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PROCESS AND APPARATUS FOR STEAMTREATING MOLDABLE FIBER MAT

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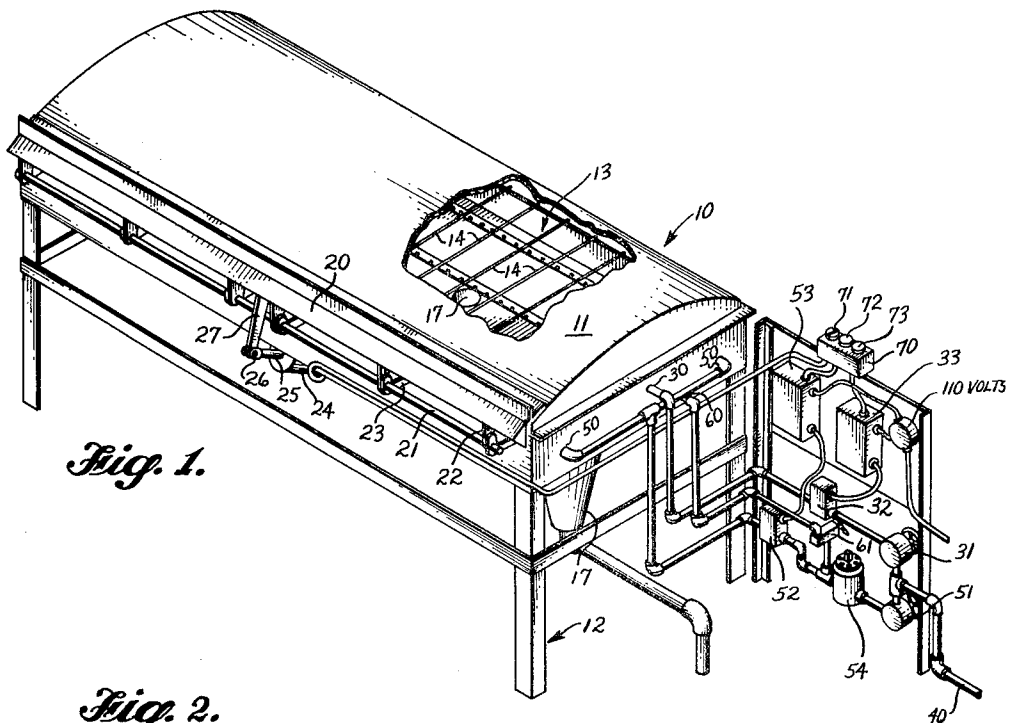


Fig. 1.

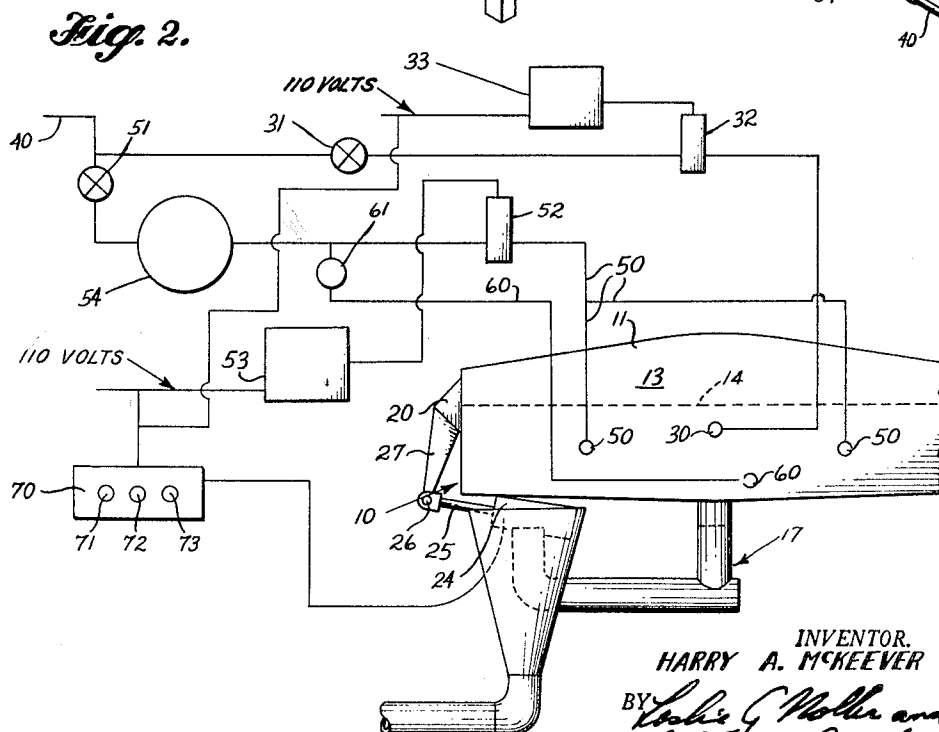


Fig. 2.

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PROCESS AND APPARATUS FOR STEAM-TREATING MOLDABLE FIBER MAT

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9 Claims. (Cl. 34-16)

This invention relates to an apparatus for and a method of heating materials under controlled conditions.

In the conversion of a moldable fiber mat from the prefinished mat form to the molded product, the mat is first preheated for the purpose of making it hot and pliable, and then introduced into a set of matched metal dies where pressure and heat are exerted on it for a specified length of time to form and cure it, converting it in shape and physical properties to the final article.

Heretofore the final articles were unsatisfactory because too many of the articles deviated from the desired standard. These deviations were traced to variations in temperature and moisture content in the mats entering the dies resulting from an improper preheating technique.

Prior to the development of the present invention, preheating, or steaming, was accomplished in a more or less uncontrolled manner. Steam was bled continuously into a semi-enclosed cabinet. Preheating was controlled by varying the length of time that the mat was left in this steam atmosphere. When these steamers were opened to introduce a new mat, the steam escaped through the doors and was replaced by outside air, cooling the interior of the steamer and condensing the incoming steam. The new mat was placed in the steamer, the steamer was closed, and the incoming steam slowly purged the air from the steamer and reheated the interior of the steamer. During the purging and reheating process the steam condensed and collected on the surface of the mat. As a result, there was a variation in the moisture content within each mat as well as between various mats, and a variation in the final temperature of the mats. In addition, steam was wasted.

In order to minimize these variations, it has been found necessary to provide a steamer which allows a minimum ingress of outside air to the steamer, a fast purge of such air from the steamer, and a close control of the heating conditions.

It is, therefore, an object of this invention to provide a steamer in which outside air is quickly purged from the steamer.

It is also an object of this invention to provide a steamer for and a method of steaming under controlled conditions so that excess condensation is avoided.

These and other objects will become apparent from a reading of the following specification in conjunction with the attached drawings.

FIGURE 1 is an isometric view of the mat steamer and the controls therefor, with portions cut away to illustrate the inner construction of the steamer.

FIGURE 2 is a schematic diagram of a steamer and the controls therefor.

Referring to the drawings, the numeral 10 indicates a steamer having a shell 11 mounted on a support 12. Shell 11 defines a steaming chamber 13 having an inner supporting grid 14 for supporting the mat during the steaming cycle.

Ingress and egress to chamber 13 is provided by door 20 which is placed on one side of the chamber to provide for rapid withdrawal of a preheated mat and replacement with a new mat. The side placement of the door also minimizes the amount of outside air that may enter the chamber.

Door 20 is hinged and rotatably mounted on bar 21

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by arms 22. Bar 21 is fixedly mounted to the steamer by arms 23. Rapid and positive opening and closing of door 20 is provided by air cylinder 24. Cylinder 24 has a movable arm 25 mounted to a piston (not shown) within the cylinder. Arm 25 is pivotally mounted at 26 to arm 27 which is fixed to door 20. A solenoid actuated valve (not shown) allows air to enter either the top or bottom of cylinder 24, rapidly moving the piston and arm 25 to either the lower end of the cylinder, opening door 20, or to the upper end of the cylinder closing door 20. After door 20 closes, the steamer can go through the steaming cycle.

The steaming cycle consists of a short burst of high pressure steam, 125 to 150 p.s.i. steam, to drive out any air which may have entered the steaming chamber. This high pressure steam burst, usually lasting from 1 to 5 seconds, is followed by a preheating cycle of low pressure steam, 10 to 30 p.s.i. steam, usually lasting from 15 to 20 seconds. The length of these cycles will vary depending on the type of material and the finished product. A small amount of low pressure steam is bled into the chamber continuously to prevent large quantities of air from entering the chamber, and to keep the chamber preheated.

The various steam lines have entry to chamber 13 below the supporting grid 14. The high pressure steam line 30, providing the short burst of high pressure steam to the chamber, is connected to the main steam line 40 through a pair of valves. Valve 31, an emergency shut-off valve, is used to shut off the line for repairs. Valve 32, a solenoid actuated on/off valve, is used to open and close steam line 30 during operation. The solenoid is actuated by a timer 33, a typical time delay mechanism, to open the valve at the start of the steaming cycle and close it after approximately 1 to 5 seconds. Timer 33 is adjustable from 1 to 10 seconds.

Low pressure steam lines 50 are also connected to main steam line 40 through a number of valves. Valve 51 is, like valve 31, an emergency shut-off valve. Valve 52 is, like valve 32, a solenoid operated on/off valve in which the solenoid is again connected to a timer 53. This timer is also adjustable and may be pre-set to any desired length of time. Between valves 51 and 52 is a third valve 54 for reducing the high pressure of the main steam line 40 to the low preheating pressure of low pressure steam line 50.

Steam line 60, connected to low pressure line 50 between valves 54 and 52, continuously bleeds low pressure steam into the steaming chamber 13 to keep the chamber warm. The connection is through bleeder valve 61. Line 60 also provides against large fluctuations of steam through the valve 54 by continuously drawing steam through the valve.

Condensate and outside air is removed from the chamber 13 through steam trap and drain 17.

The door 20 and timers 33 and 53 are operated by three switches in a control box 70. These switches are a selector switch 71, an on switch 72, and an off switch 73. The selector switch 71 may be placed in either a manual or an automatic position. In either position actuation of on switch 72 will cause air cylinder 24 to close door 20, and actuation of off switch 73 will cause air cylinder 24 to open door 20.

With the selector switch 71 in automatic position, actuation of on switch 72 will also cause the steaming cycle to start. Simultaneously with the closing of door 20, timers 33 and 53 start, opening solenoid actuated valves 32 and 52, and allowing both high pressure and low pressure steam to enter chamber 13. After approximately 1 to 5 seconds, timer 34 causes solenoid actuated valve 32 to close, stopping the burst of high pressure steam to chamber 13. The low pressure steam from line 50 continues to enter chamber 13 for the required preheating time until

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timer 53 causes solenoid actuated valve 52 to close, stopping the flow of low pressure steam to chamber 13. Timer 53 also operates the solenoid actuated valve on air cylinder 24, causing door 20 to open so that the preheated mat may be removed from the chamber. The cycle may be stopped at any time by actuation of off switch 72.

While specific details of preferred embodiments have been set forth above, it will be apparent that many changes and modifications may be made therein without departing from the spirit of the invention. It will therefore be understood that what has been described herein is intended to be illustrative only, and is not intended to limit the scope of the invention.

What is claimed is:

1. The process of heating a moldable fiber mat under controlled conditions of temperature and moisture content comprising

placing said mat in a chamber,
sealing said chamber,

injecting a high pressure steam into said chamber to remove ambient air from said chamber,

injecting a low pressure steam into said chamber whereby said mat is heated to a desired temperature,

unsealing said chamber and

withdrawing said heated mat.

2. The process of claim 1 in which said chamber is preheated prior to placing said mat into said chamber.

3. The process of claim 1 in which the high pressure steam is at a pressure of from 125 to 150 p.s.i., and said low pressure steam is at a pressure of from 10 to 30 p.s.i.

4. The process of claim 3 in which said high pressure steam is injected into said chamber for a period of from 1 to 5 seconds; and said low pressure steam is injected into said chamber for a period of from 15 to 20 seconds.

5. Apparatus for heating a moldable fiber mat under controlled conditions of temperature and moisture content comprising

a chamber having an inlet,
means for closing said inlet,

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means for injecting a high pressure steam into said chamber,

means for injecting a low pressure steam into said chamber,

each of said injecting means having on/off valve means therein, and

means pre-setting said valves whereby said high pressure steam valve means closes prior to said low pressure steam valve means.

6. The apparatus of claim 5 in which said chamber has a second means for injecting a low pressure steam therein.

7. The apparatus of claim 5 in which said means pre-setting said valves comprises an adjustable timing mechanism on each of said valves.

8. The apparatus of claim 7 comprising means for controlling said means for closing said inlet and said timers whereby said inlet is closed and both valves are opened simultaneously.

9. The apparatus of claim 8 in which said control means opens said inlet closing means simultaneously with the closing of the second valve.

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