Nov. 3, 1931. M. KLIEFOTH 1,829,802

MACHINE AND METHOD FOR MAKING WALL BOARD

Filed Dec. 22, 1927

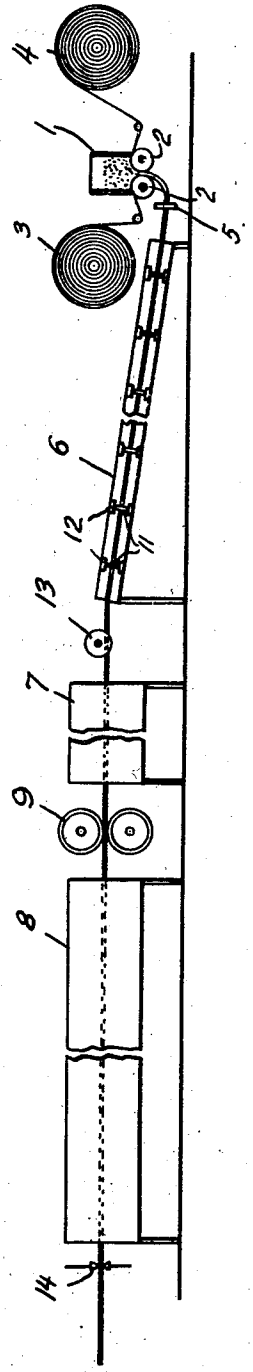


Fig. 1.

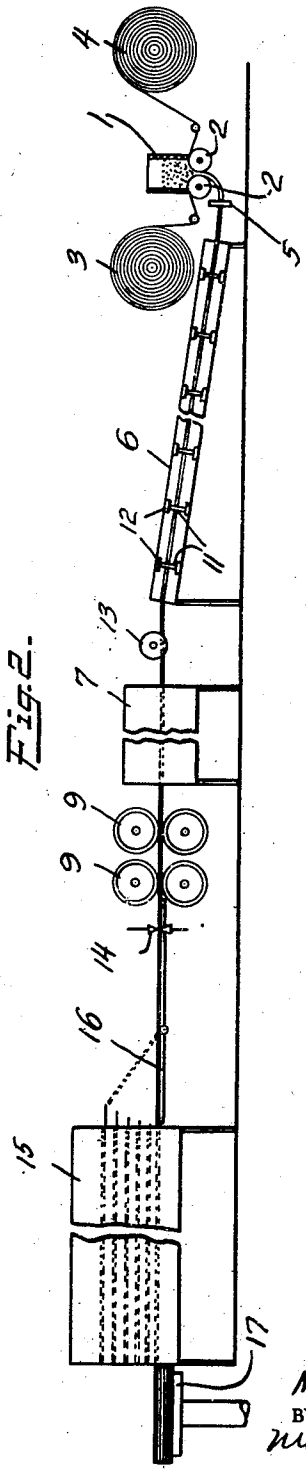


Fig. 2.

INVENTOR
Max Kliefoth
BY Pennie, Davis, Marvin & Edmonds
ATTORNEYS

Patented Nov. 3, 1931

1,829,802

UNITED STATES PATENT OFFICE

MAX KLIEFOTH, OF MADISON, WISCONSIN, ASSIGNOR TO C. F. BURGESS LABORATORIES, INC., OF MADISON, WISCONSIN, A CORPORATION OF DELAWARE

MACHINE AND METHOD FOR MAKING WALL BOARD

Application filed December 22, 1927. Serial No. 241,765.

My invention relates to a machine for making wall board from a mixture of alkali silicate and filler between two facings as described in the pending application of my co-workers, Howard F. Weiss and Ralph F. Norris, filed June 17, 1924, Serial No. 720,510 (now Patent Number 1,655,718, granted January 10, 1928).

The object of my invention is to construct a machine which is adapted to continuously make wall board with the minimum amount of labor and waste. Further objects and advantages will be apparent from the following description.

In a co-pending application of Kemper Slidell, Serial No. 103,213, filed April 20, 1926, (now Patent Number 1,655,714 granted January 10, 1928) there is disclosed and claimed a machine and method for making wall board of this type. In the Slidell machine the paper facings and raw mix are passed between heated platens to form the board and give it an initial set, then through a heat treater to dry and harden it, and then through pull rolls by means of which it is drawn through the machine. If the boards are passed directly from the platens to the pull rolls, they are not sufficiently hard to stand the pressure of the rolls and are crushed.

I have found that if a hardening chamber is placed behind the platens and the board hardened before it is passed through the heat treater, the pull rolls may be arranged in front of the heat treater without injuring the board as it passes through said rolls. The arrangement of the pull rolls in this position permits certain economies and flexibility in operation not possible in the Slidell machine.

In the accompanying drawings I have shown several forms of apparatus capable of use in practicing the process of my invention.

Fig. 1 is a diagrammatic side elevation of one form of apparatus, and

Fig. 2 is a similar view of another form of apparatus.

My invention applies especially to wall boards and similar structures made by puffing by heat a doughlike mixture of alkali silicate and filler. The heat treating apparatus may also be used for boards made with an alkali silicate and filler core but which are not puffed. In wall boards of the puffed type the mix is usually puffed between two facings, such as chip board liners. The doughlike mix is made of about one part of alkali silicate, such as sodium silicate, and about two parts of powdered filler, which may be dolomite, limestone, slate, ashes, and the like. To this a small amount of soap usually is added to help the puffing action. This doughlike mix is rolled between the two facings to the proper thickness after which it is subjected to a heating operation, preferably between steam heated platens. The sudden vaporization of the water contained in the doughlike mix containing sodium silicate causes a puffing action which results in a porous breadlike structure. The rapid escape of the steam soon causes the structure to harden. This heat treatment may be continued to dehydrate the silicate still further and thereby make it more water resistant. By using higher temperatures than are practical with steam, improved results are obtained, this procedure requiring a secondary heat-treating operation. My apparatus and method contemplate the use of such a secondary heat-treater.

In accordance with my present invention the operations of puffing, hardening and subsequently heat-treating the board may be carried out in the apparatus of Fig. 1 or 2. Referring specifically to Fig. 1 of the drawings, the doughlike mix may be placed in a hopper 1 arranged above a pair of rolls 2. Suitable facings or liners 3 and 4 may be fed from conveniently arranged winders and threaded through the rolls 2. The mix, as is leaves the hopper, is squeezed between the facings to a predetermined thickness, dependent upon the desired weight and thickness of the finished board, which may be regulated by adjustment of the rolls 2. The sides of the hopper are spaced from the edges of the facings and from the ends of the rolls 2 so that the doughlike mix will not squeeze over the edges of the facings. Should this happen, the surplus may be removed by trim

wires 5. From the squeeze rolls 2 the board passes through a puffing apparatus 6, a hardening chamber 7 and a heat-treater 8. When the boards are submitted to a hardening operation immediately after they have been given an initial set in the puffing apparatus, they may be pulled through the apparatus by pull rolls 9 arranged in front of the final heat-treater 8. The board is pulled through the apparatus at a rate which allows it to be subjected to the required treatments for the proper length of time. The surface speed of the squeeze rolls 2 should be about equal to the surface speed of the pull rolls 9 so that the green board between the squeeze rolls and in the puffing apparatus is neither subjected to too much tension nor becomes too slack.

The puffing apparatus 6 consists of a series of heated plates or platens accurately machined on the surfaces exposed to the board. The plates are spaced apart accurately at a distance slightly greater than the finished thickness of the board because, fortunately, the board shrinks slightly after reaching a maximum thickness during the first violent puffing reaction due to the sudden formation of steam. The facings are confined by the platens and the pressure, strange as this may seem, is not great enough to cause excessive friction between the moving facings and the confining platens. The friction of the board sliding through the platens is further reduced by using polished platen surfaces. The spacing of the platens is regulated by means of screws 11 working in brackets 12 attached to the platens. These may be used to release the board in case of sticking. The platens may be heated in any convenient way, as by various fluids. The fluids may be either liquid or gaseous, such as steam, air, gases of combustion, oil, water, molten salts and metals. Electricity may also be used.

As the green board is rapidly heated to above the boiling point of water, the moisture in the mix is volatilized and escapes through the edges of the board, at the same time pressing the facings against the platens. If the doughlike mix is of the correct composition and consistency it puffs without appreciably blowing out at the edges, and does not collapse after the steam has escaped. After the large part of the steam escapes, the board has set and is hard enough to handle.

During the puffing operation the board is puffed sufficiently to set the porous structure, but it is not then hard enough to permit it to be passed through the pull rolls 9 without injury. Furthermore the residual moisture must be removed from the porous structure to render it highly resistant to moisture. after leaving the puffing apparatus, I prefer to side trim the hot, freshly formed board with side cutting saws 13. These saws are preferably carborundum discs running at high speed. The board is cut wider than the finished dimension to allow for shrinkage during the hardening and heat treating operations. By placing the side trim saws in this position the board is cut or trimmed before hardening when the saws will readily cut it and will not be subjected to excessive wear in the cutting operation.

After side trimming, the boards are passed through the hardening chamber 7 which should be heated to a temperature at least as high as the temperature of the puffing platens and can be heated to a higher temperature so as to drive the heat through the boards. In the hardening chamber I may employ platens similar to the platens in the puffing apparatus, or the hardening operation may be accomplished by means of heated air or other gases. The hardening operation may be efficiently performed by submitting the boards to a temperature of 120° C. or more for a period of not more than five minutes. Upon leaving the hardening chamber the boards may be passed through the pull rolls 9 without injury and the board is fed through the apparatus by the pull exerted by the pull rolls. Thence it passes to the heat-treater 8 where the residual moisture is removed.

The heat-treater 8 preferably is essentially an insulated tunnel through which the puffed board passes. The board may be untrimmed or side trimmed and is subjected to a predetermined temperature for a definite length of time to secure the proper moisture or water resistance. The board should be subjected to a temperature of about 210° C. or more for about twenty minutes or more. This insures satisfactory results for a 3/8" board. The heating should be long enough to penetrate through the board and therefore depends on the thickness. The length of time of heating at about 210° C. or more and the upper temperature is limited by the danger of discoloring the facings due to scorching. While any suitable method of heat treating may be used I prefer using hot gases, especially hot gases of combustion. In my continuous heat-treater, both surfaces of the wall board are directly exposed to the hot gases. The trimmed edges expose the porous structure, thus allowing the moisture, which is driven off by the high temperature, to escape easily. I prefer to have the gases pass over the board at a high velocity in a direction opposite to the travel of the board so that the hottest gases come in contact with the hottest portion of the board. After passing through the heat-treater the boards may be cut to length by suitable cutting apparatus 14.

In the form of apparatus shown in Fig. 2 of the drawings, the green board is formed in the same manner and is passed through similar puffing apparatus 6. The construction and method of procedure with respect to the side trim saws and the hardening

chamber is substantially as that heretofore described. Two sets of pull rolls 9 or other equivalent mechanism may be employed and the cutting apparatus may be arranged immediately behind the pull rolls. In place of the heat-treater 8 I may employ a dryer 15 of the multiple deck type and the boards may be fed to the desired deck of the dryer by suitable transfer mechanism diagrammatically indicated at 16. By cutting the boards before they are given the final heat treatment and employing a multiple deck dryer, economy in heat may be obtained as the length of the dryer can be greatly reduced for a plant of a given capacity. The individual sections of board will remain in the dryer for a longer period of time as the various decks of the dryer will be successively loaded and emptied. Suitable means 17 may be employed for receiving the boards from the various decks of the dryer and the apparatus employed may be automatically raised and lowered to permit the boards to be delivered from any deck of the dryer.

An illustration of the operation of the method in commercial practice may be stated as follows:

Starting with an intumescent dough or plastic, preferably composed essentially of one part of a high viscosity sodium silicate, two parts of finely ground limestone, which may be dolomitic in character, and about ninety-five percent of which would pass through a 200 mesh screen, with less than one percent of a soap-forming acid, such as oleic acid, and starting with chipboard liners .037" thick, and of normal moisture content, and with the press rolls 2 adjusted to yield a finished board 3/8" thick, the puffing apparatus is maintained at a temperature of 120° C. to 170° C. and the time of transit of the board through the puffing apparatus is about eleven minutes. The hardening chamber may be maintained at a slightly higher temperature and the boards are passed through the hardening chamber in a period of about two minutes, and not more than five minutes. The time that the board remains in the hardening chamber will vary according to the temperature maintained therein. In the heat treating chambers 8 and 15 a temperature of about 210° C. is maintained and the boards are submitted to this heat treating operation for a period of from twenty to twenty-five minutes. The foregoing is but illustrative and I am aware that radical departures can be made from these values both with respect to the character of the raw material and with respect to the time and temperatures of treatment.

I claim:

1. A machine for making wall board comprising a puffed mixture of alkali silicate and filler, said machine comprising, in combination, means for rolling a dough-like mix of filler and alkali silicate between two continuous facings, means for puffing said dough-like mix, means for continuously trimming the edges of said puffed mix and facings, means for hardening the board so trimmed, means for pulling said board through said puffing means, said trimming means and said hardening means, means for cutting said board to suitable lengths and means for heat-treating said cut boards while still hot, said hardening means being intermediate said puffing means and said final heat treating means.

2. In a machine for making wall board, the combination of means for continuously shaping an intumescent plastic between continuous covering sheets of paper, means for intumescing said plastic to give it an initial set, means for side-trimming the initially-set board, heating means to initially harden said board, means for pulling said board through said intumescing means, said trimming means, and said hardening means, and means for heat-treating said initially-hardened board, said hardening means being intermediate said puffing means and said final heat treating means.

3. In a machine of the character described, the combination of means for shaping a plastic of alkali silicate and filler between continuous covering sheets, means for intumescing said plastic and giving it an initial set, means for continuously trimming the edges of the faced, initially-set, intumesced plastic board, heated platens between which the trimmed board may pass, said platens being hot enough to initially harden said intumesced plastic, pulling rolls for pulling said board through said intumescing means, said trimming means, and said platens, and means for cutting said initially-hardened board into suitable lengths while still hot said hardening means being intermediate said puffing means and said final heat treating means.

4. In a machine for making wall board with a layer of mixed alkali silicate and filler puffed and hardened by heat and held between paper liners, the combination of puffing means, trimming means, and pulling rolls, a hardener intermediate between said trimming means and said pulling rolls, and heat-treating apparatus beyond said pulling rolls to receive the board while still hot.

5 In a machine for making wall board with a layer of mixed alkali silicate and filler puffed and hardened by heat and held between paper liners, the combination of a hardener between the puffing means and pull rolls, cut-off mechanism beyond said pull rolls and means for heat-treating said board while still hot.

6. In a machine of the character described, the combination of a hardener intermediate between side-trimming saws and pull rolls.

7. In a machine of the character described,

the combination of a platen hardener intermediate between side-trimming saws and pull rolls.

8. In a machine of the character described, the combination of pull rolls between a hardening chamber and a heat-treating chamber.

9. The method of making wall board which comprises continuously shaping an intumescent plastic between covering sheets of paper, then quickly intumescing and setting said plastic by heat, then side trimming said initially set board, then quickly hardening said board by heat, and then subjecting the hot, initially hardened product to a temperature high enough to render said intumesced and hardened material highly resistant to moisture.

10. In a machine of the character described the combination of a hardener intermediate the puffing means and final heat treating means.

11. The step in the method of making wall board comprising a mixture of alkali silicate and filler puffed by heat, which comprises hardening hot, initially-set, intumesced wall board sufficiently to resist the crushing action of pulling rolls prior to the final heat-treatment of said board.

12. The steps in the method of making wall board comprising a mixture of alkali silicate and filler puffed by heat, which comprises side-trimming hot, initially-set, intumesced board, and hardening said hot trimmed board sufficiently to resist the crushing action of pulling rolls prior to the final heat-treatment of said board.

13. The steps in the method of making wall board comprising a mixture of alkali silicate and filler puffed by heat, which comprises quickly hardening said mixture sufficiently, after being initially set in the puffing operation, to resist the crushing action of subsequent frictionally engaging pulling rolls, cutting the hot hardened board into suitable lengths and immediately heat-treating said board while still hot to render it highly resistant to moisture.

14. The method of hardening a faced, initially-set, intumesced-plastic mixture of alkali silicate and filler which comprises exposing it while still hot and prior to final heat treatment of said board to a temperature at least as great as the intumescing temperature for not more than five minutes.

15. The method of hardening a faced, initially-set, intumesced-plastic mixture of alkali silicate and filler, which comprises heating it while still hot and prior to final heat treatment of said board between platens heated to a temperature at least as great as the intumescing temperature for not more than five minutes.

16. The method of hardening a faced, initially-set, intumesced-plastic mixture of alkali silicate and filler which comprises heating it while still hot and prior to the final heat-treatment of said board to drive off sufficient moisture so that said mixture will resist the crushing action of pull-rolls.

17. The steps in the method of making wall board comprising a mixture of alkali silicate and filler puffed by heat comprising intumescing said board by heat sufficiently to give it an initial set and then quickly hardening said hot initially set board by heat prior to the final heat treatment of said board.

18. In a machine for forming sheets from plastics, the combination with a pair of heated platen walls of substantial area, means for feeding plastic material between said walls, a hardening oven associated with the platens and closely adjacent thereto, a drying and curing oven, and a feeding device located between the two ovens adapted to draw the hardened sheet from the first and to move it into the second.

19. In a machine for forming sheets from plastics as a continuous process, the combination with a pair of heated platen walls of substantial area, means for feeding plastic material between said walls, a hardening oven associated with the platens and closely adjacent thereto, a drying and curing oven, a severing device located between the two ovens to divide the continuous sheet into lengths and a feeding device also located between the ovens and adapted to draw the sheet from the first and to move the severed sheets into the second.

20. In a machine for forming sheets from plastics as a continuous process, the combination with a pair of heated platen walls of substantial area, means for passing a lining sheet between said walls, means for supplying intumescent plastic material between the platen walls in contact with the lining sheet to be puffed and cemented to the liner surface by the action of the platens, a hardening oven associated with the platens and closely adjacent thereto, a drying and curing oven, and a feeding device located between the ovens adapted to draw the liner and the adhering hardened body of material from between the platen walls and thence through the hardening oven and to push it into the drying and curing oven.

21. In a machine for forming sheets from plastics, the combination with a pair of heated platen walls of substantial area, means for feeding plastic material between said walls, a hardening oven associated with the platens and closely adjacent thereto, a drying and curing oven, and a feeding device located between the two ovens adapted to draw the hardened sheet from the first and to move it into the second, the sheet carrying capacity of the drying and curing oven per lineal foot of its length being greater than that of the said hardening oven.

22. In a machine for forming sheets from

plastics, the combination with a pair of heated platen walls of substantial area, means for feeding plastic material between said walls, a hardening oven associated with the platens and closely adjacent thereto, a drying and curing oven, and a feeding device located between the two ovens adapted to draw the hardened sheet from the first and to move it into the second, the said second drying and curing oven being a multiple deck oven provided with means for delivering the product to different decks thereof.

23. In a machine for forming sheets from plastics, the combination with a pair of heated platen walls of substantial area, means for feeding plastic material between said walls, a hardening oven associated with the platens and closely adjacent thereto, a drying and curing oven, a feeding device located between the two ovens adapted to draw the hardened sheet from the first and to move it into the second, and a severing device in rear of the feeding device adapted to cut the product into separate sheets, the said second drying and curing oven being a multiple deck oven provided with means for passing such separate sheets of the product to different decks thereof.

In testimony whereof I affix my signature.

MAX KLIEFOTH.