March 28, 1933. B. JOHNSEN 1,903,236

PAPER MANUFACTURE

Filed Sept. 18, 1930

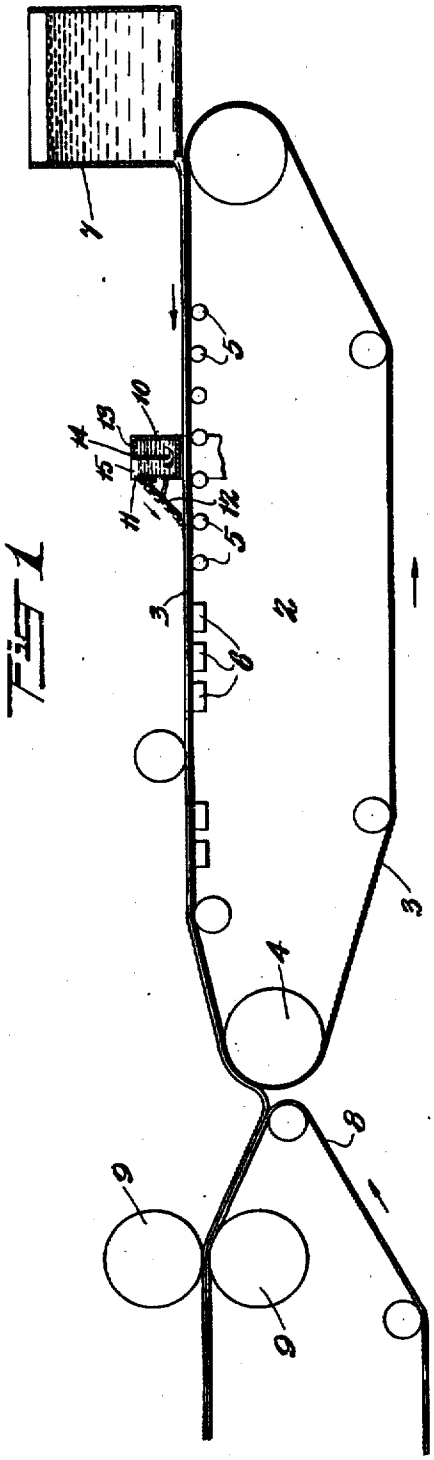


Fig 1

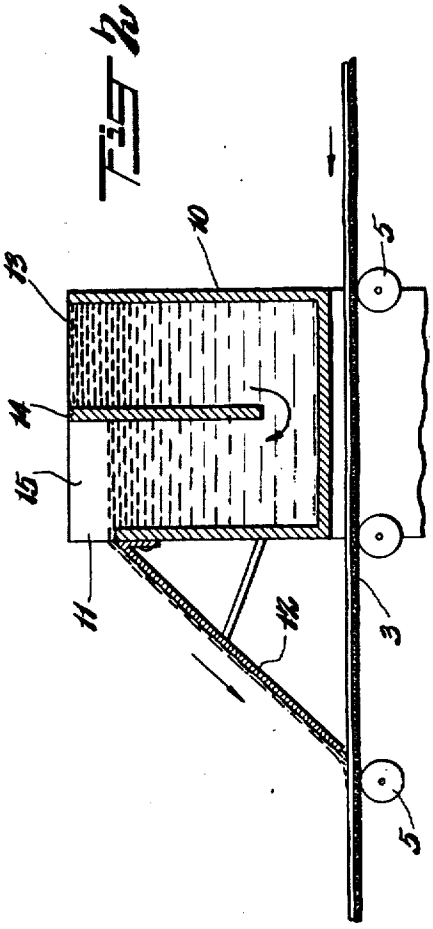


Fig 2

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UNITED STATES PATENT OFFICE

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PAPER MANUFACTURE

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This invention relates to paper manufacture. In the manufacture of most papers used for writing and printing, it is necessary to add to the paper pulp so-called sizing materials for the purpose of covering the surface of the fibers with an adhesive material thereby sealing up the natural pores of the fibers and serving as a binding material between the individual fibers. The sizing material most commonly used is rosin, which is added to the so-called beating engines either in the form of sodium resinate or as a colloid solution of free rosin or as a combination of sodium resinate and free rosin, the latter being the customary practice. In order to bring about the desired reaction between the rosin and the fibers, it is necessary to change the acidity of the solution by adding an acid or salt, and aluminum sulphate has been found to be the most suitable salt for this reaction and is therefore most commonly used. Following this reaction, the paper pulp is acid in character and this acidity depends upon the amount of aluminum sulphate added which again is governed by the local manufacturing conditions of the individual paper mills.

During the formation of the paper sheet on the Fourdrinier wire, most of the acid water is removed from the sheet but sufficient acid water is left to give a distinct acidity to the final dried paper sheet. It has been found that the acidity of the paper affects its durability adversely and that a minimum acidity should be maintained in the paper sheet to insure greater permanence of the paper.

The affinity between the fibers and the rosin particles is not sufficient to retain in the sheet the total rosin added to the paper pulp, a great portion being removed during the rapid draining of the water on the paper machine wire and while some of the unattached rosin particles may be held by the sheet particularly on the upper side, practically all such particles are removed from the lower side (called the wire side) due to the suction of the suction boxes and the suction roll. This creates a disturbance of the lower surface of the sheet and a difference between the two sides of the paper. While this can be controlled by surface sizing by passing the dried or partly dried sheet through a bath containing a solution of glue or starch or a mixture of both or other sizing material, such additional treatment is costly and most paper machines are not equipped for it and the installation of the necessary equipment would add materially to the production cost.

For the purpose of improving the surfaces of the paper sheet, it is also common practice to add to the paper pulp in the beater starch or starch products, but these have very little affinity to the fibre and with the high dilution of the starch as it enters on the paper machine wire and the rapid drainage necessary on the wire, most of the starch material is removed and only a small percentage is retained in the sheet.

I have developed a method whereby starch or other sizing material may be incorporated in the sheet in greater concentration and with better surface effect, simultaneously reducing the acidity of the sheet and improving its quality in respect to durability or permanence.

In the accompanying drawing Fig. 1 is a diagrammatic view of apparatus which may be employed in carrying out my invention, and

Fig. 2 is a vertical sectional view of a detail.

Referring to the drawing a Fourdrinier paper-making machine of standard construction is indicated at 2, said machine comprising a well-known Fourdrinier screen or wire 3 which is caused to travel in the usual way over a series of rollers including suction roll 4 and table rollers 5. The screen 3 also passes over vacuum boxes 6 of standard construction. As is well-understood in the art, the paper stock or pulp stream flows from a head box 7 on to the screen or wire 3 and is carried along by the latter. When flowing onto the wire 3 the paper stock has a concentration of approximately one half of one per cent fiber and sizing material to 99.5 per cent water. A substantial portion of the water separates from the stock by gravity, passing through the perforations of the screen or wire 3. Another portion of the water is pulled out of the wet stock or sheet as the

wire passes over the suction boxes 6 and suction roll 4, so that the sheet finally leaves the wire with about twenty percent solids (fiber and sizing material) and eighty percent water. The sheet thence is carred by a strip 8 of felt or similar material between the customary pressure rollers, such as are indicated at 9. Thence the sheet passes to drying cylinders (not shown) of the usual type.

In carrying out my invention I add a starch solution or other suitable material to the sheet or paper stock while the latter is on the Fourdrinier wire 3. Said material is added in any convenient way, such, for example, as by means of a box 10 suitably secured to the frame of the paper machine and having an overflow passage 11 from which extends a lip 12. Said box, overflow passage, and lip 12 extend across the full width of the machine, and the solution to be added to the stock on the wire 3 may be flowed continuously into compartment 13 of the box 10 in any desired manner. A partition 14 extending downwardly but terminating above the bottom of the box divides the box into compartments 13, 15. The overflow passage communicates with compartment 15 as shown. The partition 14 enables a uniform flow of solution to be obtained through the overflow passage 11 and eliminates the effect of undesirable currents which might be caused by the entrance of the sizing solution into the box 10. A smooth and continuous flow of sizing solution thus takes place over the lip 12 to the stock on the wire 3.

The sizing material is carried along the wire 3 with the paper sheet or stock and is drawn into said sheet by the action of gravity, supplemented by the action of the suction boxes 6 and suction roll 4. Said sizing material thus displaces the acid solution originally in the sheet, replacing the displaced acid material and decreasing the acidity of the paper while at the same time increasing the amount of starch therein. When the wet sheet passes through the pressure rollers 9, a further quantity of water is removed from the sheet by pressure and some of the starch contained in this water is forced by said pressure to both surfaces of the sheet. When the sheet thence passes to the drying cylinders the heat of the latter causes the starch to form a film on the surfaces, improving the writing and printing quality of the paper.

It is to be noted that through my invention an improvement not only of the surface but also of the entire body of the paper is accomplished. This is in marked distinction to the customary surface sizing wherein merely a film is formed on the surface and can be removed by erasure, leaving a new surface of inferior sizing quality. My invention brings about not merely a surface treatment, but a treatment of the entire paper body.

The position of the box 10 on the Fourdrinier machine may be varied according to the point at which the sizing solution is to be added to the stock on the wire 3. Preferably the sizing solution is added to the stock at a point where a substantial amount of water has been removed. In the accompanying drawing the box 10 is shown in such position on the Fourdrinier machine as to add the sizing solution to the stock where the latter consists of approximately five percent fiber and ninety-five percent water, but it will be apparent that the invention does not depend upon any particular point of application of said solution to the stock. Said point of application may be varied as desired. If the solution is added at a point where a small quantity of water has been removed the solution should of course be stronger than when added at a point where more water has been removed, assuming the same amount of sizing material to be desired in the sheet.

While I have specifically mentioned starch, it will be evident that the invention is applicable to any starch products or other sizing materials. The invention may in fact be employed for impregnating the paper with any similar non-acid material for displacing a quantity of acid matter in the paper and thereby reducing the acidity of the latter.

The terms and expressions which I have employed are used as terms of description and not of limitation, and I have no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof, but recognize that various modifications are possible within the scope of the invention claimed.

I claim:

1. That improvement in the art of paper manufacture which comprises adding sizing material to paper stock during the travel of the latter on a Fourdrinier wire.

2. That improvement in the art of paper manufacture which comprises adding sizing material to paper stock while the latter is on a Fourdrinier wire and causing the body of said stock to be impregnated with said material.

3. That improvement in the art of paper manufacture which comprises adding sizing material to paper stock while the latter is on a Fourdrinier wire and causing the lower surface of the stock to receive a portion of said material.

4. That improvement in the art of paper manufacture which comprises adding starch to paper stock while the latter is on a Fourdrinier wire, causing said starch to be distributed through the body of the stock and upon the lower as well as the upper surface thereof, and applying heat to said starch.

5. A method of diminishing the acidity of paper stock which comprises adding non-acid material to the stock while the latter is on

a Fourdrinier wire and subjecting said material to suction to cause said material to displace acid matter from within the body of said stock.

6. That improvement in the art of paper manufacture which comprises treating the paper stock during its travel on a Fourdrinier wire with sizing material and causing said material to displace acid matter from within the body of said stock.

In testimony whereof, I have signed my name to this specification this 27th day of August, 1930.

BJARNE JOHNSEN.