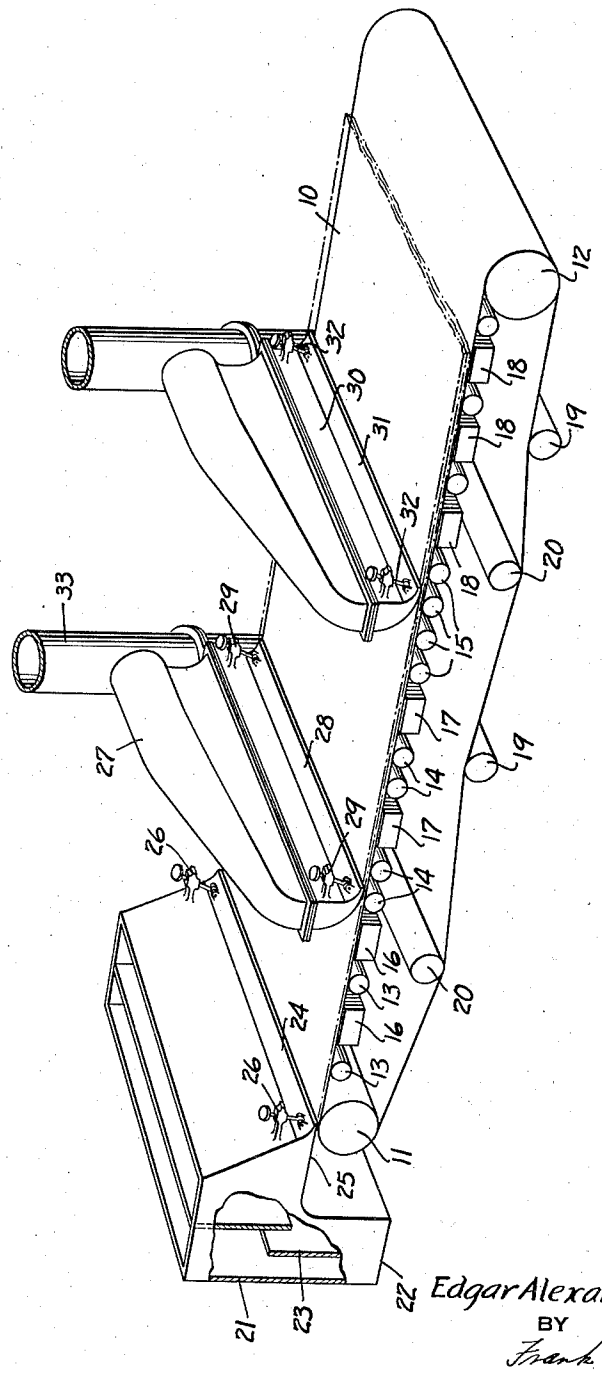
Aug. 8, 1939. E. A. CHARLTON 2,168,560

PROCESS AND APPARATUS FOR THE MANUFACTURE OF PAPER

Original Filed Dec. 17, 1934



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Patented Aug. 8, 1939

2,168,560

UNITED STATES PATENT OFFICE

2,168,560

PROCESS AND APPARATUS FOR THE MANUFACTURE OF PAPER

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Application December 17, 1934, Serial No. 757,763
Renewed March 27, 1937

5 Claims. (Cl. 92—40)

This invention relates to improvements in the manufacture of paper, and more particularly to an improved method and apparatus for the manufacture of paper, wherein the rate of production of the paper may be increased, and the qualities thereof greatly improved.

In the normal production of paper, a suitably prepared stock of fibrous material is mixed with an excess amount of water and deposited on a moving endless wire or screen, generally known as a Fourdrinier wire, where it is subjected to the action of instrumentalities which serve to remove the water from the fibrous stock, leaving on the wire a web of fibrous material. The formed web of fibrous material, after being removed from the wire in a continuous manner, is then suitably dried and wound on reels for subsequent conversion into desired sizes and forms. Under present operating conditions, the commercial rate of production, although depending to a great extent upon the type of paper produced, ranges from between 50 feet per minute as the lowest limit, and 1300 feet per minute as the top limit. The quality, or what will be hereinafter termed as the "formation" of the paper, depends primarily upon the manner in which the fibres of the paper are interlaced or matted, and the manner in which they are distributed in the paper web. By the time the web of paper is transferred to the drying apparatus, the fibre distribution and the interlacing thereof, have become sufficiently set to prevent any subsequent material change in the structure of the paper sheet. Many methods of, and apparatus for increasing the interlacing of the fibres and more even distribution thereof in the web have been devised, but so far as I am aware the net result has been but a negligible improvement in the "formation" qualities of the paper.

It is accordingly a primary object of this invention to provide a new and improved method and apparatus for the manufacture of paper, wherein the present commercial rate 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 of the paper may be considerably improved.

Another object of this invention resides in the provision of a method of, and apparatus for depositing fibrous paper-making stock on a travelling Fourdrinier wire in such a manner that the stock is deposited at successive stages upon the wire. The amount of stock deposited on the wire may be more closely regulated so that the web of paper may be built up to the desired thickness, and at the same time each layer of paper, forming as it does but a fractional part of the finished web, has its fibres thoroughly interlaced and matted, and evenly distributed throughout the web.

Still another object of this invention resides in a new and improved method for the manufacture of filled papers, such as carbonate filled papers, which consists in depositing a layer of fibrous material containing the desired amount of filler, next depositing on the layer thus formed a layer of fibrous material containing no filler and being formed preferably from the base fibres of low cost and thereafter depositing on said latter layer a layer of fibrous material containing the same amount of filler as contained in the layer initially formed.

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 drawing in which such a portion of a Fourdrinier paper machine is shown, as is necessary to a proper understanding of the invention, and in which the figure is a semi-diagrammatic perspective view of that portion of the mechanism of the paper machine to which the invention pertains, many minor details of the operating mechanism being omitted for the sake of clearness.

Referring now more specifically to the drawing in which like numerals refer to like parts, 10 represents the Fourdrinier wire, or paper making wire which at one end of the machine is passed around the breast roll 11, and at the other end around a couch-roll 12, by means of which the wire is normally driven. The driving parts of the couch-roll are not shown inasmuch as they form no part of this invention. The wire is supported at intervals on table or tube rolls 13, 14 and 15, and suction boxes 16, 17 and 18 are located at intervals between these rolls for a purpose to be hereinafter more fully described. Conventional guide and stretch rolls 19 and 20 are also provided.

The invention, as will now be explained, pertains to means for depositing the fibrous paper-forming stock at intervals, on the paper-making wire and in such amounts that a web of paper of the desired thickness is gradually built up. Stock of desired consistency flows into a headbox 21, through a conduit 22, and over baffles 23, and between the slice 24 and lower lip of the

slice 25 onto the wire. The slice is provided with the usual adjusting screws 26 to regulate the thickness and amount of stock deposited on the wire. To prevent objectionable clotting of the stock in the pond formed behind the slice, a conventional flow evener, such as a rotating drum, may be used.

As the stock passes from under the slice onto the wire, it contains a considerable quantity of water which is drained through the wire by the action of the table rolls 13, and suction box or boxes 16, thereby causing a rapid settling of the fibres in the form of a web on the wire. The initial web thus formed is extremely thin and consequently may, and usually does contain small masses of clotted stock. The areas between the clots are comparatively thin. The web therefore is very poorly formed but as will hereinafter be pointed out subsequent deposition of stock thereon will not only fill in the irregularities but will disperse the clots evenly throughout the sheet thereby resulting in a finished sheet having close and even formation. Moreover, since this initial web does not represent the finished web of paper, but only a fractional part thereof, the water is quickly removed because of the thinness of the sheet. Consequently, the suction induced by the table rolls and suction boxes will provide an extremely rapid settling of the fibres from this very thin layer of stock.

At this stage of operation, the initially formed web passes under a head-box 27, provided with a slice having an upper lip 28, adjustable by means of conventional adjusting screws 29. The stock flowing from the slice is deposited in a thin layer on the web initially formed. Inasmuch as the web formed initially provides in effect, a mat, somewhat impermeable in character, it is sometimes desirable either to increase the number of table rolls 14, suction boxes 17 provided at this point, or to increase the amount of suction. The necessity for such increase depends to a considerable extent on the thickness of the initial layer of pulp and its consistency. As in the case of the first head-box, any conventional agitating device may be used to prevent clotting of the stock. The head-box 27 is so shaped as to equalize the head on the stock throughout its width, the stock itself being supplied through a conduit 33. The number of head-boxes used may vary, depending in part upon the thickness desired of the finished web, and in part upon the length of time which can be allotted during which the web must be built up into its completed form. In the embodiment shown, a third head-box 30 provided with a slice having an adjustable upper lip and adjusting screws 32 is used; the built up web being thereafter subjected to the action of the table rolls 15 and suction boxes 18. Again it may be found desirable to increase the drainage action upon the composite sheet, not only to remove as much of the water as is necessary to render the sheet fit for transfer to the drying stage of the paper making process, but also to effect a thorough interlacing of the fibres of the different layers of the sheet to the end that the finished sheet of paper is a unitary interlaced mass of fibres, having no lines of demarcation or cleavage. As has been previously pointed out, the initial layer produced is extremely thin, and the fibres forming said layer are not uniformly distributed throughout the layer. However, the subsequent deposition of stock tends to fill in the uneven portions, so that the sheet, in its final form, is of uniform formation with the fibres thoroughly interlaced or matted.

This invention also contemplates a new and improved method for the manufacture of specialty papers such as paper containing a filler or filling material. The usual filler used is either clay or calcium carbonate, or a mixture thereof. In normal operation a furnish containing the desired ingredients is made, and, after being diluted with water, is deposited on a paper making wire from which the water is drained by conventional drainage devices leaving a mat or web of fibres containing the filler. After drying and calendering, the finished paper is converted into the desired form and size. As has been previously explained the formation qualities of paper as now produced are not as uniform as desired and in the manufacture of filled papers the cost of producing a satisfactorily finished sheet from a furnish containing a filler is great.

According to the present invention a furnish containing the filler is prepared and, after dilution with water, is deposited in a comparatively thin layer on the paper making screen or wire. Due to the thinness of the layer the water in the stock, preferably through the action of conventional table rolls and suction boxes, is drained rapidly from the wire. A second stock containing no filler is then deposited on the layer initially formed and the two layers are then subjected to drainage. The fibres of the second layer tend to fill in the thin places in the first layer thereby forming a composite sheet having a closer fibre formation or distribution than either layer taken individually.

To complete the formation of the web a third layer of stock is then deposited on the second layer. This layer contains substantially an amount of filler sufficient to equalize the amount of filler in the layer first deposited on the paper making wire after the water has been drained therefrom. This will form a sheet free from "two-sidedness" and having the same surface finish and opacity.

The types of furnishes used may vary but the following, given by way of exemplification, has proven satisfactory.

Furnish A (first layer)

	Per cent
Soda pulp	40–50
Sulphite pulp	20–25
Calcium carbonate	25–40

Furnish B (second layer)

	Per cent
Sulphite pulp	10–30
Ground wood	70–90

Furnish C (third layer)

	Per cent
Soda pulp	45–50
Sulphite pulp	20–25
Calcium carbonate	25–35

As has been explained above the amount of calcium carbonate will vary depending upon the amount of filler found to have been retained by the layer of pulp initially deposited on the wire. Generally speaking, from 5–10% decrease in the amount of filler used will suffice. It will be appreciated that the sulphite pulp in Furnish B may in some cases be omitted and the Furnishes A and B may include other ingredients such as clay, lithopone, starch, broke and the like. The nature and amount of these ingredients will depend upon mill operation and the

specific type of paper to be produced. The finished sheet will usually contain from 2–20% of calcium carbonate. If clay is used the amount of calcium carbonate used will be proportionally less.

Although the preferred embodiment of the invention is illustrated as required by 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 hereinafter defined. Thus the invention lends itself to the production of colored papers, papers having novel surface finish. Moreover, by varying the paper furnishes supplied to the different head-boxes, better and different sheet formations will be obtained.

What is claimed as new is:

1. In a method for the manufacture of paper, the steps of depositing on a paper making wire a layer of fibrous stock including a filler, subjecting said layer to drainage to form a web, depositing on said web a layer of fibrous stock containing no filler, subjecting said web and layer to drainage to form a composite web, thereafter depositing on said composite web a layer of fibrous stock including a filler, and subjecting said composite web and deposited layer to drainage to form a web of material the opposite faces of which contain a filler.

2. In a method for the manufacture of paper, the steps of depositing on a paper making wire a layer of fibrous stock including a filler comprising calcium carbonate, subjecting said layer to drainage to form a web, depositing on said web a layer of fibrous stock containing no filler, subjecting said web and layer to drainage to form a composite web, thereafter depositing on said composite web a layer of fibrous stock including a filler comprising calcium carbonate, and subjecting said composite web and deposited layer to drainage to form a web of material the opposite faces of which contain a filler.

3. In a method for the manufacture of paper, the steps of depositing on a paper making wire a layer of fibrous stock including a filler comprising calcium carbonate, subjecting said layer to drainage to form a web, depositing on said web a layer of fibrous stock containing no filler, subjecting said web and layer to drainage to form a composite web, thereafter depositing on said composite web a layer of fibrous stock including a filler comprising calcium carbonate, and subjecting said composite web and deposited layer to drainage to form a web of material the opposite faces of which contain a filler, the amount of filler in said last deposited layer being such as to equal the amount of filler retained in the initially deposited layer after the latter has been subjected to drainage.

4. In a method for the manufacture of paper, the steps of depositing on a paper making wire a layer of fibrous stock containing from 40 to 50% of soda pulp, 20 to 25% of sulphite pulp and from 25 to 40% of calcium carbonate, subjecting said layer to drainage to form a web, depositing on said web a layer of fibrous stock containing no filler, subjecting said web and layer to drainage to form a composite web, thereafter depositing on said composite web a layer of fibrous stock containing from 40 to 50% of soda pulp, 20 to 25% of sulphite pulp and from 25 to 40% of calcium carbonate, and subjecting said composite web and deposited layer to drainage to form a web of material the opposite faces of which contain a filler.

5. In a method for the manufacture of paper, the steps of depositing on a paper making wire a layer of fibrous stock containing from 40 to 50% of soda pulp, 20 to 25% of sulphite pulp and from 25 to 40% of calcium carbonate, subjecting said layer to drainage to form a web, depositing on said web a layer of fibrous stock containing no filler, subjecting said web and layer to drainage to form a composite web, thereafter depositing on said composite web a layer of fibrous stock containing from 40 to 50% of soda pulp, 20 to 25% of sulphite pulp and from 25 to 40% of calcium carbonate, and subjecting said composite web and deposited layer to drainage to form a web of material the opposite faces of which contain a filler, the amount of filler in said last deposited layer being such as to equal the amount of filler retained in the initially deposited layer after the latter has been subjected to drainage.

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