Dec. 30, 1930. J. TRAQUAIR 1,786,681

METHOD OF AND APPARATUS FOR MANUFACTURING PAPER

Filed July 31, 1926 2 Sheets-Sheet 1

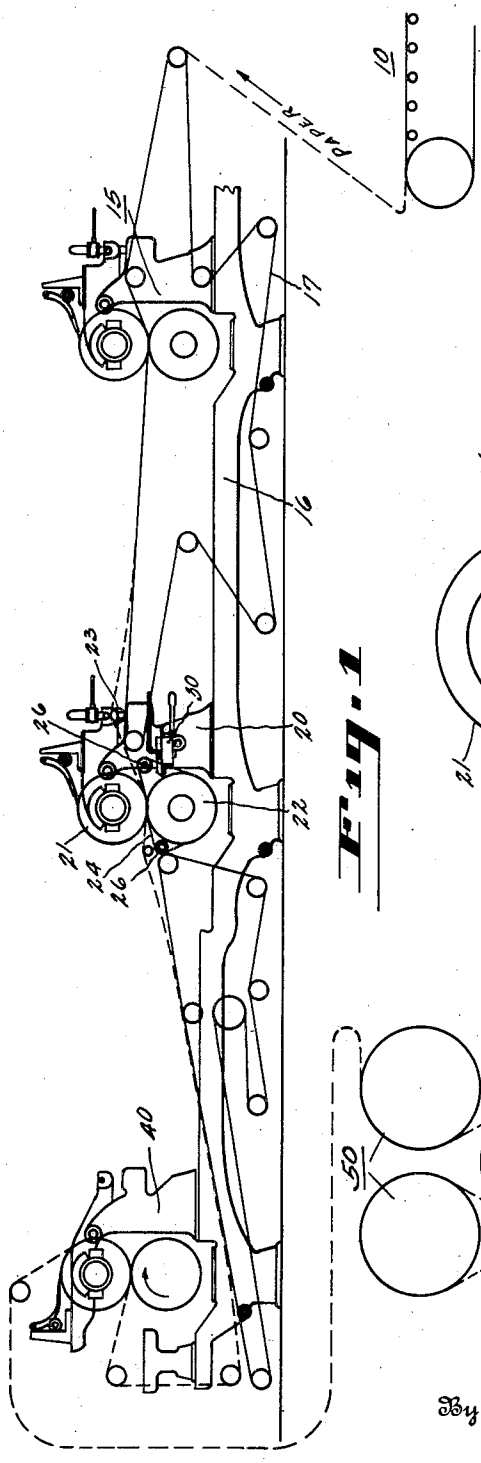


Fig. 1

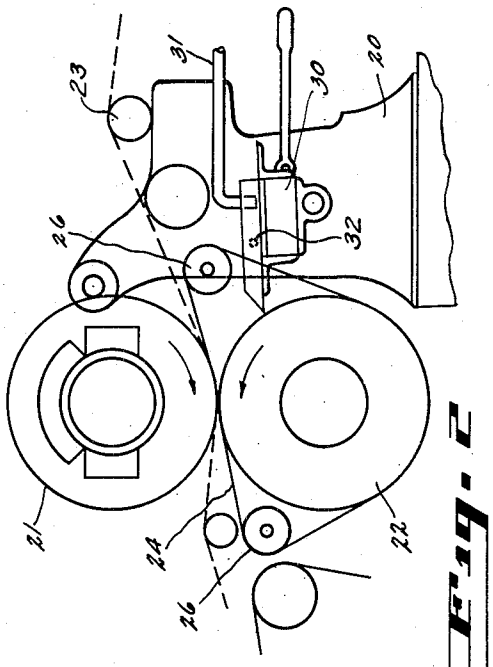


Fig. 2

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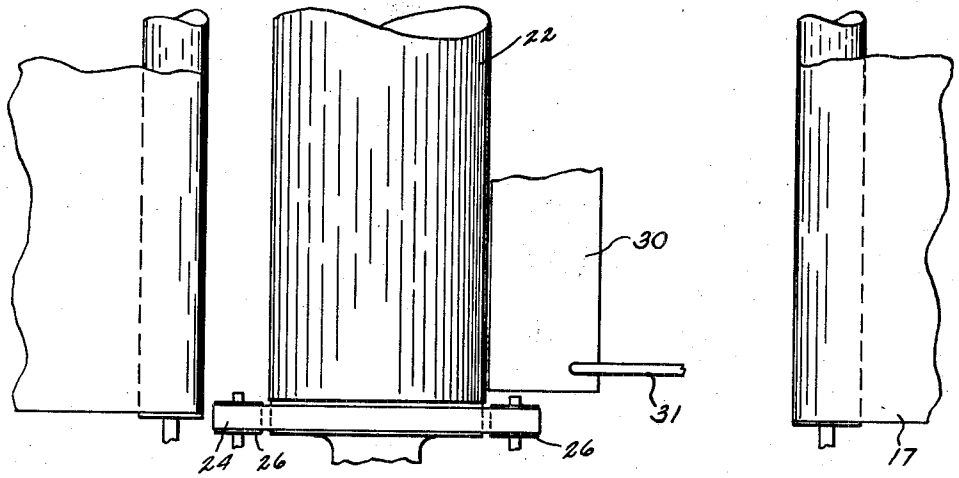


Fig. 3

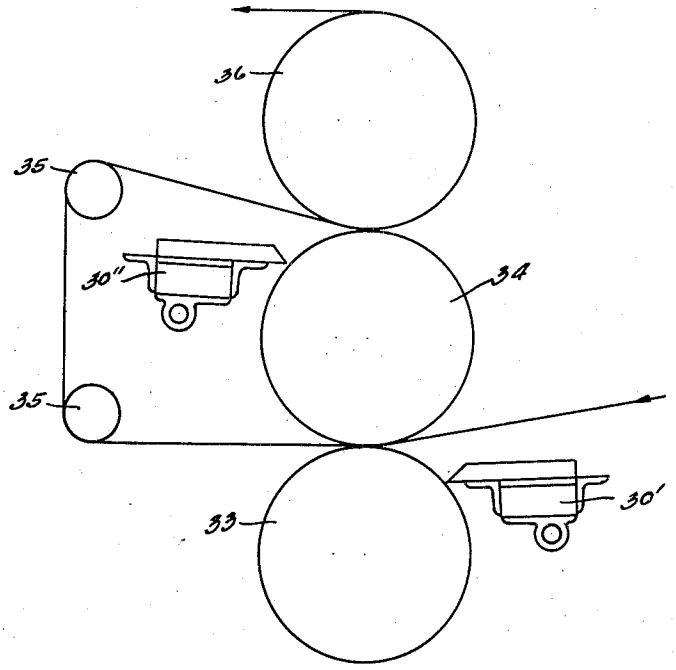


Fig. 4

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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR MANUFACTURING PAPER

Application filed July 31, 1926. Serial No. 126,230.

This invention relates to the manufacture of paper.

One of the principal objects of the invention is to provide a method of forming paper which is effective in producing a formed sheet or web of paper of hitherto unknown and superior characteristics.

Another object of the invention is to provide a method of forming a paper sheet which has an improved and superior surface due to its formation, and which is free from two-sidedness, and which makes for a correspondingly improved or superior surface in the final production after calendering or other treatment.

Another object of the invention is to provide apparatus for carrying out this method, which is simple in construction and effective in operation.

Other objects and advantages of the invention will be apparent from the description thereof set out below when taken in connection with the accompanying drawing.

In the drawing in which like characters of reference designate like parts throughout the several views thereof,

Fig. 1 illustrates, somewhat diagrammatically apparatus for forming paper according to the present invention;

Fig. 2 shows an enlarged detail of the second press shown in Fig. 1;

Fig. 3 is a plan view showing particularly the mechanism for feeding the wet formed sheet of paper between the press rolls; and

Fig. 4 shows, diagrammatically, means for applying a surfacing layer to both sides of the sheet of paper.

In the manufacture of paper it is the general practice to flow paper-forming stock onto a traveling wire. This stock comprises pulp made from the separated fibers of wood or the like suspended in water. Admixed as constituents of the stock, particularly where the paper to be made is of better grade such as is used, for example, for book or magazine printing, finely-divided clay or the like, known as filler, size, and also other constituents may be used, according to the character of sheet desired, as is well understood. While the stock is on this traveling wire or forming part some of the water of the stock escapes through the wire to form the web or sheet of paper, which is subsequently removed from the wire and subjected to treatment such as pressing, drying, calendering, and the like. As the stock is flowed onto the wire the major proportion of the water of the stock which escapes through the wire, flows through the wire in the first few feet of travel. The remainder of the water which escapes through the wire escapes during the remaining distance of the wire. In this first few feet of travel of the stock upon the wire there is quite a rush of water through the wire, and concomitantly some of the finely-divided filler and the like, and some of the fibers tend to flow away with the water through the forming wire. But the greater portion of the fibers are stopped by the wire and deposited thereon as an initial web or sheet of paper, which acts as a filter mat, through which the remainder of the water which escapes through the wire must pass. As a result, particularly where filler is used, a homogeneous sheet of paper is not secured; and in practice it is found that the top side of the formed sheet will contain considerably greater proportions of the filler than will the wire side. This condition gives rise to what is known as "two-sidedness," by which is meant that the two sides of the paper are not alike, the top side being of better characteristics than the wire side.

In actual practice, in the manufacture of white paper such as is generally used in the trade for books and magazines, it has been the general practice to limit the amount of filler added to the stock so that the resulting formed sheet of paper contains as a maximum less than 20% of filler. The including of a greater percentage of filler than this will ordinarily so accentuate the relative differences of the two sides—that is, will exaggerate the two-sidedness—that paper having a larger percentage of filler is commercially objectionable. However, from a practical point of view additional quantities of filler are very desirable. For, it may be generally said, that the printing qualities of a sheet of paper improves as the quantity of

filler carried on the surface increases. In addition filler is very much cheaper than the pulp which forms the body of the paper, and from a commercial point of view it is desirable to have only so much pulp as is necessary for giving sufficient strength to the paper, with the inclusion of filler to add additional body, opacity, and printing quality.

The present method permits of forming a sheet of paper having proportions of filler much in excess of the maximum heretofore attainable, as mentioned above, while at the same time producing a sheet which is free from two-sidedness. In fact the only limit to the amount of filler which may be added to the capacity of the fibrous web to retain the filler material and also give desired strength.

According to this method a sheet of paper is formed from stock having any practicable desired proportion of filler, size, etc. therein. This sheet may be formed in any desired manner and upon any suitable forming part. For purposes of description, and as illustrating an embodiment of apparatus which will function satisfactorily for so forming the sheet of paper, a conventional Fourdrinier forming part is illustrated; but any other suitable forming mechanism may be used. In the drawing the details of construction of this paper-forming part are not illustrated, since any form of Fourdrinier may be used, and the paper-forming part is therefore shown only diagrammatically and designated generally by the numeral 10. Of course, in operation the forming part is usually on the same level as the press roll section the paper sheet passing from the forming part into the presses. But in order to permit of showing the press parts in larger size the forming part, and the drying section described below are shown, diagrammatically, below the press part. The sheet after it is formed is removed from the wire, at the couch roll end of a Fourdrinier, or its equivalent part in any other type of forming mechanism, and passed through the first press rolls, which in the drawing are designated generally by the numeral 15, the construction of this first set of press rolls being of any suitable conventional character. As shown all of the press rolls forming elements of the mechanism are mounted upon a suitable base structure or framework 16, this construction being of well-known every-day use in the industry. A suitable felt 17 is provided for the first press rolls, and the paper is removed from the Fourdrinier and transferred to the felt and through the first press rolls where part of the moisture therein is removed, in the well-known manner.

The still wet sheet of paper is then passed through a second set of press rolls, which are supported upon suitable standards designated by the numeral 20. The two rolls 21 and 22 of this second set of press rolls are without the usual felt, and are adjustable with respect to each other in any desired manner. The paper passing from the first press rolls, along the carrier felt 17, is lifted from the felt and passed over a supporting roller 23, and thence between the two rolls 21 and 22. A tail carrier ribbon 24 is provided for leading the paper into the nip of these two rolls. As shown, particularly in Fig. 3, this tail carrier ribbon is a narrow belt which runs over one end of the lower press roll 22, and suitably spaced supporting rolls 26. This ribbon is driven by the lower press roll and serves to receive a tail or strip of the wet sheet of paper approaching the second press and to thus carry the sheet of paper into the nip and between the two press rolls. This tail carrier ribbon gives very desirable results, but other means may be used such, for example, as an air nozzle or blower.

Positioned in cooperative relation with the lower press roll 22 is a trough 30 which is shown somewhat diagrammatically, and may be of any suitable construction. This trough is mounted adjacent the roll so that any solution therein may be flowed onto the surface of the roll 22. This trough should be adjustably mounted, preferably on pivots, so that it may be readily swung into or out of operative position, as the work conditions demand. Leading into the trough is a supply pipe 31 through which solution is fed to the trough at such rate as will maintain an adequate supply of solution within the trough during operation. The trough is provided with an overflow 32 which controls the level of solution therein and also causes the solution to flow or circulate throughout the trough thus insuring uniformity. As shown the trough is so positioned with respect to the roll 22 that the solution which flows onto the surface of the roll is carried upwardly into contact with the wire side of the web of paper, the thickness of the surface layer being controlled by adjusting the pressure between the two press rolls. As the paper passes between these two rolls, as shown in Figs. 1 and 2, the surface layer is spread upon the wire side and is pressed into the wet sheet of paper, and caused to bond and become incorporated with the body of the sheet of paper. By properly controlling the components of the solution in the trough 30, and the quantity of solution applied to the paper, any desired surface characteristics may be imparted to the wire side of the paper. The device is shown in Figs. 1 and 2 as adapted to add a surface layer only to the wire side to impart thereto surface characteristics which correspond with the surface characteristics of the other, or non-wire, side. But of course means may be provided so that an additional or surface layer may be applied to both sides of the sheet of paper if desired—and by suitably controlling the solutions applied to the re-

spective sides the two sides may be given the same or varying surface characteristics.

A simple form of mechanism for applying a surfacing layer to both sides of the sheet of paper is shown in Fig. 4. In this construction a three roll press is used the wet sheet of paper being passed between the bottom roll 33 and the middle roll 34, solution being supplied to the lower roll from an adjustable trough 30′ such as described above. From between the two rolls 33 and 34 the paper passes over two guide rolls 35 which are arranged to reverse it, and then passes between the middle roll 34 and the upper roll 36. A solution trough 30″ is associated with the middle roll 34 to apply a surfacing layer to the opposite—or non-wire in this case—side. The contacting press rolls in this arrangement should be one hard surfaced and one soft surfaced. In practice the hard surface is metal or granite and the soft surface rubber on a metal core. Rolls of this character are well known in the art. Arranging the middle roll hard surface and the upper and lower rolls soft surface—or the middle roll soft surface and the upper and lower rolls hard surface—will give good results.

As an illustration of practical results that have been attained in the manufacture of so-called book paper using a Fourdrinier as the forming part, where the stock being flowed upon the Fourdrinier comprised substantially 35% of filler, on a dry basis, satisfactory results in bringing the wire side up to the top side of the sheet in surface characteristics have been attained with the application of a solution at the second press roll consisting of a suspension of clay, size, and a fiber such as is found in the tray water collected in the Fourdrinier, the total percent of solids in solution being approximately 18%. On a dry basis the solids were in proportion of substantially 5% of the starch size, 5% of fiber and 90% of filler clay. In fact thickened tray water, and additional quantities of clay and size makes a very desirable material for forming this surface layer for book paper. This tray water contains the fine fibers and fine filler that escape through the forming wire and when used for the forming of the subsequent surfacing layer produces a paper having very superior surface characteristics.

From the second press the resurfaced paper is passed through the third press which is designated generally by the numeral 40, and has the conventional felt. From the third press the paper is passed to the drier section illustrated diagrammatically in the drawing and designated by the numeral 50. This drier section may be of any desired character such as is used generally in the industry. And if desired the paper may be passed through additional presses, or treated in any other usual way. Naturally the paper as it leaves the second press, after this treatment, contains a somewhat larger percentage of water than it would contain at this point if this surfacing layer were not applied. And the paper as it reaches the drier section therefore also contains additional water but this is easily taken care of by providing additional drier capacity.

The apparatus shown for carrying out this method is of course largely conventional in character, and the particular form of mechanism shown is not at all essential to the practicing of the method. Any other suitable means for applying an additional surfacing layer to the formed sheet of paper, after that sheet is formed, and properly pressing or bonding and incorporating into this formed sheet of paper this additional surfacing layer so that it becomes in effect an integral part of the sheet of paper may be used. When this method is thus carried out, the amount of filler which may be used is limited only by the capacity of the fibrous material constituting the body of the web of paper to retain the filler and still have sufficient strength. Some fibrous materials are capable of retaining a greater proportion of filler than others. But whereas, as mentioned above, in the manufacture of book paper for printing, for example, the maximum amount of filler which might be used has been heretofore limited by the tendency to two-sidedness, so that in actual practice as much as 20% of filler in the paper is seldom if ever attempted, by this method very much larger percentages of filler may be used, up to 30% or more.

No endeavor is made to point out at length the specific proportions of the components of the additional surfacing solution, inasmuch as these components will have to be varied under varying circumstances in accordance with variations in the characteristics of the sheet of paper being made on the forming part of the machine, and the characteristics desired for the finished paper. For some desired papers one filler material may be superior to another, in some instances an insoluble size may be superior to a soluble size, thickened tray water may be quite desirable in some cases and in others not, and so on. But anyone skilled in the industry can easily determine the components that should go to make up this additional surfacing solution. In fact, the test may be empirical, inasmuch as the sought result is to obtain desired surface characteristics; as, for example, to impart to the wire side of the paper characteristics which correspond to the surface characteristics on the other side of the paper. Furthermore the characteristics of the original formed sheet of paper may be controlled as desired. If using the mechanism shown in Fig. 4 for applying a surface layer to both sides of the paper sheet the original formed sheet may be made of inferior stocks and its surface characteristics brought up as desired

by controlling the character of the surfacing material subsequently applied to the wet sheet of paper.

While the method herein described, and the forms of apparatus for carrying this method into effect, constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to the precise method and forms of apparatus, and that changes may be made in either without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. The method in the making of paper which comprises forming a sheet of wet paper and thereafter incorporating a paper surface layer of controlled characteristics upon such wet sheet of paper before it is passed to the driers by flowing a liquid stock suspension containing fibrous material thereon.

2. The method in the making of paper which comprises forming a sheet of paper and thereafter treating the wire side of the said formed sheet of paper by applying a liquid suspension containing fibrous material thereto to impart to the said wire side surface characteristics which are substantially the same as the surface characteristics of the other side of the sheet of paper as originally formed.

3. The method in the making of paper which comprises forming a sheet of paper upon a forming wire, removing the said formed sheet of paper from the wire, and flowing a secondary paper surface layer containing fibrous stock and filler onto the wire side of said formed sheet of paper, to impart to the wire side surface characteristics which are substantially the same as the surface characteristics of the other side of the sheet of paper as formed.

4. The method in the making of paper, which comprises forming a sheet of paper upon a forming wire, passing the formed sheet of paper through press rolls, and applying a secondary supply of paper-forming stock including fibrous material and filler upon the wire side of the said formed sheet of paper at the said press rolls.

5. The method in the making of paper which comprises forming a sheet of paper upon a forming wire, applying a secondary paper surface layer by adding a liquid stock suspension including fibrous material and filler to the wire side of said formed sheet of paper, and subjecting the resulting sheet of paper to a bonding action, to bond said secondary surface layer to the formed sheet of paper, to provide a sheet of paper having substantially the same surface characteristics on both sides.

6. The method in the making of paper which comprises forming a sheet of paper upon a forming wire, removing the sheet thus formed from said wire, subjecting said sheet to pressing to remove moisture therefrom, applying a layer of surfacing material to said sheet by flowing a liquid suspension of surfacing material thereon, removing the surfaced sheet from the surfacing material applying means, and subjecting said surfaced sheet to further pressing to cause bonding of said surfacing material with said sheet.

7. In the making of paper in which a sheet of paper is formed upon a forming wire, and the sheet then subjected to a series of pressing operations; the method which comprises the steps of applying a surfacing material comprising a mixture of filler and thickened tray water to said sheet during the pressing operations.

8. The method in the making of paper to form a sheet of paper which is free from two-sidedness, which comprises the steps of flowing upon a forming wire fibrous stock containing a percentage of filler sufficiently high to impart a distinct two-sidedness to the sheet, removing the sheet thus formed from said wire, applying a liquid suspension of fibrous surfacing material to the wire side of said formed sheet to bring the surface characteristics of said wire side up to the surface characteristics of the non-wire side of said sheet, and then subjecting said surfaced sheet to treatment to cause bonding of said surfacing material with said sheet.

9. The method in the making of printing paper, which comprises incorporating in a paper forming stock an amount of filler in excess of 20% on the weight of the total solids of the stock, forming a sheet of paper from said stock having a distinct two-sidedness and providing a sheet having an upper or felt surface of superior printing quality, and then subjecting the formed sheet of paper to surface treatment on the lower or wire side by the application of a liquid suspension of surfacing material to impart to said lower side surface characteristics of superior printing quality.

10. In apparatus of the character described, and in combination, a traveling wire for forming a traveling sheet, means for pressing said sheet, means for flowing a paper surfacing material onto said pressed sheet, means for pressing said surfaced sheet, and means for drying said pressed surfaced sheet.

11. In apparatus of the character described, a pressing arrangement comprising three presses arranged in series, each press having cooperating press rolls, means for passing a paper sheet successively through said presses, and a stock-applying trough associated with the second press and constructed to apply a paper surfacing material to the sheet being treated in said presses.

12. Paper-forming apparatus comprising a press having upper and lower press rolls,

a felt for delivering a traveling web of paper to said press, said web passing unsupported through said press rolls, and means for facilitating feeding of the web into the nip of said press rolls.

13. Paper-forming apparatus comprising the combination with a paper-forming part, of a wet press for treating the formed wet sheet of paper including upper and lower press rolls, and a trough positioned at the side of said lower press roll for flowing onto said lower press roll a liquid suspension of paper-forming stock, to be spread upon the formed sheet of paper and incorporated thereon as a surface layer as the formed sheet passes through said press.

14. Paper-forming apparatus comprising the combination with a traveling forming wire, for forming a sheet of paper, of means for flowing onto said formed sheet of paper after removal from said wire a liquid suspension of paper-forming stock to form a controlled surface layer thereon, means for removing said surfaced sheet from the suspension applying means, and means for pressing said surfaced sheet to cause bonding of said surfacing material with said sheet.

15. Paper-forming apparatus comprising a press having upper and lower press rolls, a felt for delivering a traveling web of paper to said press, said web passing unsupported through said press rolls, means associated with said press rolls for applying a surfacing layer of controlled characteristics to said web as it passes through said press rolls, a traveling tail-carrier ribbon for facilitating feeding of the web into the nip of said press rolls, and rollers for supporting said tail-carrier ribbon.

16. Paper-forming apparatus comprising a press having three superposed press rolls, means for passing a traveling web of paper through the nip of the middle roll and one of said outer rolls and for returning the web of paper through the nip of said middle roll and said other outer roll, and means associated with said press for applying a surfacing layer to each side of the web passing through said press.

17. The method in the making of paper which comprises forming a sheet of wet paper and thereafter incorporating upon said sheet of paper when still wet, a liquid suspension of surfacing material containing an insoluble precipitated size to form a surface layer thereon.

18. The method in the making of paper which comprises forming a sheet of paper upon a perforate forming surface, and thereafter incorporating a paper surface layer of controlled characteristics upon such sheet of paper after the sheet has been removed from the perforate forming surface by flowing a liquid stock suspension containing fibrous material thereon.

In testimony whereof I hereto affix my signature.

JOHN TRAQUAIR.

6

CERTIFICATE OF CORRECTION.

Patent No. 1,786,681. Granted December 30, 1930, to

JOHN TRAQUAIR.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 15, for the word "to" second occurrence, read is; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of February, A. D. 1931.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)