

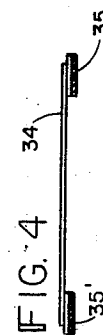
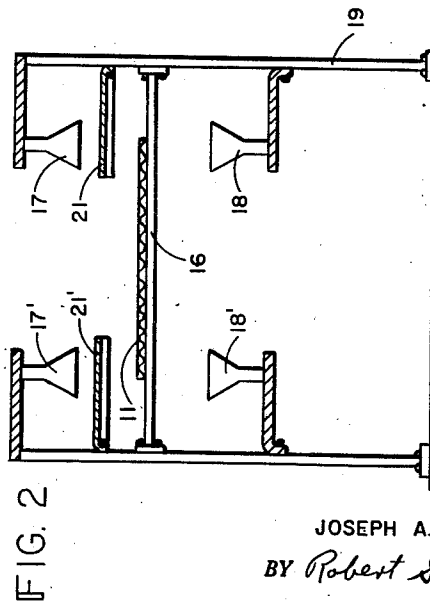
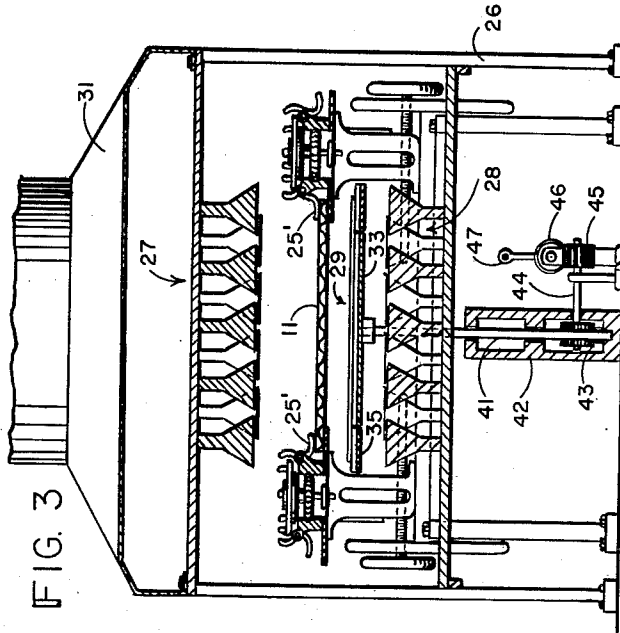
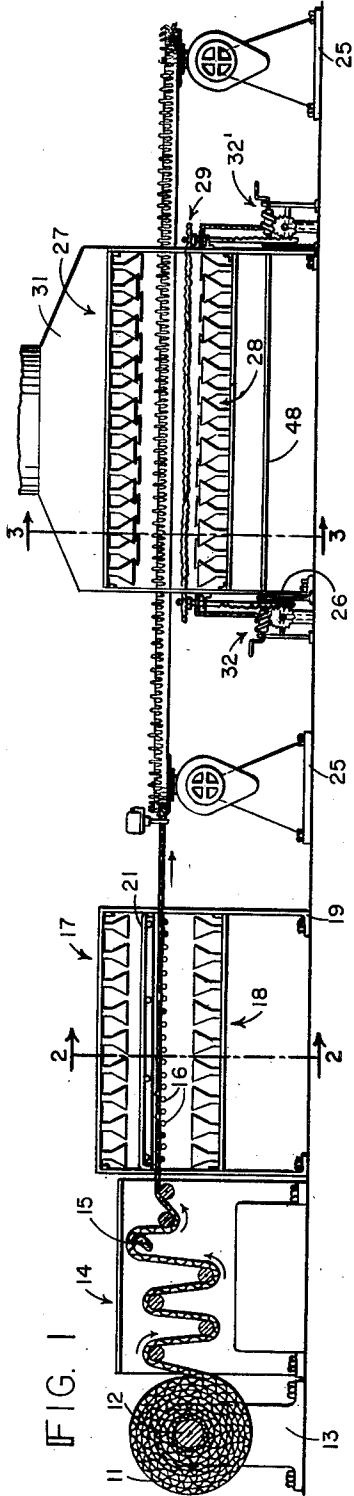
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APPARATUS AND METHOD FOR HEAT TREATING TEXTILE FABRICS

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APPARATUS AND METHOD FOR HEAT
TREATING TEXTILE FABRICS

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This invention relates to the heat treating of textile fabrics particularly thermoplastic coated fabrics.

In processing certain kinds of textile fabrics and in particular thermoplastic coated fabrics, such as fiber glass screening material, it is necessary to subject the material to a certain amount of heat in order to give it a dimensional stability or set. Fiber glass screening, for example, once it is woven, is relatively soft and liable to be deformed easily, making it ill-suited for its intended purpose. By subjecting the fabric to a proper amount of heat, however, the strands or yarns of the fabric become fused together at the points where they cross so that the material then becomes very difficult to deform. Consequently, the mesh will retain its size and shape even though the material is subject to external forces of considerable magnitude, and the individual openings of the mesh will not become enlarged when some pointed object is poked through them inadvertently. This is of course most desirable for otherwise mosquitoes or other insects could penetrate the material. It follows therefore that heat treatment of fiber glass screening material is one of the most important, if not the most important, step in its manufacture for on the success of the heat treating step will depend the suitability of the material for use as screening.

Besides the requirement that the amount of heat provided in treating the fabric be sufficient to first melt the thermoplastic coating so that individual overlapping strands will become joined together as the material cools, there are several other aspects of the heat treatment which must be borne in mind. Foremost of these is the necessity for not overheating the fabric and thereby causing the yarns to become oxidized or burned which makes them weak and brittle. Even a small amount of excess heat will discolor the material enough so that its appearance is spoiled, making it generally unsaleable. Another aspect to be considered in the heat treatment of the material is speed. That is to say, if the heat treatment of the material can be carried out continuously at a relatively rapid rate and with a minimum of supervision, it follows that the cost of the material will be materially reduced to the point where it can maintain a competitive position with other types of screening material such as copper or bronze.

Accordingly, it is an object of this invention to provide a method and apparatus for rapidly heat treating a length of thermoplastic-coated textile fabric, particularly fiber glass screening material.

Briefly, according to this invention, there is provided a system of rolls for tensioning a roll of fabric longitudinally and for feeding it to a clip type textile tenter frame spaced a considerable distance therefrom. The type of tenter frame employed in accordance with my invention is very important, since it permits considerable tensioning of the fabric both longitudinally and transversely thereby properly aligning the strands in the main body of the material without deforming the strands at its edges where it is engaged by the movable elements of the tenter frame.

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In a pin type tenter frame for example the individual pins must necessarily project through the mesh, and consequently, in order to tension it either transversely or longitudinally must exert considerable forces on the individual strands defining the openings. As a result, the openings will tend to become enlarged or otherwise deformed permitting insects to penetrate the material after it is installed. With a clip type tenter frame, on the other hand, the material is engaged by individual clips having substantially flat surfaces which distribute the applied tensioning forces over a relatively large area so that very little if any deformation takes place. Hitherto an obstacle to the use of a clip type tenter frame, however, has been that the individual clips and their associated clamping surfaces mask the edges of the material, making it practically impossible to heat the edges sufficiently to effect a fusion of the overlapping strands therealong. This difficulty is surmounted according to this invention by providing between the system of rolls aforementioned and the entrance gate of the tenter frame, means for heat treating only the edges or border portions of the material before it is placed under heavy tension in the tenter frame. More particularly, such means comprise a pair of line sources of radiant heat in the form of metal strips separated from one another by a distance slightly less than the width of the material, and positioned with their undersurfaces a fixed distance away from the top surfaces of the material. These strips are heated to a relatively high temperature so that they, in turn, radiate heat which is absorbed by the material as it moves along beneath them thereby setting the material along its edges.

Once the material clears the strips and enters the tenter frame, it is then placed under tension in order to properly align the individual strands or yarns forming the mesh. While under tension in the tenter frame, the main body of the material is then itself subjected to heat by means of a heated metal plate disposed beneath the fabric with its top surface closely adjacent the undersurface of the material. As in the case of the metal strips, the metal plate serves as a source of radiant heat which is absorbed by the fabric thereby raising its temperature enough to melt the thermoplastic coating. As is well known, radiant type heat is most effective in this kind of process, since the amount of heat transferred from the source to the material will be proportional to the fourth power of the absolute temperature differential therebetween. Consequently, the amount of heat absorbed by the material will decrease rapidly as its temperature approaches that of the plate, thereby minimizing the likelihood of overheating the material with the aforementioned detrimental results.

It is a further object of this invention, therefore, to provide a method and apparatus for heat treating a thermoplastic coated fabric wherein the main body of the fabric is tensioned in a clip type textile tenter frame prior to its being set. The novel features of this invention together with further objects and advantages thereof will become more readily apparent when considered in connection with the accompanying drawing wherein:

Fig. 1 is a side view in elevation of the apparatus according to this invention;

Fig. 2 is a cross-sectional view on an enlarged scale taken on line 2—2 of Fig. 1, and

Fig. 3 is a cross-sectional view on an enlarged scale taken on line 3—3 of Fig. 1.

Figure 4 is a detail view of a portion of the apparatus shown in Figure 3.

Referring now to the drawing wherein like elements are designated by the same reference characters and more particularly to Fig. 1, it will be observed that a length of screening material designated 11 is wound on a roll 12, the roll 12 being journaled in suitable bearings mounted on a stand 13. During the heat treating process of this

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invention the material 11 is continuously unwound from the roll 12 by means of a textile tenter frame 25 which draws the material along from left to right, and rewinds it on another roll not shown towards the right of Fig. 1. Proceeding from left to right in the figure it will be observed further that the material 11 is first threaded through a system of guide rolls 14 in a generally under and over arrangement, as shown, to tension the material somewhat before it is fed into the tenter frame 25. Included in the system of rolls 14, is a bowed member 15 which is stationary in contradistinction to the various rolls. The former tends to stress the material transversely to some extent as has been found advantageous. Between the last one of the rolls 14 and the entrance gate of tenter frame 25 is placed a frame 19 on which is mounted four rows of heating lamps 17, 17', 18, 18' as best illustrated in Fig. 2. The material, as it passes through this region, is supported in a horizontal plane by rods 16 extending transversely of the material and having their ends attached to upright members of the frame 19. Also attached to these upright members are two strips of metal 21, 21' separated by a fixed distance slightly less than the width of the material itself. Strips 21 and 21' each extend longitudinally of the material and lie in the same plane with one another, this plane being parallel to and spaced a small distance above the top surface of the material. The two top rows of lamps 17 and 17' are mounted so as to direct heat downwardly from above the respective strips 21 and 21' as shown whereas rows 18 and 18' of the lamps are mounted below the material 11 and rods 16, and are pointed upwardly so as to direct heat toward the edges of the material and also to the undersurfaces of strips 21 and 21' respectively.

Built around the tenter frame 25 is another frame structure 26 on which are mounted upper and lower banks of heat lamps 27 and 28 respectively. Lamps 27 are arranged to direct heat downwardly from above the material in tenter frame 25 whereas lamps 28 are positioned below the material to direct their heat upwardly. Interposed between the material in tenter frame 25 and the lower lamp banks 28, is a plate assembly of corrugated metal 29 substantially as wide as the material and extending longitudinally thereof for a distance at least as great as strips 21 and 21'. Like mechanisms 32 and 32' at either end of frame 26 interconnected by means of a shaft 48 serve to raise and lower plate assembly 29, and a hood 31 above the frame structure serves to carry away fumes and smoke.

Fig. 3 illustrates the details of the above described structure including lamps 27 and 28 somewhat more clearly. Referring now to Fig. 3 it will be observed that tenter frame 25 is a conventional clip type textile tenter frame having clip members 25' on an endless belt which grip the material at its edges. Thus the material 11 will be drawn along with the clip members 25' as they move on the endless belt, at the same time being tensioned by the clip members both longitudinally and transversely so that the individual strands that go to make up the material will be properly aligned. As is well known to those skilled in the art, the amount of tension applied to the material 11 may be readily altered in the tenter frame 25 according to the specific type of material being conveyed, and also the endless belts may be differently spaced to accommodate different widths of material. To permit plate assembly 29 to be readily widened or narrowed also, to the end that its width will approximate the width of the particular material under treatment, plate assembly 29 is made up of a central plate 33 and a pair of wings 35 and 35'. As shown in Fig. 4, wings 35 and 35' are each joined to transverse bars 34 which rest on the central plate 33. If the material is relatively narrow, it will be apparent that wings 35 and 35' need not be used, or alternatively if the material is relatively wide, other wing assemblies of greater width may be kept on hand for rapid installation on central plate 33 as the occasion may warrant.

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One of the mechanisms 32' for raising and lowering plate assembly 29 is also best illustrated in Fig. 3. With reference to Fig. 3, mechanism 32' includes a rack 41 disposed vertically and having its upper end affixed to central plate 33. Rack 41 is constrained to move vertically by a guide structure 42 and is adapted to be engaged by a driving pinion 43 mounted for rotation with a shaft 44. Fixedly mounted on the opposite end of shaft 44 from pinion 43 is a gear or wheel 45 in mesh with a two-toothed worm 46. Worm 46 is mounted for rotation by a crank 47 co-axially joined to shaft 48 which interconnects mechanisms 32 and 32', as explained heretofore, to permit the plate assembly 29 to be raised or lowered from either end of the frame structure 26, whichever is most convenient. If desired, a reversible motor may be provided in place of crank 47 for automatically controlling the position of plate assembly 29 as required.

In operation, tenter frame 25 serves to pass the material 11 in a substantially horizontal plane beneath metal strips 21 and 21' which in turn are heated from above and below by lamps 17, 17', 18, 18'. Strips 21 and 21', owing to their position relative to the top surface of the material 11, in effect serve as line sources of radiant heat for the edges of the material. That is to say, in contrast to plate assembly 29 strips 21 and 21' are relatively narrow and therefore do not transmit a significant amount of heat to the main body of the material but rather serve only to heat its edges or border portions. As previously mentioned, the amount of heat absorbed by the edges of the material 11 will be proportional to the fourth power of the absolute temperature difference between the strips and the material itself so that the temperature of the strips 21 and 21' will give a fairly good indication of temperature of the material at its edges. By observing the heating effects on the material at various strip temperatures, the correct amount of heat to be applied may then be readily fixed in terms of the particular strip temperature. That amount of heat just sufficient to fuse the individual strands together at the edges of the material will of course be the correct amount.

After the edges of the material have been set, the strands in the main body of the material are properly aligned by means of the longitudinal and transverse tension provided by tenter frame 25 and more particularly clip members 25', so as to prepare the main body of the material for heat treatment in a manner similar to the previous treatment of the edges. That is to say, plate assembly 29 being substantially as wide as the material itself and being heated from above and below by means of lamps 27 and 28, in turn transmits heat in radiant form which is absorbed by the main body of the material. As before, plate assembly 29 must be heated by lamps 27 and 28 an amount sufficient to cause the overlapping strands of the material to become joined together. If the amount of heat absorbed by the material is excessive causing it to burn or oxidize, some reduction in the heat may be effected by lowering plate assembly 29 with one of the mechanisms 32, 32'. In this way, the distance separating plate assembly 29 and the material 11 may be increased with the result that the heat absorbed by the material will be materially lessened. Contrarywise, if it is found that the amount of heat being applied is not sufficient to fuse together the overlapping strands, plate assembly 29 may be brought somewhat closer to the material 11 thereby increasing the heat absorption and raising the temperature sufficiently to cause fusion.

Although heat lamps have been illustrated as a means for heating the various sources of radiant energy, namely the strips and plate assembly, it will be apparent that other types of heaters, such as wire wound electrical heaters, may be used in place of the heat lamps since it is primarily their radiant heat which is effective to raise the temperature of the material. Various other modifications within the spirit and scope of the invention will occur to those skilled in the art so that I do not wish to

limit myself to the precise embodiment illustrated.

Rather my invention should be deemed to be limited only by the scope of the appended claims.

What is claimed is:

1. The method of heat treating a length of thermoplastic fabric which comprises heating the fabric along its longitudinal edge portions to join together the individual strands in these portions at the points where they overlap, tensioning the fabric to properly align the strands in the main body of the fabric, and heating the remainder of the fabric while under tension to join together the individual overlapping strands over the whole of the fabric.

2. The method of heat treating a length of thermoplastic coated fabric which comprises passing a surface of the fabric close to a pair of heat radiating elements extending longitudinally of the material and being spaced apart a distance slightly less than the width of the fabric to join together strands at the edges of the fabric, tensioning the fabric both lengthwise and crosswise to properly align the strands in the main body of the fabric, and while under tension passing a surface of the fabric close to a heat radiating surface substantially as wide as the fabric itself to join together the strands in the main body of the fabric.

3. The method of heat treating a length of thermoplastic coated fabric which comprises passing one surface of the fabric beneath a pair of flat metal strips extending longitudinally of the fabric and being spaced apart a distance slightly less than the width of the fabric while subjecting said strips to heat to join together strands at the edges of the fabric, tensioning the fabric both lengthwise and crosswise to properly align the strands in the main body of the fabric, and while under tension passing the other surface of the fabric over and closely adjacent a flat metal sheet substantially as wide as the fabric itself while subjecting said sheet to heat to join together the strands in the main body of the fabric.

4. Apparatus for heat treating a length of thermoplastic coated fabric comprising a pair of line sources

of radiant heat spaced apart a fixed distance slightly less than the width of the fabric for heating the edges thereof, means to move the fabric longitudinally of said sources, and to tension the fabric in a region beyond said sources; and radiant heating means disposed in said region to heat the main body of the fabric, said sources of radiant heat being effective to fuse together the individual strands along the edges of the fabric only, and said radiant heating means being effective to fuse together the individual strands in the main body of the fabric while under tension by said first-named means.

5. Apparatus according to claim 4 wherein said sources of radiant heat comprise strips of metal disposed with their surfaces closely adjacent to the fabric.

6. Apparatus according to claim 5 wherein said means to move the fabric includes a clip type textile tenter frame.

7. Apparatus according to claim 6 including a plurality of spacedly aligned members extending transversely of the fabric in the region beneath said sources to support the fabric in a substantially horizontal plane.

8. Apparatus according to claim 7 wherein said radiant heating means includes a heated metal plate substantially as wide as the fabric itself and being disposed beneath the fabric in said tenter frame.

9. Apparatus according to claim 8 including means to move said plate up and down so that the vertical distance separating the upper surface of the plate and the undersurface of the fabric may be increased and decreased to alter the amount of heat transmitted to the fabric.

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