Dec. 1, 1936. E. A. CHARLTON 2,062,445

APPARATUS FOR THE MANUFACTURE OF PAPER

Filed Dec. 17, 1934

Fig. 1.

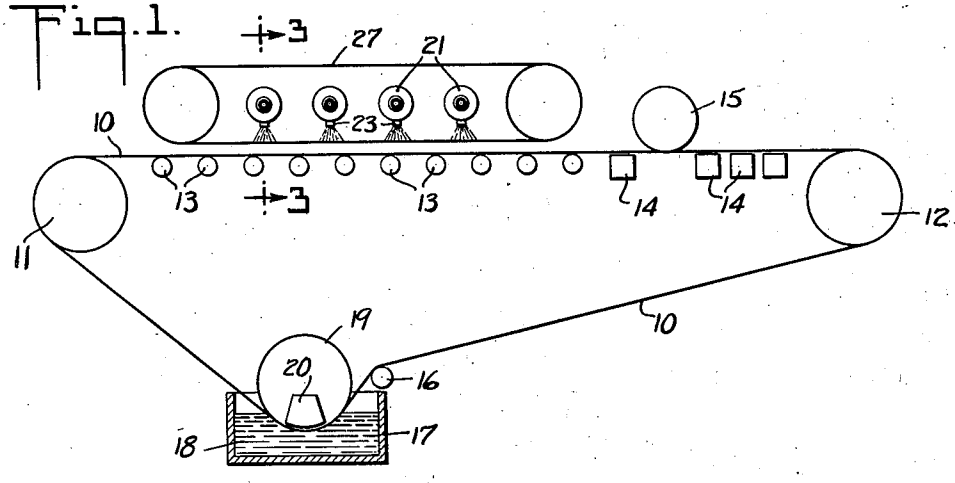


Fig. 2.

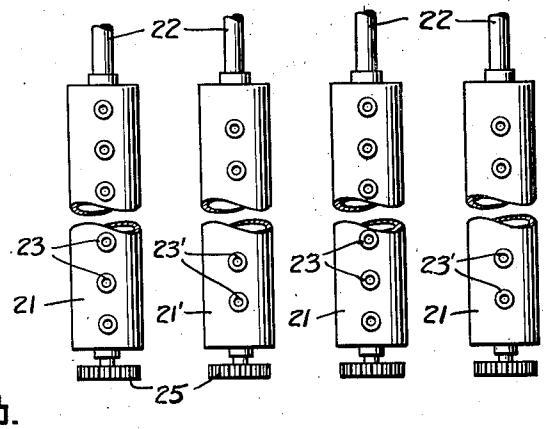
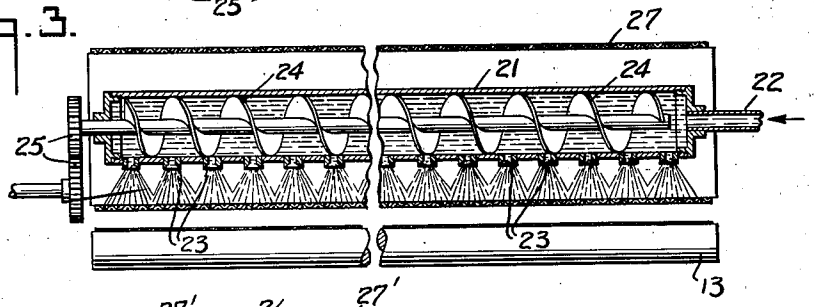


Fig. 3.



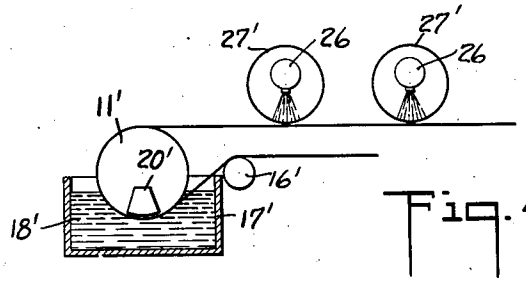


Fig. 4.

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APPARATUS FOR THE MANUFACTURE OF PAPER

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15 Claims. (Cl. 92—39)

This invention relates to improvements in the manufacture of paper and like products, and, more particularly, to a new and improved method of and apparatus for depositing the fibrous stock normally employed in the manufacture of paper on the paper making screen or Fourdrinier wire in such a manner that the web of paper formed thereon is of uniform strength in all directions and possesses a degree of formation and surface finish not heretofore obtained.

In the manufacture of paper and similar products wherein use is made of a paper machine of the Fourdrinier type, a suitably prepared fibrous stock containing a large percentage of water is deposited on a moving endless paper making screen or wire and thereafter subjected to suction or other means to drain the water therefrom leaving the fibres on the screen or wire in an interlaced and matted condition in the form of a web. The web is thereafter dried and calendered or otherwise finished. The paper making screen or wire is supported throughout the greater part of its working surface on rotatably mounted rolls, generally known in the art as table or tube rolls and which also serve to drain water from the screen or wire by the centrifugal suction action created by their rotation.

In the progress of the art of paper manufacture, the speed or rate of production of the Fourdrinier paper making has been gradually increased, so that, at the present time, it is commercially practicable to produce paper of commercial grades at production rates up to 1300 feet a minute. The gradual increase in the rate of production of paper has necessarily resulted in a corresponding increase in the rate of travel of the paper making screen or wire and the rate at which the fibrous stock is deposited thereon. As a consequence of the increase in speed of the paper making screen or wire there has been a corresponding decrease in the time during which the fibrous stock is formed into a web. A partial compensation for the decrease in the time interval during which the web must be formed has been obtained by an increase in the effective working surface of the screen or wire, but primarily the rapid formation of the web is due to the increase in suction caused by the increased speed of rotation of the table or tube rolls, which in turn is caused by the increase in the rate of travel of the paper making screen or wire.

Fundamentally the net affect of the above factors is a very rapid formation of a web of fibrous material on the paper making screen or wire, sufficiently rapid in a great many cases to prevent an even distribution of the fibrous stock on the wire and to prevent a satisfactory interlacing or matting of the fibres with one another. Moreover the rapid settling of the fibres into a web causes the formation of wire marks on the under surface of the web. Hence the finish of the paper is not as satisfactory as desired and the paper, when held in the light, will show irregular darkened areas due to an incomplete and uneven interlacing and distribution of the fibres in the web.

It is accordingly a primary object of this invention to provide a new and improved method of, and apparatus for, the production of paper wherein the present commercial rates of production of paper may be greatly increased without a corresponding decrease in the formation qualities of the paper, and wherein at present commercial web speeds now employed in the manufacture of paper, the formation qualities thereof may be improved.

Another object of this invention resides in the provision of a new method of, and apparatus for, the manufacture of paper and like products wherein the fibrous paper making stock is deposited on an endless travelling paper making screen or Fourdrinier wire in successive stages. The amount of stock thus deposited may be very closely regulated so that not only is the web built up readily and easily to the desired thickness; but also, since each layer of stock deposited on the wire forms but a fractional part of the complete web, ample opportunity is afforded to insure an even distribution of the stock on the wire, and a uniform felting or matting of the fibres thereof not only in the individual layers, but also between the fibres of different layers will take place thereby avoiding lines of demarcation or cleavage.

Another object of this invention resides in the provision of an improved method of, and apparatus for, the manufacture of paper and like products wherein a portion of the paper making screen or Fourdrinier wire is passed through a vat or other receptacle containing fibrous paper making stock and, by either the application of suction, or hydrostatic pressure, or both, as the said screen or wire passes through the vat or other receptacle a layer of fibrous material is deposited thereon to form a fibrous web or mat somewhat impermeable in character. One or more additional layers of stock is thereafter deposited on the web initially formed by means of one or more nozzles or spray devices located above the paper making screen or Fourdrinier wire. The flow of the stock from the spray devices may

be either by gravity or pressure or a combination thereof.

Still another object of this invention resides in the provision of a new and improved method of, and apparatus for, forming a web of paper wherein, after a layer of fibres has been initially deposited on the paper making screen or Fourdrinier wire, other layer or layers are thereafter deposited thereon by means of one or more stock applying nozzles positioned above said screen or wire. To prevent splashing of the stock as it flows or is forced from the nozzles and further to prevent the breaking up or injury to the initially deposited layer of fibrous material an endless travelling screen or wire is interposed between the nozzles and the web.

A further object of this invention resides in the provision of an improved method of, and apparatus for, forming a web of paper wherein the fibrous stock is deposited on the paper making screen or wire at the underside of the breast roll of the machine. The breast roll is rotatably mounted in a stock vat, and due to the hydrostatic pressure created by the immersion of the lower portion of the breast roll in the stock a layer of fibrous material is deposited on the paper making screen or wire. To insure the formation of a layer of fibrous material of sufficient thickness a suction device or devices may be employed.

A still further object of this invention resides in the provision of an improved method for forming a web of paper wherein the paper making stock is deposited on the paper making screen or wire in a plurality of layers, the thickness of each layer and the consistency of the stock being so regulated as to insure an even distribution of and a thorough felting of the fibres in the finished web.

These and other objects of this invention will become more apparent as the description proceeds.

The invention can best be seen and understood by reference to the accompanying drawing in which such a portion of a Fourdrinier paper making machine is shown as is necessary to a complete understanding of the invention, and in which;

Figure 1 is a diagrammatic view in side elevation of the web forming or web end of a paper making machine of the Fourdrinier type, certain constructional details being omitted;

Figure 2 is a plan view of the underside of the stock spraying devices or nozzles;

Figure 3 is an enlarged sectional detail view of one of the stock spraying devices;

Figure 4 is a view similar to Figure 1 but showing a modification thereof.

Referring now to the drawing in which like numerals refer to like parts, **10** represents a paper making screen or Fourdrinier wire which at one end of the machine is passed around a breast roll **11** and at the other end around a couch roll **12** by means of which the said screen or wire is normally driven. The driving mechanism for the couch roll, machine frame, guide and stretch rolls, etc. have not been shown as they form no part of this invention. As is customary in machines of this type the screen or wire is supported for a substantial part of its working length by rotatably mounted table or tube rolls **13**. Conventional suction boxes **14** are provided at the couch end of the screen or wire and a dandy roll **15** may be employed if desired.

The invention, as will now be explained, pertains to a new and improved method of and apparatus for depositing a fibrous paper making stock on an endless travelling paper making screen or Fourdrinier wire in successive superimposed layers so as gradually to build up a web of material of the desired thickness. The paper making screen or wire **10**, during its return travel or during the period when it is, in normal operation, inactive, is trained over a guide roll **16** and into a vat or other receptacle **17** containing fibrous stock **18**. The wire then passes around a rotatably mounted cylinder **19** having a foraminated peripheral surface and provided with a suction device **20**. As shown, the lower portion of the cylinder is immersed in the stock. Although a layer of fibres will be deposited on the wire as it passes around the cylinder **19** by hydrostatic pressure, it is preferable to use a suction device such as a stationary suction box **20** to ensure the deposition of a layer of fibres sufficiently matted and compact to prevent the said layer from breaking away from the wire during the movement of the latter to and around the breast roll **11**.

As the paper making screen or wire travels from the breast to the couch end of the machine it passes under one or more stock depositing nozzles **23** whose construction and operation will now be described. As has previously been pointed out a web of fibrous material is initially formed on the screen or wire as it passes through the stock vat **17**. One or more layers are then deposited on this web by means of one or more stock depositing devices. Each stock applying or depositing device comprising a cylindrical tube or pipe **21** extending preferably transversely across the paper machine and to which stock is supplied either by gravity or pressure, or both, by a conduit **22**. Located at spaced and equal intervals in the pipe are a plurality of sprays or nozzles **23**. Although the shape of the nozzles may be varied nozzles of the circular type are preferred. To prevent clogging of the nozzles and to assist in conveying the stock equally to all portions of the pipe **21** a worm **24** is rotatably mounted therein and driven through gearing **25** by any suitable mechanism (not shown).

Each pipe is mounted above the paper making screen or wire in such a manner that the angle at which the stock is deposited on the wire may be varied. Although any suitable mounting may be employed, preferably each pipe affixed thereto at one end a gear meshing with gear which in turn can be rotated by a handle. Conventional means may be provided to lock the handle against movement. The pipe is connected at its opposite end to the conduit by a sleeve or other means which will permit rotation of the said pipe.

Referring now specifically to Fig. 3 there is shown a specific arrangement of the nozzles **23** to insure an even distribution of the stock on the paper making screen or wire as it flows or is forced from the said nozzles. It will be appreciated that the spacing of the nozzles of each paper is such as to cause an overlapping of the stock flowing therefrom onto the wire in order to insure the formation of a web unbroken in character across the wire. Although the stock contains a large proportion of water, substantially 99 to 99.7% of the stock being water, the necessity for having an overlapping of the stock will tend to form thickened areas of fibre in the web and in certain instances will result in the formation of a web of uneven thickness across its width. To overcome this undesirable tendency the nozzles of alternate pipes may be posi-

tioned in staggered relation to the nozzles of adjacent pipes. Thus the nozzles 23' of the pipes 21' are in staggered relation to the nozzles 23 of the pipes 21. Hence should the stock deposited by the nozzles 23 tend to produce a web of uneven thickness, it will be compensated for by the stock deposited by the nozzles 23'.

To prevent splashing of the stock as it is forced from the nozzles an endless screen 27 trained around guide rolls 28 is interposed between the nozzles and the screen or wire 10. The mesh of the screen 27 should be such as to allow a ready passage of the fibres of the stock therethrough and either or both of the guide rolls 28 may be connected to suitable driving mechanism. Since the stock issues from the nozzles with appreciable force the screen 27 also serves to prevent damage to the already formed web carried by the screen or wire 10. It is to be noted that the screen 27 does not contact with the forming web and hence exerts no compressive force thereon. In normal operation the travel of the screen or wire 10 and the screen 27 is in the same direction and at the same linear speed. However, the screen 27 may move slower, faster or in the reverse direction to the travel of the screen or wire 10, depending upon the type of stock used and upon the formation qualities of the finished sheet. Thus, if during operation it is found that the fibres are not evenly distributed in the sheet the rate of travel of the screen 27 may be decreased. The stock, as it passes through the screen, will then be deposited on the initially formed web at a different angle thereby to increase the interlacing and felting of the fibres of the stock. It will be appreciated that the rate of travel of the screen 27 will be varied to meet conditions as they arise in mill operation.

Referring now to Figure 4 there is disclosed a modified embodiment of the invention. In this modification a separate stock applying cylinder is dispensed with and the breast roll is utilized to form the initial web of fibrous material. The breast roll 11' is rotatably mounted in a stock vat or receptacle 17', the paper making screen or wire being led over a guide roll 16' into the stock 18' and thence around the breast roll. Although the hydrostatic pressure induced by the submersion of the screen or wire by the breast roll as it passes through the stock will be sufficient to form therein a layer or web of fibrous material in some instances it is desirable to set up a positive suction by the use of a suction box or other device 20'.

As in the modification disclosed in Figure 1 additional layers of stock are deposited by means of spray devices 26 but in this instance each spray device is positioned within a rotatably mounted foraminated cylinder 27 the mesh of which is such as to permit a free passage of stock and at the same time to prevent splashing of the stock as it is deposited on the screen or wire 10'. The arrangement and type of nozzle used is otherwise identical to that above described in connection with the modification disclosed in Figures 1–3 inclusive. Each of the cylinders may be rotated by conventional mechanism.

Although the preferred embodiment of the invention has been illustrated and described in accordance with the requirements of the patent statutes it will be appreciated that the invention is susceptible of many variations without departing from the spirit or scope of the invention as defined in the claims appended hereto and which are to be broadly construed. Thus the invention lends itself to the production of all grades of paper, colored papers, papers containing fillers of various kinds, paper having novel finishes, etc. Moreover, by varying the paper furnishes supplied to the stock depositing agencies better and different sheet formations will be obtained.

What is claimed as new is:

1. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, a stock vat, a rotatably mounted suction cylinder in said vat and around which said screen is passed during its travel from couch to the breast roll whereby a layer of stock is deposited on said screen as it passes through said vat, and means to deposit a layer of stock on the layer initially formed during the travel of the screen between the breast and couch rolls.

2. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, a stock vat, a rotatably mounted suction cylinder in said vat and around which said screen is passed during its travel from couch to the breast roll whereby a layer of stock is deposited on said screen as it passes through said vat, and means to spray stock on the said layer.

3. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, a stock vat, a rotatably mounted suction cylinder in said vat and around which said screen is passed during its travel from couch to the breast roll whereby a layer of stock is deposited on said screen as it passes through said vat, and means located above said screen to spray stock on the initially formed layer of stock.

4. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, a stock vat, a rotatably mounted suction cylinder in said vat and around which said screen is passed during its travel from couch to the breast roll whereby a layer of stock is deposited on said screen as it passes through said vat, and a plurality of stock spraying devices to spray successive layers of stock on the first formed layer.

5. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, a stock vat, a rotatably mounted suction cylinder in said vat and around which said screen is passed during its travel from couch to the breast roll whereby a layer of stock is deposited on said screen as it passes through said vat, and a plurality of stock spraying devices to spray successive layers of stock on the first formed layer, and means interposed between said screen and stock spray devices to prevent splashing of the stock as it is deposited on said initially formed layer.

6. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, a stock vat, a rotatably mounted suction cylinder in said vat and around which said screen is passed during its travel from couch to the breast roll whereby a layer of stock is deposited on said screen as it passes through said vat, and a plurality of stock spraying devices to spray successive layers of stock on the first formed layer, and a foraminated belt interposed between said screen and stock spraying devices to prevent splashing of the stock as it is deposited on said initially formed layer.

7. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, a stock vat, a rotatably mounted suction cylinder in said vat and around which said screen is passed during its travel from couch to the breast roll whereby a layer of stock is deposited on said screen as it passes through said vat, and a plurality of stock spraying devices to spray successive layers of stock on the first formed layer, and an endless travelling foraminated belt interposed between said screen and stock spraying devices to prevent splashing of the stock as it is deposited on said initially formed layer.

8. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, means to deposit a layer of stock on said screen during that period during which it is normally inactive, and means located above said screen to spray stock on the initially formed layer of stock.

9. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, means to deposit a layer of stock on said screen during that period during which it is normally inactive, and a plurality of stock spraying devices to spray successive layers of stock on the first formed layer.

10. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, means to deposit a layer of stock on said screen during that period during which it is normally inactive, and a plurality of stock spraying devices to spray successive layers of stock on the first formed layer, and means interposed between said screen and stock spray devices to prevent splashing of the stock as it is deposited on said initially formed layer.

11. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, means to deposit a layer of stock on said screen during that period during which it is normally inactice, and a plurality of stock spraying devices to spray successive layers of stock on the first formed layer, and a foraminated belt interposed between said screen and stock spraying devices to prevent splashing of the stock as it is deposited on said initially formed layer.

12. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, means to deposit a layer of stock on said screen during that period during which it is normally inactive, and a plurality of stock spraying devices to spray successive layers of stock on the first formed layer, and an endless travelling foraminated belt interposed between said screen and stock spraying devices to prevent splashing of the stock as it is deposited on said initially formed layer.

13. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, means to deposit a layer of stock on said screen as it passes around said breast roll, and a plurality of stock spraying devices to spray successive layers of stock on the first formed layer, and means interposed between said screen and stock spray devices to prevent splashing of the stock as it is deposited on said initially formed layer.

14. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, means to deposit a layer of stock on said screen as it passes around said breast roll, and a plurality of stock spraying devices to spray successive layers of stock on the first formed layers, and a foraminated belt interposed between said screen and stock spraying devices to prevent splashing of the stock as it is deposited on said initially formed layer.

15. In an apparatus of the class described, a paper making screen, a breast roll and couch roll around which said screen is trained, means to deposit a layer of stock on said screen as it passes around said breast roll, and a plurality of stock spraying devices to spray successive layers of stock on the first formed layer, and an endless travelling foraminated belt interposed between said screen and stock spraying devices to prevent splashing of the stock as it is deposited on said initially formed layer.

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