

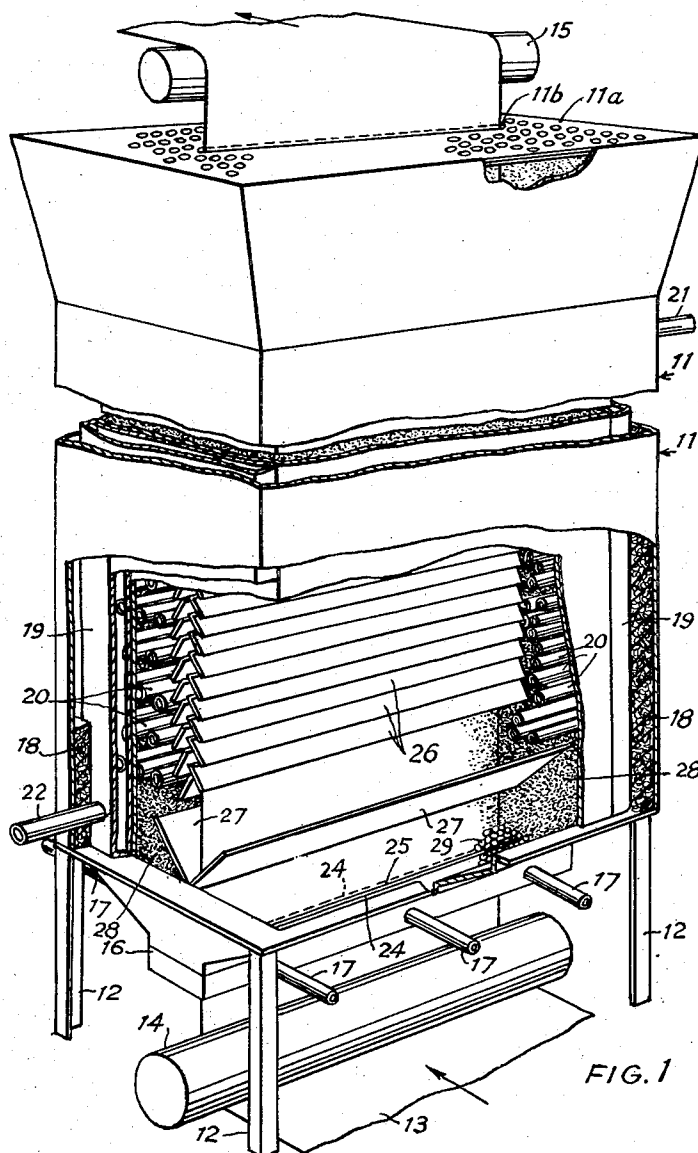
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J. DOLEMAN ET AL
HEAT TREATMENT OF FILAMENTS, FIBRES, THREADS, FILMS
AND SHEET MATERIAL

2,964,852

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2 Sheets-Sheet 1



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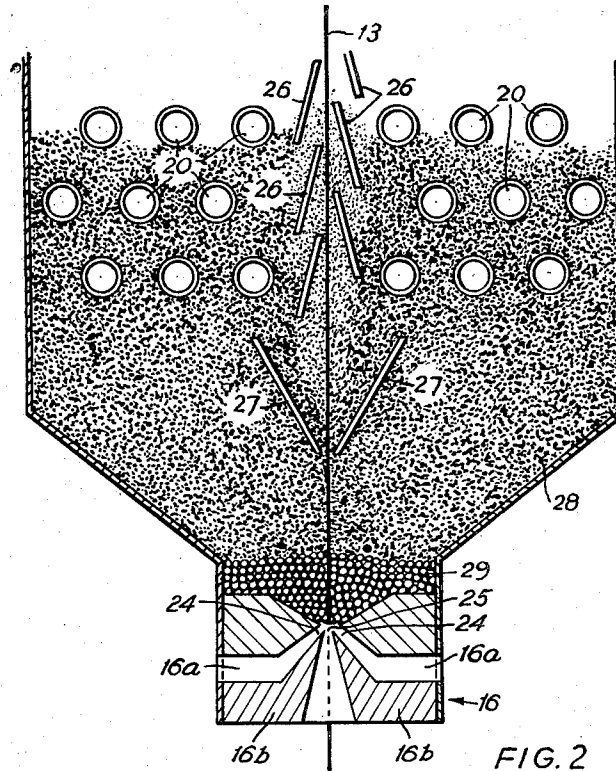


FIG. 2

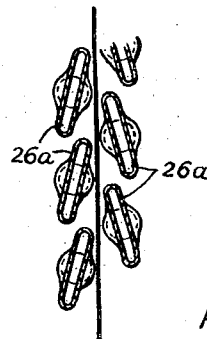


FIG. 3

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1

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HEAT TREATMENT OF FILAMENTS, FIBRES, THREADS, FILMS, AND SHEET MATERIAL

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3 Claims. (Cl. 34—95)

This invention concerns the treatment of filaments, fibres, threads, films and sheet material in the unwoven or woven, knitted, or likewise fabricated form.

It is known (U.S. Patent No. 2,785,478 for example) to treat filaments, fibres, threads, films and sheet material in the unwoven or woven, knitted or likewise fabricated form (hereinafter called "the material under treatment") in a bed of solid discrete particles, while subjecting the bed to an upward gaseous current, the size and weight of the particles and the velocity and nature of the current and the disposition of the material under treatment being so chosen that the forces exerted by the current on the particles are sufficient to counterbalance the gravitational force on free particles and to expand the bed thus allowing movement of the particles but is insufficient to convert the whole bed into a uni-directional stream of particles. The said movement of the particles in the bed may be random or include those analogous to convection or circulatory flow in a liquid, that is to say, localised upward movement of particles may occur in a zone or zones of the bed, for example in zones adjacent to the material under treatment, and localised downward movement of particles may occur in another zone or other zones of the bed and these localised movements may vary in position and/or direction but the current must not be such as to substitute for these random or convective or circulatory movements a unidirectional flow of the particles of the whole bed. A bed of solid discrete particles subjected to and expanded by such an upward gaseous current in the manner described is herein and in the claiming clauses hereof called "a fluidised bed."

We have found that when passing the material under treatment through such a fluidised bed that it is subjected to considerable mechanical stresses induced, it is believed, by masses of particles set in motion by the fluidising gas and by difference of density in different zones of the bed. The object of the present invention is to minimise such stresses and to reduce as much as possible the tension applied to the material under treatment when passing it through the bed.

According to the present invention a method of treating a filament, fibre, thread, film or sheet material in the unwoven or woven, knitted or likewise fabricated form by location of the same in a fluidised bed as herein defined is characterised by the provision in the fluidised bed of particle movement controlling means adjacent the material under treatment which means impede the horizontal or substantially horizontal movement of masses of particles towards or away from the said material while permitting convectional or circulatory movement of particles to continue between zones adjacent the said material under treatment and other parts of the fluidised bed. By thus controlling the movement of the particles in the fluidised bed, the mechanical stresses induced as aforesaid may be considerably reduced with correspondingly reduced tension in the material under treatment. This reduction of tension is of particular importance in the case of delicate materials, such as certain textile fabrics.

2

The treatment to which the said material in the fluidised bed is subjected may be merely mechanical but more frequently this fluidised bed will be used to convey heat to or from the material under treatment. The fluidised bed or the gas supplied thereto may also be used in dyeing or heat treatment or chemical processes.

The material under treatment may be drawn continuously through the fluidised bed or it may be passed intermittently. The direction of passing may be periodically reversed.

The bed particles are preferably solid glass particles, spherical or approximately spherical in shape (although shapes other than spherical are not excluded), for example, spheres of a diameter not less than 100 microns and not more than 1,000 microns and of substantially uniform size and density and the fluidising gas may conveniently be air. By "substantially uniform" we mean within a diameter range of 300 microns. In practice we prefer the bed particles to have diameters of between 400 and 700 microns.

In a preferred embodiment the material under treatment is passed through the bed while disposed in a substantially vertical plane and the said particle movement controlling means include or consist of louvre-like members disposed in two vertical columnar series, one column being located on each side of and adjacent to the path taken by the material under treatment.

The particle movement controlling means may take many forms without departing from our invention. For example, instead of the louvre-like members mentioned in the preceding paragraph, the said controlling means may have other geometrical shapes, and be otherwise arranged adjacent the material and these may (as may louvre-like members) form part of means for conveying heat to or from the particles in the fluidised bed but we have found those movement controlling means particularly advantageous which tend to break up masses of particles moving towards the material under treatment, and to divert the movement of particles adjacent and moving towards the material from the horizontal or substantially horizontal plane to a plane sloping inwardly towards the material under treatment. Louvre-like members sloped in this way and disposed one above the other in vertical columns are particularly effective. Such louvre-like members may be made hollow and also form part of the heat conveying means. The angle of slope of such louvre-like members may be adjustable if desired.

In the case of fluidised beds in which the material under treatment is to be passed alternatively in either direction vertically through the bed the louvre-like member with fixed angular slope may not be as effective as adjustable louvres.

Beds in which the material under treatment is passed vertically downwards through the bed are particularly advantageous when the purpose of the treatment is the fixing of a dye on a textile fabric since in this case the dye may be fixed before the fabric is caused to make contact with metal projections such as seal or fabric location elements in the bed.

The invention also includes apparatus for use according to such methods and comprising a container adapted to contain a bed of solid discrete particles when in the unfluidised and when in the fluidised state, the overall particle diameter being not less than 100 microns and preferably not more than 1,000 microns, means for applying an upward gaseous current to the said container for the purpose of forming a fluidised bed therein, means for conveying material under treatment through the fluidised bed and particle movement controlling means adjacent to the path of the said material under treatment and capable of impeding the horizontal or substantially hori-

zontal movement of masses of particles towards or away from the said path while permitting convectional or circulatory movement of particles between zones adjacent the said path and other parts of the fluidised bed when the apparatus is in operation. Preferably the particle movement controlling means comprises a series of louvre-like members in a vertical column at each side of the path taken by the material.

The apparatus may include means for conveying heat to or from the particles in the fluidised bed when the apparatus is to be used for thermal treatment and the particle flow controlling means may form part of the means for conveying heat.

The invention will now be described further, by way of example, with reference to the accompanying drawings in which:

Fig. 1 is a perspective view, partly in section to show more clearly the internal construction, of a fluid bed machine for the treatment of textile fabric,

Fig. 2 shows diagrammatically in side view the arrangement of the internal parts and the action of the fluidising air, and

Fig. 3 is a detail view showing an alternative arrangement.

Referring firstly to Fig. 1, a container 11 for the bed is supported in vertical position by a suitable framework 12. The length of the container is adequate to accommodate the widest fabric to be treated, the width is adequate to accommodate sufficient heating means, and the height is adequate to accommodate sufficient bed material to achieve the desired rate of treatment. Typical measurements might be about three feet six long, by one foot wide by seven feet high. Suitable means are provided to lead a travelling length of fabric 13 to a position beneath the container 11, and to convey it away from the top thereof. Such means have not been fully shown in the drawings since their design is a matter of normal engineering practice, a bottom roller 14 and a top roller 15 only being shown. The top and bottom of the container 11 are of special construction, the top being flared, and the bottom being fitted with a seal, through which the fabric may enter the bed through the air supply box 16. Air supply pipes 17 feed compressed air into the box 16. At the top end of the flared portion of the container 11, a perforated plate 11a, the apertures thereof being covered with fine gauze, is fitted horizontally to form an air-permeable top closure. This closure has a central and longitudinal slit 11b to allow the fabric under treatment to pass from the container.

The main body of the container has lagging 18 around its sides and ends, the lagging at the ends lying between the well of the container 11 and headers 19. The headers 19 are connected by hollow, externally-finned tubes 20, which pass through the bed, in two groups one towards each side of the container. Both headers 19 are provided with a steam inlet pipe 21, and with a condensate outlet pipe 22, whereby steam may be passed through the tubes 20 to enable the latter to act as heating means for the bed.

The box 16 has three narrow longitudinal slits disposed centrally thereof, the two outer ones 24 of which constitute inlets for the fluidising air or other gas, and the central one 25 constituting means by which the fabric enters the bed. As may be seen from Fig. 2, the air box 16 is provided between a pair of end walls, one of which is visible in Fig. 2, with a pair of longitudinal members having inner walls 16b located adjacent and spaced from each other and defining between themselves at their top edges the central passage 25 through which the material 13 passes, these longitudinal members having hollow chambers 16a which communicate with the supply pipes 17 and with the slits 24 located at the top of these members.

In the region between the two groups of tubes 20, ex-

tending from end to end of the container (being there secured by suitable means), are a plurality of metal plates 26 arranged in two vertical columns, between which the fabric passes.

Each plate measures two inches wide by a quarter of an inch thick, and is horizontally disposed with its two inch faces inclined at about 15° to the vertical. This angle is not critical and may be raised but we prefer to dispose the louvres between angles of 5° and 45°. The upper edge of each plate is nearer to the fabric and is spaced by about one eighth of an inch therefrom. The lower edge of each plate is level with or slightly above the upper edge of the next lower plate. This does not however preclude the plates being disposed so that the lower edge of each one is slightly below the upper edge of the next lower plate. The plates of the two columns are in staggered relationship.

The plates terminate some inches above the box 16 and beneath them are disposed two deflectors 27 in generally V configuration. The deflectors are made from similar metal to that of the plates 26 but are much wider. They are spaced apart at the lower ends by about a quarter of an inch, whilst their upper ends lie beneath the innermost of the tubes 20, spaced apart by about 2 inches.

In use the material to be treated is first threaded through the container. The region above and around the slits in the box 16 is then supplied with steel balls 29 of about 4,000 microns diameter. The bed container is then filled with the bed particles 28. These are spheres of 400 to 700 microns diameter, and the main part of the container is filled to about four-fifths of its depth. The material to be treated is then fed through the slit 11b in the perforated plate 11a and the latter secured in position.

The supply of fluidising air and the steam for heating are then switched on. The provision of the deflectors 27 serves to prevent an undue proportion of the air passing between the plates 26, and, hence, the satisfactory fluidising of the whole bed. The fabric is then passed through for treatment.

With the bed fluidised and the fabric passing through, we have found that the tension in the fabric is satisfactorily low for processing. For example when treating a 4 oz. per square yard viscose fabric the tension was less than ½ oz. per inch width of the fabric. The properties of the fabric, apart from the intended effect of the treatment, are substantially unaffected.

In Fig. 3 is illustrated an alternative arrangement of louvre-like members. These are hollow each having a generally elliptical main central portion 26a comprising the greater part of the length thereof, the ends being of annular section. Steam for heating purposes is passed through each member.

Although in the foregoing description of an exemplified embodiment we have referred exclusively to the treatment of textile fabric we wish it to be understood that other materials may be treated equally successfully. As an example may be quoted a group of filaments.

What we claim is:

1. Apparatus for treating material in a fluidized bed comprising, in combination, a container adapted to contain a bed of solid discrete particles when in the unfluidized and when in the fluidized state; means cooperating with said container for forming a fluidized bed therein; means for conveying material under treatment through the fluidized bed; and particle movement control means adjacent to the path of the said material under treatment in said bed impeding the horizontal movement of masses of particles towards or away from the said path while permitting convectional, circulatory movement of particles between zones adjacent to said path and other parts of the fluidized bed when the apparatus is in operation, said particle movement controlling means comprising louver members disposed in two columnar series, one column being located on each side

5

of and adjacent to the path taken by the material under treatment.

2. Apparatus as claimed in claim 1 in which the louvre members are in the form of flat plates with their longitudinal axes parallel and horizontal and with the plane of each plate sloped at an angle of between 5° and 45° to the vertical. 5

3. Apparatus as claimed in claim 2 in which the plane of each plate is sloped at an angle of 15°.

6

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