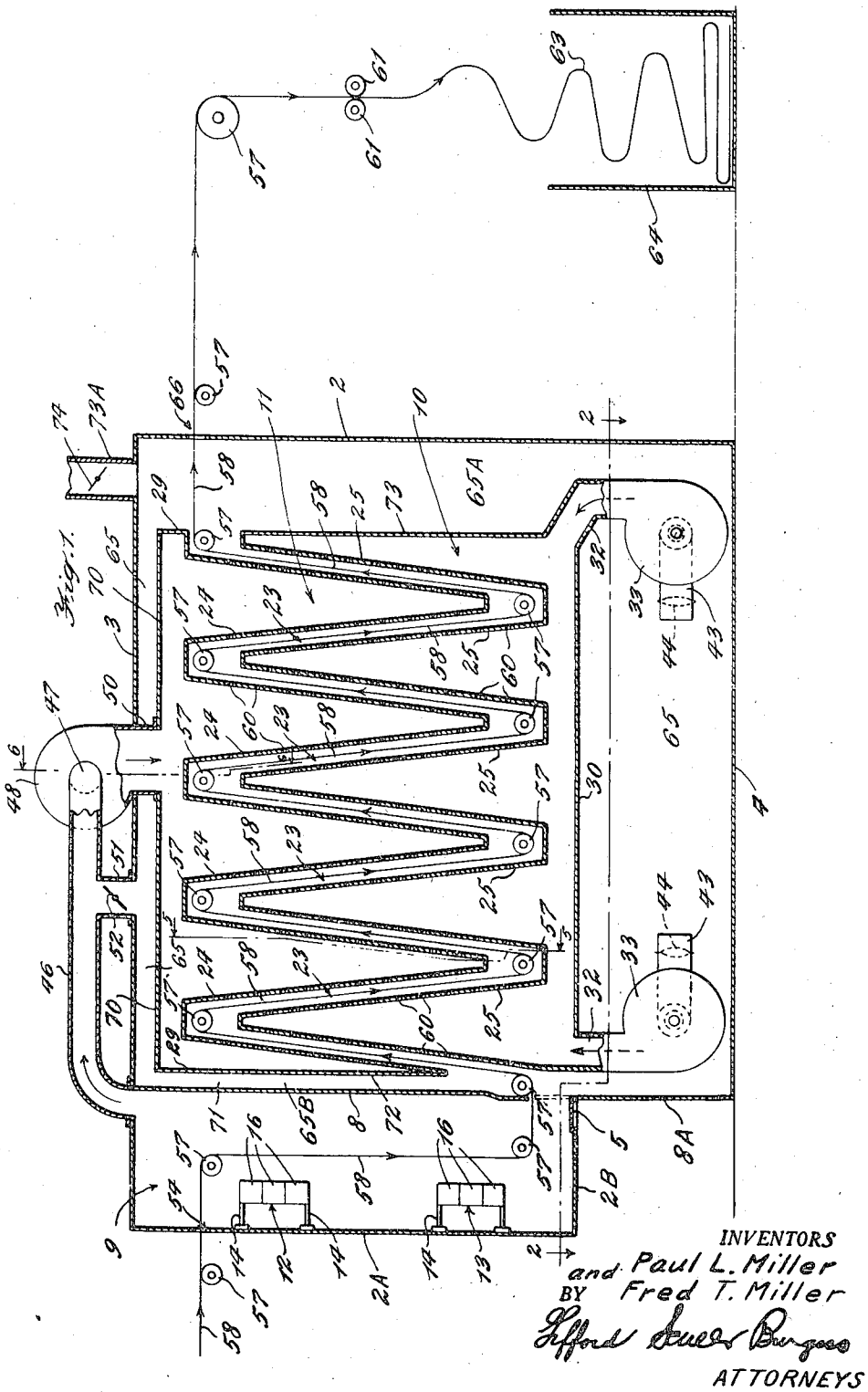
Dec. 14, 1948. P. L. MILLER ET AL 2,456,301

PROCESS AND APPARATUS FOR DRYING TEXTILES

Filed Sept. 14, 1943 2 Sheets-Sheet 1



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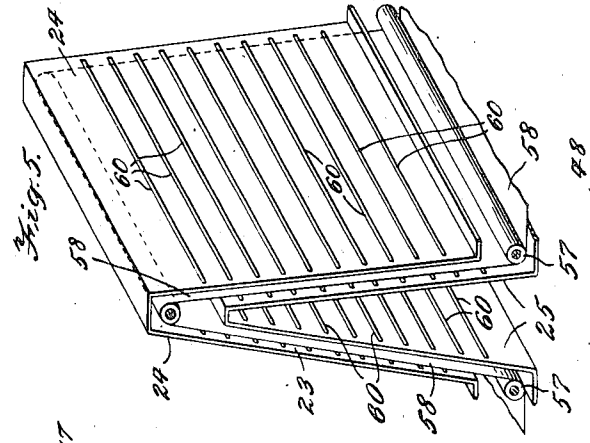


Fig. 5.

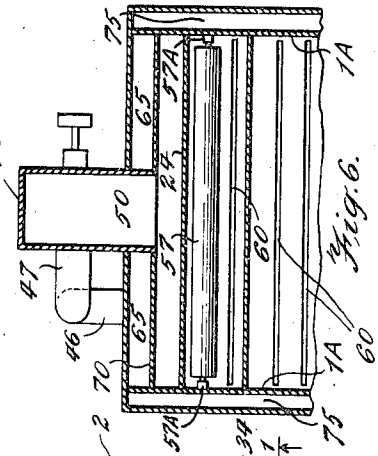


Fig. 6.

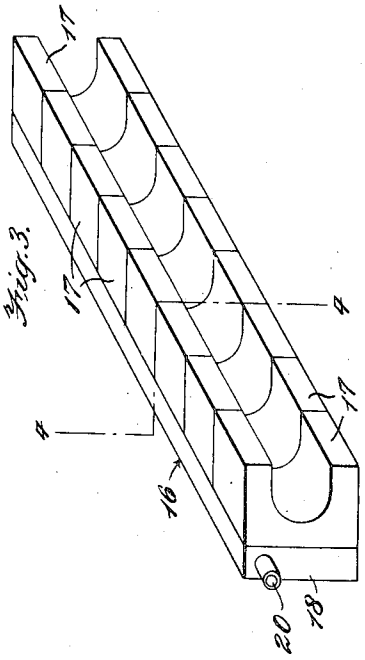


Fig. 3.

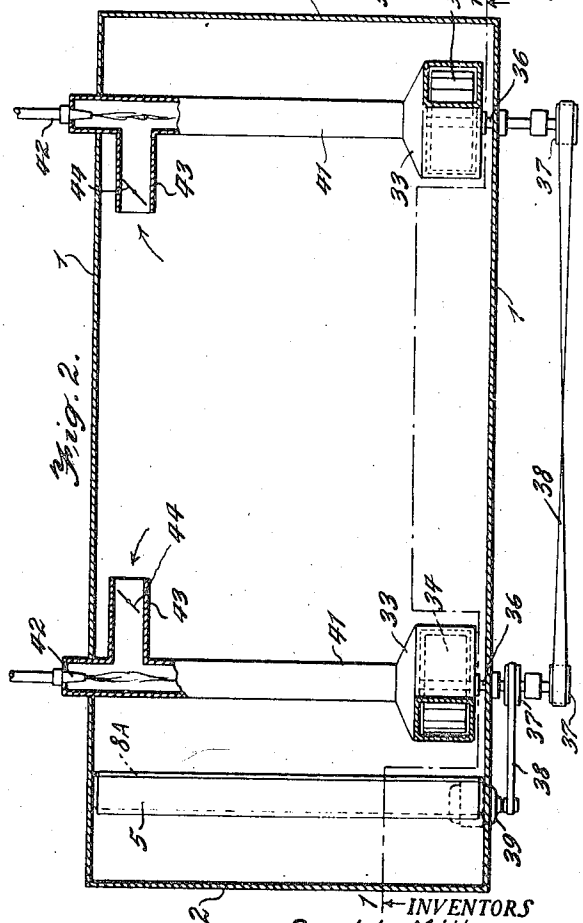


Fig. 2.

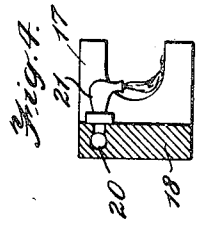


Fig. 4.

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PROCESS AND APPARATUS FOR DRYING TEXTILES

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3 Claims. (Cl. 34—18)

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This invention relates to a method and apparatus for drying wet fabric.

In the textile industry, fabric is produced in large quantities in the form of elongated sheets of predetermined widths. It is subjected to various wet treatments such as washing, bleaching, sizing, dyeing, etc., and it is highly desirable to provide means of drying which will be effective and economical.

It is an object of this invention to provide an improved drying method and apparatus adapted for the practice thereof.

It is a further object to provide an improved method and apparatus which will enable the effective and economical drying of fabric while it is passing continuously at high speed from an accumulation thereof to a place of storage, temporary or otherwise.

In accordance with this invention, the fabric is first passed in closely spaced relation to a source of concentrated, preferably radiant heat the energy of which is sufficient to cause an instantaneous or flash volatilization of at least a substantial part of the water in the fabric. This source of heat may be a refractory body heated to incandescence or to flame temperatures by any suitable heating means which may be a flame.

The wet fabric is continuously passed at high speed in spaced relation to this body and is directly exposed to the radiant heat thereof and to the flame if flame is used as the source of heat. The direct exposure of the fabric to these high temperatures and concentrated heat sources is, however, only momentary so that although a substantial part of the water is evaporated, the fabric is not impaired.

Further according to the invention, the drying of the fabric is completed by a more prolonged exposure of the fabric to heated gases or vapors for example hot combustion gases which may be mixed with steam. Where such mixture is employed, the invention preferably employs the steam generated by volatilization of the water from the fabric by the herein above described momentary direct exposure to the source of concentrated heat.

The principles of the invention will be defined in the claims and one of the various embodiments of those principles will be described by reference to the accompanying drawings in which

Fig. 1 is a diagrammatic view showing the drying apparatus in elevation taken on line 1—1 of Fig. 2;

Fig. 2 is a horizontal diagrammatic sectional view on the line 2—2 of Fig. 1;

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Fig. 3 is a perspective view of a source of radiant heat;

Fig. 4 is a section on the line 4—4 of Fig. 3;

Fig. 5 is a perspective view looking in the direction of 5—5 of Fig. 1; and

Fig. 6 is a partial section on the line 6—6 of Fig. 1.

The apparatus specifically shown comprises a generally rectangular body having vertical side walls 1, vertical end walls 2 and 2A, a top 3 and bottom 4. A partition 8 separates the chamber into what may be termed a flame chamber or radiant heat chamber 9 and a convection heat chamber, including the chambers 10, 11 and passageways 23. The wall 2A terminates in a horizontal wall 2B provided with a door 5 pivoted to swing about an axis coincident with the intersection of the planes of walls 2B and 8A, the latter being substantially aligned with the wall 8. The function of the door will be later described.

In the chamber 9 groups 12, 13 of heating elements 16 are mounted on brackets 14 secured to the wall 2A, each of these groups 12, 13 consisting of heating elements supported one above the other. One of the heating elements is shown in perspective view in Fig. 3 and in sectional view in Fig. 4. As there shown, the heating element designated generally as 16 is made up of a series of refractory U-shaped blocks 17 arranged side by side and provided with a backing member 18. A manifold 20 for fuel gas extends within and longitudinally of the backing member 18 to which manifold nozzles 21 are connected, there being conveniently one nozzle for each block 17. The orifices of the nozzles 21 are directed downwardly, that is, substantially perpendicular to the longitudinal axis of the U-shaped depression in the heating element 16 so that the flame delivered by the nozzles impinges on a curved surface of the blocks and is then directed outwardly. It will be understood that a mixture of air and fuel gas may be delivered through the manifold 20 or this manifold may merely carry fuel gas and be mixed with air at each individual nozzle. Details as to the specific burner structure are not needed since they may readily be supplied in accordance with the knowledge of the burner art.

Between the chambers 10 and 11, there are a series of serpentine passageways 23 defined by a series of spaced V-shaped walls 24 and 25, constituting a drying tunnel. The upper series of walls 24 partly define the chamber 11 and the lower series of walls 25 partly define the chamber 10 also partly defined by the horizontal partition 30. Delivery ducts 32 leading from blowers

33 are arranged to deliver hot combustion gases from the blowers 33 to the undersides of the walls 25. The impellers 34 of the blowers 33 are mounted on shafts 36 rotated by pulleys 37 driven by belts 38 from motor 39 as shown in Fig. 2. Each blower 33 is provided with an intake duct 41 to which hot combustion gases are delivered by burners 42 (note Fig. 2). Each duct 41 is provided with an auxiliary or branch duct 43 carrying a control damper 44 for purpose of control of recirculation of hot combustion gases.

Partition 70 extends part way across the convection chamber 11 adjacent the top 3 thereof and is secured to side walls 1A (note Fig. 6) positioned in spaced relation to wall 1. This partition 70 terminates in spaced relation to walls 8 and 2 respectively and, with top 3 defines a space 65 communicating at one end with a space 65B and at the other end with space 65A. The space 71 is defined by wall 8 and a vertical wall 72 joined to the partition 70 and to one of the walls 24. The walls 72 and 73 extend transversely of chambers 10 and 11 and are secured to side walls 1A. The space 65A is defined, in part, by wall 2 and a vertical wall 73 which is joined to one of the walls 25 and to the partition 30. The latter terminates in spaced relation to walls 2 and 8A, respectively, and is joined to side walls 1A. It will be seen therefore that the walls 70, 30, 72, 73 and 1A, defining the convection chambers 10 and 11, are in spaced relation to the end walls 2 and 8, the side walls 1 and the top and bottom walls 3 and 4 constituting the outside shell of the apparatus (exclusive of the radiant chamber 9) and that between this outside shell and the walls defining chambers 10 and 11 there is clearance at the top, bottom, sides and both ends. Delivery ducts 32 are connected to openings in partition 30. At the top of space 65A and adjacent one end of space 65, a vent 73A carrying control damper 74 is provided.

A duct 46 leads from the space 9 to the intake 47 of a blower 48, the discharge duct 50 of which passes through walls 3 and 70 and discharges into the chamber 11. The duct 46 communicates with space 65 through pipe 51 carrying control damper 52.

Guide rollers 57 are provided and suitably mounted in journals 57A secured to side walls 1A to conduct the fabric 58 from an accumulation thereof through opening 54 in wall 2A, first in spaced relation to the groups 12, 13 of heating elements 16 and then through the serpentine passageways 23 and in spaced relation to the walls 24, 25 which define those passageways (said walls being provided with slots 60; note Figs. 5 and 6) and between a pair of rolls 61 which pull the fabric through the apparatus and deliver it to an accumulation 63 in a storage bin 64.

In practicing the method of the invention and using the illustrated apparatus, the fabric 58 continually passes downwardly in the chamber 9 in spaced relation to the groups 12, 13 of heating elements 16, the door 5 being in the closed position shown in full lines. These elements are preferably made of refractory material and may be heated to flame temperatures or incandescence by electrical resistance elements or, as specifically shown, by a flame of burning fuel gas. When using the specific heating elements shown herein, the flame will be directed outwardly from the U-shaped depression in the elements as a sheet of flame substantially perpendicular to the plane of the downwardly passing fabric. The latter passes in closely spaced relation to the heating elements and is directly exposed to the radiant heat thereof and also to the flame and the flame may actually impinge on the fabric. However, the speed of travel of the fabric is such that the exposure to these drastic heating conditions is only momentary and therefore the fabric is not in any way impaired since the latter never reaches the temperature of carbonization or incineration, the heat energy reaching the fabric being absorbed in volatilizing a substantial part of the water in the fabric. This water in the form of superheated steam is delivered by the intake duct 46, blower 48 and discharge duct 50 to what may be termed the convection heating chamber 11 and delivered downwardly to the walls 24 by the blower 48. At the same time, hot combustion gases are delivered upwardly against the walls 25 by blowers 33 through ducts 32. The steam and hot gases, respectively, enter the serpentine passageways through elongated slots 60 while the fabric is passing through those passageways and effect completion of the drying of the fabric which is already partly dried in the radiant chamber 9.

Ample opportunity is provided for recirculation of the mixture of steam and hot combustion gases delivered to the serpentine passageways and discharged into the space 65A. The mixture may pass to the space 65 and down into space 65B, then into space 9 and back to chamber 11 via the blower 48. If damper 52 is open or partly open, the mixture may pass through space 65, duct 51 and then to chamber 11 via blower 48. If dampers 44 in ducts 43 are open or partly open, the mixture may pass down to space 65 between partition 30 and bottom 4 and then to walls 25 via blowers 33. The mixture may also pass through the spaces 75, between walls 1 and 1A (note Fig. 6), then to space 9 and back to chamber 11 via blower 48. The mixture may be vented through vent 73A. The proportions of the mixture distributed through these various paths may be controlled by dampers 44, 52 and 74.

When the apparatus is shut down, the door 5 is opened, i. e., placed in the position indicated by dotted lines in Fig. 1. Continued operation of the blower 48 then draws cold air from the outside through space 9 and hot gases from chambers 10, 11 and 65 are excluded. This precaution prevents burning of the fabric by residual radiation from elements 16.

While the exposure of the fabric to the drastic heating conditions described in connection with chamber 9 is only momentary, the exposure to the milder heating conditions in chambers 10 and 11 is more prolonged, as will be readily seen, so that by the time the fabric leaves the apparatus through the opening 66, it is in substantially dry condition for delivery to the storage bin 64.

We claim:

1. The process of drying wet fabric which comprises continuously passing said fabric through a flame chamber in closely juxtaposed and spaced relation to an incandescent refractory body; directly exposing the fabric to said body for a time sufficient to volatilize a substantial proportion of water from said fabric and convert it into steam; mixing said steam with hot combustion gases, passing the fabric through a convection heat chamber, introducing said mixture of steam and combustion gases to said convection heat chamber from opposite sides thereof and in direct heat exchange relation with said fabric in order to complete the drying of the fabric, and recirculating said mixture through said convection heat chamber only in contact with said fabric.

2. Apparatus for continuously drying wet fabric comprising an enclosed chamber, means to pass fabric in elongated sheet form through said chamber, means in one part of said chamber providing a flame-heated source of radiant heat; a series of interconnected serpentine passageways in another part of said chamber, said passageways being defined in part by parallel walls in spaced relation, said walls having slots therein, means to continuously pass said fabric at high speed first in closely spaced relation to said source of radiant heat to volatilize a substantial part of the water in said fabric without injuring it and then through said serpentine passageways to complete the drying of said fabric; means to generate combustion gases and to circulate the same through said slots; and means to mix with said combustion gases steam evolved by exposure of said fabric to said source of radiant heat.

3. Apparatus for continuously drying wet fabric comprising an enclosed chamber, means to pass fabric in elongated sheet form through said chamber, including a series of widely spaced upper and lower rollers in said chamber adapted to support the fabric in a multiplicity of substantially vertically extending stretches intermediate the rollers, partition means separating off a limited section of said chamber at the entrance end thereof to accommodate a short length only of the total length of fabric supported within the chamber, a source of radiant heat in said section located adjacent the said fabric, means to circulate steam drawn from said limited section through the remainder of the chamber, and means to introduce combustion gases to the remainder of said chamber in a direction opposite to the introduction of the steam.

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