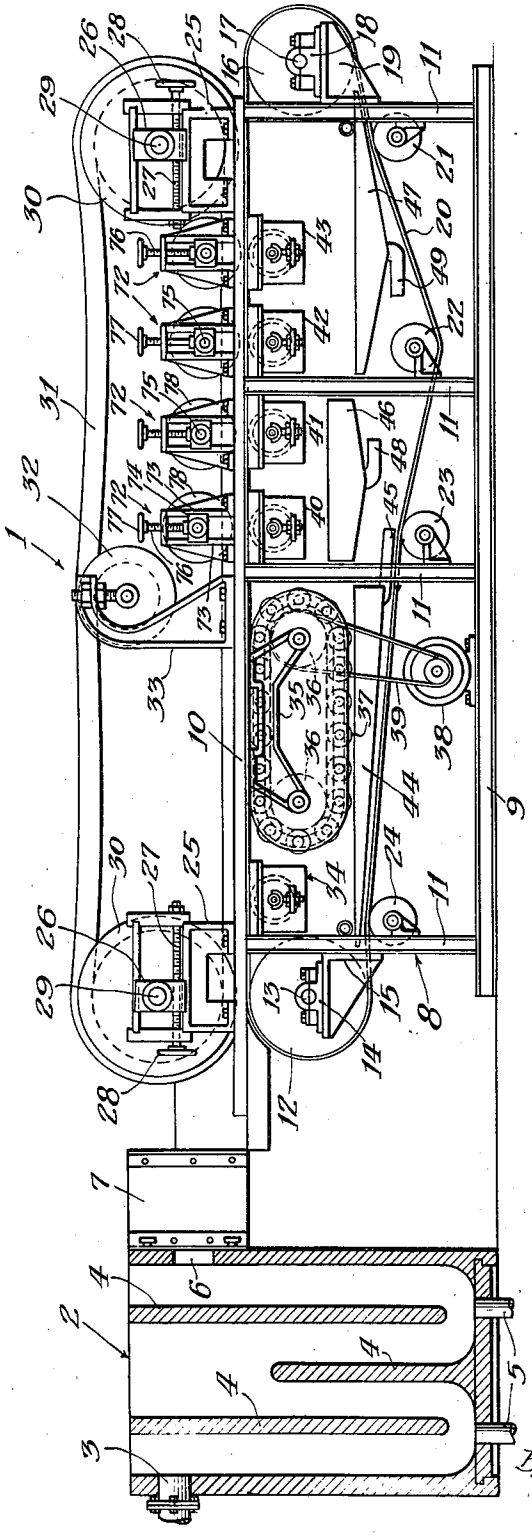


Fig. 1.

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Fig. 2.

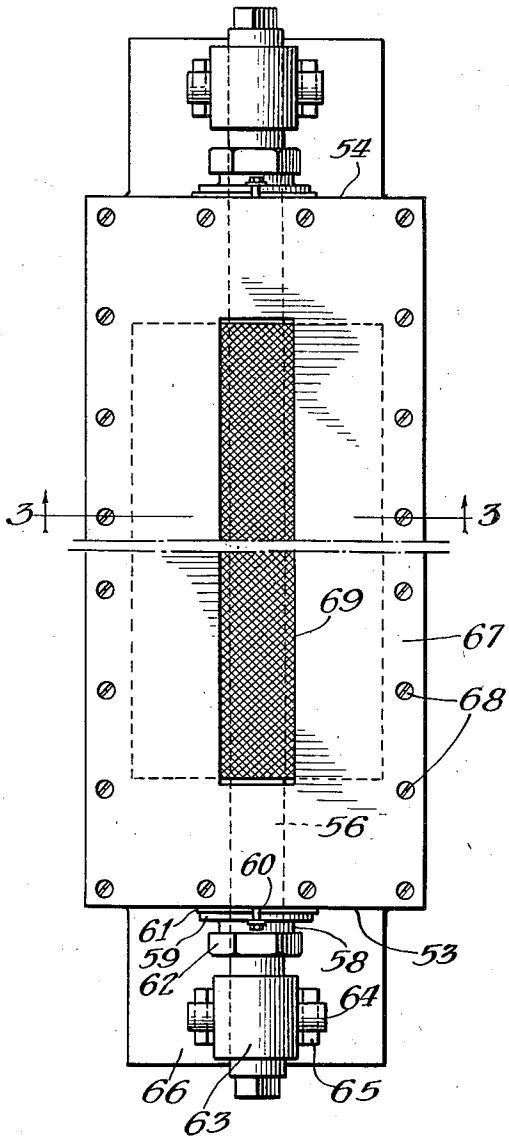
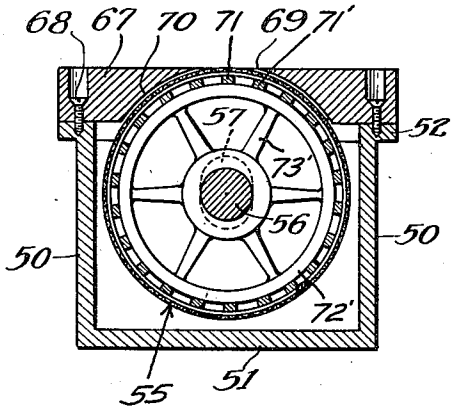


Fig. 3.



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PAPERMAKING MACHINERY

William C. Nash, Neenah, Wis., assignor of one-fourth to Mary Jones, Neenah, Wis., one-fourth to William M. Nash, Menasha, Wis., one-fourth to Roy A. Nash, Bronxville, N. Y., and one-fourth to Marie Duvall Nash, Neenah, Wis.

Application January 11, 1939, Serial No. 250,296

1 Claim. (Cl. 92—44)

This invention relates to improvements in means for making paper.

It is the ultimate object in the manufacture of paper to make a well formed, smooth surfaced paper as rapidly as possible. To properly lay the fibres upon the paper forming wire the pulp must be highly diluted. For example, the fibrous content of the pulp heretofore used has ranged as low as ½ to ¼%. However, the removal of such a high percentage of carrier after the pulp has been passed to the forming wire presents a serious problem, particularly in the passage of the forming wire over the tube rolls. This problem has been completely discussed in my issued United States Patents No. 2,083,341 and No. 2,083,342. Utilizing the principles of my present invention the percentage of aqueous carrier can be increased accompanied by the advantages which flow from the use of a highly diluted pulp and yet by the rapid removal of the carrier after the pulp has passed to the forming wire, as contemplated by my present invention, the disadvantages of a high aqueous carrier content are eliminated.

By the rapid removal of the aqueous content of the pulp, wire speeds may be increased without in any way decreasing the quality of the paper.

Another advantage accruing from the use of my invention resides in the saving which may be effected by returning the aqueous carrier drained through the wire to the head box. This drainage is rich in filler and short fibres which are thus recovered. It is possible to effect this saving because higher carrier percentages may be used than has heretofore been possible.

In addition, by the use of my invention, the overall length of the paper forming wire may be materially decreased and in many instances the usual presses between the Fourdrinier wire and the driers may be eliminated.

Briefly described my invention comprises the passage of an aqueous pulp to a paper forming wire and by applying vacuum beneath a relatively large area of the wire immediately following the breast roll, quickly forming a preliminary fibrous mat surface upon the wire which serves as a foundation upon which the remainder of the mat is formed. The wire upon passing forwardly passes over a plurality of relatively large suction areas with or without press rolls acting in conjunction with said suction areas to further dehydrate the web.

Other objects and advantages of my invention will be apparent from the accompanying drawings and following detailed description.

In the drawings,

Fig. 1 is a side elevational view of suitable apparatus for carrying out my invention.

Fig. 2 is a top plan view of one of the suction boxes employed.

Fig. 3 is a transverse sectional view taken on line 3—3 of Fig. 2.

Referring in detail to the drawings, 1 indicate generally a paper making machine embodying the features of my invention. The paper machine comprises a head box 2 having an inlet 3 for pulp, the interior of the box being provided with a plurality of baffles 4 defining a tortuous passageway for the pulp. Draw-offs 5 are provided at the bottom of the head box and an outlet 6 permits passage of pulp into the compartment 7.

A frame 8, comprising a lower beam 9, an upper beam 10 supported by uprights 11 is positioned adjacent the head box 2. A breast roll 12 carried on shaft 13 is journalled in bearings 14 which in turn are carried by hangers 15 mounted upon an opposite pair of uprights 11. At the opposite end of the machine 1 a couch roll 16, of either the solid surface or suction type, is carried by shaft 17, journalled in bearings 18, supported by hanger 19 mounted upon an opposite pair of uprights 11. A paper forming wire 20 is trained in endless fashion around breast roll 12 and couch roll 16 and on its upper pass said wire is carried over the upper portion of the frame 8. On its lower pass the wire 20 is carried about rolls 21, 22, 23 and 24 which serve to guide the wire and tension the same.

Upon the upper beam 10 a bearing support 25 is mounted, said support carrying a bearing block 26 which is horizontally slidable upon said support. A screw 27 manipulated by hand wheel 28 is threadedly engaged with block 26 and functions to move said block horizontally in the supporting ways. A shaft 29 is journalled in blocks 26 on each side of the machine and carries a pair of wheels 30. A similar arrangement is provided at the opposite end of the machine 1 and without further description, similar reference numerals will be applied to the similar parts. A deckle strap 31 is trained in endless fashion around each pair of wheels 30 on each side of the machine. Intermediate the path of travel of the deckle strap 31 the same is supported by the idler wheel 32 carried by support

33 which in turn is mounted upon beam 10 on each side of the machine.

In carrying out my invention the pulp is discharged from the head box on to the wire 20 at approximately the vertical center line of the breast roll 12. Consequently, the deckle straps 31 are arranged to make initial contact with the wire 20 at approximately that point.

A suction box 34 is positioned beneath the wire 20 adjacent breast roll 12, said suction box being disposed as close to roll 12 as possible. Adjacent to suction box 34 beneath the wire 20 in the direction of travel of the wire a hanger frame 35 is mounted upon beam 10. The frame 35 is adapted to carry sprocket wheels 36 over which a sprocket chain (not shown) travels in endless fashion. A similar arrangement is provided upon the opposite side of the machine and a plurality of tube rolls 37 are journalled in the opposite chains. A motor 38 drives a belt 39 which, in turn, drives one of the sprocket wheels 36 thereby moving the chain carrying the tube rolls 37. This movable tube roll arrangement is fully described in my issued United States patents hereinbefore referred to.

Adjacent the frames 35 in the direction of travel of the wire 20 is a plurality of suction boxes 40, 41, 42 and 43 all disposed beneath the wire. Beneath suction box 34 and frame 35 is a trough or pan 44 having a discharge outlet 45, said trough being adapted to retrieve carrier which seeps through wire 20. Similarly, troughs 46 and 47 having discharge outlets 48 and 49, respectively, are disposed beneath the suction boxes 40, 41, 42 and 43. The discharge outlets 45, 48 and 49 may, if desired, be connected ahead of the head box 2 whereby the retrieved liquid may be returned to the system ahead of the head box.

Referring to Figs. 2 and 3, enlarged views of the suction box 34 are shown, suction boxes 40, 41, 42 and 43 being of similar construction. Each suction box comprises a box-like structure having side walls 50, bottom 51 and a top 52. The box-like structure is oblong in longitudinal section and is provided with ends 53 and 54. All of the suction boxes are disposed with their longitudinal axes transverse to the path of travel of the wire 20. The bottom portion of each of the boxes is provided with an opening (not shown) whereby a condition of vacuum may be established within said boxes.

A rotating member in the form of a roll 55 is confined in the interior of each of the boxes, said roll being mounted upon shaft 56. The ends 53 and 54 are provided with openings 57, which are oval in shape, through which opposite ends of shaft 56 extend. A collar 58 having an annular flange 59 embraces shaft 56 adjacent the box ends and is secured to said box ends by means of screws 60 or the like, the outer diameter of the flange 59 being greater than the major axis of the oval hole 57 so that said hole is completely covered by said flange. A gasket 61 is interposed between the flange 59 and the box end. A packing nut 62 embraces the collar 58 to seal the collar and shaft against the passage of air into the box along the shaft.

The endmost portions of shaft 56 are journalled in bearings 63 which carry oppositely extending trunnions 64, which in turn, are supported in a yoke 65. The yoke 65 at each end of the box is supported by an extension 66 of the bottom 51 and means is provided (not shown) for raising and lowering said yokes to adjust the roll 55 within the box.

A superstructure 67 is mounted upon the box top 52 and is secured thereto by means of countersunk screws 68. The upper surface of the superstructure or head 67 constitutes a support for wire 20 and is adapted to be perfectly smooth. An elongated opening 69 is provided in the head 67 which extends co-extensively with roll 55. Shaft 56 is so adjusted by raising or lowering bearings 63 that the surface of roll 55 extends through opening 69 slightly above the surface of the head 67. The head 67 is so curved as to traverse the upper portion of the roll 55, as shown best at 70 in Fig. 3. When a condition of vacuum is established within the suction box, the interior of the roll 55 is evacuated since the surface of the roll comprises a foraminated screen 71 mounted upon longitudinal ribs 71' which in turn are mounted upon rings 72' supported by spiders 73'.

In carrying out my invention, pulp is passed from the head box to the forming wire. The pulp is almost immediately subjected to suction by the suction box 34 whose capacity is such as to draw a large quantity of the liquid carrier through the wire. This action quickly forms a relatively thin preliminary layer of matted fibres upon the upper surface of the wire upon which the remaining fibres build the complete web. In view of the fact that this initial thin layer is quickly built up by the rapid passage of the liquid carrier through the wire the remaining thickness of the web cannot readily be deformed or the fibre formation thereof cannot be easily disturbed during the forward passage of the wire, as is the case when the liquid carrier is removed at a slower rate as had been heretofore practiced.

Of course, the suction box 34 must be capable of rapidly removing a large quantity of liquid, and consequently there must be provided a relatively large suction area beneath the wire. The width of the opening 69 in the direction of travel of the wire is in the neighborhood of 2½ to 3 inches. In view of the fact that the forming wire slides over the suction area it would be impossible to utilize the conventional type of suction box since the wire would be drawn down into the box through the relatively wide opening therein or if a large number of small openings were used, the wire would be quickly ruined by excessive wear. Accordingly a wire covered roll 55 is utilized in the suction box 34 whereby the wire is carried over the surface of the roll while the wire is passing over the suction area, said roll being freely rotatable or may be driven to synchronize with the speed of the wire. In rapidly forming the preliminary layer of fibres, the web when passing over the tube rolls will not be injured by disturbances normally created by said tube rolls and, hence, higher wire speeds may be used.

Suction boxes 40, 41, 42 and 43 are all similar in construction to suction box 34. The skeleton rolls in the suction boxes 40, 41, 42 and 43 may be driven at a peripheral speed equal to the translatory speed of the wire or may run idle. The vacuum established in suction box 34 may be in the neighborhood of seven inches of mercury as may also be the case with suction box 40. The vacuum established in the remaining boxes may progressively increase from about ten inches to twenty-one inches of mercury. Of course, the degree of vacuum in the boxes may be varied de-

pending upon the type of stock, the speed of wire and other factors. However, in general the degree of vacuum progressively increases as the moisture content of the web decreases.

A press **72** may be positioned over each of the suction boxes **40**, **41**, **42** and **43**. Each press **72** comprises standards **73** which slidably support a bearing block **74** in which a shaft **75** is journalled. A screw **76** manipulated by a hand wheel **77** functions to raise or lower the block **74** and, hence, shaft **75**. A press roll **78** is mounted upon shaft **75**, said roll being adapted to make contact with the web carried upon wire **20** immediately above the perforated roll of the suction box. The rolls of the presses above suction boxes **40**, **41**, **42** and **43** are progressively adjusted closer to the suction roll as more liquid is removed from the web and the web becomes densified. The press rolls may be driven at web speed or may run idle.

It is to be understood, of course, that the presses **72** may or may not be used depending upon the degree of liquid extraction desired. Obviously, if said presses are employed they cooperate ideally with the suction boxes since any moisture removed by the pressure of the presses is immediately removed by the suction boxes.

The web after passing beneath the last press is stripped from the wire **20** and may if desired be delivered directly to the driers on certain grades of paper since a very large percentage of the liquid is removed from the web while it is on the wire and the web is comparable in moisture content to a web, which has been made in the conventional way, which has passed through the usual presses which are normally positioned between the couch roll and the driers.

It can readily be seen that my invention materially shortens the overall length of the paper machine by eliminating the presses on some grades of paper and on others the conventional presses may be used for finishing rather than water extraction. In addition the travel of the wire is materially shortened by the rapid removal of the liquid carrier and the rapid densifying of the web. It is to be understood, of course, that conventional presses or smoothing rolls may be used after the web leaves the couch roll. However, such use merely removes an additional quantity of moisture effecting a saving in the number of drying drums employed since the web will enter the driers with a lower moisture content.

By the provision of the suction box **34** closely adjacent the breast roll the normal consistency of the pulp stock may be reduced by adding more liquid to the stock, thereby causing a faster flow which, in turn, permits the formation of a better closed sheet of paper at a greater wire speed. If desired, two suction boxes similar to suction box **34** may be positioned in tandem (not shown) between the breast roll and tube rolls. In the average paper machine this would give a wire run of approximately thirty-six inches for a film of fibres to form on the wire before the wire contacts the tube rolls.

I claim as my invention:

A machine for making a felted fibrous material which comprises a breast roll and a couch roll spaced therefrom, an endless paper forming wire carried around said breast roll and couch roll, means for discharging aqueous fibrous pulp upon said paper forming wire on the upper pass thereof adjacent said breast roll, a suction box positioned closely adjacent said breast roll beneath the upper pass of said wire, said suction box having an opening which faces the paper forming wire at its upper pass whereby the pulp upon said wire is substantially immediately subjected to suction upon its deposition upon said wire to quickly form a preliminary fibrous film upon said wire during passage over said opening, a plurality of tube rolls disposed transversely beneath said wire upon which said wire rides during its upper pass after passing over said suction box, means for moving said tube rolls transaxially in the direction of travel of said paper forming wire, and a suction box positioned beneath said wire and having an opening which faces said wire at its upper pass and after it has passed over said tube rolls, a foraminated roll rotatable in said last mentioned suction box which protrudes through the opening in said box and upon which said wire rides, and a press roll positioned immediately above said foraminated roll whereby said wire and web carried thereon is subjected to pressure between said rolls.

WILLIAM C. NASH.