

April 11, 1944.

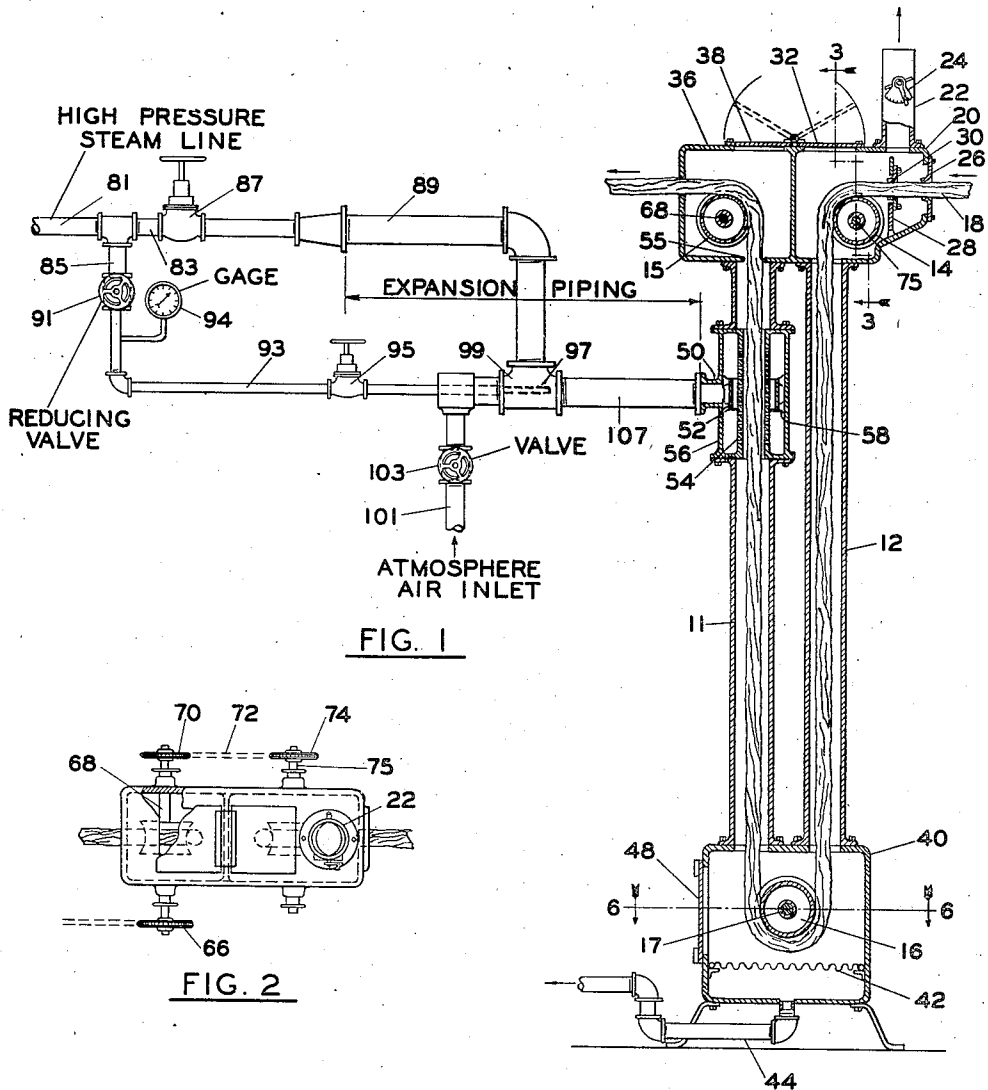
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2,346,186

HEAT TREATMENT OF TEXTILES

Filed Oct. 8, 1942

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

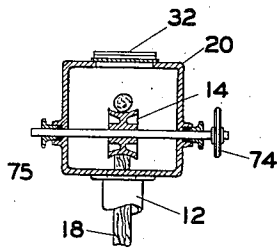


FIG. 3

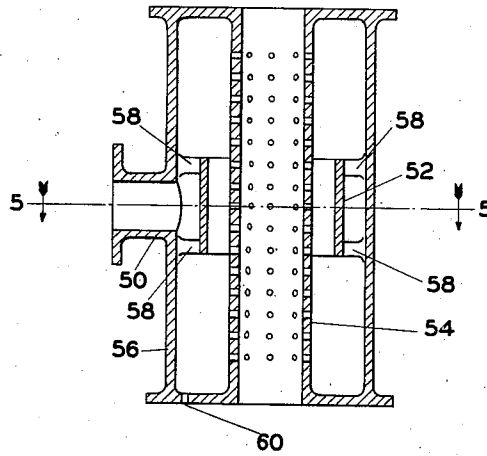


FIG. 4

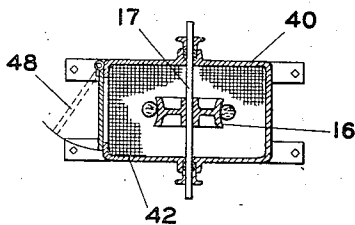


FIG. 6

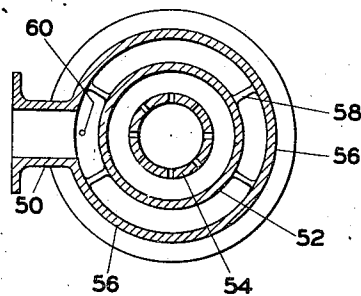


FIG. 5

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HEAT TREATMENT OF TEXTILES

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Application October 8, 1942, Serial No. 461,291

5 Claims. (Cl. 68—6)

This invention relates to the treatment of textile fabrics with a heated fluid such as steam, or with a hot mixture of steam and another gas or vapor such as air, for the purpose of thoroughly heating said fabric and raising its temperature to a suitable degree. The invention relates to certain new and improved apparatus suitable for treating textile fabrics with a heated fluid, more particularly with a mixture of steam and air, so constructed as to permit this treatment to be carried out in an efficient and convenient manner. This application is, in part, a continuation of my copending patent application Serial No. 394,646, filed May 22, 1941, now Patent No. 2,304,474.

Textile fabrics, either in the web form or coiled into a generally rope-shaped form, are frequently subjected in various textile finishing processes to the action of various heated fluids. For example, in the treatment of textile goods of vegetable origin with alkaline scouring liquids, or with peroxide bleaching solutions, or with both agents, such as by methods disclosed in the Campbell and Fennell Patent 2,267,718, it is essential that the textile material be subjected to the action of a heated fluid such as steam. This may be readily accomplished either by passing the textile material in web form through a tube filled with steam or with a hot steam-air mixture, or by loosely forming the web of textile fabric into rope form and passing this rope through the chamber containing the hot fluid. Since the success of various subsequent operations employed for treatment of the textile fabric frequently depends on the thoroughness of heating in this preliminary treatment step, I have devised a new and improved apparatus which can be more efficiently employed for heating textile fabric, either in web or rope form, by means of a hot fluid, particularly a steam-air mixture.

Accordingly, it is one of the objects of this invention to develop a new and improved steam tube construction which permits readier and more efficient treatment of textile fabrics with a heated fluid such as steam or, more particularly with a heated fluid such as a mixture of steam and air. Where steam under pressure and at a high temperature is available it is frequently essential not only to reduce the pressure to atmospheric or near atmospheric, but also to mix with the main body of steam air in sufficient amount to lower the steam temperature to one below the atmospheric boiling point. Thus, by suitably introducing a stream of air into the main body of steam at or near atmospheric pressure, it is pos-

sible to reduce its temperature from 212° F. to 200° F. or lower, and to regulate the amount of mixed fluid supplied at the desired temperature. Accordingly, another object of my invention is to develop a new and improved steaming tube construction, including expansion piping, which permits the high pressure steam to expand to or nearly to atmospheric pressure, and an air induction tube whereby steam at high pressure may have its temperature reduced below 212° F. by suitably admixing therewith a sufficient amount of air at room temperature. These steps are carried out in my improved apparatus before the mixture is brought into contact with the textile fabric to be heated.

Still other objects of this invention involve the improvement of the heating tubes which are now available by providing a construction which permits a longer period of contact between the textile fabric and the heated fluid, which heated fluid in my improved apparatus constitutes a mixture of steam and air. A further object is the provision of a heating tube so arranged as to permit ready access for inspection and for threading-through the rope or web of textile material. An additional object of my invention is the improvement of presently available heating tubes by providing for a powerful jet of a steam-air mixture, this jet being permitted to act upon the textile fabric which is traveling in a direction counter-current to the direction of flow of the steam-air mixture. In this way the jet serves not only to drive out air present in the interstices of the textile fabric, but also to secure thorough impregnation and consequent heating thereof by the hot steam-air mixture. Other objects of my invention will be apparent from the ensuing disclosure of certain preferred embodiments thereof.

My invention may be more completely described with reference to the annexed drawing wherein Fig. 1 is a vertical cross-sectional view, some parts being shown in elevation, of my improved heating tube construction and accessory steam expansion and air induction elements. This view shows the fabric in rope form passing through the U-shaped heating tube and being therein subjected to the action of the heated air-steam mixture.

Fig. 2 is a plan view showing the upper pulleys and driving mechanism at the right hand portion of Fig. 1. Fig. 3 is a cross-sectional view taken on the line 3—3 of Fig. 1. Fig. 4 is a cross-sectional view showing in detail an element of the general assembly shown in Fig. 1, this part being more fully described as the conduit and dis-

tributor for supplying the hot steam-air mixture to the textile fabric. Fig. 5 is a cross-sectional view taken on the line 5-5 of Fig. 4. Fig. 6 is a cross-sectional view taken on the line 6-6 of Fig. 1.

My improved device consists generally of two vertical tubular members 11 and 12 through which the cloth is passed and wherein it is subjected to the action of the heated fluid. Above tube 12 there is provided pulley 14, while above tube 11 there is provided pulley 15, the fabric passing over these pulleys on its way into and out of the vertically-extending tubes. Below tubes 11 and 12 there is provided a pulley 16. The textile material 18, in web or rope form, travels in the general direction shown by the arrows, entering at the upper right in Fig. 1, passing over pulley 14 down through vertical tube 12, around pulley 16, up through vertical tube 11, over pulley 15, and thence out of the apparatus.

Around pulley 14 there is provided an enlarged box member 20 which is provided with a vent pipe 22 opening to the atmosphere. This pipe is provided with damper 24 which can be adjusted in a number of positions for controlling the venting.

In a wall of the enlarged chamber 20 there is provided an opening 26 for the passage of the textile material 18. Within chamber 20 there is positioned a supporting plate 28, attached as by welding to the lower wall of member 20, and in this plate another opening 30 is provided for the passage of and guidance of the rope or web of textile material being treated. As shown, the pivoted plate member 32 may be opened to permit ready access to the pulley 14.

Around pulley 15 is provided another enlarged chamber or box member 36, provided with a pivoted plate or door member 38. This plate may be opened to permit access to the pulley 15.

Below vertical tubes 11 and 12 there is provided the lower enlarged portion 40 surrounding pulley 16. This member is constructed with a foraminous false bottom 42 through which condensed steam may pass to discharge pipe 44 but on which lint or other foreign matter which may be present is retained. Access to the pulley 16 and to the gauze 42 is afforded through the opening in the member 40 covered by door 48. The pipe for removing condensate 44 is constructed in U-form so as to provide a liquid seal at the bottom of the apparatus, thereby preventing escape of steam through this pipe.

In the vertical tube 11 there is provided the member supplying and distributing the hot steam-air mixture, this element being shown more clearly in detail in Figs. 4 and 5. The steam-air mixture is supplied through conduit 50, from a source which will be subsequently described, and it impinges against the cylindrical baffle 52 positioned in the distribution member between the inlet 50 and the apertured distribution pipe 54. This baffle member is supported in the distribution member, designated generally by the numeral 56, by spider members 58. Extending down through the center of the distribution member 56 and in general alignment with vertical tube 11 is the apertured tube 54, through the apertures of which the steam-air mixture passes into the vertical tube 11. The baffle members 58 serve to distribute the heated fluid uniformly over the entire length of the apertured distribution pipes 54. To permit the escape of condensed steam there is provided outlet 60 below

baffle member 52, this outlet serving to discharge condensate outside the vertical tube 11 as shown in Figure 1.

As shown at the upper left hand end of Fig. 1, the steam-air mixture is supplied to distribution member 56 from the high pressure steam line 81. The steam under pressure and at a high temperature in this line flows through two conduits 83 and 85, these conduits being branched from the high pressure steam main 81. The steam in conduit 83 passes through valve 87 and into enlarged expansion piping 89 wherein it expands to substantially atmospheric pressure, at the same time its temperature being lowered. That portion of the steam circulated into conduit 85 serves primarily for air aspirating or induction purposes, and may constitute only a very small part of the entire amount supplied to steam distribution member 56, the principal supply coming through conduit 89. In conduit 85 the steam passes through reducing valve 91 wherein its pressure is reduced to a gage pressure slightly above atmospheric, from 15 to 25 lbs. and then into that portion of the conduit designated by the numeral 93. The pressure at this point is indicated on gage 94. Valve 95 can be opened in amount sufficient to control the supply of steam to the discharge nozzle 97, positioned within enlarged portion 99 of expansion piping conduit 89. As shown, there is provided a conduit 101 open to the atmosphere and controlled by valve 103, this conduit being in communication with enlarged portion 99 of expansion piping conduit 89 surrounding the steam discharge nozzle 97. The steam jet issuing from nozzle 97 acts as an injector serving to draw in atmospheric air through air inlet conduit 101, the amount inducted at this point being controlled by valve 103. This atmospheric air is at room temperature and, when admixed with the expanded steam in enlarged portion 99 of expansion piping 89, the temperature of the resulting steam-air mixture is reduced below 212° F. This steam-air mixture is then supplied through conduit 107 as the heated fluid to distribution member 56 as previously described, thus bringing the heating medium into contact with the textile fabric to be heated.

In operation, the textile material enters in either web or rope form through eyes 26 and 30, passes over pulley 14, down through vertical tube 12, over pulley 16, up through vertical tube 11, through the area within the apertured distribution tube 54, and out of the apparatus over pulley 15. The steam-air mixture supplied through conduit 50 is distributed by baffle 52 throughout the entire extent of the member 56, and passing through the apertures in the apertured distribution tube 54, comes into contact with the textile material. The steam-air mixture entering through the apertures in distribution member 54 passes downwardly through pipe 11, its upward travel being restricted by the partial closure lip 55, forming an eye through which the fabric being treated passes. After passing downwardly through the vertical tube 11, the heated fluid then passes upwardly through vertical tube 12, thus coming into contact and impregnating and heating the textile material during the entire period that it is within the apparatus. Excess uncondensed steam is permitted to escape to the atmosphere after emerging from the upper part of the vertical tube 12 through the damper controlled vent discharge 22. Condensed steam is drawn off through the outlet

pipe 44, constructed in U-form as previously explained to provide for a sealing trap at the bottom of the apparatus.

It will be noticed that the direction of flow of the steam-air mixture serving as heating fluid is generally counter-current to the direction of travel of the textile web or rope. This is an important feature of my arrangement, and, combined with the impinging of the steam-air mixture directly on the textile fabric, thus driving out air present in the interstices therein and replacing it by heated medium (thereby serving to effect thorough impregnation) results in much more satisfactory heating than heretofore possible. Moreover, any air entering with the web or rope of fabric at 26 is discharged through the flue 22, its removal from the apparatus at this point being aided by the stream of steam escaping therethrough, in which stream of steam the air is entrained and removed. By providing expansion piping and means by which air at a lower temperature may be introduced or injected into the steam to form a steam-air heating mixture I can secure any temperature desired, either above or below the atmospheric boiling point of water (212° F.), and can control the supply of heated fluid in various volumes as desired.

Access to the pulleys 14, 15 and 16 for inspection and for the purpose of threading the textile material through the apparatus is provided by pivoted door members 32 and 38 and through the pivoted door 48 in the lower enlarged compartment 40. Pulleys 14 and 15 are driven from sprocket 66, drive shaft 68, sprocket 70, chain or sprocket belt 72, sprocket 74, and drive shaft 75, serving to drive pulley 14, as shown more fully in Fig. 2. The lower pulley 16 on shaft 17 is an idler pulley.

It should be understood that various changes and modifications might be made in the apparatus as described which would nevertheless come within the purview of my invention. Its scope is therefore not to be restricted to details intended merely as illustrative of the preferred embodiment thereof herein described, except as necessitated by the appended claims.

I claim:

1. In an apparatus for subjecting textile fabric to the action of a heated fluid, in combination: a plurality of tubes arranged in a generally parallel arrangement; pulleys positioned adjacent the ends of said tubes for passing the textile material therethrough; a heated fluid distributor member positioned in and forming a part of one of said tubes and adapted to distribute a heated fluid uniformly in contact with said textile fabric; a source of high pressure steam; means for expanding said steam to substantially atmospheric pressure; means for reducing the temperature of said expanded steam by admixing therewith air at room temperature; and a conduit in communication with said fluid distributor member for conveying said heated steam-air mixture to said distributor member, whereby it may come into contact with said textile fabric to be heated.

2. In an apparatus for subjecting textile fabric to the action of a heated fluid, in combination: a plurality of tubes arranged in a generally parallel arrangement; pulleys positioned adjacent the ends of said tubes for passing the textile material therethrough; a heated fluid distributor member positioned in and forming a part of one of said tubes; said distributor member being adapted to supply heated fluid uni-

formly to said textile fabrics; a source of high pressure steam; expansion means for expanding a part of said high pressure steam to substantially atmospheric pressure; a conduit for withdrawing another portion of said steam, said conduit terminating in a nozzle; an air inlet conduit arranged in communication with said nozzle in such a manner that air is injected into the main body of expanded steam by the action of said steam passing through said nozzle; and a conduit for supplying said heated air-steam mixture to said fluid distributor member whereby it may come in contact with said textile fabric.

3. In an apparatus for subjecting textile fabric to the action of a heated fluid, in combination: a plurality of tubes arranged in a generally parallel arrangement; pulleys positioned adjacent the ends of said tubes for passing the textile material therethrough; a heated fluid distributor member inserted in and forming a part of one of said tubes; a source of high pressure steam; a conduit for withdrawing and expanding a portion of said high pressure steam to substantially atmospheric pressure; a second conduit provided with an air injector whereby air may be withdrawn from the outside atmosphere into said steam, said second conduit being in communication with the expanded steam in said first conduit and serving to admix therewith air at room temperature whereby the temperature of the resulting steam-air mixture is lowered; and a third conduit for supplying said heated air-steam mixture to said fluid distributor member, whereby it may come into contact with said textile fabric passing through said plurality of tubes.

4. In an apparatus for subjecting textile fabric to the action of a heated fluid, apparatus for supplying thereto a heated air-steam mixture, said apparatus comprising: a source of high pressure steam; a first conduit in communication with said high pressure steam and so arranged as to permit a portion of said steam to expand therein whereby the pressure of said steam is reduced to substantially atmospheric; a second conduit in communication with said source of high pressure steam and arranged to withdraw a portion of said steam, said second conduit terminating in a nozzle; an air induction pipe located adjacent to said nozzle whereby outside air at room temperature is aspirated into that portion of said second conduit surrounding said nozzle, said nozzle and the portion of said second conduit adjacent the same being in communication with said first-named conduit containing said expanded steam; and a third conduit for conveying the resulting steam-air mixture to a point at which it is contacted with said textile fabric to be heated.

5. In an apparatus for subjecting textile fabric to the action of a heated fluid, in combination: a plurality of tubes arranged in a generally parallel arrangement; pulleys positioned adjacent the end of said tubes for passing the textile material therethrough; a damper member serving to remove spent heated fluid positioned adjacent the upper end of one of said tubes; a heated fluid distributor member positioned in and forming a part of one of said tubes, said heated fluid distributor member including an inlet conduit, a distributor baffle for distributing said heated fluid uniformly throughout said distributor member, and a perforated distributor pipe through which said heated fluid passes; a source of high pressure steam; a conduit for

withdrawing and expanding a portion of said high pressure steam to substantially atmospheric pressure; a second conduit provided with an air injector whereby air may be withdrawn from the outside atmosphere into said steam, said second conduit being in communication with the expanded steam in said first conduit and serving to admix therewith air at room temperature whereby the temperature of the resulting steam-air

mixture is lowered; and a third conduit for supplying said heated air-steam mixture to said fluid distributor member, whereby said air-steam mixture may come into contact with said textile fabric passing through said plurality of tubes before leaving said apparatus in the spent condition through said damper member.

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