

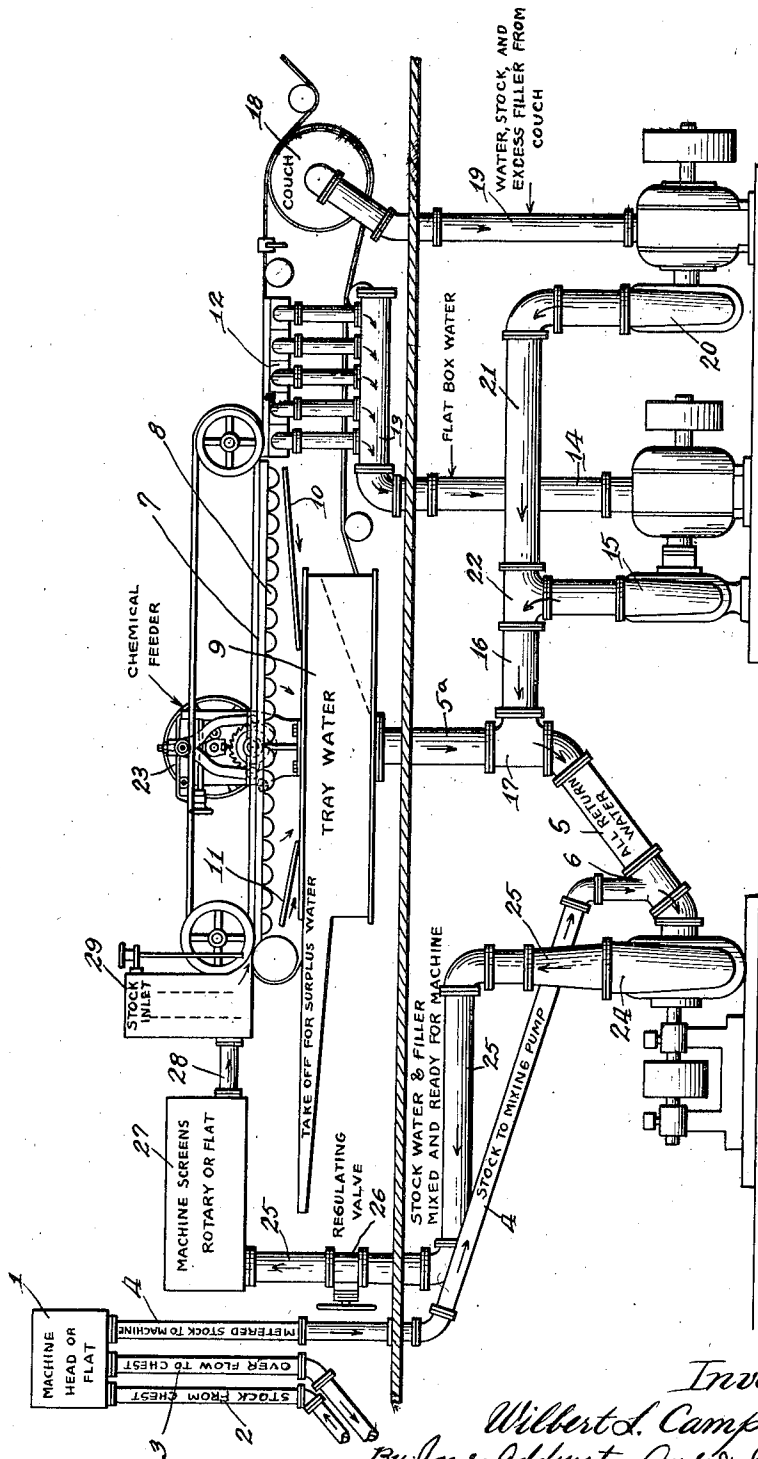
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METHOD OF INCORPORATING SPECIAL MATERIALS WITH PAPER STOCK

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## METHOD OF INCORPORATING SPECIAL MATERIALS WITH PAPER STOCK

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The present invention relates to an improved process of incorporating special materials and the like with paper stock.

One of the objects of the invention is to feed special materials to the paper pulp in such a manner as greatly to reduce the loss of the material, while at the same time insuring the retention of a high percentage thereof.

A further object of the present invention is to prevent loss of fillers, etc., as the result of the water-solubility thereof, by feeding them in such a manner and at such a point in the flow of the materials into and through a paper-making machine, that the water becomes saturated with the fillers, etc., as a result of which no further amounts thereof will pass into solution. This therefore involves the recirculation of the white-water from the paper-making machine.

Still a further object of the present invention is to insure high retention of calcium sulfate fillers in paper by feeding the calcium sulfate into the stream of white-water coming from the machine at about the point, or shortly before, where the returning stream of white-water meets the stream of concentrated paper-stock that is to be passed to the machine, passing the admixed stream of filler and paper-stock through a suitable pump, preferably of the centrifugal type, so as to insure a thorough admixture of the calcium sulfate, water and paper-fibers.

Further objects will become apparent from the following description and the drawing filed with the present application.

In the said drawing there is but one figure, and this is a diagrammatic showing of just sufficient parts of the paper-machine (not to scale and without any attempt to make a complete showing of such a machine) so that the method involved in the carrying out of the present invention can properly be understood.

Special materials have been incorporated with paper stock in various ways. For example, fillers may be added to the beaters in which the cellulosic material undergoes the necessary refining operation. Methods have also been disclosed for feeding the fillers at a point intermediate the beaters or Jordan and the head-box of the paper-machine. Furthermore, methods of incorporating fillers of a slightly soluble nature, such as calcium sulfate, have been described, in which water saturated with calcium sulfate has first been prepared and kept in stock, such water being used in the beaters in place of ordinary water, so as to minimize the solubility of the calcium sulfate filler.

It has also been proposed to use water saturated with calcium sulfate, but containing none of it in suspension, for the purpose of insuring a freer stock, and to prevent adhesion of the paper to the wires and other parts of the paper-ma-

chine. In this connection the calcium sulfate solution was employed as a substitute for alum or aluminum sulfate, and not as a filler.

However, when feeding calcium sulfate to the beaters, in accordance with the older methods, even though calcium-sulfate-saturated water is used, the retention of this filling material is quite inadequate, and the losses of filler in the white-water are very considerable. There is the further difficulty that the filler will not be adequately dispersed among the fiber-suspension.

All these difficulties are successfully overcome by the practice of the present invention which involves feeding the special material, filler, etc., as for example calcium sulfate, preferably, but not necessarily, in dry powdered form, to the white-water leaving the machine. In this way a suspension of calcium sulfate, or other filler, in the white-water is formed; and this suspension is then mixed, preferably while flowing in a continuous stream, with a similarly flowing stream of paper-stock, the mixed streams then being directed to the paper-machine. As the white-water is recirculated, it soon becomes saturated with material, so that the latter will for all intents and purposes behave as an insoluble substance.

One of the outstanding advantages of feeding the material in this manner is that the same, conjointly with the paper-stock coming from the head-box, is passed through the pump that pumps the mixture to the machine-screen of the paper-machine, so that there results a double functioning of the pump, whereby the same acts not only as a conveying mechanism but also as a most effective mixing-machine.

Referring to the drawing, it will be seen that it illustrates, in purely diagrammatic form, certain portions of a paper-making plant. At the extreme left there is the head-box 1 of the machine, showing pipes 2 and 3 leading, respectively, from and to the stuff-chest (not shown). A pipe 4 leads from the head-box 1 to the white-water-return-pipe 5, meeting the same at the junction point, or Y, 6.

Now directing attention to the course of the white-water, this is derived from three sources, namely, from the Fourdrinier wire where it contacts with the small rollers that are in superficial contact with the underside of the wire, from the suction box or "flat-box" that removes additional water from the freshly formed paper web, and from the couch-roll. Thus water coming from the Fourdrinier wire 7 and rollers 8 collects in the collecting box 9, being directed thereinto by the trays 10 and 11. The water thus collected passes downwardly through the vertical pipe 5—A. Water from the flat-box 12 passes through horizontal pipe 13 and vertical pipe 14 to the pump 15, and then through pipe 16 into

the T 17, where it meets the water flowing through pipe 5—A, the combined streams taking their course through pipe 5. The water coming from the couch 18 flows through pipe 19 into pump 20, and thence through pipe 21 to T 22 where it meets the stream of water flowing from pump 15. It will thus be seen that all the water that was originally mixed with the paper stock finds its way eventually to pipe 5.

Located at a convenient and accessible point, there is provided a chemical feeder 23, which may be of any standard type, provided only that it is capable of feeding predetermined amounts of the special material into the water that is contained either in the box 9 or the pipe 5—A. A suitable feeder for this purpose is one made by the B. F. Gump Co., of Chicago, Illinois, being known as type "JJ" Draver style chemical feeder, as illustrated on page 11 of their catalog No. 42, copyrighted 1928. An end view of this feeder is shown at 23 in the present drawing. It is primarily intended to feed dry materials, which may be stored in any suitable bin and fed to the feeder. The latter is so arranged that from a few ounces to as much as seven hundred pounds of material can be continuously fed per hour. By suitable adjustments provided by the manufacturers, the rate of feed can be almost instantly changed and controlled. It is to be distinctly understood, however, that this type of feeder is mentioned purely as illustrative, there being many similar devices available. The invention is, of course, not to be limited in any way by the particular instrumentality employed for feeding the material into the white-water.

As the material mixes with the white-water, it is at once carried forward through pipe 5 and, after joining with the stream of paper stock flowing through pipe 4 at the point 6, passes conjointly with the paper stock through the pump 24. The latter is preferably of the centrifugal or the rotary type, so that the materials will not only be forced through the discharge pipe 25 but will also be thoroughly intermingled and rendered homogeneous. From this pipe 25 the mixed filler and stock pass through regulating valve 26 to the machine-screen compartment 27 of the machine. Thence the material flows through pipe 28 into the stock-inlet box 29. As the web is formed on the Fourdrinier wire, the paper and material remain on the wire, while the water passes back into tank 9, carrying with it a small amount of material and a little of the filler. Because of the solubility of calcium sulfate, if this is the material used, the water will also dissolve sufficient thereof to form a saturated solution of calcium sulfate, so that after about thirty minutes' operation of the machine, an equilibrium will have been reached, and no further amounts of calcium sulfate will dissolve.

It is to be understood to be within the scope of the present invention to mix the material with water or to have it fed into a stream of water before admixing it with the white-water. The dry-feeding method is, however, the simplest and easiest to control.

Many quite unexpected benefits result from the method of feeding the material in the manner, and at the place, shown. The most outstanding advantage is the greatly increased retention of the material and the concomitant increase in yield of pounds of paper produced from a given amount of raw materials. Actual comparisons

on a full commercial scale have been made, and the following results have been obtained:

Four tests, made by added calcium sulfate filler to the beaters, showed a retention, respectively, of 41.0%, 48.3%, 47.7%, and 46.0%, or an average of 43.7%. When feeding, however, into the white-water in accordance with the present invention, the retention was, respectively, 77.3%, 74.6%, 66.6%, 66.6%, 74.0%, or an average of about 71.0%. This means an increase in retention of 27.3%, or 162% more than when adding filler in the beaters. It will be plainly evident that this involves more than a matter of mere degree.

The ability to feed dry materials, such as calcium sulfate, in the extremely simple manner of the present invention has further dominant advantages. Thus the speed of the feeder can be accurately adjusted to the speed of the wire, and the operators thus have a perfect control not only of the weight of the paper made but can control its whiteness or color (in case the filler itself is colored or pigmented). The loss of filling material is reduced to a minimum, and the entire operation made simpler and more efficient.

A further advantage is that no extra parts, except the feeding device, need be attached to the paper-making machine, and there is no contamination of the beaters by the special material, which latter might interfere with the proper carrying out of the sizing operations. Still a further advantage is that the sizing operation and special material adding operation are thus made entirely separate, each under perfect control.

It is to be understood that the point of feed of the material, etc., need not be at the precise place shown, and it will be considered as within the spirit of the present invention to feed the same at any point in the course of the flow of the white-water before it meets with the stream of paper-stock. Addition of the material, on the other hand, in the head-box, is not within the scope of the present invention.

While the invention is particularly applicable to the feeding of calcium sulfate, which is slightly water-soluble, it is, of course, equally applicable for the feeding of other materials, particularly such as are of a nature that might interfere otherwise with the sizing or beating operation. Thus it would be considered as within the scope of the invention to feed natural or synthetic resins to the paper-stock to be incorporated therewith, or to add size-precipitating or influencing materials as well.

What it is desired to protect by Letters Patent is:

1. The process of making paper on a paper-making machine in which white-water is recirculated, which comprises, feeding a suspension of paper-stock to the forming wire to form a web thereon, collecting the white-water passing through said wire and immediately feeding a filler thereto prior to its recirculation to form an advancing stream of filler-containing water, forming an advancing stream of a suspension of paper-stock, combining and mixing said streams and causing the resulting mixed stream to be fed to the forming wire to form a web of filler-containing paper thereon.

2. The process as defined in claim 1 in which the filler is calcium sulfate.

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