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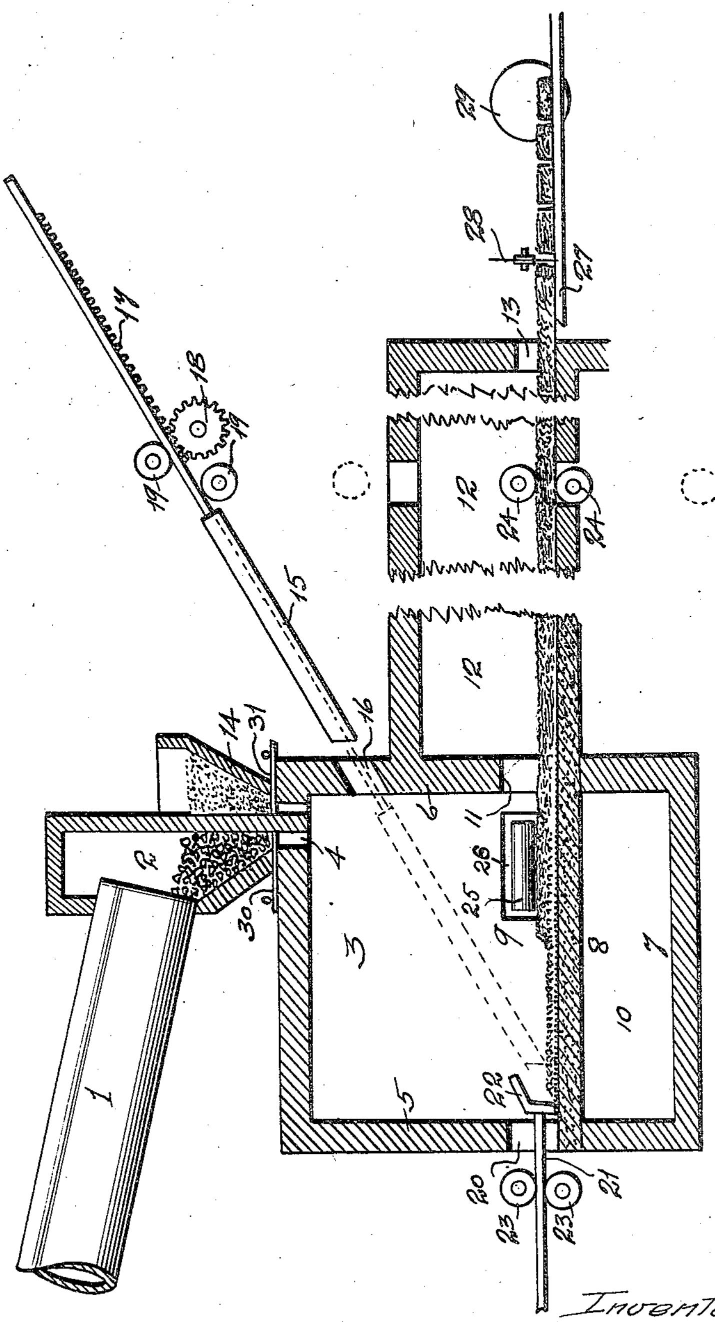

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KILN FOR PRODUCING CELLULAR BLOCKS

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This invention relates to a kiln for producing cellular blocks, and is designed primarily to produce, by continuous process, a slab or column of cellular argillaceous material, by first preheating and afterwards bloating and expending granular argillaceous material fed into a furnace in the granular form, and thereafter caused to fuse and coalesce into a continuous slab which is added to from time to time by accretions of material which is fused and bloated and which coalesces or welds with the previously formed portion of the slab, so that the material will continuously progress through the furnace and emerge either continuously or at recurrent intervals from the delivery end of the furnace, at which point it will be cut up into blocks or units of the desired size and shape.

The material of the present invention is of cellular formation, light in weight, and impervious to water. It possesses adequate strength to meet structural requirements, and may be cut into blocks or units of the desired size and shape. It is formed by first grinding or breaking up the argillaceous material into granular particles, preferably not larger than will pass through a one-sixth inch mesh screen. These granular particles are first preheated, preferably under agitation in a rotary kiln, to a temperature of from 1500° to 1800° F., the temperature, however, being insufficient to cause the particles to fuse and adhere together. During this stage of the process, the material is thoroughly dried and some of the undesirable constituents are driven off.

After the preheating, the granular material is fed into a bloating chamber usually maintained at a temperature of from 2000° to 2200° F., although in some cases this temperature may be as low as 1800° F. or as high as 2500° F., and is there spread or leveled off in the form of a layer of the desired thickness.

Within the bloating chamber the material is heated to a sufficiently high temperature to first cause a fusion and coalescence of the surface particles in the formation of a continuous skin or sheath, which surrounds the body of granular material and encloses it, so that thereafter, as the heat penetrates into the body of the mass, the gases evolved from the gas-forming constituents of the mass will be trapped, with the result that the material will begin to swell or bloat and enlarge in volume by the formation of individual cells or pockets which give to the bloated mass the cellular characteristics of baked bread.

After the bloating has been completed, the mass in the form of a slab or block is advanced into the annealing oven, where it is slowly cooled and afterwards discharged onto a table or support, where it is cut up into blocks or units of the desired dimensions.

The kiln of the present invention is designed to provide mechanism for continuously carrying on the process above described, by affording means for charging the material at frequent intervals, so that new charges of material will be added from time to time as accretions to the slab previously formed, as the same is moved forwardly and delivered from the furnace.

In the drawing:

The figure constitutes a diagrammatic representation in longitudinal section in a kiln embodying the features of the present invention, and designed to carry out the process above set forth.

The kiln in the form shown comprises a preheater 1 in the form of a rotary kiln of a type commonly in use at the present time. The rotary kiln at its delivery end discharges its contents into hopper 2 mounted upon the main structure 3 and discharging thereinto through a duct 4. The main structure, as shown, is of rectangular shape, comprising a rear wall 5, a forward wall 6, a floor 7, and a hearth 8, which latter divides the kiln into two chambers, the upper chamber 9 being a combustion and a bloating chamber, the lower chamber 10 being a combustion chamber only.

The hearth 8 constitutes a floor for the bloating chamber, which communicates through an aperture 11 with an annealing chamber 12 of elongated formation and of sufficient length to accommodate the continuous slab or column of material as it is fed forward from the bloating chamber and

through the annealing chamber, from which latter chamber it is discharged through an orifice 13.

In order to prevent adherence of the bloated material to the floor of the furnace, it is necessary to spread a thin layer of sand or the like over the floor of the bloating chamber, which sand is discharged from a hopper 14, which, as shown, occupies a position adjacent to the hopper 2, from which the granular material is discharged.

Suitable means are provided for first discharging a thin even layer of sand upon the floor of the bloating chamber and for thereafter charging the granular material to the desired depth, and, as shown, in the present embodiment said means comprise a charging chute 15 in the form of an obliquely or otherwise disposed plate, preferably having side walls or flanges, which charging chute is adapted to be thrust inwardly into the bloating chamber through an aperture 16 in the forward wall 6, until it assumes the position indicated in dotted lines in the figure.

When in the dotted line position, sand will be fed from the hopper 14 and travel down the inclined charging chute and be discharged from the lower end onto the surface of the floor of the bloating chamber. As the sand is fed downwardly along the sloping surface, the charging chute will be progressively withdrawn at a uniform rate, so that a layer of sand of uniform depth will be distributed from end to end of the floor of the bloating chamber.

After the sand has been distributed, the charging chute is again moved downwardly to the dotted line position, and the granular material is fed from the hopper 2 to the desired amount, and the charger progressively withdrawn in the manner previously described, so that a uniform layer of granular material of the desired depth will be spread upon the floor of the bloating chamber.

As shown, the charging chute is provided at its forward end with a rack 17 which meshes with a pinion 18. Rollers 19 serve to guide the charging chute throughout its line of travel. Any other suitable and convenient means for moving the charging chute may be employed, the rack and pinion arrangement merely serving for purposes of illustration.

The rear wall 5 of the bloating chamber is provided with an aperture 20 through which is entered a push bar 21 provided at its inner end with a pusher head 22. Rollers 23 serve to guide the pusher bar and permit it to travel from end to end of the bloating chamber. The pusher co-operates with a pair of rollers 24, or other mechanism, located within the annealing chamber, or at the end of said chamber, which rollers or other mechanism serve to withdraw the completed slab of material at the same rate of speed that the material is pushed forwardly, the two devices operating conjointly in the advancing of the slab of material and feeding thereof from the bloating chamber and through the annealing chamber to the point of discharge.

It is preferred to provide means for moving the rollers 24 or other mechanism from the feeding position indicated in full lines to the idle position indicated in dotted lines, should they be located in the annealing chamber, in order to relieve the rollers from the heat of the annealing chamber when they are not in service. Any suitable and adequate means may be provided for mounting and lifting the rollers 24 or other mechanism from the active to the idle position, and it is not deemed necessary to illustrate these details.

In order to level down the surface of the bloated slab, a roller 25 is provided which is mounted to move transversely or longitudinally of the bloating chamber across the surface of the bloated slab, and this roller, when not in use, may be withdrawn through a door or aperture 26 in the side wall of the bloating chamber.

After the slab of material is discharged from the annealing chamber, it passes onto a table or support 27 which is aligned with the discharge orifice 13, and above the table 27 is mounted a cross cutting wheel or disk 28 and a longitudinal cutting wheel or disk 29 so arranged and operated as to cut the material into blocks or units of the desired size. Any suitable and adequate means may be provided for feeding and rotating the cutting wheels, after the manner of a circular saw, and it is not deemed necessary to illustrate these features in detail.

The discharge of the granular material and of the sand may be regulated in any suitable manner, but for purposes of illustration we have shown slide valves or plates 30 and 31 at the lower ends of the respective hoppers, for regulating the discharge.

In operation, the granular material preheated from 1500° to 1800° F. under agitation in the rotary kiln 1, will be discharged while still in granular form into the hopper 2, and after a coating of sand has been spread upon the floor of the bloating chamber, a charge of granular material will be fed down upon the charging chute and deposited to the desired depth upon the floor of the bloating chamber.

During the operation of charging the bloating chamber, the charging chute will be progressively withdrawn, so that after a full charge has been delivered, the charging chute will occupy a position outside of the bloating chamber, where it will be relieved, during the bloating operation, from the heat of the chamber.

After the first charge of material has been

thoroughly bloated in the bloating chamber, it will be shoved forwardly by the pusher 21 into the annealing chamber, but before leaving the bloating chamber its surface, if desired, may be leveled down by the action of the roller 25.

If it is desired to form a continuous slab or column of material, the rear end of the first formed section will be allowed to remain within the bloating chamber, and a second charge of material will be delivered in position to allow the second charge to weld onto and unite with the terminal end of the first charge, so that after one or more accretions of material have been added, the continuous slab will advance to the point where it will encounter the rollers 24, so that in subsequent feeding operations the rollers will co-operate with the pusher which acts from the rear so that danger of bulging or buckling the material while in a more or less plastic state will be obviated.

The material is allowed to remain within the annealing chamber for several hours, so that it may be gradually cooled down to a handling temperature, during which time it will become sufficiently tough to serve its purpose as a building unit. It is necessary to make the annealing chamber of sufficient length to afford sufficient time for proper cooling of the slab, and with due regard to the speed with which it is fed forwardly and the frequency with which charges are added to the rear of the slab or column.

If desired, the charging chute can be operated with sufficient frequency to add relatively small accretions to the advancing slab, or in other words the material can be fed in small charges, in which case the bloating operation will be progressive throughout the bloating chamber and will be completed at about the time the material leaves the bloating chamber and enters the annealing chamber.

Where the operation is performed in this manner, it will not be possible to use the push bar at the rear, and reliance must be had upon the rollers or other advancing device for withdrawing the completed slab. If additional rollers are required to provide adequate means for withdrawing the slab, such additional rollers may be employed. In such case, the forward progress of the slab will be practically continuous and at a slow rate of speed, while the charging operation will likewise proceed with practical continuity, so that the slab will be formed at the rear while it is being discharged in completely bloated and annealed form at the forward end of the apparatus.

Numerous modifications in detail may be provided, but the mechanism shown is one which is adapted to adequately handle the material at all stages in the performance of the bloating and annealing processes.

It is preferable to provide both pusher means and roller or other means for advancing the material, since it will ordinarily be necessary, in initiating the operation, to feed one or more complete charges to the bloating chamber and to shove these initial charges, when bloated, from the rear, in order to develop a slab of sufficient length to engage the rollers or other advancing mechanism which continue the forward feeding, but after a slab of the required length has been built up, the feeding of the material may be in the form of small or continuous accretions constantly being added to the slab, in which case the movement will be effected entirely by the rollers or other mechanism and the pusher mechanism will remain idle for the time being.

The invention is one which permits the bloating operation to be performed with practical continuity and at a rate of speed which will be limited only by the size of the apparatus, due regard being had for the period of time required for annealing, in order to prevent shattering due to rapid cooling of the bloated material.

We claim:

1. In apparatus of the class described, the combination of a bloating chamber, a charging device for spreading granular earthy material evenly in the form of a layer within the bloating chamber, an annealing chamber in communication with the bloating chamber, and means for removing the material, when bloated to the form of a slab, from the bloating chamber to the annealing chamber, such means including a pusher adapted to engage the rear end of the bloated slab and thrust it forwardly into the annealing chamber, and also including means for engaging the bloated slab and advancing the same through the annealing chamber, and cutting means at the discharge end of the annealing chamber for severing the slab into sections.

2. In apparatus of the class described, the combination of a bloating chamber, a charging device adapted to be moved from end to end of the bloating chamber, means for delivering granular material to the charging device in position to be spread in the form of an even layer within the bloating chamber, an annealing chamber, and means for advancing the material, when bloated to the form of a slab, from the bloating chamber to the annealing chamber, said means including a pusher adapted to engage the rear of the slab and thrust the same forwardly into the annealing chamber, and also including means adapted to engage the slab of material delivered into the annealing chamber and to discharge the slab from the annealing chamber, and cutting means at the discharge end of the annealing chamber for severing the slab into sections.

3. In apparatus of the class described, the combination of a bloating chamber, an agitating preheating processor located in a position to allow of discharge with minimum

heat loss, a hopper for receiving granular material from the preheating processor and delivering it to the bloating chamber, a charging chute positioned to convey material from the hopper and to spread such material in the form of a layer within the bloating chamber, means for moving the charger to spread material in the form of a layer within the bloating chamber, an annealing chamber communicating with the bloating chamber, and means for feeding a slab of material, when bloated, from the bloating chamber to the annealing chamber.

4. In apparatus of the class described, the combination of a bloating chamber, an agitating preheating processor located in a position to allow of discharge with minimum heat loss, a hopper for receiving granular material from the agitating preheating processor and delivering it to the bloating chamber, a hopper for containing material adapted to prevent adherence of the granular material, a charging chute positioned to convey materials from either of the hoppers and to spread such materials in the form of layers within the bloating chamber, means for moving the charger to spread the materials in the form of layers within the bloating chamber, an annealing chamber communicating with the bloating chamber, and means for feeding a slab of material, when bloated, from the bloating chamber to the annealing chamber.

5. In apparatus of the class described, the combination of a bloating chamber, an agitating preheating processor located in a position to allow of discharge with minimum heat loss, a hopper for receiving granular material from the agitating preheating processor and delivering it to the bloating chamber, a charging chute positioned to convey material from the hopper and to spread such material in the form of a layer within the bloating chamber, means for moving the charger to spread the material in the form of a layer within the bloating chamber, an annealing chamber communicating with the bloating chamber, and means for feeding a slab of material, when bloated, from the bloating chamber to the annealing chamber, said means including pushing mechanism adapted to engage the rear end of a slab of material, when bloated, and move it forwardly, and also including engaging means for engaging a slab of material and advancing it through the annealing chamber.

6. In apparatus of the class described, the combination of a bloating chamber, an agitating preheating processor located in a position to allow of discharge with minimum heat loss, a hopper for receiving granular material from the agitating preheating processor and delivering it to the bloating chamber, a hopper for containing material adapted to prevent adherence of the granular material, a charging chute positioned to convey materials from either of the hoppers and to spread such materials in the form of a layer within the bloating chamber, means for moving the charger to spread the materials in the form of layers within the bloating chamber, an annealing chamber communicating with the bloating chamber, and means for feeding a slab of material, when bloated, from the bloating chamber to the annealing chamber, said means including pushing mechanism adapted to engage the rear end of a slab of material, when bloated, and move it forwardly, and also including means contiguous to the annealing chamber for engaging a slab of material and advancing it through the annealing chamber.

7. In apparatus of the class described, the combination of a bloating chamber, a charging device for spreading granular earthy material evenly in the form of a layer within the bloating chamber, a roller in the bloating chamber adapted to level off the surface of the slab when bloated, an annealing chamber in communication with the bloating chamber, and means for removing the material, when bloated to the form of a slab, from the bloating chamber to the annealing chamber.

8. In apparatus of the class described, the combination of a bloating chamber, a charging device adapted to be moved with respect to the bloating chamber and adapted to direct the downflow and deposit of granular material and to spread the same within the bloating chamber in the form of an even layer, means for delivering granular material to the charging device, and means for discharging the material from the bloating chamber when bloated.

9. In apparatus of the class described, the combination of a bloating chamber, a charging device adapted to be moved with respect to the bloating chamber and adapted to direct the downflow and deposit of granular material and to spread the same within the bloating chamber in the form of an even layer, means for delivering granular material to the charging device, an annealing chamber, and means for advancing the material when bloated to the form of a slab from the bloating chamber to the annealing chamber.

10. In apparatus of the class described, the combination of a bloating chamber provided with a hearth, a charging device relatively movable with respect to the hearth across the surface thereof and adapted during relative movement between the charging device and the hearth to direct the downflow and deposit of granular material and to spread the same over the hearth in the form of an even layer, means for delivering granular material to the charging device, and means for discharging the material from the bloating chamber when bloated to the form of a slab.

11. In apparatus of the class described, the combination of a bloating chamber provided with a hearth, a charging device relatively movable with respect to the hearth across the surface thereof and adapted during relative movement between the charging device and the hearth to direct the downflow and deposit of granular material and to spread the same over the hearth in the form of an even layer, means for delivering granular material to the charging device, an annealing chamber, and means for advancing the material when bloated to the form of a slab, from the bloating chamber to the annealing chamber.

12. In apparatus of the class described, the combination of a bloating chamber, a charging device adapted to be moved with respect to the bloating chamber and adapted to direct the downflow and deposit of granular material and to spread the same in the form of an even layer within the bloating chamber, and a chute positioned to discharge granular material downwardly to the charging device, and means for removing the material from the bloating chamber when bloated to the form of a slab.

13. In apparatus of the class described, the combination of a bloating chamber, a charging device adapted to be moved with respect to the bloating chamber and adapted to direct the downflow and deposit of granular material and to spread the same in the form of an even layer within the bloating chamber, and a chute positioned to discharge granular material downwardly to the charging device, a second chute positioned in proximity to the first chute and adapted to downwardly discharge to the charging device a material adapted to prevent adhesion of the granular material, and means for removing the material from the bloating chamber when bloated to the form of a slab.

14. In apparatus of the class described, the combination of a bloating chamber, a charging device adapted to be moved with respect to the bloating chamber and adapted to direct the downflow and deposit of granular material and to spread the same in the form of an even layer within the bloating chamber, and a chute positioned to discharge granular material downwardly to the charging device, a second chute positioned in proximity to the first chute and adapted to downwardly discharge to the charging device a material adapted to prevent adhesion of the granular material, an annealing chamber, and means for advancing the material when bloated to the form of a slab, from the bloating chamber to the annealing chamber.

In witness that we claim the foregoing we have hereunto subscribed our names this 26th day of July, 1929.

WARNER HATHAWAY.
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