

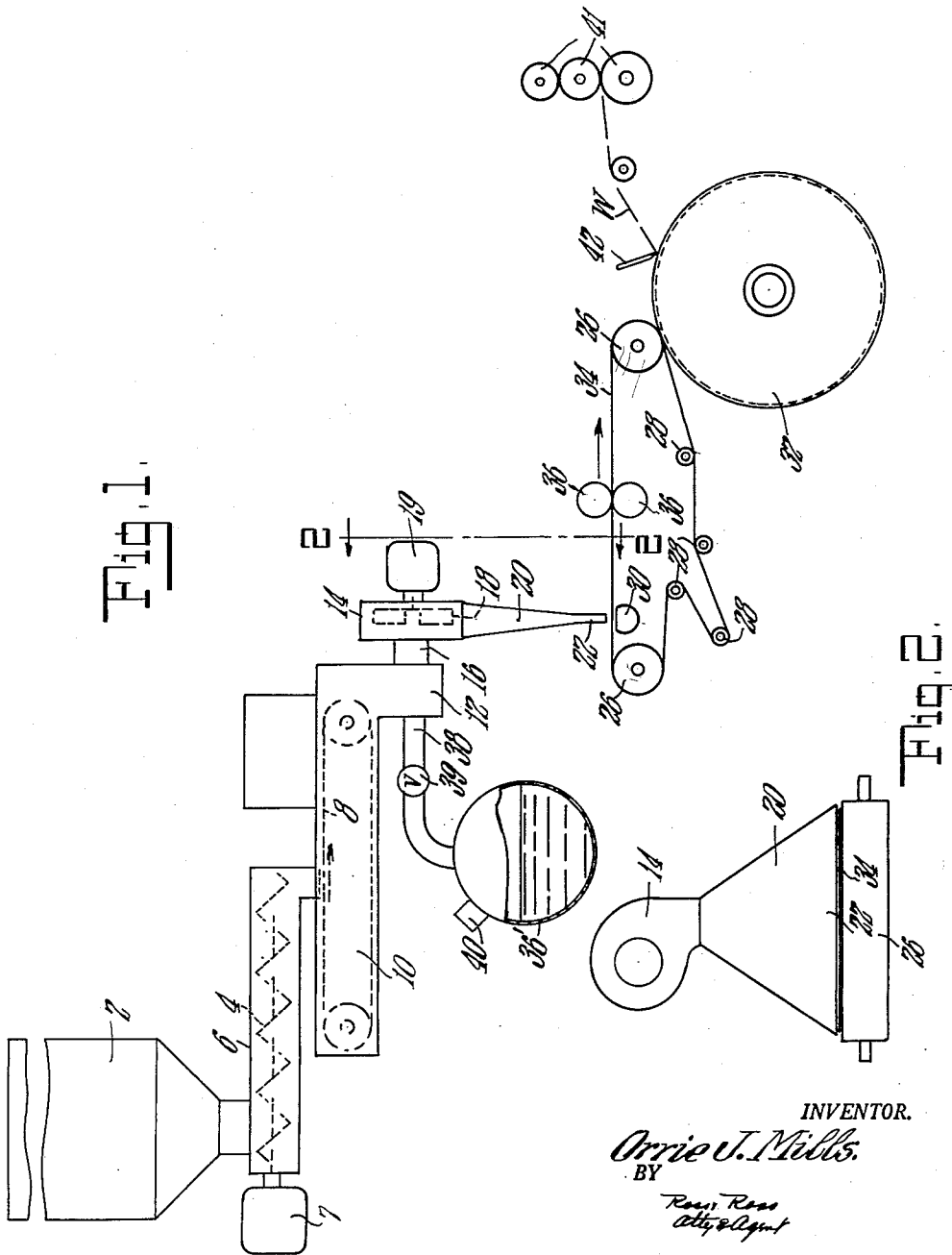
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O. J. MILLS
PAPER MANUFACTURE

2,810,940

Filed April 23, 1953

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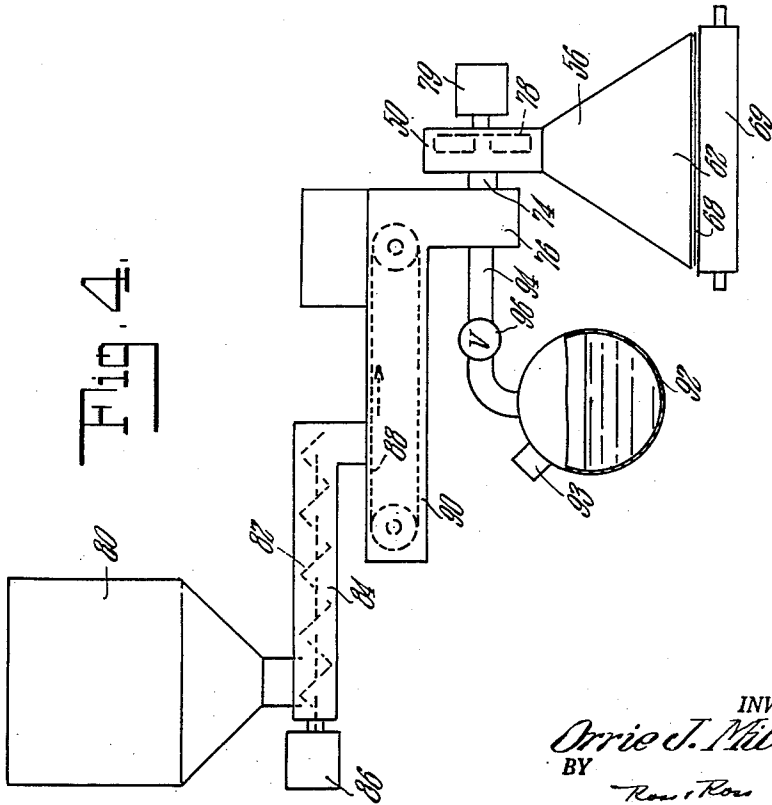
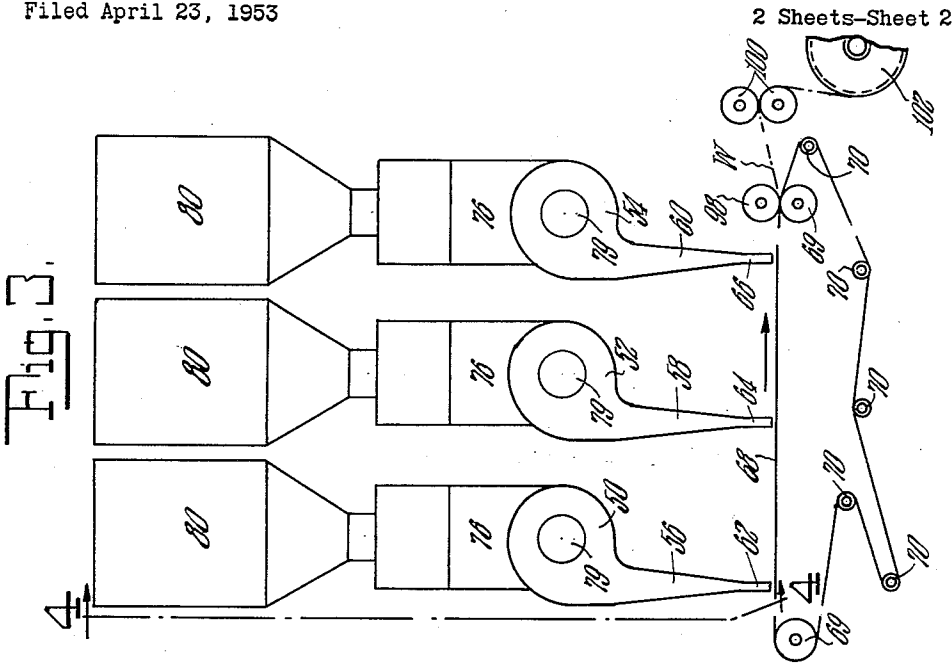
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PAPER MANUFACTURE

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1 Claim. (Cl. 19—155)

This invention relates to improvements in paper manufacture.

The principal objects of this invention are directed to improvements in the method of paper manufacture which, in a general way, permit greater production with relatively less equipment and lower cost than has heretofore been possible according to the prior art.

There are increasing demands for increasing operating speeds in order to increase tonnage per inch of trim of paper machines. In attempts to obtain the increased tonnage, special equipment has been designed at great cost and as the furnish consists of one-half or one percent fiber with ninety-nine percent water, the increased tonnage increases the problem of handling and the cost of water.

According to the invention, machines of higher speed and narrower width than prior art machines are capable of production equal to and in many cases in excess of prior art machines.

As an example, a machine producing newsprint with a basis weight of 32#, having a trim of 132" operating at 600 feet per minute, will produce 50 tons of paper in 24 hours. A machine according to the invention having a trim of 66" and operating at 1200 feet per minute will produce the same tonnage in the same period of time, or a machine having a trim of 33", operating at 2400 feet per minute will produce 50 tons in a 24-hour period.

The speed of prior art machines is limited to a large extent by the enormous amount of water used, the handling thereof and its elimination. That is, there is a limit to the speed at which a machine can be run to obtain satisfactory products.

According to the novel features of this invention, the Fourdrinier section of the prior art paper machine and its auxiliaries and pit are eliminated, the handling of very large quantities of water is obviated, less dryers are required, there is much less steam consumption for drying, there are no couch and wire marks in the paper, and there are other advantages as will appear hereinafter.

In ordinary paper manufacture, papermaking fibers are suspended in water and in order to produce paper of the desired characteristics there are many factors which must be considered, with the basis weight of the paper to be produced. Some of the factors are, character of fibers, speed of forming element, mesh of wire, length of forming element, shake for interlocking of fibers, drainage from paper web, suction boxes, amount of dilution, etc. The various factors must be adjusted by the papermaker to their proper relationships but according to the novel features of this invention, there is no such multiplicity of factors requiring a proper relationship.

An important consideration with prior art papermaking is the large quantity of water required, as for example, where the consistency of stock going onto the Fourdrinier wire is one-half of one percent to, say, one percent of fiber with ninety-nine or so percent of water. The availability of the large quantity of suitable water is frequently a problem. The handling thereof, the drainage from the stock, and the drying of the web, consistently presents

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problems while adequate equipment therefore is space consuming and expensive.

All of the above objects, I accomplish by means of such structure and relative arrangements of parts thereof, as will fully appear by a perusal of the description below and by various specific features which will be hereinafter set forth.

To the above cited and other ends and with the foregoing and various other novel features and advantages and other objects of my invention as will become more readily apparent as the description proceeds, my invention consists in certain novel features of construction and in the combination and arrangement of parts as will be hereinafter more particularly pointed out in the claim hereunto annexed and more fully described and referred to in connection with the accompanying drawings wherein:

Fig. 1 is a diagrammatic side elevational view of apparatus to explain the novel features of the invention;

Fig. 2 is a diagrammatic sectional elevational view on the line 2—2 of Fig. 1;

Fig. 3 is a diagrammatic side elevational view of apparatus to further explain the novel features of the invention; and

Fig. 4 is a diagrammatic elevational view on the line 4—4 of Fig. 3.

Referring now to the drawings more in detail, the invention will be fully described.

A supply vat or stock chest 2 is shown in Fig. 1 for papermaking stock which according to the invention will have been prepared in a suitable manner for the paper to be produced. For purposes of description, the paper to be produced will be considered lightweight or tissue paper as distinguished from wrapping paper, heavy bond paper, or the like.

The stock will be prepared in much the ordinary manner so that it will provide a furnish for the basis weight paper to be produced. Said stock, however, instead of including a half to one percent fiber as is the common practice will be about 75 percent of the proper fiber and about 25 percent only of water.

The stock is transported by a continuously rotating screw 4 through a conveyor tube 6 onto an endless conveyor band 8 of a conveyor scale 10. The screw will be driven by a motor 7 or the like at the proper speed for the practice of the invention.

The stock on the band 8 is delivered thereby to a compartment 12. A fan housing 14 connected to the compartment by a conduit 16 encloses a suction fan 18 operated by a motor 19. A delivery nozzle 20 depends from the housing and terminates in a relatively wide delivery outlet 22.

An endless felt band 34 has an upper run supported and driven by rolls 26, and is otherwise guided by rolls 28, all as shown. A suction box or suction roll 30 of suitable form is disposed below the band 24 at a point below the outlet 22.

A hollow cylinder 32 is rotatable adjacent the delivery end of the band. This cylinder is similar to that known as a Yankee dryer and is supplied with steam for drying purposes. Cooperating rotatable and continuously driven press rolls 36 receive these between the band 34 and fiber thereon.

A tank 36' for water has an outlet conduit 38 to the compartment 12 and may have an air inlet such as 40 for the passage of air to the compartment 12. Rolls 41 represent the rolls of a calender stock of ordinary form.

Stock from chest 2 onto the weighing band 8 is delivered at such rate as to satisfy the weighing scale and may be accomplished by regulating the speed of screw 4.

The weighing scale will be of the type to continuously weigh the correct amount or volume of stock for the particular paper being formed, taking into consideration

the basis weight of the paper being produced, the speed of band 34, etc. One form of such device is that known as "Feedoweight" manufactured by Merrick Scale Mfg. Co. of Passaic, New Jersey. Such devices operate continuously and the adjustability thereof makes it possible to continuously deliver a predetermined weight of stock or amount thereof according to the basis weight of the paper to be formed.

The propeller 18 blows the stock from the compartment 14 downwardly through the nozzle 20 and out the outlet 22 onto the band 34 which moves continuously in the direction of the arrow. The stock is pressed between the press rods and the web formed on the band passes onto the cylinder 32, by means of the pressing action of roll 26.

The cylinder 32 is heated by steam so that the formed web is dried and said web represented by W is doctored form cylinder 32 by a doctor and enters the calender stock.

Obviously, the stock may be delivered to the band 34 in such a manner as to form a very thin or relatively thicker layer depending upon the operation of the weighing device and speed of the band 34 in order to form the paper web desired, but in all cases, the fibers delivered to the band will be such as to produce the basis weight desired.

In some cases it may be desired to add moisture to the fibers. This may be accomplished by opening a valve 39 in conduit 38 whereupon a fan 18 draws air from over the water in tank 36 so that moisture laden air is mixed with the stock so that the fibers take on moisture. If desired, of course, the air or water may be heated to facilitate moisture absorption. The suction device 30 when in operation functions to assist intermingling of the fibers and to remove moisture from the stock as it is delivered to the band.

It will be understood that the various components will be operated in suitable timed relation for producing the web in the manner described.

It will be noted that the fibers are dry relative to ordinary papermaking procedure, therefore the removal of water ceases to be a problem and that therefore the speed of production is not limited by the handling of vast amounts of water as formerly. The fiber suspended in air as it is and delivered to the forming band is properly intermingled and felted to form a web of the desired characteristics.

According to the invention, a plural ply web is formed by the apparatus of Figs. 3 and 4. Plural housings 50, 52, and 54 have depending nozzles 56, 58 and 60 terminating in outlets 62, 64 and 66. An endless band 68 supported and driven by rolls 69 and guided by rolls 70 receives fibers from the outlets.

Each housing is connected by connections such as 74 to a compartment 76 having a suction fan 78 rotatable therein which is driven by a motor 79.

Stock chests such as 80 deliver stock to a conveyor having a screw 82 rotatable in a tube 84. The screw is operated by a motor 86 and the stock is discharged onto an endless band 88 of a weighing device 90. Weighed stock is delivered to the compartment 76. A water tank 92 is connected by a conduit 94 to the compartment 76 and a valve 96 is disposed in said conduit. The tank may have an air inlet 93.

Apparatus such as shown in Fig. 4 and similar to that described in connection with Figs. 1 and 2 is duplicated so that stock will be delivered to apron 68 at spaced points.

There may be suction devices below the band 68 and nozzles such as shown in Fig. 1.

In this way, a multiple ply web is produced. The stock from each nozzle may have such characteristics as may be desired. As an illustration, the endmost nozzles may deliver stock for what is known as liners and the intermediate nozzle may deliver filler stock.

The stock in all cases will include much less water than has been the practice and of approximately the proportions already set forth.

A roll 98 cooperates with the roll 69 at the delivery end of the band 68 for a pressing action and the multiple web W passes from the band 68 to and through rolls 100 and from said rolls to drying cylinders 102.

It will be observed that stock having a relatively greater proportion of fiber than water is used to obviate the handling and elimination of water renders the use of a large amount of equipment unnecessary.

According to the prior art where the stock is practically all water, production is limited to the ability to handle and eliminate water not only in the web forming step but in the subsequent drying step.

According to this invention, with the relatively dry fiber it is conveyed by air to the forming element as distinguished from water and the fibers are in such condition as to interfelt and intermingle so as to provide a web having the desired formation. Inasmuch as the stock is weighed for the basis weight of the web to be formed, the web is uniform in all important respects.

Altogether, the method enables a greatly increased production and more economically than has been possible heretofore and without an enormous amount of expensive equipment.

The invention may be embodied in other specific forms without departing from the essential characteristics thereof. Hence, the present embodiments are therefore to be considered in all respects merely as being illustrative and not as being restrictive, the scope of the invention being indicated by the appended claim rather than by the foregoing description, and all modifications and variations as fall within the meaning and purview and range of equivalency of the appended claim are therefore intended to be embraced therein.

What is desired to claim and secure by Letters Patent of the United States is:

In the art of paper making, the method of making a web consisting of the steps: continuously weighing on a weighing scale separate quantities of fibers having a relatively low and uniform water content, continuously delivering at a speed controlled by the desired basis weight of the web being formed as indicated by the weighing scale the separate weighed quantities of fibers by way of an air suspension means to a continuously moving forming band, each of the quantities of stock being weighed and measured relative to the predetermined weight of the web being formed, subjecting the delivered fibers on the forming band to a web forming element, and drying the web so formed.

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