March 9, 1971 H. W. LOVEDAY 3,568,331

SUCTION DRYING APPARATUS

Filed Jan. 8, 1969 3 Sheets-Sheet 1

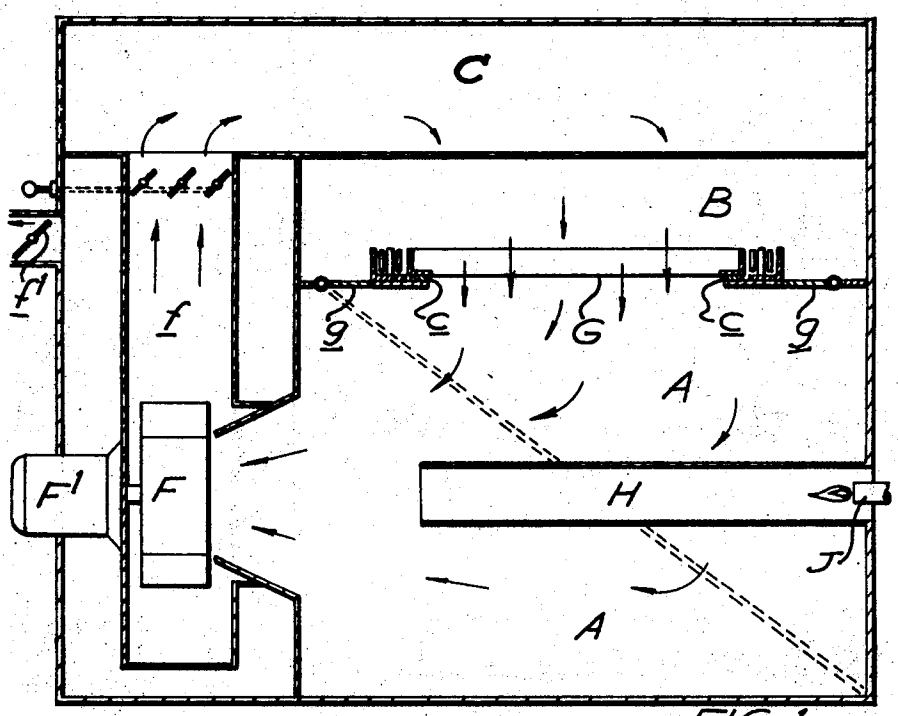

FIG. 1.

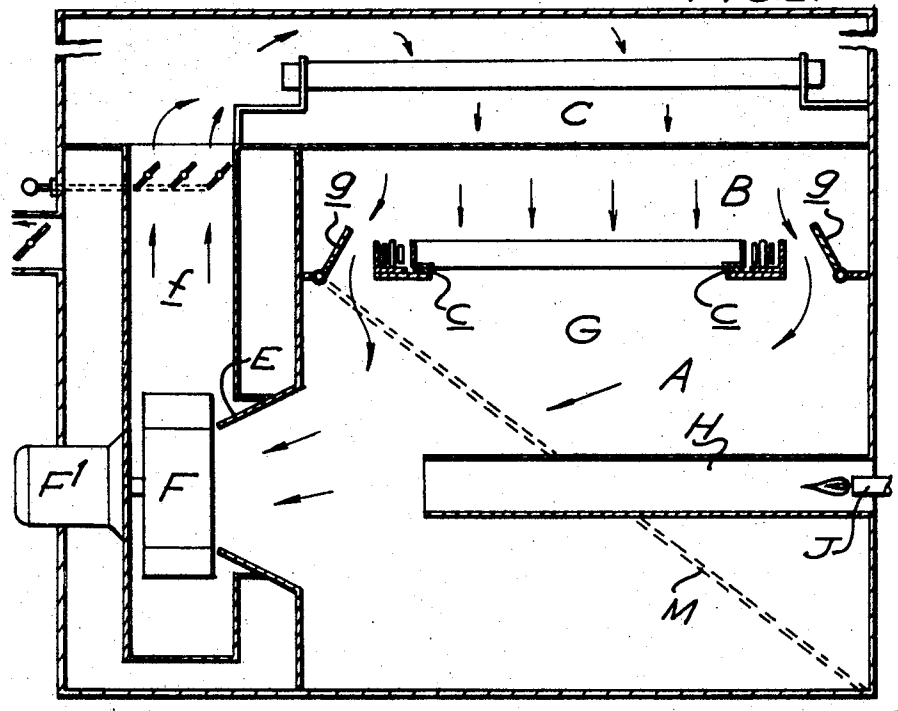

FIG. 2.

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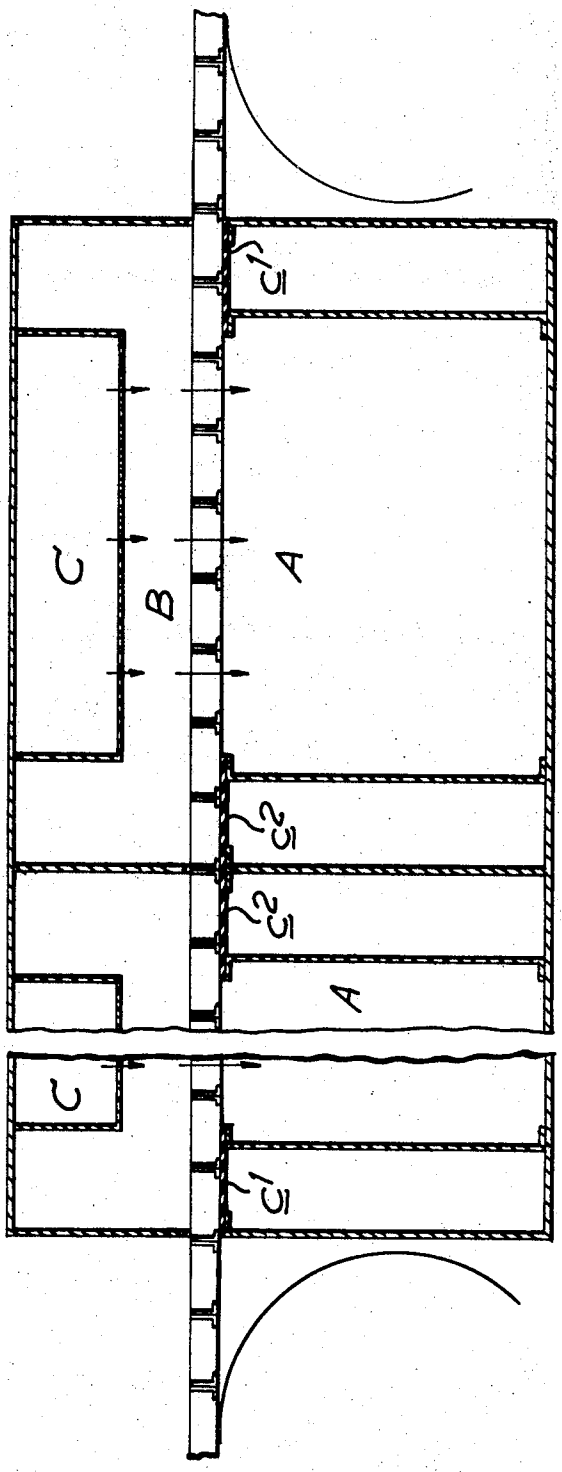

FIG. 3

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SUCTION DRYING APPARATUS

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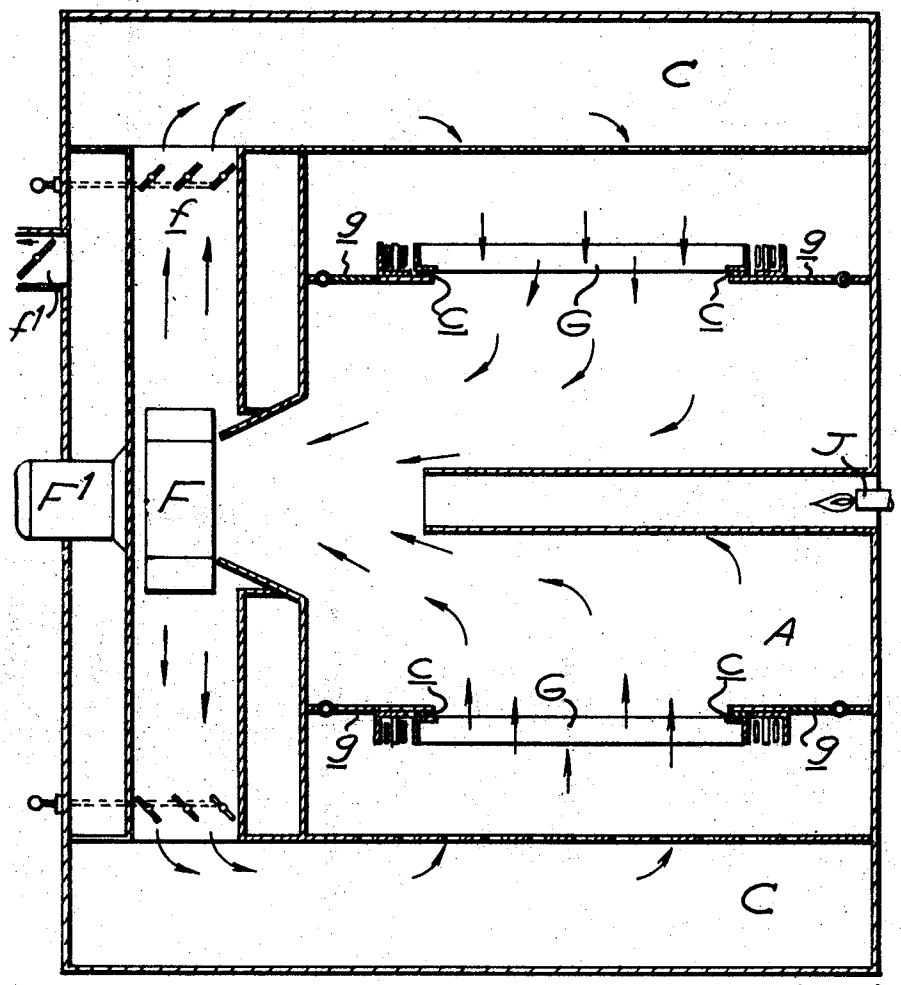

FIG 4

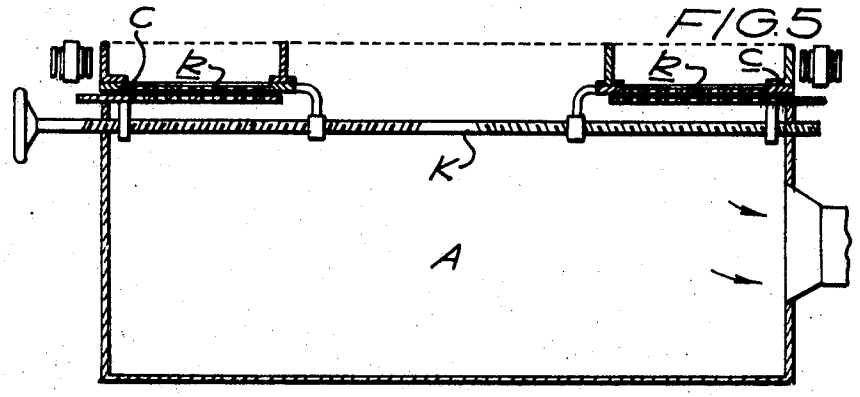

FIG 5

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3,568,331

SUCTION DRYING APPARATUS

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U.S. Cl. 34—155 7 Claims

ABSTRACT OF THE DISCLOSURE

A suction dryer for permeable fabrics or material in web form in which the fabric or material is traversed through the dryer on an endless perforated conveyor, which divides the drying chamber into two compartments, one compartment being a pressure compartment and the other a suction compartment sealing means being provided for the conveyor at both the inlet and discharge ends.

This invention relates to improvements in apparatus for the suction drying of permeable fabrics or material in web form.

In forced convection drying of permeable fabrics, i.e., wherein hot air is impinged at high velocity onto the material being dried, a considerable amount of the useful work available from the hot air is wasted due to the bounce-back from the material, this bounce-back causing a low utilisation of the drying power available.

The object of suction drying is to overcome the aforesaid disadvantage of force convection drying by presenting a very low velocity blanket of hot air above the material web, which is pulled through the material by means of a negative pressure, the hot air being thus divide into exceedingly fine increments of flow by virtue of the interstices of the web being dried, thus allowing all the heat contained in the hot air supply to be in intimate contact with the moisture to be removed. Moreover, due to the porous nature of the materials having a fairly low free area, a high velocity can be generated through the material, thereby giving a very high evaporative performance.

Hitherto, suction drying has been carried out by passing the web round a perforated drum or drums operating under a negative pressure, but a considerable number of problems have arisen when using this method of employing drums, including the following:

(1) When using it on loose dyed material, the transfer point from drum to drum permits lumps of material to fall into the body of the dryer, thereby leading to severe contamination problems when requiring periodic colour changes of stock.

(2) The point of transfer from drum to drum makes self-threading rather problematic.

(3) When handling impregnated materials, any contamination of the drum surface necessitates the operator working within the hot housing of the dryer to clean the drum, or alternatively, the machine must be shut down and allowed to cool.

(4) When drying pile fabrics, because of the serpentine nature of the material run over the drums, the pile tends to crush when in contact wih the drum face giving a flattening effect which is undesirable.

(5) With the drum design, more moving parts are required, all of which have to be maintained and furthermore, lubrication problems are present due to so many drum bearings being within the heat.

(6) Because the perforated drums have to operate at maximum width, maximum efficiency cannot be reached when a narrower width is run due to a large volume of air by-passing through the exposed perforations.

The object of the present is to provide a suction dryer

which will overcome the aforesaid disadvantages of the known drum type of suction dryer and this object is achieved according to the invention by constructing the apparatus as a chamber divided into two compartments by an endless travelling conveyor onto which the web of material is fed before entering the chamber and from which it is removed on leaving the chamber, the conveyor being constructed so as to allow the passage of heated air or other vapour therethrough, suction means being connected to the lower compartment of the chamber and the drying air or vapour supplied to the upper compartment.

As stated a suction dryer constructed according to the invention overcomes the problems arising from the known drum type form of conveyor, since:

(1) No transfer of the material such as from one drum to another is required and therefore in the case of loose material loose fibres cannot be turbulated within the apparatus thereby avoiding contamination.

(2) When initially presenting the web to the apparatus it is only necessary to lay the front end on the conveyor which then carries the web through the drying zone of the apparatus.

(3) Should the conveyor become contaminated with substances with which the web is impregnated it can be cleaned from outside the apparatus without the operator having to enter the latter.

(4) In the case of pile fabrics the material is never in contact with the surface of the conveyor and therefore there is no flattening or ironing effect.

(5) There are no moving parts except the conveyor within the apparatus since the conveyor will extend outside the latter both for loading and unloading and its drive can therefore be outside.

(6) Closure baffles can be fitted on the flat bed dryer to close off perforations at each side of the conveyor when a narrow material is being run, thereby leading to higher efficiency within the machine.

The conveyor may be arranged to have a single horizontal passage through the apparatus or to have a forward and backward run in the latter arrangement the suction compartment is arranged between the two runs and one drying air or vapour supplying compartment is arranged above the upper run and another below the lower run. This modification is not applicable for drying loose material since loose material would fall from the conveyor during the return run.

In a further modification of the invention the conveyor is arranged to travel vertically, it being provided, if necessary with means for holding the web onto the surface of the conveyor.

The invention illustrated diagrammatically in the accompanying drawings and will be described with reference thereto. In these drawings:

FIG. 1 is a transverse section of the form of the invention in which the conveyor has a single run through the chamber;

FIG. 2 is a similar view, but showing dampers at the longitudinal edges of the conveyor open;

FIG. 3 is a longtudinal section showing seals at the inlet and outlet for the conveyor and between dryer sections;

FIG. 4 is a transverse section of the form of the invention in which the conveyor has a forward and backward run through the chamber, and

FIG. 5 shows means for controlling the effective width of the conveyor.

The apparatus shown in FIGS. 1 and 2 consists of a suction compartment A and a drying air or vapour supply compartment B to which the drying air is delivered from the pressure duct or compartment C the lower surface of which is perforated or otherwise open for the passage of the air or vapour therethrough.

The two compartments A and B are separated by a travelling conveyor G which enters the chamber at one end and leaves it at the other, the conveyor being driven by means located outside the chamber.

The conveyor G may be in the form of a perforated band, or it may be formed of a series of transverse members each end of which is mounted on an endless chain the chain passing around toothed sprocket wheels and is driven by a variable speed drive or it may be of any other desired construction to support the web and allow the passage of drying air or vapour therethrough. In its preferred form it consists of chains spaced by perforated trays. The trays are of a box section with the lower edge of the box turned in to form sealing faces.

The sides of the suction chamber A are provided with plates *c* over which the lower edges of the trays travel to form a seal between the sides of conveyor G and the chamber A.

Further sealing plates c^1 (FIG. 3) are provided at each end of the dryer extending transversely of the conveyor to blank off the holes in the trays during entry and exit of the conveyor into and out of the dryer. The seal plates c^1 are important for the satisfactory operation of the dryer and dead zones are necessary to accommodate the sealing plates c^1. Sealing plates c^1 may also be provided for differential temperature control between the dryer sections.

A circulating fan F driven by an electric motor F^1 is arranged at one side of the chamber and is connected to the suction compartment A. This fan draws air or vapour from the compartment A and delivers it through the duct *f* to the compartment C from which it passes to the compartment B and is then drawn by the negative pressure in the compartment A through the web carried by the conveyor G.

The fan is housed within a fan compartment E which is isolated from the rest of the dryer and also serves as an exhaust extract chamber.

The fan is also connected to the duct *f* controlled by a manually operated damper f^1 for bleeding off a desired amount of the circulating air to atmosphere. Manually controlled dampers *g* may be arranged at the edges of the conveyor G so that by opening them some of the circulating air can by-pass the conveyor G.

Fresh air enters the suction compartment A through a tube or tubes H arranged centrally therein and is heated as it enters by a gas or oil burner J. Alternatively, the air may be heated electrically or by a steam heating battery L the heater battery being arranged with the pressure compartment C. Filters M may also be fitted in the suction compartment A.

The modification shown in FIG. 4 is of the same general arrangement as that shown in FIGS. 1 and 2 except that the conveyor G has a forward and backward run through the chamber, the suction compartment A is between the two runs, there are two pressure chambers C one at the top and one at the bottom and two drying air supplying chambers B. In this arrangement two circulating fans may be necessary both drawing from the suction chamber, but one feeding to the first run pressure chamber and one feeding to the second run pressure chamber. All other details are as previously described.

By providing plates *k* (see FIG. 5) adapted to be moved laterally over the longitudinal edges of the conveyor the effective width of the latter can be varied. These plates may be moved by the operation of a right and left handed screwed rod K.

What I claim is:

1. Apparatus for the suction drying of permeable material in web form comprising means defining a drying chamber, means comprising a substantially horizontal pervious endless travelling conveyor passing through said chamber to separate it into a suction compartment and at least one pressure compartment, material being fed onto said conveyor before it enters said chamber and being removed from said conveyor after leaving said chamber, means for supplying drying air into said pressure compartment to provide therein a relatively low velocity blanket of said drying air overlying said web, means for applying suction to the suction compartment, guide means supporting said moving conveyor in the chamber, and means providing seals between the conveyor and said guide means, whereby said drying air is pulled through said material and the conveyor into said suction compartment.

2. Apparatus for the suction drying of permeable material as in claim **1** in which the conveyor has a forward and a backward run through the chamber and wherein the suction compartment is arranged between the two runs and one pressure compartment above the upper run and a second pressure compartment below the lower run.

3. Apparatus for the suction drying of permeable material as in claim **6** having means for heating the circulating drying air in one of the compartments.

4. Apparatus for the suction drying of permeable material as in claim **1** including a tube for the entry of fresh air to the suction compartment and means for heating the air as it passes through the tube.

5. Apparatus for the suction drying of permeable material as in claim **1** including means for varying the effective width of the conveyor with said chamber.

6. Apparatus for the suction drying of permeable material as defined in claim **1**, wherein said suction means recirculates drying air into said pressure compartment.

7. Apparatus for the suction drying of material as defined in claim **1**, comprising normally closed baffle means in said chamber adapted to be opened to permit drying air to bypass said conveyor.

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U.S. Cl. X.R.

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