APPARATUS FOR CONTINUOUSLY DRYING FIBER BOARDS

Original Filed Nov. 3, 1931
This invention relates to methods of and apparatus for the continuous drying and conditioning of fiber boards. Various machines for the continuous manufacture of fiber boards of the type used for insulating purposes, partitions, etc., in the building industry have been heretofore designed or suggested and a number of such machines placed in actual use. Generally speaking, each such machine of the continuous type comprises essentially a foraminous member together with means for maintaining in contact with such member a body of pulp stock. In the operation of the machine, the foraminous member is caused to travel, the liquid of the pulp stock passes through the openings therein, and the fiber is continuously deposited on the surface of such member. As the foraminous member leaves the forming area, the fiber board is removed therefrom in a continuous strip, generally being subjected thereafter to pressure for the removal of as great a proportion of the contained liquid as may be extracted by such means, and finally comes into a drying machine in which the remainder of the liquid content of the board is removed, generally by means of heat.

The problem of completely drying the board, particularly where it is of considerable thickness, is a major one, and it has heretofore been found necessary to provide large, cumbersome, and expensive machines for performing this operation, particularly where the board is of such character that it is difficult to remove the water content from the interstices of the fibers of which it is composed. In accordance with the present invention, however, a relatively simple method and mechanism are provided whereby a board of any thickness may be completely and thoroughly dried in a continuous manner as it comes from the forming machine, the improved machine being of small size as compared with those heretofore thought necessary for performing this function, relatively inexpensive, and containing few and simple operating parts.

I contemplate the utilization of spaced hood-like members positioned on opposite sides of the path of the board, one such hood-like member being particularly designed for maintaining against one surface of the board a body of heated gas, such as air, and the other such member comprising essentially a vacuum chamber in which a sub-atmospheric pressure is continuously maintained. Each successive portion of the board as it passes between these members, therefore, has one side exposed to a sub-atmospheric pressure and the other side to the body of heated gas, the result being that the heated gas is drawn through the board laterally. Some of the water content of the board is mechanically removed by the passage of the heated gas, and the remaining moisture is transformed into steam or vapor by the heat of the gas and is removed in this form.

The board, as it passes from the apparatus, is completely dried in all portions, therefore, and is ready to be cut into suitable sizes or shapes for subsequent utilization. The invention contemplates a novel means for supporting the board laterally as it passes between the hood-like members so that it is not deflected, bent, or broken in any manner by reason of the presence of the sub-atmospheric pressure on one side.

The invention is of utility in connection with the drying of all types of fiber boards where it is possible to draw a gas laterally therethrough, that is, where the board is actually composed of fiber and does not comprise a gas impervious body. It is particularly useful, however, in connection with boards comprising mineral wool and a suitable binder, and that form of the apparatus which is illustrated by way of example in the accompanying drawing has been particularly designed with this object in view. In adapting the invention to the drying of boards having somewhat different characteristics, the design and arrangement of the component elements of the invention may be modified considerably as circumstances require.

In the drawing:

Figure 1 is a longitudinal vertical sectional view through the apparatus; and

Figure 2 is a section on line 2—2 of Figure 1.

The fiber board itself is indicated at 18 in the drawing and is being drawn through the apparatus in the direction of the arrow A. The machine is particularly designed for drying boards which come continuously from forming machines in a fixed plane, that is, flat boards, but may be adapted for curved boards if desired. The board illustrated in the drawing is disposed in a horizontal plane, but it is not essential to the invention that the board be thus disposed. Positioned above the board is a hood-like member 11, the lower edge of which is disposed in a horizontal plane and close to the upper surface of the board 18. This member is provided with an inlet port 12 for heated gases, this port being indicated at 12, and also with fans or agitating devices 13 for maintaining the heated gases in a constant state of circulation or agitation within the hood so that all portions of the gas body will be of the same
temperature. Any suitable means (not illustrated) may be provided for generating the heated gas which is, in the usual case, air, this means being connected to the intake 12.

Positioned beneath the board is a second hood-like member 14, the upper edges of which are disposed in a plane parallel to and closely adjacent to the lower surface of the fiber board 16. An aperture 15 in the wall of hood-like member 14 is connected by a suitable conduit to an exhaust pump by means of which a sub-atmospheric pressure may be maintained within the hood and below the upper surface of the board. The exhaust pump is not illustrated and may be of any customary type, or, if desired, two exhaust pumps may be employed, one primarily intended for the removal of water which collects on the bottom of chamber 14 and the other for removal of gas or vapor.

Inasmuch as the existence of a sub-atmospheric pressure in hood 14 would tend to deflect downwardly the board 10 and to break and destroy the same unless the board is adequately supported, means must be provided for supporting the board firmly against this downward movement as it passes across the mouth of hood 14. This means may vary somewhat in details of construction, but that which is illustrated is eminently satisfactory for the purpose. At the opposite ends of the hood 14 are positioned shafts 16 and 17 respectively, these shafts being disposed parallel to each other and having spaced sprockets 18 and 19 mounted thereon respectively. Passing around each pair of sprockets is a chain, these chains being indicated at 20 and 21 and each comprising a series of links pivotally connected together by pins, one of which is indicated at 22. Each pin 22 carries a roller 23, which rollers are adapted to be received successively between the teeth of the sprockets over which the chain passes and also to have rolling contact with the upper surface of a trackway 24, of which there are two, one positioned horizontally beneath the upper reach of each chain. The upper reach of each chain is, therefore, positively supported as it passes from one sprocket to the other.

Each link of the chain is furthermore provided with two parallel bracket members 26 which are either integral with or rigidly connected to a cross piece or bridging element 26, each of which last mentioned members is disposed parallel to the shafts 16 and 17 and connects the bracket members 25 of one link with the similar members of the directly opposite link of the parallel chain.

Members 26 are provided as supporting members for the fiber board; that is, they are designed and constructed to transmit not only the weight of the fiber board but also the downward thrust of the board developed because of the sub-atmospheric pressure existing below it. Interposed between members 26 and the under surface of the board itself, however, are the relatively fine mesh wire screen 27 and the perforated flexible steel plate 28. Screen 27 may be the actual forming wire upon which the board was formed or may, on the other hand, be an entirely separate wire which rests upon the board after it is passed completely from the forming machine. It is preferably endless although its ends are not shown to be joined in the drawing.

Wire 27 has close and intimate contact with the bottom of the fiber board but is without great mechanical strength, and hence the flexible steel sheet or band 28 is in turn provided to carry the weight of the wire and board and to transmit this weight to the cross brace members 26. Sheet 28 is continuous and passes over the curved forward edge 14' of the suction chamber or hood onto the supporting members 26 and, after leaving these supporting members, passes onto and over the curved edge 14' of hood 14, making close contact with each of these surfaces. In passing from end 14' to end 14", the lateral edges of band 28 move along horizontal surfaces provided by the upper faces of the horizontally extending flanges 29 and 30 and which are integral with the upper edges of the hood parallel side walls 31 and 32. The upper edges of the hood 14, therefore, are provided with surfaces which, in conjunction with the band 28, constitute sealing means for the suction chamber, the contact between the band 28 and these several surfaces being sufficiently close to prevent any substantial inflow of air from the atmosphere. The band is perforated uniformly throughout its area, the perforations being relatively close together so that the heated air may be forced through the board into chamber 14 by the atmospheric pressure above it. Sheet 28, by reason of its stiffness and strength, provides a firm support for the board and the wire 27.

Longitudinal movement of the board and also movement of the wire 27 and endless sheet carrier 28 may be produced in various ways, but preferably one or the other or both of the shafts 16 are positively driven as by means of an electric motor. Driving the chain in this manner results in movement of the band 28, wire 27, and board 10 inasmuch as these members are firmly held in contact with the bridging elements 26 by atmospheric pressure above the board. This is a simple and convenient method of procuring the necessary longitudinal movement of the board at the desired speed, the speed of progression being regulated in accordance with the speed of the drying operation. If the board is relatively thin and presents little obstruction to the passage of gas, its progress through the drying chamber may be rather rapid, but if the board is thick and offers a considerable resistance to the passage of the gas used in drying, its speed of progression should be reduced or a longer apparatus provided.

Preferably I maintain the temperature of the gas in the hood 11 relatively high, for instance in the neighborhood of 150° C., so that, before the board leaves the apparatus, any moisture which may not have been removed by mechanical flow will be turned to steam and removed in this manner.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

In a machine for continuously drying fiber board, in combination, two hood-like members opening toward each other, the edges of said members being spaced apart to permit the passage therebetween of a fiber board, means for supplying one of the hoods with heated gas, means for circulating the heated gas therein, means for maintaining a sub-atmospheric pressure in the second hood whereby heated gas is drawn through any interposed fiber board, and means for positively supporting the board against deflection as it passes said hoods, said last mentioned means including a movable support positioned wholly in the last mentioned hood.

FRANCIS I. DU PONT.