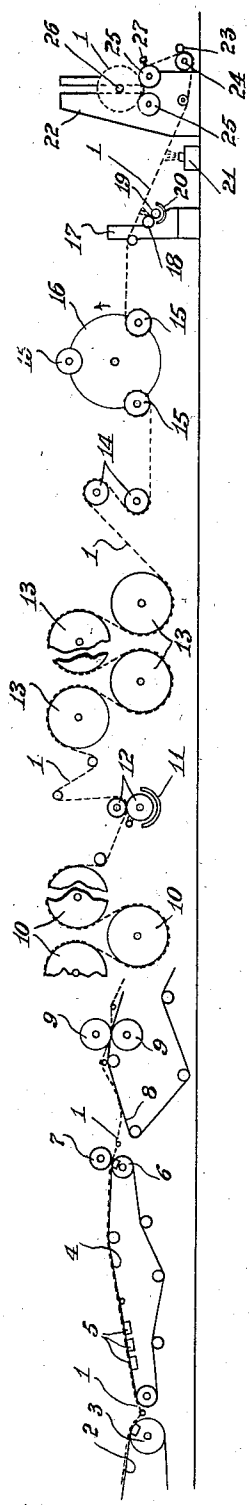
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MANUFACTURE OF PAPER

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MANUFACTURE OF PAPER

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This invention relates to paper making, and more particularly to the manufacture of paper, such as glassine, imitation parchment, and the like, from stock of highly gelatinized fibers; and the object thereof is both to improve and control the quality and other desirable characteristics of paper of this type.

In the standard fourdrinier paper making machine, the paper stock is caused to flow on the fourdrinier wire where the web is formed and a portion of the water is extracted therefrom first by capillary attraction as the web passes over tube rolls and then by suction as it passes over the usual flat suction boxes and the final suction couch roll. From the fourdrinier wire the web is conducted, upon one or more, usually three, endless felt carriers, first between lower suction and top press rolls and then between one or more pairs of standard press rolls by which more water is mechanically pressed from the web. On leaving the last of these rolls the web passes over and around a preliminary pair of smoothing rolls and then over and around an extended battery of steam drying cylinders, which serve to evaporate out most of the water contained therein. If the paper is to be sized the usual size press is inserted at the end of the battery of drying cylinders and a few more drying cylinders are added to remove some or all of the moisture taken up by the paper web from the size press, the number of the extra cylinders used depending upon the grade of the paper to be made. The paper web or sheet, thus dried, is then fed through a pair of calender rolls and wound up into rolls upon reels; and as each roll of paper is completed the reel is removed and set in bearings on a frame and the paper is unrolled and run through a slitting and winding machine. The imitation parchment is a finished product at this stage, but, in the case of glassine, the paper requires further treatment which consists in dampening it, by passing it through a standard dampener, then running it through a supercalender to give it a high finish and partial transparency, and, usually, running it through a waxing machine to render it waterproof and still more transparent.

With a standard paper machine, however, it is impossible to control the degree of transparency, glossy surface, silver whiteness, pliability, flatness, and grease-proof qualities of glassine and imitation parchment papers because the stock is so highly gelatinized that the paper web is very reluctant to give up its water as it is carried on the fourdrinier wire over the tube rolls, suction boxes and suction couch roll. The surface of the sheet, therefore, receives a very distinct wire mark, and, further, the "nap" on the felts becomes "pasty" because sufficient water has not been removed from the highly gelatinized stock by the wire to allow the woolen felts to remove water at the press rolls without leaving felt marks in the surface of the paper; and both wire marks and felt marks leave a white field in glassine paper when it is supercalendered, thereby giving it a more or less opaque characteristic instead of a clear transparent look-through.

I have discovered, and this constitutes one feature of my invention, that by inserting a second fourdrinier wire between the usual fourdrinier wire and the first felt, or by substituting it in place of the first felt, it is possible to carry the hydration of fibers for these papers to almost a state of gelatin without the production of either wire or felt marks in the surface of the sheet. The very wet paper is so dried as it passes over the suction boxes and between the suction couch and upper press rolls of this second wire that when it is transferred to the woolen felt the "nap" of the felt will not become "pasty" and the press-rolls will remove considerable water, and on the last woolen felt the press rolls will remove more water without crushing or marking the surface of the sheet.

A second feature of the invention consists in impregnating the sheet after it has been partially dried but while still holding a considerable percentage of moisture, as by suitably dividing the battery of drying cylinders into two sections and passing the sheet through a bath in a size-press installed be-

tween the two sections, with an aqueous solution composed of a mild alkali like sodium meta-silicate, cerelose or its equivalent in grape sugar, glucose, or dextrose, or a combination of two or more of these materials, and a plasticizer like glycerin, glycol, magnesium chloride, or zinc chloride.

I have found that by the use of cerelose or its equivalent I can improve the transparency, glossy surface, silver whiteness, flatness, and grease-proof qualities of the paper, while when thus applied, the mild alkali adds to the sheen and the plasticizer serves to give the paper pliability and more or less stretch and, in the case of magnesium or zinc chloride, also adds to the weight of the sheet, and by varying the proportions of these ingredients and by diluting the solution with more or less water, I can control the degree of these various characteristics in the finished paper.

Another feature, which relates to the final steps in the manufacture of glassine paper and which enhances both its transparency and glossy surface, consists in a thorough and even dampening of the paper effected by running it through a mechanical dampener which throws a fine spray of water, preferably alkali treated as by dissolving therein approximately 2 to 5 per cent. of sodium meta-silicate or its equivalent, against its under side and further spraying it with an air-operated atomizer, brushing the sprayed water evenly into the paper, and then winding it up tightly into a roll. Both surfaces of the sheet are thus so softened that when it is run through the supercalenders it takes on a very high gloss and becomes exceedingly transparent.

The invention also comprises the other novel features hereinafter described and specifically pointed out in the appended claims.

The invention will be understood by reference to the accompanying drawing the single figure of which is a broken view showing, diagrammatically and with some of the usual parts omitted, a standard fourdrinier paper machine as modified by the improvements by which I effect and control the desired characteristics of glassine and/or imitation parchment paper made thereon.

As herein illustrated, 2 indicates an end of the usual fourdrinier endless wire cloth, on which the paper web 1 (indicated throughout by a line of dashes) is formed, and 3 is the suction couch roll with which this end of the wire is equipped. The second or additional fourdrinier endless wire cloth 4, which as stated is either inserted immediately before or in place of the first of the usual endless felts, is equipped with flat suction boxes 5 and a suction couch roll 6 and top press roll 7. 8 is an endless felt, only one of which is shown, and is equipped with the usual pair of press rolls 9. The drying cylinders 10 are those of the first of the two sections into which the battery of dryers is divided. The size-press, installed between the two sections of the drying battery, comprises a pan 11, in which is placed the solution with which I at this stage impregnate the paper web to improve and control the characteristics of the paper, and two rolls 12 the lower of which rotates in the pan to pick up from the bath a film of the solution and transfer it to the under side of the paper web. The drying cylinders 13 constitute the second of the two sections of the drying battery, and the rolls 14 are two cooling rolls contacting each with an opposite side of the sheet of paper. On leaving the cooling rolls, the paper web or now dried sheet is wound into rolls upon reels, ordinarily a reel which is mounted in standards and when filled is removed therefrom and transferred to a standard slitting and winding machine, but here as shown upon one of a plurality of similar reels 15 mounted upon a rotatable frame 16, which, as one reel is filled, is revolved so to carry that reel forward into an unwinding position and bring a second reel down into winding position, where it is connected by any suitable clutch mechanism to a driven member. From a filled reel, when shifted to unwinding position, the paper is carried through a mechanical dampener 17, comprising a revolving brush 18 geared to a driven brass roll 19 rotating in a pan 20 of water, preferably alkali treated as stated, the roll picking up a film of the water which the brush throws in a fine spray against the under side of the paper, and thence over an air-operated atomizer 21, used in combination with the mechanical dampener, which throws an exceedingly uniform mist of water, also preferably alkali treated, over the under side of the sheet just before it passes to and is slit and trimmed to proper width in a slitter and winder 22. The slitter and winder, as shown, comprises a score-cutting slitter 23 working against a case-hardened drum 24, two revolving drums 25 supporting a shaft 26, upon which the paper is tightly wound on the drum principle, the roll of paper as formed upon the shaft resting upon and being rotated by the drums, and an oscillating brush 27 of the coating type which thoroughly brushes the sprayed water into the paper, and evenly over and intimately in contact with all the gelatinous fibers that make up the sheet, and as the roll of paper is wound up tightly on the shaft, supported by the revolving drums, the wet side of the sheet dampens the other side by its contact therewith.

In the operation of the paper machine modified as illustrated and described it is possible, as stated, to carry the hydration of the fibers to almost a state of gelatin and yet sufficient water will be removed from the very wet web in its passage over the second

fourdrinier wire to enable it to be handled on the felts without leaving either wire or felt marks in its surface.

For the impregnating bath I now prefer, and recommend, cerelose as the material for improving what may be termed the visual characteristics of the paper and glycerin as the plasticizer to give it pliability and stretch, and I have obtained highly satisfactory results both from a solution composed approximately of 4 per cent. sodium meta-silicate, 20 per cent. cerelose, 20 per cent. glycerin, and 56 per cent. water or of 4 per cent. sodium meta-silicate, 50 per cent. cerelose, 20 per cent. glycerin, and 36 per cent. water. A still more plastic sheet is obtained by the use of a solution with 4 per cent. sodium meta-silicate, 10 per cent. chloride of magnesium or chloride of zinc, 20 per cent. glycerin, 30 per cent. cerelose, and 36 per cent. water, while a very handsome sheet can be made with as simple a solution as 20 per cent. glycerin, 20 percent. cerelose, and 60 per cent. water. However, if very good plastic qualities are required, the heavier solutions are more desirable. The sodium meta-silicate adds sheen to the sheet and hence it is desirable, although not essential, to use it in the size-press as well as in the dampeners.

Attempts have been made to impregnate the paper with this solution both before it reaches and after leaving the drying cylinders. Such attempts, however, have proven unsatisfactory and uncommercial. For example, if the paper web is passed through the solution when nearly dry it will take up large quantities thereof and the excess will have to be dried out again. I have found that decidedly the best results are obtained by bringing the paper web to the first section of the drying battery with a moisture content of approximately 82 per cent to 18 per cent of fiber and to so divide the battery that the cylinders in the first section will remove about 14 to 20 of such 82 per cent. moisture content, leaving the sheet with some 60 to 68 per cent. of moisture at the time it passes through the impregnating bath in the size-press. The sheet will then lose all except approximately 5 per cent. of its moisture in passing through the second section of the drying battery and this moisture content will be increased to approximately 7 per cent. by the action of the cooling rolls before the sheet is reeled. The ordinary size press and extra drying cylinders, if used, should be inserted between the second section of the drying battery and the cooling rolls.

Glassine paper when thus treated and afterwards thoroughly and evenly dampened by the combined spraying, atomizing and brushing described, especially where the water used is alkali treated, takes on a very high gloss and becomes exceedingly transparent on passing through the super-calenders and these qualities are further enhanced when the paper is put through a waxing machine using a wax of high temperature.

It will of course be understood that the invention can be modified in its various details, within the scope of the appended claims, without departing from the spirit or sacrificing the substantial advantages thereof.

What I claim as new, and desire to secure by Letters Patent, is—

1. The process of manufacturing paper free from wire and felt marks from highly gelatinized stock which comprises as a step therein the transfer of the wet web on leaving the usual fourdrinier wire to a second wire equipped only with suction and press means for removing a further moderate amount of the moisture content of the web before its transfer to the felts.

2. The process of manufacturing paper from highly gelatinized stock which comprises as a step therein carrying the wet paper web from the usual forming fourdrinier wire over a second fourdrinier wire equipped with flat suction boxes and final couch and press rolls for the removal of a further moderate portion of the moisture content of the web prior to transferring it to the felts.

3. The process of manufacturing glassine, imitation parchment, and like paper which comprises as a step therein impregnating the sheet when partially dried but still containing a considerable moisture content with a solution containing a material like cerelose adapted to enhance the transparency, silver whiteness, and other desirable characteristics of the finished paper.

4. The process of making glassine, imitation parchment, and like paper which comprises as a step therein impregnating the paper web when partially dried but still containing a considerable percentage of moisture with a solution containing a plasticizer like glycerin or its equivalent.

5. The process of making glassine, imitation parchment and like paper which comprises as a step therein impregnating the paper web when partially dried but still containing a considerable moisture content with an aqueous solution of materials like cerelose and glycerin adapted to enhance the transparency, pliability and other desirable features of the paper.

6. The process of making paper of the type described which comprises impregnating the paper web when partially dried but still retaining a considerable portion of its moisture content with an aqueous solution of materials like cerelose and glycerin adapted to enhance the transparency, plasticity, and other qualities of the paper and controlling the degree of such qualities by varying the water in said solution.

7. The process of manufacturing glassine paper which comprises as a step therein dampening the paper, preparatory to running it through the supercalenders, with an alkali treated water.

8. The process of manufacturing glassine paper which comprises as a step therein dampening the paper by running it through a mechanical dampener and then over an atomizer and brushing the moisture thus applied evenly over the surface of the sheet and tightly winding the sheet into a roll supported on revolving drums.

9. The process of manufacturing glassine paper which comprises as a step therein dampening the paper with alkali treated water both in a dampening machine and with an atomizer and then winding it into a tight roll.

10. The process of manufacturing paper from a highly gelatinized stock which comprises as steps therein removing from the wet paper web a portion of its moisture content after leaving the first fourdrinier wire and before passing to the felts, and while the sheet is being dried impregnating it with a solution of materials like meta-silicate, cerelose and a plasticizer adapted to improve the transparency, glossiness of surface, silver whiteness, and pliability of the finished paper.

11. The process of manufacturing glassine paper which comprises as steps therein impregnating the sheet while it is being dried with a solution containing materials like cerelose and glycerin adapted to improve the transparency, silver whiteness, glossiness of surface, and pliability of the finished paper, and dampening it preparatory to running it through the supercalenders with an alkali treated water.

12. The process of manufacturing glassine paper which comprises as steps therein impregnating the sheet while it is being dried with a solution containing materials like cerelose and glycerin adapted to improve the transparency, silver whiteness, glossiness of surface, and pliability of the finished paper, and dampening it preparatory to running it through the supercalenders with an alkali treated water applied to one side thereof both by a mechanical dampener and an atomizer, brushing the water evenly over its surface, and rolling the moistened paper into a tight roll.

13. The process of making a supercalendered and waxed paper from highly gelatinized stock which comprises as steps therein removing additional moisture from the wet web after it leaves the fourdrinier wire and before it is transferred to the felts, impregnating the sheet while being dried with a solution containing cerelose and glycerin or their equivalents, thoroughly and evenly dampening the sheet with an alkali treated water preparatory to running it through the supercalenders, and coating the supercalendered sheet with a high temperature wax.

14. A paper machine of the type described comprising a second fourdrinier wire inserted in tandem with the usual fourdrinier wire and before the first felt.

15. A paper machine for the manufacture of paper from highly gelatinized stock having its battery of drying cylinders divided at a point where the paper web still retains a considerable portion of its moisture content into two sections and intermediate said sections, a press through which the partially dried paper web is carried in contact with a film of an impregnating solution adapted to enhance the transparency, silver whiteness and plasticity of the paper.

16. A paper machine for the manufacture of a supercalendered paper from a highly gelatinized stock comprising as means for dampening the paper preparatory to running it through the supercalenders a mechanical dampener, an atomizer, means for brushing the sprayed water evenly over and intimately in contact with the fibers of the sheet, and means for reeling the sheet into a tight roll.

17. A paper machine for the manufacture of paper from a highly gelatinized stock comprising a second fourdrinier wire inserted in tandem with the usual fourdrinier wire and before the first felt and a battery of drying cylinders divided into two sections and between said sections means for subjecting the partially dried sheet to a bath of impregnating solution.

18. A paper machine for the manufacture of a supercalendered and waxed paper from a highly gelatinized stock comprising a second fourdrinier wire inserted in tandem with the usual fourdrinier wire and before the first felt, a battery of drying cylinders divided into two sections and between said sections, means for subjecting the partially dried sheet to a bath of an impregnating solution, means for cooling the surfaces of the sheet after leaving the drying cylinders, and means for dampening the sheet preparatory to running it through the supercalenders including a mechanical dampener, an atomizer and means for rubbing the sprayed water evenly over and in intimate contact with the fibers of the sheet, and means for coating the sheet with a high temperature wax.

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