

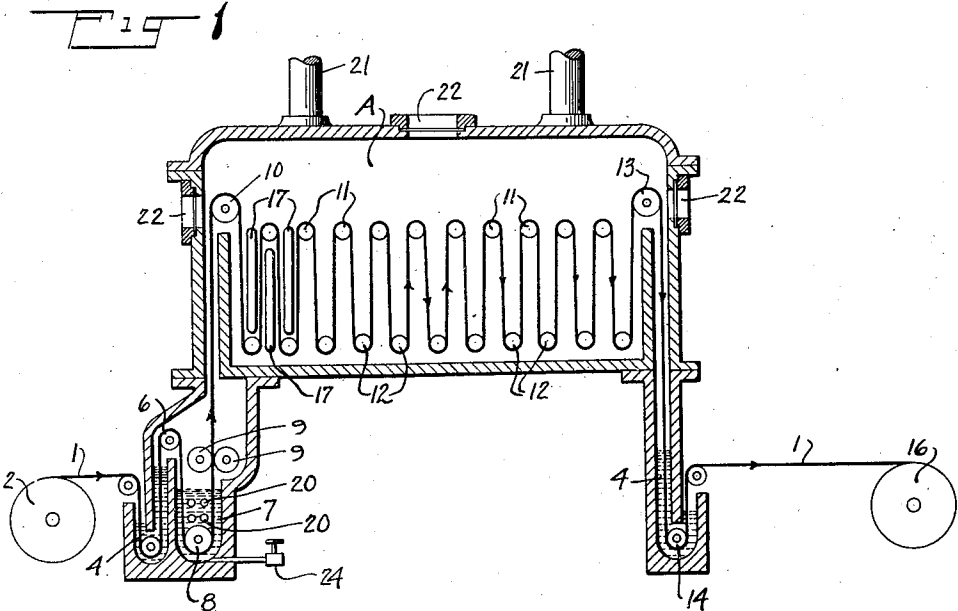
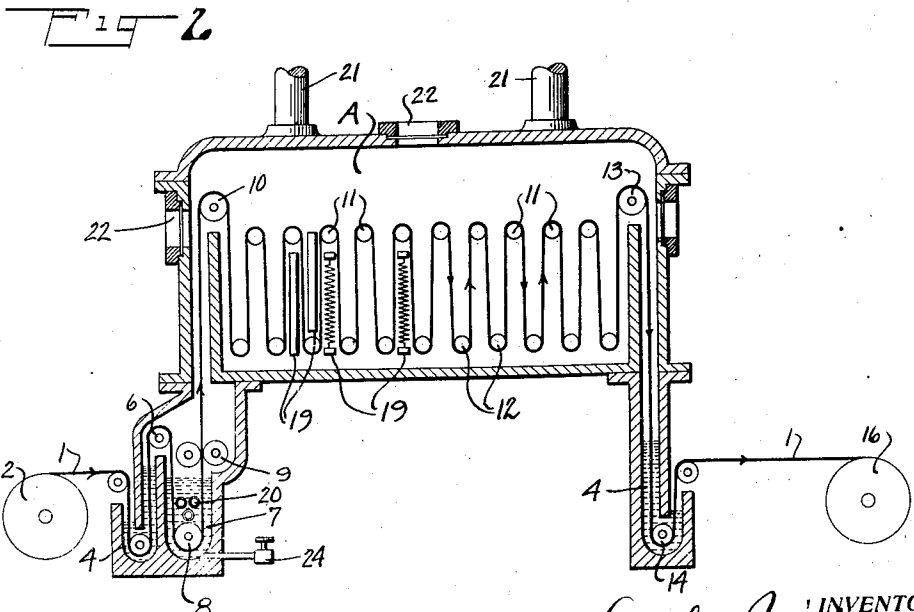
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METHOD OF TREATING MATERIAL IN A VACUUM AND APPARATUS

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METHOD OF TREATING MATERIAL IN A VACUUM AND APPARATUS.

Original application filed March 4, 1920, Serial No. 363,349. Divided and this application filed March 20, 1922, Serial No. 545,215. Renewed December 18, 1925.

This application is a division of my co-
pending application "Method of treating
material in a vacuum and apparatus", filed
March 4, 1920, Ser. No. 363,349, Case E.

The present invention relates to an ap-
paratus and method for coating or coloring,
or sizing or impregnating paper or other
sheet material, in a vacuum chamber, and
drying said sheet material in the vacuum
chamber before it is again subjected to the
atmosphere.

My improved method consists in passing
the sheet material which is to be coated,
colored, sized or impregnated into a vac-
uum chamber through a liquid sealing med-
ium which has no affinity for the material,
then coating, coloring, sizing or impregnat-
ing the paper or other sheet material while
in the vacuum chamber, then drying the
coated, colored, sized, or impregnated sheet
material while still in the vacuum cham-
ber, and then passing the dried material
out of the vacuum chamber through a seal.

My invention further relates to obtain-
ing a better and more uniform product than
any now known on the market. My in-
vention further relates to the method of
coating or impregnating sheet material
which insures that there will be no blem-
ishes, uneven surfaces, blisters or minute
raised portions due to the air which may
be held or occluded within the sheet ma-
terial which, in the present practice of
coating as for example with a water-proof
compound, leads to rejections or discards
due to these imperfections with the con-
sequent waste of material and labor.

My invention further relates to the treat-
ment of paper and coating or impregnating
it in a vacuum chamber, without breaking
the vacuum, and drying it within said vac-
uum chamber.

My invention further relates to manufac-
turing paper wherein the fibers are not
weakened and the size in the paper is not
injured or damaged due to drying at high
temperatures.

My invention further relates to manu-
facturing colored paper and drying it
without substantially impairing the color-
ing matter and mordants used in the paper.
Among other advantages this insures that
the paper will have bright colors, which

will be substantially uniform in different
runs of paper, permitting matching of col-
ored paper without any appreciable differ-
ence in tone or color.

My invention further relates to rapidly
and expeditiously coating or impregnating
sheet material in a continuous web or sheet.

My invention further relates to sizing
paper in a vacuum chamber and drying the
sized paper in said vacuum chamber at such
low temperatures as not to injure the fibers
of the paper or the size. My invention fur-
ther relates to withdrawing the occluded
air from the paper and immediately filling
the interstices normally filled with the oc-
cluded air with the size, and then drying
the thoroughly sized paper in the vacuum
chamber before it is subjected to atmos-
pheric conditions.

My invention further relates to carrying
out this method continuously with a con-
tinuous web of paper which passes into
and out of the vacuum chamber without
breaking the vacuum.

My invention further relates to immedi-
ately drying, in the vacuum chamber, the
coated or impregnated material, as a web
of paper, without putting the web of paper
under more than sufficient tension to just
feed it through the vacuum chamber. That
is, the web of paper is not put under suffi-
cient tension to substantially rearrange its
fibers, as those fibers were interlaced or
matted together on the wire of the paper
machine. Where the web is put under ten-
sion in drying, these fibers are pulled out in
the direction of travel of the web, which
weakens the web and makes it of unequal
strength. It will be stronger crosswise of
the sheet or web than it is lengthwise of the
web or sheet.

In my present invention by letting the
fibers dry under little or no tension—only
sufficient to feed the web through the vacuum
chamber—the fibers will not be substantially
pulled out or substantially disarranged from
their position as they were on the wire of the
paper making machine. I have termed this
manner of letting the fibers dry under sub-
stantially little or no tension as "drying at
random or at will"; distinguishing this
method from the common one in which the
fibers dry under tension sufficient to pull

them, more or less, from each other and thereby weaken the web or sheet of paper. A web treated according to my method, will form a sheet of paper substantially as strong lengthwise of the sheet as it is across the sheet.

My invention further relates to certain steps, and combinations of steps, also to certain elements and combinations of elements, whereby the method or processes herein described may be carried out, as well as to certain details of construction, all of which will be more fully hereinafter described in the specification and pointed out in the claims.

Of course, my method may be practiced by the use of various forms of apparatus. In the accompanying drawings, which are partly diagrammatic, I have shown for purposes of example two different forms of apparatus.

Fig. 1 is a vertical diagrammatic section; Fig. 2 is a vertical diagrammatic section similar to Fig. 1, but showing electric heaters.

In describing my invention, I will describe it as applied to sheet material in the form of paper though it is to be distinctly understood that textile fabrics may also be treated by my process and that my claims cover all forms of sheet materials.

In the ordinary drying of a web of paper such high heat is used as to injuriously affect the fibers of the paper; and in case the paper is colored it will materially affect the coloring matter and mordants used. Drying paper in the high temperatures used in ordinary practice often affects the size so that the resulting paper varies in quality, is not uniform and is not a perfect product.

In coating or impregnating fabrics it is found in practice that the coated fabric will frequently have blemishes due to large or small blisters and blow holes, these often being about the size of a pin-head or a pin-point. This is caused by the air which is held or occluded being collected, more or less, in small pockets under the coating or impregnating material, or in some cases causing minute blow holes. In water proof fabrics this results in large quantities of the material being rejected with the consequent loss to the manufacturer.

By my invention I insure that substantially all the occluded air is withdrawn from the sheet material which will permit the coating or impregnating material, whatever it may be, to thoroughly fill these minute interstices or pockets normally occupied by occluded air, forming thereby a better and more uniform product and one devoid of blisters, blow holes or such blemishes. By my invention I immediately dry such coated or impregnated sheet material while still in the vacuum chamber so that when the sheet material emerges from the vacuum

chamber the coating or impregnating material is dry and set without any danger of atmospheric pressure or atmospheric conditions spoiling or marring the finished product.

As previously stated, I will describe my invention with relation to coating, coloring or impregnating paper, though it is to be understood that textile fabrics may be treated in the same manner.

The web 1 of paper is fed from the reel or roll 2 over the guide roll 3 into a liquid seal 4. The liquid of this seal may be of any suitable material which has no affinity for, or deleterious action upon, either the web 1 as it is first fed into the machine or after it has been coated or impregnated. I preferably employ mercury as the sealing medium 4, but it is to be distinctly understood that any amalgam, alloy, or any other suitable liquid sealing medium may be employed which has the characteristics above specified.

The web is then led over the guide roll 6 into the coating or coloring or impregnating bath 7 under the submerging roller 8, between the squeeze rolls 9, 9 and over the guide roll 10.

It is now passed through the vacuum chamber A under little or no tension. That is just sufficient tension to feed it through the apparatus but not to substantially rearrange the fibers of the web 1, as those fibers were matted or interlaced on the wire of the paper machine. In this manner, I permit the fibers to dry "at will or at random" without being under sufficient tension to substantially rearrange them from the position that they assumed originally upon the wire of the paper machine.

The web may be fed through the vacuum chamber and dried in any suitable manner provided the fibers are not caused to substantially rearrange themselves which weakens, more or less, the web or sheet. I have shown in Fig. 1 the web led through the vacuum chamber A in folds or loops passing over the guide rolls 11, 11 and 12, 12 until at the end of the vacuum chamber the web passes over the guide roll 13 and hence out of the liquid seal 4, under the submerging roll 14, over the guide roller 15 and thence can be immediately wound up into the finished roll or reel 16.

The web can be heated in any suitable manner. I have shown in Fig. 1 steam or hot water radiators 17, 17 mounted between the folds or loops of the web but at a sufficient distance to give clearance, the web not touching the radiators. To touch the radiators would cause the web to stick to the radiators and probably cause it to break and foul the machine; or, what is known in the trade, as "broke" to occur.

In Fig. 2 I have shown electric heaters 19, 19

19 mounted between the folds or loops to dry the web as it passes through the vacuum apparatus.

The bath 7 may be heated by steam pipes 5 20. The material of this bath may be replenished from time to time by forcing additional liquid through the cock 24. The liquid can also be withdrawn by opening the cock 24 permitting the chamber, in which 10 the liquid 7 is mounted, to be cleaned.

The vacuum chamber A is provided with pipes 21, 21 leading to any suitable vacuum apparatus. I also preferably provide the vacuum chamber with windows 22, 22 so 15 that the operator can at all times watch the web on its continuous passage through the vacuum chamber.

By my process and apparatus the web of sheet material, whether it be paper or textile 20 material, is rapidly coated or impregnated and immediately dried within the vacuum chamber so that when it emerges the coating or impregnating material is dried and set permitting it to be immediately wound 25 into a roll or reel for transportation.

The thermal efficiency of my vacuum method is very much greater than that of the atmospheric cylinder drying heretofore in universal use for drying paper. Theoretically, it requires about 5287 pounds of 30 steam to dry one ton of paper at atmospheric pressure, but to compensate for convection and conduction losses, and those due to leaks in the piping system, and other inefficiencies, it has been shown in practice 35 that about 10,600 pounds are required.

In my method using a vacuum of about 28", the convection, conduction and piping losses are exceedingly small and the total 40 steam required to dry a ton of paper by my method is approximately 5200 pounds.

It is an established fact that paper dried at low temperatures is much stronger than when it is dried at the high temperatures 45 used in paper machine atmospheric drying. Paper dried in a vacuum at 28", or at a temperature of about 100° F., as in my method, is very much stronger than paper dried at atmospheric pressure, when the steam in the 50 driers is at 228° F. When paper is dried by my method, therefore, a cheaper furnish can be used and still produce a coated or sized paper equal in strength to atmospheric dried paper, in which a higher grade furnish 55 is used. In making newsprint paper, I am able to dispense with a considerable portion of the more expensive sulphite pulp, as this can be replaced with the cheaper ground wood pulp. By my method I also 60 reduce the number of breaks in the web as it passes over the cylinder.

Furthermore, in my method there is a great saving of heat (or steam) because the process is carried on in a vacuum chamber 65 which acts on the principle of a thermos

bottle, and the steam and vapors driven out of the wet paper are caught in the closed vacuum chamber, and conducted away to the condenser. The operating room is free from steam, humidity and heat, and fans, and ex- 70 hausters are dispensed with. In the use of my method the apparatus is at all times operating under definite humidity, the control of the drying can be closely standardized, and the moisture content in the paper carefully regulated. I am enabled also to use a comparatively small machine, which takes 75 up comparatively small floor space thereby reducing overhead expenses.

Having pointed out the many advantages 80 of my method and apparatus over those heretofore used, it will be apparent that the use of my invention results in great economy in the initial cost of apparatus and in large savings in cost of operation, maintenance 85 and repairs.

Having thus described this invention in connection with illustrative embodiments thereof, to the details of which I do not desire to be limited, what is claimed as new 90 and what is desired to secure by Letters Patent is set forth in the appended claims.

What I claim is:—

1. The method of treating sheet material consisting in feeding it into and out of a vacuum chamber without breaking the vacuum, 95 then coating or impregnating the sheet material in the vacuum chamber, and then passing it through the vacuum chamber in a manner which will permit the fibers of the 100 sheet material to dry under substantially little tension and not sufficient to cause the fibers to substantially rearrange themselves from their original position.

2. The method of treating a web of paper 105 consisting in feeding it into and out of a vacuum chamber without breaking the vacuum, then coating or impregnating the web in the vacuum chamber, and then drying the coated or impregnated web in the vacuum chamber under little or no tension, the 110 tension being only sufficient to feed the web through the vacuum chamber and not sufficient to cause the fibers of the paper to substantially rearrange themselves from the interlaced position formed on the wire of the 115 paper machine.

3. The method of treating paper consisting in passing the paper into and out of a vacuum chamber continuously without breaking the vacuum, then sizing the paper in the vacuum chamber, and immediately drying the sized paper in the vacuum chamber under little or no tension, the tension being 120 only sufficient to feed the paper through the vacuum chamber but not sufficient to cause the fibers of the paper to substantially rearrange themselves from the position assumed by them on the wire of the paper machine. 125

4. An apparatus for treating material in- 130

cluding a vacuum chamber, means to permit the material to pass continuously into and out of the vacuum chamber without breaking the vacuum, coating, coloring or impregnating means mounted in the vacuum chamber, and means to permit the material to dry in the vacuum chamber under little or no tension, the tension being sufficient to feed the material through the vacuum chamber but not sufficient to cause the constituent elements of the material to substantially rearrange themselves.

5. An apparatus for treating a web of paper including a vacuum chamber, means to permit the web of paper to pass continuously into and out of the vacuum chamber without breaking the vacuum, coating, coloring or impregnating means mounted in the vacuum chamber, and means to permit the web of paper to dry in the vacuum chamber under little or no tension, the tension being sufficient to feed the web of paper through the vacuum chamber but not sufficient to cause the fibers of the web to substantially rear-

range themselves from the position that they assumed on the wire of the paper making machine.

6. An apparatus for treating material including a vacuum chamber, means to permit the material to pass continuously into and out of the vacuum chamber without breaking the vacuum, coating, coloring, or impregnating means mounted in the vacuum chamber, and means to permit the material to dry in folds or loops and under little or no tension while it passes through the vacuum chamber.

7. An apparatus for treating material including a vacuum chamber, means to permit the material to pass continuously into and out of the vacuum chamber without breaking the vacuum, coating, coloring or impregnating means mounted in the vacuum chamber, and means to permit the material to dry in folds or loops and under little or no tension while it passes through the vacuum chamber and means to heat one or more of the folds or loops.

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