uid, means to hold said liquid, a floating body within the liquid provided with a hollow space, a liquid within said hollow space, means to spin said holding means and the two liquids and the floating body, a second floating body within the second liquid, which thus will be capable of moving in one direction or the other along a path substantially parallel to the spinning axis of the second liquid whenever said axis is deflected relatively to the horizontal and means to provide a second floating body with a restoring tendency which will tend to return said floating body to its predetermined normal position whenever displaced therefrom.

In testimony whereof I affix my signature.

RODRIGO M. SMYTH.

Dec. 13, 1932. C. H. VON HOESSLE ET AL 1,890,832

METHOD FOR DRYING THIN CELLULOSE SHEETS

Filed Dec. 6, 1930 2 Sheets-Sheet 1

FIG 1

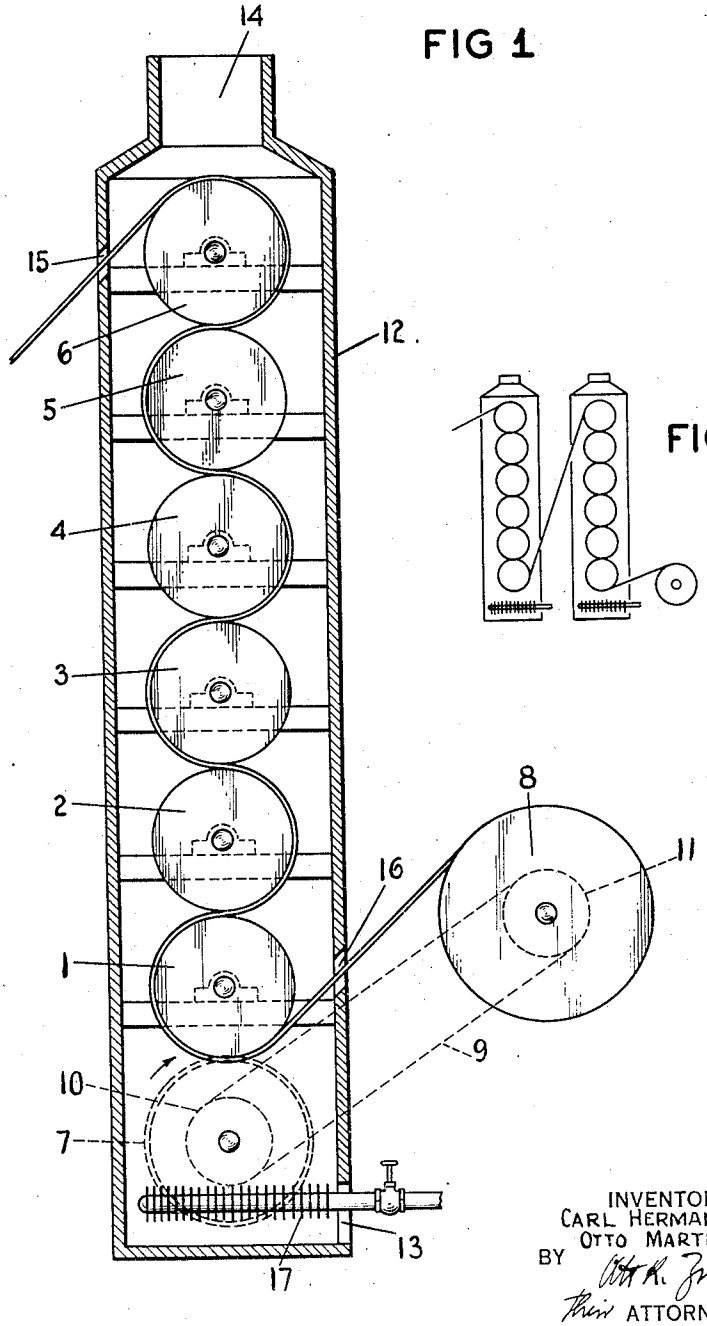


FIG 5

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METHOD FOR DRYING THIN CELLULOSE SHEETS

Filed Dec. 6, 1930 2 Sheets-Sheet 2

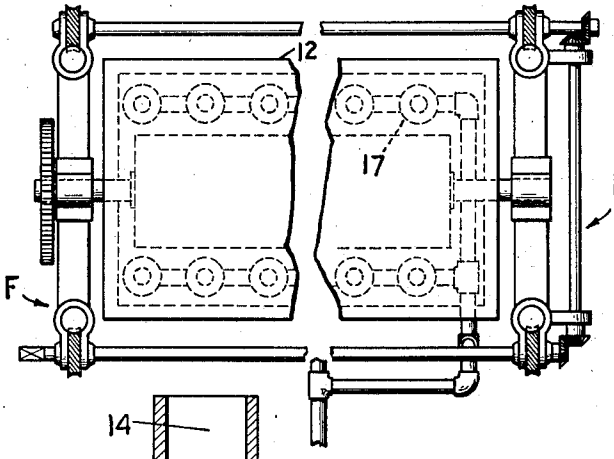


FIG. 3

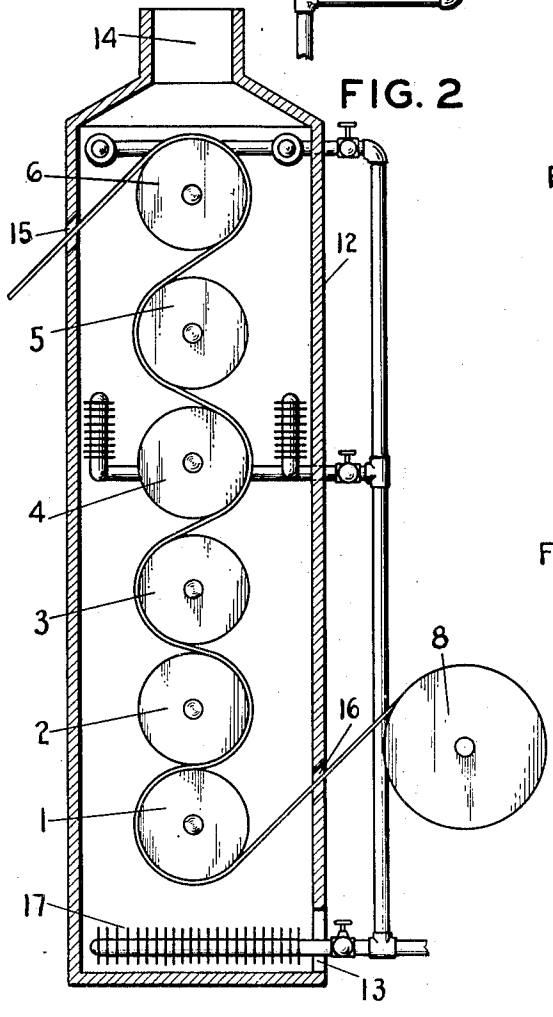


FIG. 2

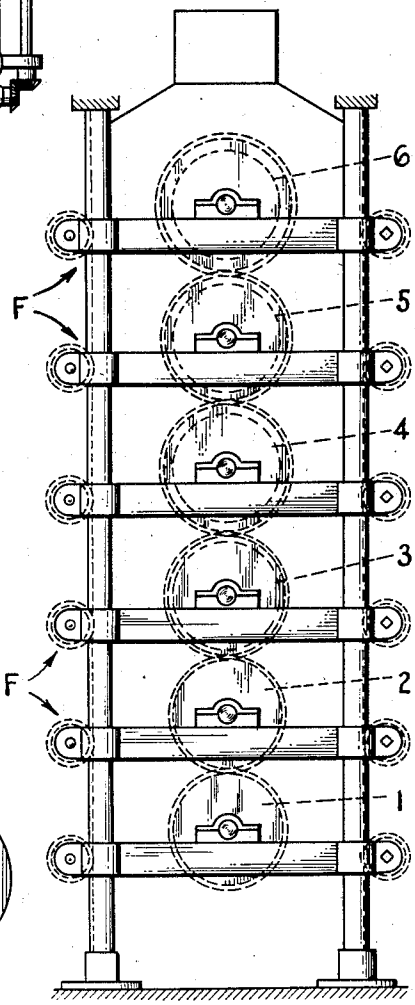


FIG. 4

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METHOD FOR DRYING THIN CELLULOSE SHEETS

Application filed December 6, 1930, Serial No. 500,559, and in Germany November 8, 1924.

Applications have been filed in Germany on Nov. 8, 1924; Nov. 28, 1925; Nov. 30, 1925; Apr. 28, 1925; and Jan. 29, 1927; and of which the following is a specification.

This invention relates to a method of drying thin sheets of cellulose and it particularly relates to the drying of long continuous webs of cellulose made of viscose, the object of the invention being to provide means which will allow to evenly dry such webs without causing the same to create undulations in the web whereby it is impossible to bring the same on the market in proper form.

The drying of thin pellicles, of cellulose, for instance made of viscose, is difficult because such thin pellicles of cellulose are not only highly sensitive in their mechanical handling, but are also subject to an enormous shrinkage during the drying process.

These difficulties have created a considerable prejudice among the men of the art in that these webs of cellulose should only be passed through the drying apparatus with the greatest care so as to submit them to as little strain as possible. After the infancy of this industry, in which carrier belts, ropes, etc. were used for transporting the web, the wet cellulose webs are passed today in all drying machines over horizontally arranged cylinders, or rolls, of which there were usually two series, the cylinders of one being arranged above those of the other so as to have its individual cylinders disposed in the interstice between two adjoining cylinders of the lower series, the web being thus passed alternately from a lower to an upper cylinder and so on without actually undergoing any but a minimum of strain. The prevailing prejudice did not dare to put the web to a greater strain than required to adhere in its travel to the surface of the adjoining rotating cylinders. The climbing of the web in the arrangement of the rollers in A-shape fashion was still effected in the same way from one roll to another as in the horizontal arrangements of the cylinders.

These arrangements had considerable shortcomings on account of the pockets formed by the adjoining cylinders, in which pockets the air was stagnating, thereby delaying the drying. It required cumbersome mechanical contrivances to cause a continuous flow of the drying air around the drying cylinders and even then it was extremely hard to pass an air-current of an even temperature over all parts of the web. Owing to this bad regulation of the temperature inferior products were often the result.

Even the adoption of a distance between each of the drying cylinders, from the paper industry, all through the drying machine does not give the desired relief in the mechanical handling of the web in view of the phenomena actually taking place during the drying. Moreover, all the drying machinery of the prior art does not answer the economical requirements, which are asked of it, because its original cost is unusually and unnecessarily high, and its requirement of space is often prohibitive, all the more as its spaciousness, also entails great costs of operation.

Aforesaid considerable shortcomings have induced us to study the behavior of the web from its first wet state to its ultimate dry end. Though the prior art knew that a web shrinks considerably during its drying and that it does not shrink uniformly over its surface, the prejudice prevailing in the prior art prevented the observation, made by us during our studies, that the web actually does not shrink at all in the first stage of the drying process while it still has a considerable content of moisture. In view of the absence of any noticeable shrinkage in the initial stage of the drying, the position of the adjoining cylinders either without, or with a greater or lesser distance from each other, is without any influence whatever on the shrinking of the web during this initial stage; it is in the later drying stage where the spaced relation of the cylinders plays a significant part in connection with the shrinkage of the web.

We have found that it is more advantageous to dry the web of cellulose by passing it over a plurality of cylinders arranged in a stack vertically one above the other, because the downwardly directed, sinuous path,

which the web is thus forced to take, allows the phenomena, occurring during the drying process and causing the undulations of the web, to counteract each other with the result that a perfectly smooth web of cellulose is obtained.

Other features of the invention will appear as the specification proceeds.

As an example of how to carry our invention into effect we shall describe below and illustrate in the accompanying drawings one set of vertically arranged cylinders we found advantageous in the operation of our invention.

In the drawings: Fig. 1 is a vertical section through one set of cylinders;

Fig. 2 is a vertical section through a modified set of cylinders;

Fig. 3 is a plan view of the apparatus;

Fig. 4 is an end elevation; and

Fig. 5 shows a combination of two driers.

In said drawings Figure 1 is a vertical section through one set of cylinders, showing a plurality of for instance six cylinders, 1, 2, 3, 4, 5 and 6 arranged in a suitable frame (not shown), one cylinder being superimposed upon the other; a gearing 7 engages a suitable gearing (not shown) of the cylinder 1 and causes the same to rotate in the direction of the arrow 1 thereby imparting motion to all the upper cylinders in the direction of the arrows along the peripheral face of each of the same. Gearing 7 is co-operatively engaging the cylinder 8, serving as a reel, by a suitable connection, for instance a sprocket wheel chain drive 9, engaging suitable sprocket wheels 10 and 11 arranged on the axles of the gearing 7 and cylinder 8, respectively, and indicated in dashed lines.

The vertical arrangement of the gearing 7 together with the cylinders 1—6 is encased by a housing 12, made of any suitable material; it has at the bottom an air inlet 13 and at the top an outlet 14; openings 15 and 16 are provided at the top and near the bottom for the inlet of the wet and the outlet for the dry web, respectively. A radiator 17 is provided inside the housing 12 above the air inlet; the radiator is fed with steam, hot water or the like agents to heat the air coming from below.

In the operation of our method of drying the web the same is passed in the wet state, coming either directly from the treating tanks, in which it was purified, or from a roll (both tanks and roll not shown), over the cylinder 6 and is then passed downward from the same over the cylinders 5—1; it is then transferred to and wound up by the cylinder 8 where it arrives in the dry state.

Owing to the motion imparted, to the cylinder 1, a pulling or stretching effect is exerted on the web which extends to it over all the cylinders up to the cylinder 6.

By this arrangement we succeed in drying the web, while under the stretching strain, with only one power transferring means. Because the whole arrangement is encased in the housing 12 the warm air ascending from the radiator 17 on both sides of the web dries the same very efficiently according to the counter-current principle; there is also a suction effect created by the ascending air current and as this effect is exerted in absolutely the same degree to both sides of the web, a perfectly smooth and even web, or film, is obtained.

In the prior art it was usually considered beneficial to exert a pressure upon the web to reduce its shrinkage, this was done by having one or more rotary cylinders roll upon the web. We have found that this weighting of the web is very helpful in reducing the thickness of the web, if desired, by squeezing the web and to assist in stretching the web in co-operation with an adjoining roller, but it is without any material help in the beginning of the drying process, except for reducing the thickness of the web by simply squeezing it, which to do is not always advisable because the web is easily affected by the surface of the cylinders.

A desirable bilaterally acting suction effect of the air current is obtained if we move the bearings of the cylinders apart from each other so as to create an interstice between the adjoining cylinders as illustrated by Figure 2, which shows a vertical sectional view of a slightly differently arranged stack. We thus freely expose both sides of the web to the warm air when moving through those interstices. This arrangement of the cylinders with an interstice between each of them has the advantage that the web, being dried evenly from both sides, dries very much quicker; moreover the possibility of having the web affected by the surface of the cylinders, is reduced. Inasmuch as the mode of driving the cylinders is practically the same as in the case of the arrangement with partly free and partly journaled rollers, we do not describe this feature because of being within the skill of a mechanic.

It is by no means necessary to have the interstice between the cylinders of the same length. In view of the non-shrinkage of the wet web in the initial stage of the drying process we arrange that the web passes first over a number of cylinders which are relatively far apart from each other. As soon as a certain amount of moisture has evaporated the shrinkage becomes noticeable and the more the drying process and the shrinkage increase the nearer we bring then the cylinders to each other so as to have in the last stage with the greatest shrinkage only a small, or no interstice between the cylinders. It is hard to give definite measurements of the distance between the cylinders, or to state any figures as to evaporation etc.