

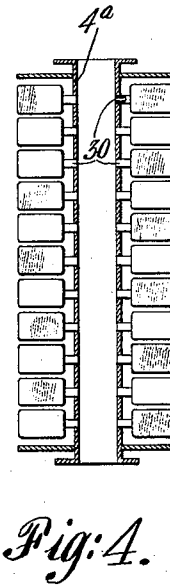
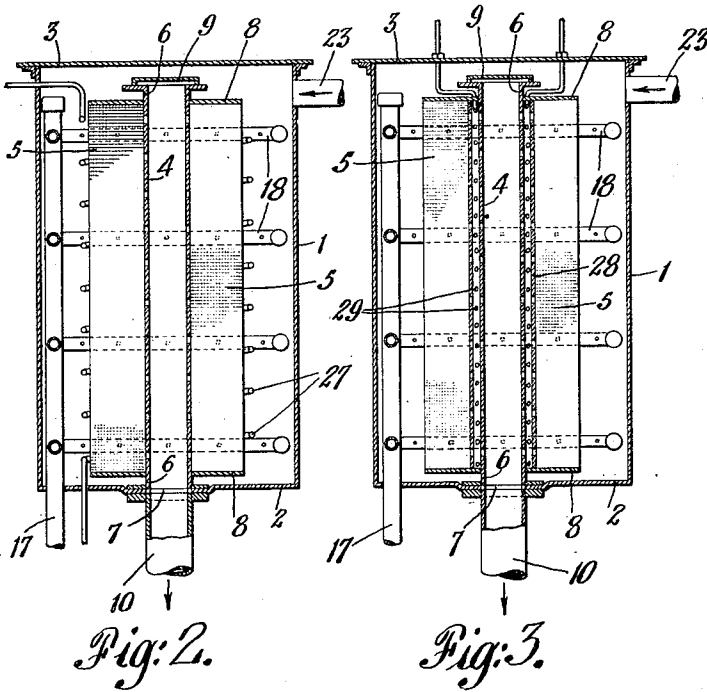
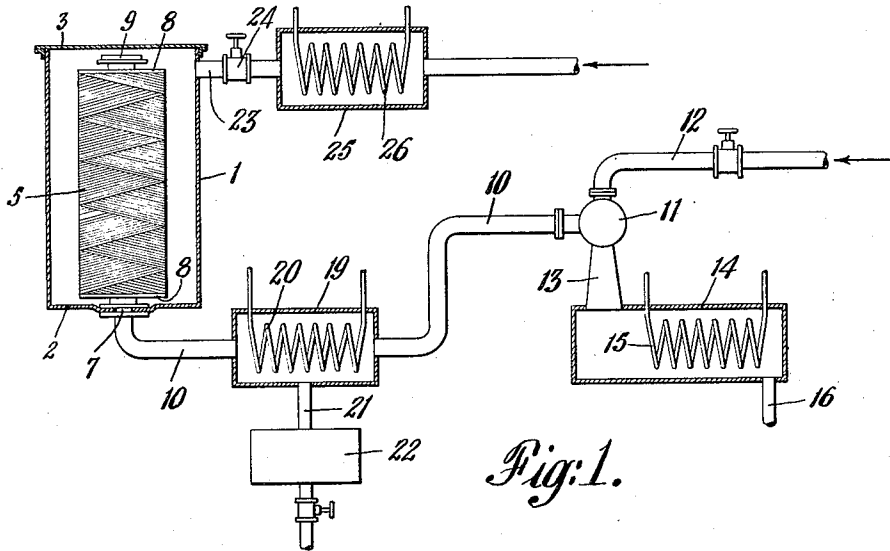
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EXTRACTING AND DRYING SYSTEM

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EXTRACTING AND DRYING SYSTEM

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2 Claims. (Cl. 34—30)

This invention relates to the drying of textile materials, for example, such as wool, silk or cotton threads or yarns or artificial filaments or goods made from any of them, and more particularly to an improved method for drying yarns, etc., which is especially adapted for use in the drying of the yarns, etc., in the wound or warp form, which have been subjected to washing, dyeing or other wet treatments.

It has been the practice in the drying of such materials to subject them to an initial treatment, such as dripping, centrifuging, etc., for the separation of free water, followed by drying in cabinet-driers with hot air ventilators. In recent years vacuum pumps have been used for extracting moisture and hot air blowers have been used as driers. With such procedures, however, relatively low vacuums were used and the products, after extraction, contained considerable quantities of moisture, for example, as high as 80%, it being necessary to complete the drying by the use of cabinet-driers or hot air blowers.

It is an object of the present invention to provide a method and apparatus whereby a great improvement in drying may be accomplished. A further object is to provide an economical procedure whereby the drying of textile materials may be greatly hastened and facilitated. It is also an object to provide an improvement in the supplying of heat to the material being dried. Other objects will become apparent.

I have found that by subjecting the textile material to a very much higher degree of vacuum than has heretofore been used, for example, a vacuum such as may be obtained by the use of a steam jet ejector, for instance, a vacuum of 20 to 29½ inches of mercury and preferably above 25 inches of mercury, the drying of the filaments may be very greatly facilitated. Still greater improvement may be obtained by bleeding air or other inert gas into the chamber in which the drying takes place, the bleeding being at such a rate as to maintain a vacuum within the range indicated above. A further improvement may be accomplished by heating or warming the air or other inert gas bled into the drying chamber or by providing a heating element, such as an electric resistance element or a steam or hot water jacket or coil, within the chamber and close to the material being dried. In the preferred embodiment, dry live steam is introduced into the drying chamber maintained at about the degree of vacuum indicated above, whereupon the live steam becomes highly super-

heated and, when it is drawn through the textile material, transfers a portion of its sensible heat to the material being dried.

In describing the invention, reference will be made to the drawing in which Figure 1 is a diagrammatic illustration of an embodiment of the apparatus described, the several containers being shown in section to illustrate the arrangement inside.

Figure 2 is a vertical section through the drying chamber, illustrating the heating means within the chamber.

Figure 3 is a view similar to Figure 2 showing a modified form of heating means.

Figure 4 is an elevation of an arrangement by which yarn wound on spools may be dried.

The numeral 1 designates the casing of the drying unit, which casing is closed at one end by the bottom wall or closure 2 and at the other or top end by the removable cover 3. The body of yarn being dried is, in the instance illustrated in Figures 1 to 3, wound upon a hollow perforated iron beam 4, as illustrated at 5. The perforated iron beam has an imperforate extension 6 at each end, the lower one of which registers with an outlet 7 in the lower head 2 of the casing. Imperforate flanges 8 are also provided at each end and the upper end of the hollow core of the iron beam may be closed during the drying operation by a removable cover 9. With this arrangement any air drawn from the core must pass through the yarn body. The outlet 7 communicates, through a pipe 10, with the intake side of a steam jet evacuator 11, which is of well known construction and may be of sufficient capacity to produce the desired degree of vacuum. The steam may be supplied to the evacuator through the line 12 and may be discharged through the outlet 13 into a container or condenser 14 including a cooling coil 15, whereby the steam used in the jet may be condensed and the resulting water may be discharged through the outlet 16 and used in subsequent washings or in making up solutions for treatment of the yarn or for other uses.

In the preferred embodiment of my invention, live steam is introduced into the portion of the casing surrounding the body of yarn being dried while a vacuum of 20 to 29½ inches of mercury, preferably 27 to 29 inches, is being applied to the inside of the core. This steam may be supplied, for example, through a pipe 17 and distributed around the material being dried by means of the perforated pipes 18. Other suitable means may, of course, be provided for intro-

ducing the steam so as to give the desired degree of uniformity of its distribution over the surface of the material being dried.

When steam is introduced during the drying, it is advisable to include a precooling condenser 19 in the line 10 between the casing 1 and the steam jet evacuator 11, in order to condense the steam introduced into the casing. This condenser may be provided with a cooling coil 20, the outlet end of which, if desired, may be connected to the inlet end of the coil 15. A discharge pipe 21 leads to a container 22 for collecting the condensate which may be used as indicated above in describing the condenser 14. With this arrangement the steam introduced into the casing 1 may be condensed and removed before reaching the steam evacuator 11, thus reducing the capacity required in the latter to that sufficient to withdraw the air from the casing and maintain the desired degree of vacuum.

In some instances it may be desirable to bleed air into the casing during the drying, with or without the steam. This may be accomplished by means of an inlet pipe 23 having a valve 24 and communicating with the atmosphere or with some other source of inert gas. A heater 25, heated, for example, by a steam coil 26, or other suitable means, may be provided to warm the air entering the casing.

Also, if desired, a heating element may be provided within the casing 1. Since the negative pressure greatly retards the conduction of heat, the heating element should be either in contact or substantially in contact with the metal beam or core upon which the material is wound or with the yarn body or should be so placed that the air or steam drawn through the material will pass through the heating element. In Figure 2 a heating element is illustrated in the form of a steam coil 27 permanently positioned in the casing 1 so as to fit close to the surface of the material being dried when the beam 4 is introduced. This coil will supply heat to the material being dried and also will serve to heat the steam or air drawn through the material being dried. In Figure 3 a heating element is illustrated which is formed by having the perforated walls 28 of the core of the beam spaced apart and providing a steam or electric heating element 29 within the space between the walls. Such a heating element would have to be connected to and disconnected from the source of heat when the beam is placed in and removed from the casing. If desired, both of these heating elements may be used together or other suitable heating means may be provided. For example, the flanges 8 may be double walled to provide a space for a heating medium or a heating element. Electrical heaters of suitable shape to permit the desired flow of inert gases through the material being dried, may be used in a similar manner.

In carrying out my improved process in one form, the cover 3 of the casing may be omitted and the yarn may be wound on the perforated beam sufficiently tightly to require a vacuum of 27 to 29 inches of mercury to draw air through the filaments wound on the beam. The core of the beam may be connected through the pipe 10 to the steam jet 11 and the vacuum applied, preferably as high as 29 inches of mercury. With the cover 9 in the position shown in Figure 1, the negative pressure will apply directly to the wound filaments through the perforations in the beam 4. If desired, heat may be applied to the beam or material on the beam during the drying,

by means of the electric or steam heating unit or other suitable heating means.

The procedure may also be used with a less tightly wound body of yarn by closing the cover 3 and the valve 24. The high vacuum of 27 to 29 inches of mercury within the casing 1 will cause the water to quickly vaporize at ordinary temperatures. The drying may be further hastened by the use of the heating elements within the casing and close to the yarn body, as previously described.

The drying may also be hastened by bleeding air into the casing through the pipe 23 and the valve 24. As an example, a vacuum of 29 inches of mercury may be applied by the steam evacuator 11 and the valve 24 may be opened sufficiently to give a vacuum of about 27 inches of mercury within the casing 1. If necessary, heat may be applied to the air drawn into the casing, either before or after it enters the casing, by drawing the air through a heating element before it passes through the material being dried.

It is preferred, however, to carry out the drying by introducing dry live steam into the casing 1 while the vacuum of 20 to 29½ inches of mercury is applied, thus causing the steam to become highly superheated and to pass through the textile material being dried, whereupon it will give up a portion of its heat to the material being dried. Ordinarily additional heating means will not be required when the steam is used, but if it is, it may be applied within the casing, as hereinbefore described, preferably in such a manner that the steam passes through heating element before it is drawn through the textile material.

The use of steam as the heating element has the important advantage over the use of air in that the steam may be condensed and removed before it reaches the evacuator, thus requiring less capacity in the evacuator. If desired, the steam and air may be used together or other condensable vapors may be used in place of the steam.

In the figures I have illustrated the vacuum as applied to the core. If desired, the connections 10 and 23 may be reversed and the vacuum applied to the space surrounding the material to be dried, thus drawing the moisture toward the outside of the body of yarn. In that event an arrangement as shown in Figure 3 is preferred in which the heating element is within the core. Also, with such an arrangement it would be preferable to introduce the steam into the space within the core.

In carrying out my improved procedure, very greatly improved results in the drying may be obtained at a greatly decreased cost. The very high degree of vacuum used in my process permits of the drying at unusually low temperatures, whereby the deleterious effect of higher temperatures applied to the material may be avoided. Very greatly increased rates of drying may be accomplished with only a very slight addition of heat.

In the modifications illustrated in Figures 1 to 3, I have shown the invention as applied to a body of yarn wound upon an iron beam. It may also be applied to the treatment of yarn wound upon perforated bobbins, as illustrated in Figure 4, by providing a core 4a having pipes 30 connected with perforated cores within each bobbin. The procedure may also be applied to spin cakes from a centrifuge by inserting a perforated core within the spin cakes, which core

communicates with the outlet line 10, as herein-
before described. Also, the improvement may be
applied to loose yarn, for example, by centrifugally
separating the free water from the loose yarn in
skeins, etc. and placing the perforated cage of the
centrifugal separator or other perforated con-
tainer for the yarn being dried, within the cas-
ing 1. Means for applying such vacuum to spin
cakes and loose filaments are well known and so
are not described herein.

It is obvious that many variations may be
made in the procedure described and it is not
intended to limit it to the particular embod-
iments referred to herein. The terms used in
describing the invention have been used in their
descriptive sense and not as terms of limitation
and it is intended that all equivalents thereof be
included within the scope of the appended claims.

In using the term yarn in the appended claims,
it is intended to include any threads, yarns or
other filaments, natural or artificial, or any ma-
terials made from them, and raw fibres, like raw
cotton, loose wool, or any other textile fibres.

My improvement may also be applied to the
drying of other materials, for example, such as
granular material, or other material separated
by interstices, in a suitable container whereby the
inert gas may be drawn through it under high
vacuum.

What I claim is:

1. The combination of a casing having a bot-
tom wall and a cover for a material to be dried,
a hollow perforated beam in the casing bearing
on its bottom wall for supporting the material to
be dried, a pipe to lead an inert gas into the cas-
ing, means to heat said inert gas before entering
the casing, perforated piping to lead steam into
the casing, a steam coil in the casing, a pipe lead-
ing from an opening in the bottom wall of the

casing, a pre-cooling condenser connected to the
latter pipe to condense steam flowing there-
through, a discharge pipe extending from said
pre-cooling condenser to lead condensed steam
therefrom, a steam jet evacuator for producing a
vacuum in the casing, a pipe connecting the pre-
cooling condenser and the steam jet evacuator, an
outlet extending from the steam jet evacuator, a
condenser connected to said outlet, a cooling
coil in the latter condenser and an outlet for the
latter condenser.

2. The combination of a casing for a material
to be dried, a detachable cover for the casing, a
closure or bottom wall having an outlet opening
at the lower end of the casing, a hollow perfo-
rated beam in the casing to support the material
to be dried, an extension at the top end and an
extension at the bottom end of the beam, a re-
movable cover for the extension at the top end
of the beam, the extension at the bottom end of
the beam supported upon the closure at the bot-
tom end of the casing, a pipe to lead air into the
upper portion of the casing, a heater connected
to said pipe, a steam coil in the heater, perforated
piping to lead steam into the casing, a pipe lead-
ing from the opening in the closure at the bottom
end of the casing, a pre-cooling condenser con-
nected to the latter pipe to condense steam flow-
ing therethrough, a cooling coil in the pre-cooling
condenser, a discharge pipe extending from said
condenser, a container connected to said dis-
charge pipe to collect condensed steam, a steam
jet evacuator for producing a vacuum in the cas-
ing, a pipe connecting said condenser and steam
jet evacuator, an outlet extending from the steam
jet evacuator, a condenser connected to said out-
let, a cooling coil in the latter condenser and an
outlet for the latter condenser.

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