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[54] **WORKING PROCESS FOR AN IMPREGNATION LIQUID FOR CONTINUOUS TREATMENT OF A TEXTILE FIBER BAND**

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[52] **U.S. Cl.** ..... **8/149.1,** 8/151, 8/156, 68/18 C

[51] **Int. Cl.** **D06c 1/00**

[58] **Field of Search** ..... 8/149.1, 149.2, 149.3, 8/156, 151; 68/18 C

[56] **References Cited**

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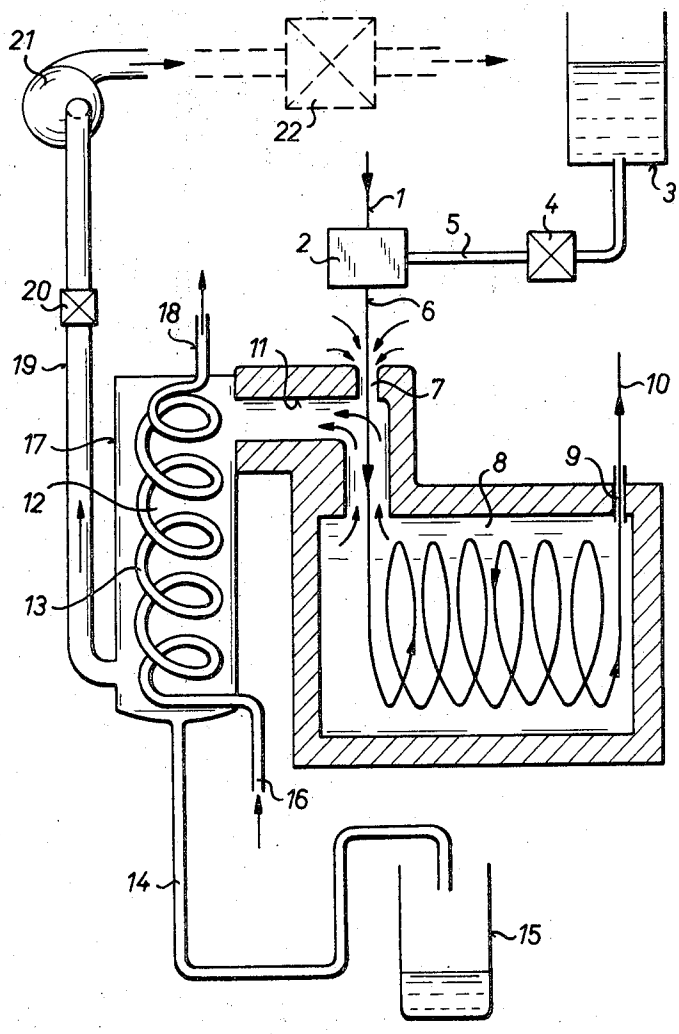
[57] **ABSTRACT**

A working process for an impregnation liquid for continuous treatment of a textile fiber band, comprising the steps of applying the impregnation liquid to a fiber arrangement and delivering an impregnated fiber band, introducing the fiber band into a heated and essentially closed compartment which is at atmospheric pressure, heating the impregnated fiber band, vaporizing the impregnation liquid, removing the vapor atmosphere from the compartment and condensing the vapor atmosphere in a condensation compartment which is at a pressure differential in relation to the closed compartment.

12 Claims, 2 Drawing Figures



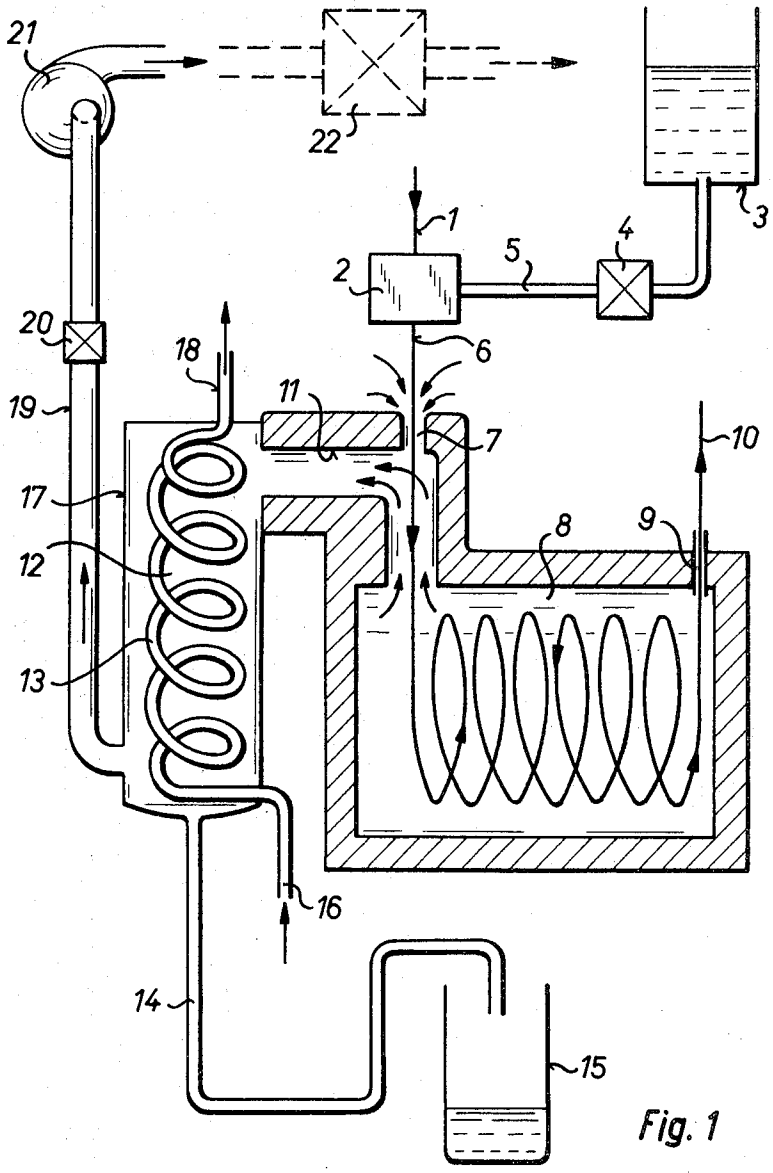


Fig. 1

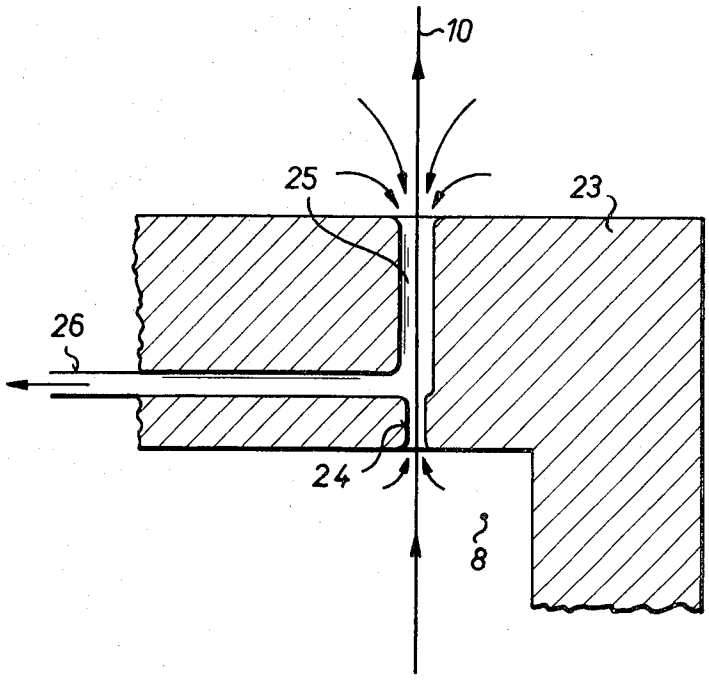


Fig. 2

WORKING PROCESS FOR AN IMPREGNATION LIQUID FOR CONTINUOUS TREATMENT OF A TEXTILE FIBER BAND

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved working process for an impregnation liquid for the continuous treatment of a textile fiber band or arrangement.

There is already known in the textile spinning art the technique of continuously applying an impregnation liquid into a band formed of textile fibers and then to subject the moist band to heat treatment. Depending upon the desired objectives there is employed as the impregnation liquid an aqueous and/or organic solvent-containing solution, emulsion or dispersion. It is also known to the art to additionally add to such impregnation liquids adhesives, dyes, swelling agents and generally chemicals. In order to obtain the desired treatment effect such type impregnated bands are then, as a general rule, subjected to a high temperature during passage through a treatment compartment which is at a temperature which is considerably above the boiling point of the introduced liquid and often exceeds the vaporization- or sublimation temperature of the added chemicals. In order to ensure that the physical conditions internally of the treatment compartment, i.e., temperature and possibly pressure, do not change it is standard procedure to provide the compartment with sluices and special seals. Such devices are not only complicated in construction and subject to wear, but also impair the uniformness or homogenity of the impregnation liquid introduced into the band and thus produce spotted bands. Since it is possible that the vapors of the impregnation liquid can possess an activity which is harmful to health, it has already been proposed for the purpose of protecting the operating personnel to additionally equip the treatment compartment ahead of and following the inlet and outlet respectively for the material web with suction conduits which merge with a common suction channel or flue which leads to the atmosphere. Apart from the fact that such type installations are still further complicated in their construction and rendered more expensive the aforementioned measured do not satisfy the strict requirements regarding environmental protection.

SUMMARY OF THE INVENTION

Hence, it is a primary object of the present invention to provide an improved working process for an impregnation liquid for the continuous treatment of a textile fiber band or the like which effectively satisfies the existing need in the art and is not associated with the aforementioned drawbacks and limitations of the state-of-the-art proposals.

Now the working process for an impregnation liquid for the continuous treatment of a textile fiber band as contemplated by this development and which overcomes the previously discussed drawbacks and provides adequate measures to overcome same comtemplates introducing an impregnation liquid into a fiber arrangement, delivering an impregnated fiber band, introducing the impregnated fiber band into a heated closed compartment which is essentially at atmospheric pressure, heating the impregnated fiber band, vaporizing the impregnation liquid, removing the vapor atmosphere from the compartment, and condensing the vapor atmosphere in a condensation compartment which is at a differential pressure with respect to the closed compartment.

It has been found to be advantageous to maintain the condensation compartment at a negative pressure and to provide measures in order to regulate the negative pressure.

In order to separate the surroundings or environment completely from the expelled vapor atmosphere it is advantageous, during introduction of the fiber band into the closed compartment, to simultaneously suck-in ambient air.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 is a schematic view of apparatus for carrying out the inventive working process; and

FIG. 2 illustrates a portion of the apparatus depicted in FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, according to the exemplary embodiment of apparatus used in the practice of the inventive working process for an impregnation liquid such impregnation liquid is introduced by means of a liquid application device or application 2 into a textile fiber band or arrangement 1. The impregnation liquid is delivered from a container 3 through the agency of a suitable conveying mechanism 4 and a conduit 5 to the applicator mechanism 2 and there is then produced or delivered an impregnated fiber band 6. A suitable applicator mechanism has been disclosed, for instance, in Swiss Pat. No. 426,704 and U.S. Pat. No. 3,426,389. While undergoing continuous processing the impregnated fiber band 6 is introduced without contact through an inlet opening 7 into a closed and heat-insulated compartment or chamber 8. The impregnated fiber band again leaves this compartment 8 after a certain treatment time in the form of a treated fiber band 10, departure from the compartment 8 being through a narrow outlet opening 9. The treated fiber band 10 can be then, for instance, subsequently wound upon a bobbin or the like. The feeding of the band 6 in the closed compartment 8 is in the direction of the indicated arrows and there can be used for this purpose any suitable means which have therefore not been particularly shown. Also contained within the closed compartment 8 is a conventional and thus not particularly illustrated heat source and, if desired, means for circulating the treatment medium.

Directly after the contactless introduction of the impregnated, moist fiber band 6 through the inlet opening 7 such is heated in the closed compartment or chamber 8 and after reaching the boiling point the impregnation liquid begins to evaporate or vaporize. In a great many situations it has been found to be advantageous to superheat the formed vapor atmosphere through the additional infeed of heat, and specifically up to a temperature which, if desired, considerably exceeds the boiling point of the impregnation liquid. The vapor atmosphere which is continuously produced in this manner then arrives at a connection channel 11 communicating

with the compartment 8 into a condensation compartment 12 of a condenser 17 and condenses upon the surface of a cooling coil 13 arranged within condensation compartment 12. The condensate formed at the cooling coil 13 is collected and delivered by means of a conduit 14 to a container 15. A coolant or cooling medium flowing through the cooling coil 13, for instance cool water, flows countercurrent to the flow of the vapor of the impregnation agent through the condensation compartment 12. The infeed of coolant takes place through the agency of the infeed line or conduit 16, the discharge of such coolant from the condenser 17 occurs through the agency of the removal or withdrawal line 18. A vent line 19 is provided for the condenser 17 at the inlet side of the cooling medium. A throttle mechanism 20 is located in the vent line or conduit 19 and such is operatively associated with a ventilator or fan 21. During continuous operation and in the operational stationary condition there is present within the compartment 8 which is closed at all sides a vapor atmosphere which for the most part consists of the vapor of the impregnation liquid, air entrained by the band 6 and possibly vapors or sublimates of the added chemicals. The vapor atmosphere, as indicated by the arrows of FIG. 1, departs from the closed compartment 8 in a direction opposite to the incoming impregnated fiber band 6, moves into the connection channel 11 and arrives via the latter at the condensation compartment 12. With such type mode of operation there is achieved the effect that at the fiber band 6 immersed in the vapor atmosphere there occurs a shock-like condensation accompanied by an extensive displacement of the air entrained with the band. The vapor content which is thus present in the closed compartment 8 is high and amounts to more than 90 percent by volume. This constitutes a favorable procedural marginal condition for a number of processes.

The vapor escaping into the condensation compartment 12 condensates with a corresponding reduction in volume, whereas the non-condensating constituents, for instance air, are continuously removed via the vent or withdrawal conduit 19.

A specific aspect of the invention resides in the fact that between the closed compartment 8 which is essentially at atmospheric pressure and the condensation compartment 12 there prevails a pressure difference. This pressure differential can be determined in such a manner that at the inlet opening 7 the contactless incoming fiber band 6 automatically also sucks-in ambient or surrounding air, as indicated by the associated arrows of FIG. 1, and which completely closes the vapor atmosphere flowing into the connection channel 11 towards the surroundings or ambient space. In order to obtain this effect it is advantageous, for instance, to maintain the condensation compartment 12 at negative pressure. This can be realized by accommodating or adjusting the conveying output of the ventilator or fan 21, but it is also possible to adjust or regulate the negative pressure for a given conveying output of the ventilator 21 by means of the throttle mechanism 20.

According to a particular embodiment of the invention the quantity of air sucked-in at the inlet opening 7 is preferably maintained at a minimum, that is to say, there is for instance only ensured for absolute closure of the vapor atmosphere moving through the connection channel 11 from the surroundings.

Owing to these measures the residence time of constituents which are more difficult to condensate can be increased at the condenser 17. This for instance results in a better cleaning effect, that is to say, a better separation of such constituents from the vapor. If necessary a further cleaning of the waste air can be attained for instance by an activated carbon-filter installation 22, as such has been schematically shown in phantom lines in FIG. 1. Such further cleaning is of particular significance in the case of impregnation liquids containing organic solvents.

Instead of the outlet opening 9 provided for the departure of the treated fiber band 10 from the closed compartment 8, it is also possible to provide a through-flow opening analogous in design to the inlet opening 7 for the band 6, as such has been illustrated in FIG. 2. The closed compartment 8 surrounded by the thermal insulation 23 opens into a relatively narrow bore 24 which is accommodated to the cross-section of the treated fiber band 10, in order to thereafter widen into a bore 25. At these bores 24 and 25 there merges a conduit 26 which is in flow communication with the connection channel 11 which is at negative pressure and can be directly connected with the condensation compartment 12 (FIG. 1). The ambient air entering via the mouth of the bore 25 completely separates from the surroundings or ambient space the vapor atmosphere entrained by the band 10 through the bore 24, and therefore also in this case there are present absolutely faultless ecological conditions.

It is also possible to omit the ventilator or fan 21 provided for the arrangement of FIG. 1 and instead of such to provide, for instance, a blower at the connection channel 11 which can produce appropriate negative conditions in conformity with the inlet opening 7. With this arrangement the condensation compartment 12 is, for instance, at an excess pressure, which then results in a pressure differential with respect to the closed compartment 8. For the purpose of regulating the negative pressure at the inlet opening 7 there can likewise be used the throttle device or mechanism 20.

The condensate deposited in the container 15 can, while taking into account the different material concentrations and possible decomposition products, again be readily employed for preparing a similar impregnation liquid, once again decisively contributing to polution-abatement of the environment.

It should be now recognized that the invention has taught a very simple way of employing impregnation liquids, for instance containing toxic or in fact poisonous chemicals, for example swelling agents, organic solvents or the like and for subjecting such to a high temperature in a treatment compartment devoid of seals without for instance contaminating or endangering in any way the surroundings or the operating personnel. At the same time there has also been ensured that by virtue of the employed condensation technique it is possible, for instance, to afford a continuous reuse of the required solvent and in part also the chemicals, to reduce to a minimum the basic consumption of such components, and to extensively free from contaminants the waste air ejected for instance into the surroundings. As far as the impregnation liquid is concerned there is provided a practically completely closed system. Hence, process conditions can be realized which, for instance, correspond to the highest ecological requirements.

While there shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

Accordingly, what is claimed is:

1. A working process for an impregnation liquid for continuous treatment of a textile fiber band or the like, comprising the steps of introducing the impregnation liquid into a fiber arrangement, delivering an impregnated fiber band, introducing the fiber band into a heated closed compartment which is essentially at atmospheric pressure, heating the impregnated fiber band, vaporizing the impregnation liquid, removing the vapor atmosphere from the closed compartment, and condensing the vapor atmosphere in a condensation compartment which is at a pressure differential with regard to the closed compartment.

2. The process as defined in claim 1, including the step of regulating the pressure in the condensation compartment.

3. The process as defined in claim 1, including the step of maintaining the condensation compartment at a negative pressure.

4. The process as defined in claim 1, including the step of superheating the vaporized impregnation liquid by further heating.

5. The process as defined in claim 1, including the step of introducing the fiber band without contact into the closed compartment.

6. The process as defined in claim 1, further including the step of removing the vapor atmosphere from the closed compartment in a direction opposite to the direction of infeed of the impregnated fiber band.

7. The process as defined in claim 6, including the step of completely separating the departing vapor atmosphere from the surroundings by simultaneously sucking-in ambient air with the fiber band during introduction of the fiber band into the closed compartment.

8. The process as defined in claim 7, further including the step of ejecting the ambient air back into the surroundings after passing through the condensation compartment.

9. The process as defined in claim 1, including the step of introducing an impregnation liquid into the fiber band which contains adhesive distributed therein.

10. The process as defined in claim 1, including the step of introducing an impregnation liquid into the fiber band which contains chemicals.

11. The process as defined in claim 1, including the step of introducing an impregnation liquid into the fiber band which is in the form of an aqueous solution.

12. The process as defined in claim 1, including the step of introducing an impregnation liquid into the fiber band which contains an organic solvent.

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