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[54] **APPARATUS FOR AIR-TREATING SHEET MATERIAL SURFACES AND THE LIKE**
6 Claims, 3 Drawing Figs.

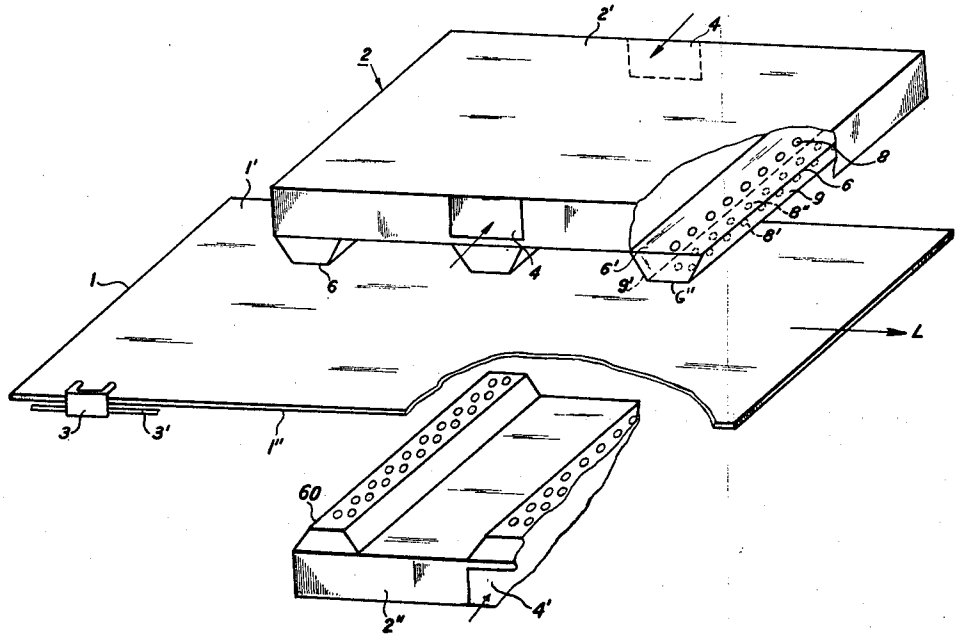
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[51] **Int. Cl.** **F26b 13/02**
[50] **Field of Search** 34/155, 156, 157

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ABSTRACT: This disclosure deals with the air-treating of sheet material surfaces and the like by introducing pressurized air upon the material through novel transversely extending and longitudinally spaced nozzle members provided with vertically separated perforated discharge members for providing substantially uniform air flow.



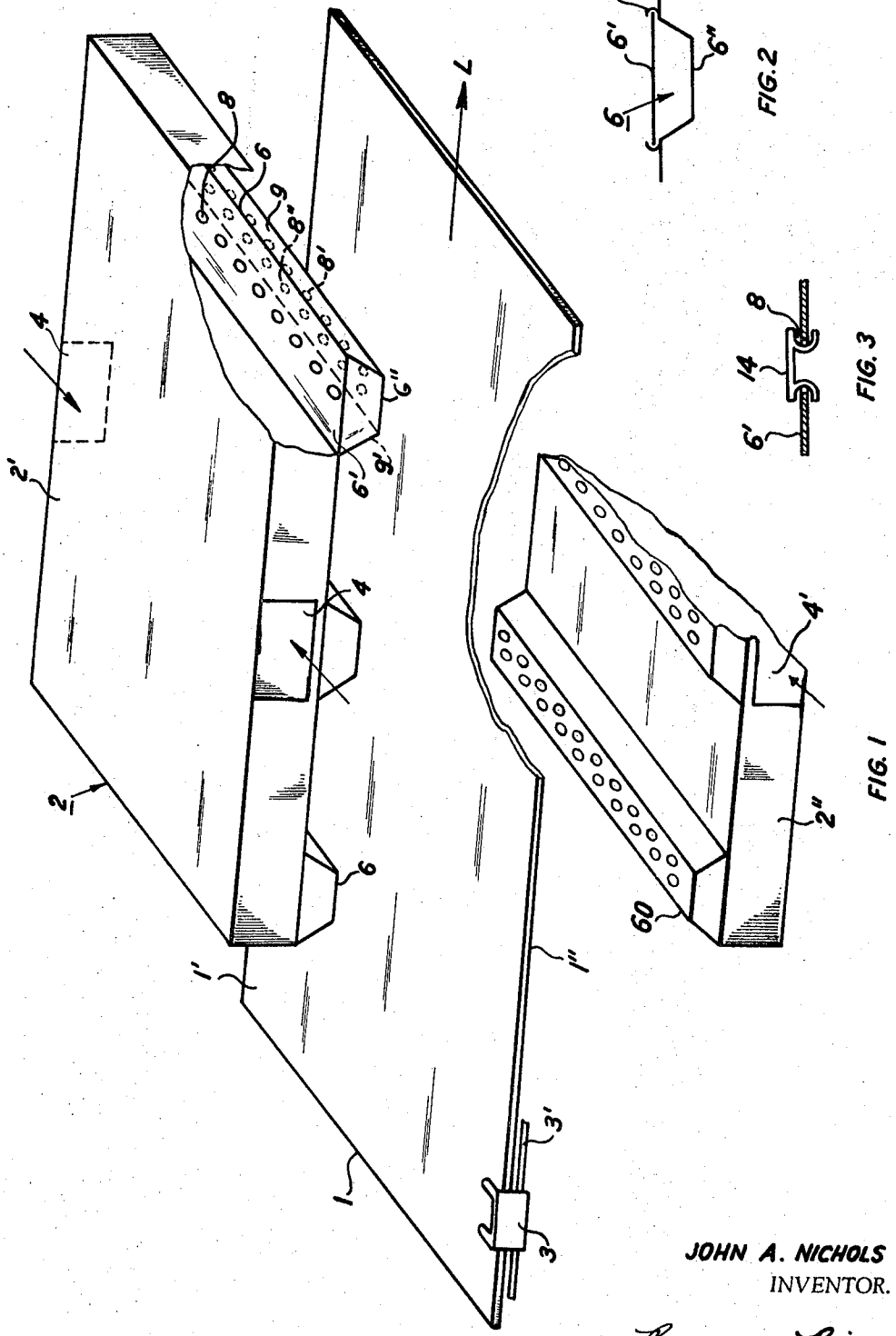


FIG. 1

FIG. 2

FIG. 3

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APPARATUS FOR AIR-TREATING SHEET MATERIAL SURFACES AND THE LIKE

The present invention relates to apparatus for air-treating sheet material surfaces and the like, being more specifically directed to the heating, drying and/or cooling of such surfaces as the material is passed through a predetermined treatment zone. The term "air" as herein employed is intended to embrace, also, other airlike fluid media, as well.

Apparatus of the above-described type has been used for many years in the heating, drying or cooling of such surfaces. In, for example, the plastic coating field, it has been customary to coat the surfaces of asphalt or felt paper backing sheets with vinyl or similar coatings, say of the order of 5 mils thick, more or less, for the purpose of providing tiles or other floor covering sheets. Similar coating processes have also long been used for other articles of commerce, as well.

The plastic-coated sheet is then generally passed through a hot air fusion chamber zone of controlled temperature, in the range of 300°—360° F. in the case of vinyl coatings, to heat, dry or cure the plastic layers. The fusion chambers have employed open slots disposed transversely of the direction of travel of the sheet for the directing of hot air laterally across the coated surfaces. In view of the substantially unequal and uneven volume and velocity airflow distribution characteristics of such slots, however, problems in uneven drying and curing of the plastic layers or coatings across the width thereof have arisen, including streaking. To obviate these undesirable effects, a relatively slow rate of travel of the vinyl or otherwise coated sheet material past the air fusion chamber has heretofore been necessary; say, a relatively slow speed of the order of 30 feet per minute of, for example, 154-inch wide sheet material.

In accordance with the present invention, on the other hand, a novel chamber and nozzle construction is provided for substantially equalizing air flow transversely over the complete sheet, thus enabling the sheet material to be dried and cured substantially uniformly with greatly accelerated speeds up to more than several hundred times as fast as in prior-art systems above described.

An object of the invention, accordingly, is to provide a new and improved apparatus for air-treating sheet material surfaces and the like.

A further object is to provide a novel heat-curing or drying apparatus.

Still a further object is to provide a novel air-cooling apparatus.

Other and further objects will be explained hereinafter and are more particularly pointed out in the appended claims. In summary, however, the invention contemplates the use of a plurality of transversely extending nozzle means spaced at successive longitudinally displaced intervals along a longitudinal path of travel of the coated sheet material, each nozzle means comprising a pair of perforated discharge members or plates spaced vertically from one another for receiving pressurized air and distributing the same through the perforations, in substantially equalized volume and velocity, across the sheet as it passes thereby. Preferred constructional details are hereinafter set forth.

The invention will now be described with reference to the accompanying drawings:

FIG. 1 of which is a fragmentary isometric view illustrating a system employing the invention in preferred form; and

FIGS. 2 and 3 are fragmentary side elevations of modified constructions of portions of the nozzle means embodied in the system of FIG. 1.

Referring to FIG. 1, sheet material 1, such as the beforementioned asphalt or felt paper sheeting, is conveyed, as by well-known tenter clips 3 holding the edges of the sheet and driven by a chain drive mechanism 3', longitudinally in the direction of the arrow L past an air treatment chamber station 2. The upper surface 1' (and in this case the lower surface 1'', as well) is provided with a coating as of vinyl, which is to be fused, heat treated or cured in passing by the chamber station 2 during the passage of the coated sheet 1 thereby. The station 2 is shown comprising an upper plenum chamber 2' (and since there is a lower opposite-surface coating 1'' also involved, an oppositely disposed similar lower plenum chamber 2'') provided with duct means 4 (and 4') at its longitudinal edges for receiving pressurized hot air to be used in the treatment of the coating; the thusly introduced pressurized hot air, in turn, being directed through a first perforated discharge member or plate 6' in a nozzle structure generally indicated at 6 (and 60) which extends transversely across the sheet 1 and distributes the air from its adjacent portion of the plenum chamber 2' (and 2''). In accordance with the invention, by using a second perforated discharge member or plate 6'' spaced in a directional orthogonal to the horizontal transverse and longitudinal dimensions of said sheet (i.e., vertically spaced), the introduced pressurized air can be caused to be discharged transversely across the sheet 1 with substantially equalized volume and velocity air flow.

In the preferred form illustrated, the perforations 8 in the upper discharge member of plate 6' of the nozzle 6 are formed in a transverse line, while the perforations 8' and 8'' in the lower discharge member or plate 6'' are formed in parallel but staggered or interlaced transverse lines extending across the width of the sheet 1. In the nozzle construction 6, the upper and lower discharge members 6' and 6'' are shown interconnected by front and rear converging walls 9 and 9' which have been found further to aid in achieving the substantially equalized discharge of air distribution uniformly across the sheet 1. By virtue of the attainment of this uniform distribution completely across the sheet 1, the coating 1' (and the coating 1'' adjacent the lower plenum chamber 2'') is subjected to substantially equalized volume and velocity air flow, such that the speed of travel of the sheet 1 in the direction L may be rapidly increased without fear of uneven curing, drying or streaking. The use of the staggered perforations 8'–8'' in the converging space of the nozzle 6 has been found to provide remarkable uniformity of flow and substantially streakless curing operation. With 154-inch wide sheet material coated with 5 mil. vinyl layers, for example, and nozzle perforations 8–8'–8'' about three-eighth of an inch in diameter, spaced 3 inches on center, and with hot air of about 600° F. introduced into the plenum chambers 2' and 2'' at about 4 inches of static pressure, the rate of travel of the sheet material 1 has be increased in excess of 6,000 feet per minute with less than 1 percent variation in the velocity of volume flow of the hot air completely across the sheet material.

The construction of the present invention, moreover, enables ready variation in the flow characteristics (as distributed by the nozzles 6 and 60) merely by controlling the number and/or size of perforations. This variation in air flow characteristic can be achieved either by providing detachable mountings for the discharge members or plates 6' (and/or 6''), as shown by the clip-securing structure 12 of FIG. 2, thus to enable ready replacement of, for example, the discharge member or plate 6' by one having a different perforation open area, or by the filling or blocking of any desired number of perforations 8 in the discharge plate 6' (or the plate 6''), with detachably insertable resilient blocking plugs as illustrated at 14 in FIG. 3.

While the invention has been described in connection with its use for hot-air curing, drying and the like, it clearly is adapted for cooling purposes, as well, as, for example, in a subsequent station following curing station 2 but prior to the rolling of the sheet material 1 upon a storage roll. At production speeds, of course, warm coatings upon the sheet material forbid direct winding upon storage rolls; and the structure of the present invention, when used with pressurized cool air will enable a continuing of the production run right up to and including the storing of the same on rolls. In addition, instead of a single continuous plenum chamber 2' or 2'' for feeding the plurality of longitudinally spaced nozzles, each nozzle may be provided with its own chamber.

Further modifications will also occur to those skilled in the art and all such are considered to fall within the spirit and scope of the invention as defined in the appended claims.

I claim:

1. Apparatus for air-treating sheet material surfaces and the like having, in combination, means for conveying along a predetermined longitudinal path sheet material provided with a surface to be air treated, chamber means disposed adjacent said surface and extending transversely thereof, said chamber means being provided with means for introducing pressurized air therein and a plurality of transversely extending nozzle means spaced at successive longitudinally displaced intervals along said path, each nozzle means comprising a pair of perforated discharge members spaced from one another in a plane substantially perpendicular to the transverse and longitudinal directions of the material, one member having perforations extending in a line substantially parallel to the transverse dimensions of said sheet material and communicating through its perforations with said chamber means and the other member having perforations extending in staggered transverse lines and disposed near said surface for directing through its perforations air flow distributed from said chamber means through the perforations in said one member transversely upon said surface with substantially equalized volume and velocity thereacross.

2. Apparatus as claimed in claim 1 and in which means are provided for varying the air flow characteristics through said nozzle means.

3. Apparatus as claimed in claim 2 and in which said varying means comprises means for detachably securing either of said members to said nozzle means.

4. Apparatus as in claim 3 wherein said securing means include detachable mountings operatively associated with said one member for normally holding said one member in position adjacent said other member and for enabling replacement of said one member whereby variation in air flow characteristics can be achieved by said replacement with another of said one members having perforations of a different size than the size of the perforations of said one member.

5. Apparatus as claimed in claim 1 further including front and rear walls interconnecting said members and converging from said one member toward said other member.

6. Apparatus as claimed in claim 1 and in which said sheet material is provided with opposite surfaces to be simultaneously air treated, the said chamber means with the plurality of transversely extending nozzle means being disposed adjacent one of the surfaces, and a second similar chamber means with a similar plurality of transversely extending nozzle means being disposed adjacent the opposite surface.