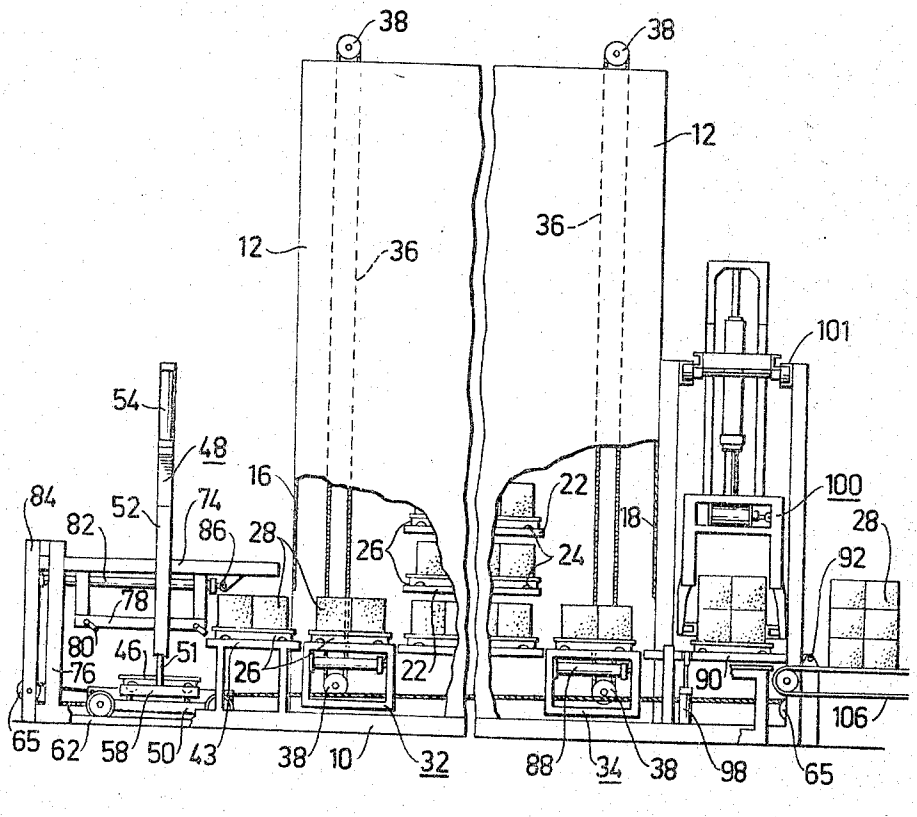
June 6, 1967 P. A. D. S. DANIELSSON ETAL 3,323,662

PLANT FOR THE HARDENING OF SHAPED SLABS

Filed June 16, 1964

3 Sheets-Sheet 1

Fig.1



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Filed June 16, 1964

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Fig. 2

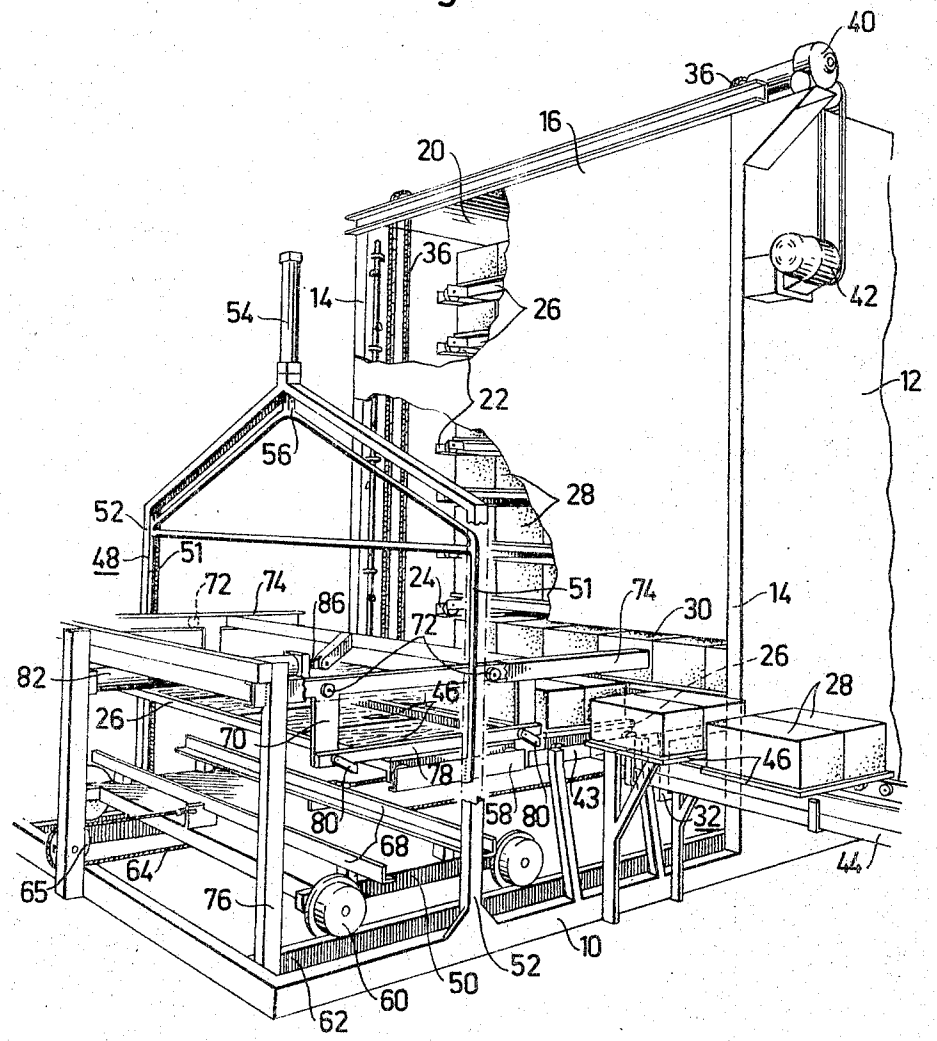

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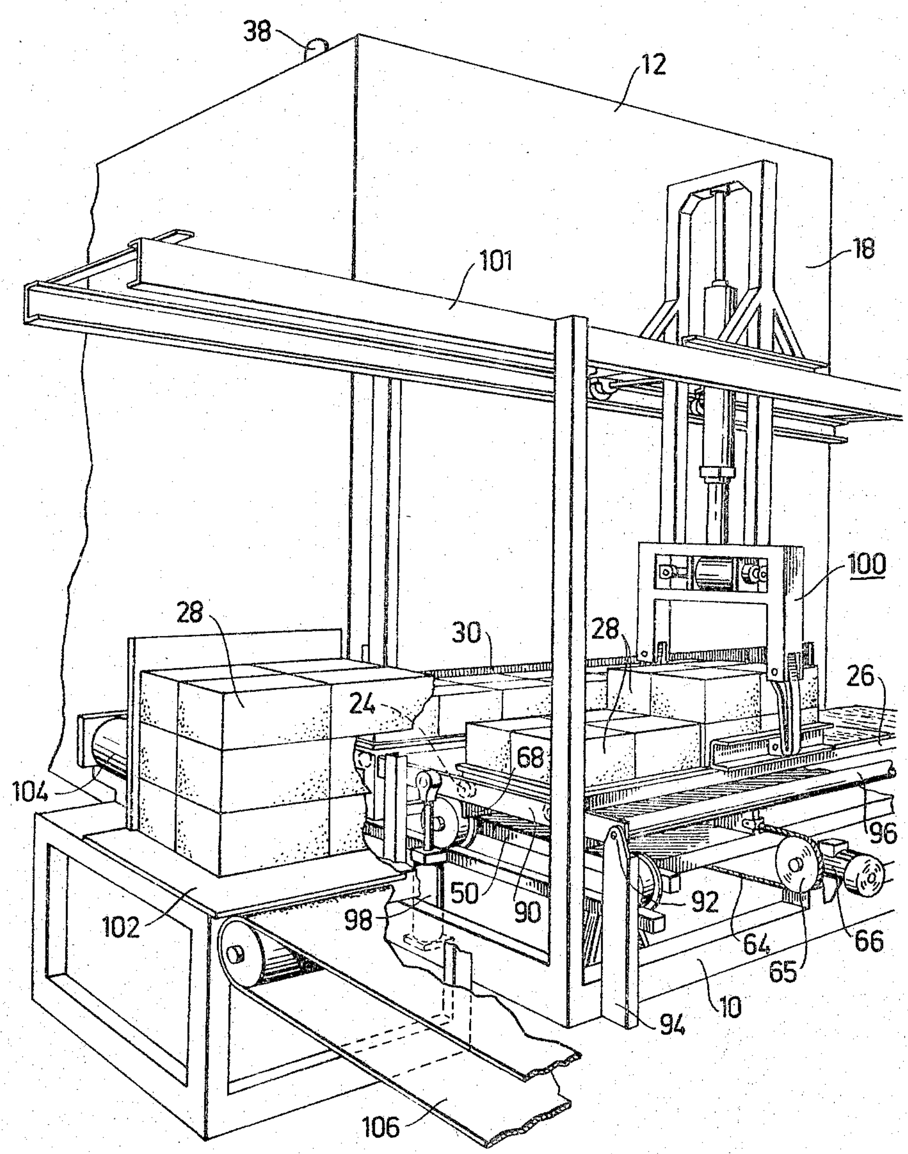
Fig.3



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United States Patent Office 3,323,662 Patented June 6, 1967

3,323,662

PLANT FOR THE HARDENING OF SHAPED SLABS

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Filed June 16, 1964, Ser. No. 375,529
Claims priority, application Sweden, June 26, 1963, 7,069/63
4 Claims. (Cl. 214—16.4)

This invention relates to a plant for the hardening of shaped slabs or similar building stones.

More particularly this invention relates to a plant for the hardening of shaped slabs or similar building stones in which plant the slabs are fed from a slab forming machine at a loading station on trucks for transport to a hardening chamber.

One main object of the invention is to provide a plant of the type in consideration rendering it possible to maintain continuous operation and at the same time to utilize within a relatively small space the heat and the moisture produced by the hardening operation. Said utilization is of great importance for both the economy of the operation of the plant and for an improvement of the quality of the shaped slabs.

According to one main feature of the invention the interior of the hardening chamber is provided with rails positioned in pairs in equally spaced relation with one pair above the other and extending generally parallel to one another in a horizontal direction from the intake end of the hardening chamber to the discharge end thereof. Such rails are intended to receive guide roller members of trucks which have been raised by an elevator located adjacent the intake end of the hardening chamber and such trucks are adapted to be transferred in sequence at a predetermined level and at a predetermined rate from the loading station to one pair of rails while simultaneously a truck is being transferred from the rails onto a second elevator located adjacent the discharge end of the hardening chamber and thereafter conveyed to a discharge station from which the trucks are unloaded and returned to the loading station.

Suitably the hardening chamber is provided at its base on both the intake and discharge ends with an opening fitted for passage of the trucks loaded with a load of slabs, the hardening chamber above said openings constituting a closed space.

Further objects and advantages of the invention will become apparent from the following description, considered in connection with the accompanying drawings which form part of this specification and of which:

FIG. 1 is a partially sectional diagrammatic side elevation of a plant constructed according to the invention.

FIG. 2 is a partially sectional perspective view of the intake end of the plant.

FIG. 3 is a partially sectional perspective view of the outlet end of the plant.

Referring to the drawings, reference numeral 10 denotes a base frame supporting a hardening chamber 12 forming part of the plant of the invention. Adjacent to one end of said hardening chamber there is disposed a loading station and adjacent the opposite end of said chamber a discharge station. These stations will be described in more detail later.

The hardening chamber 12 consists of side wall 14, a front wall 16, a rear wall 18 and a roof 20. Disposed in the chamber 12 are rails 22 extending in generally parallel relation to one another in a horizontal direction and in pairs positioned above one another on different levels. In the embodiment shown said rails consist for instance of irons of L-profile having one flange rigidly secured to the side walls 14 and the other flange adapted

to support roller members 24 of a plurality of trucks 26. Such trucks have been loaded with shaped slabs 28 in a manner to be described later and are fed into the chamber so as to occupy substantially available space as will clearly be seen in FIGS. 1 and 2. The trucks include frames having a rectangular form with suitably profiled irons in the end portions on which the roller members or wheels 24 are rotatably mounted. For introduction and discharge, respectively, of the trucks the front wall 16 and the rear wall 18 of the hardening chamber are provided with an opening 30 of a size to allow a truck with its load of shaped slabs to pass therethrough. In the embodiment shown the openings 30 are permanently open but they may be closable.

An elevator 30 is located in the hardening chamber 12 between the front wall 16 and the end of the rails 22. This elevator is capable of receiving one truck 26 at a time for alignment with the front of the pair of rails 22 on a predetermined level so that the truck can be transferred from the elevator to the rails. A second elevator 34 is located between the rear chamber wall 18 and the ends of the rails on the other side of the chamber for receiving trucks to be discharged from the chamber 12. Each of the elevators 32 and 34 has a driving equipment of a type known per se and thus only diagrammatically indicated in the drawings. Said equipment includes endless chains 36 running around upper and lower sprockets 38 with the upper sprockets being mounted on a common shaft driven by gear 40 by means of an electric motor 42. Located outside this hardening chamber 12 at the intake end thereof is a bench 43 supported by the base frame 10 as shown in FIG. 2, and such bench projecting to the opening 30 of the chamber wall 16. This bench constitutes a prolongation of a discharge bench 44 emanating from a shaping machine not shown in the drawings for the shaping of the slabs 28 mentioned hereinbefore. The slabs are advanced while resting on supporting plates 46 along the discharge bench 44 by means of some suitable conveyor device, the slabs as shown being capable of being advanced with a predetermined interspacing until they are transferred onto the truck 26 which stands ready on the bench 43 and which collects a predetermined number of slabs with the edges of the supporting plate 46 bearing against one another.

The truck has been fed to this position of readiness on the bench from an elevator device generally denoted 48 which has lifted the truck to the level of the bench 43 from a position of rest on a return carriage 50.

The elevator device 48 has the form of a fork or yoke having shanks 51 guided in a vertical direction by upright stands 52 mounted on the base frame 10 and consisting of inwardly directed irons of U-profile. The stands 52 are connected at their tops by means of bent portions which constitute a support for a vertically disposed hydraulic cylinder 54. The piston rod of the cylinder 54 is connected to the shaft 56 of the elevator fork so that the fork can be lifted or lowered as desired. The lower ends of the shanks 51 are provided with angle irons 58 for supporting and guiding the trucks 26 during their lift from the return carriage 50 and their transfer to the bench 43.

The return carriage 50 is supported by flanged wheels 60 carried on rails 62 provided at the base of the hardening chamber 12 and rigidly secured to the base frame 10 to allow movement of the carriage between the loading station located in front of the hardening chamber and the discharge station located behind the chamber. The movement of the carriage 50 is accomplished by means of a wire 64 running over grooved wheels 65 at each end of the base frame 10, one of which is driven in any desired manner as by an electric motor 66. Secured to the carriage 50 are a pair of spaced parallel rails 68 form-

ing supports for the roller members of the hardening trucks 26 when resting on the return carriage.

A slide device 70 is provided for transferring the trucks 26 from the elevator fork 48 to the bench 43. The device 70 includes a plurality of small rolls 72 pivotably mounted on the sides of such device and rotatably mounted in irons 74 of U-profile facing one another with their openings extending horizontally in spaced relation to one another. The irons 74 are supported by stands 52 and by upright posts 76 secured to the base frame 10. Each side of the slide device 70 is provided with a pair of downwardly extending members connected by a lower frame element 78 having swingably mounted front and rear stops 80. These stops are normally inclined toward the bench 43 and arranged so that the front stops engage a truck 26 on the bench 43 during the forward movement of the slide device and the rear stops engage a truck 26 on the elevator fork 48. During the return movement of the slide device in the opposite direction, the stops will swing upwardly freely when they engage an obstruction.

The movements of the slide are brought about by means of a hydraulic cylinder 82 rigidly secured to a stand 84 projecting upwardly from the base frame 10 and having its piston rod 86 connected to the slide device 70.

The trucks 26 are conducted to the discharge station mentioned earlier by the elevator 34 and discharged from hardening chamber 12 (FIGS. 1 and 3) by means of a hydraulic cylinder 88 provided on the elevator 34 and operating on this side of the plant to transfer such trucks out of the hardening chamber onto a discharge bench located adjacent the opening 30 of the rear wall 18. This bench consists of two rails 90 which are positioned in line with the roller members 24 of the trucks 26. The outer ends of the rails 90 are connected by pivots 92 to stands 94 rigidly secured to the base frame 10 and moreover in the illustrated embodiment interconnected by means of a transverse bar 96. The inner end of each of the rails 90 is supported by a vertically positioned hydraulic device 98 comprising a piston operating within a cylinder to maintain the rails 90 in a generally horizontal position to receive the trucks from the elevator 34 and after the trucks have been unloaded, the device 98 will lower the inner ends of the rails to cause the trucks to be deposited on the carriage 50 for return to the loading station. The return carriage 50 shown in FIG. 3 is obviously the same which is presented in FIG. 2. The truck unloading operation may be performed by means of a conventional pair of tongs generally denoted 100 and movable in a crossbar or traverse 101. As shown in FIG. 3, the tongs 100 are adapted to stack the shaped slabs 28 one above the other end thereafter transfer them to a receiving board 102 located at one side of the station. From here the stack of slabs is transferred by means of a hydraulic device 104.

The plant described hereinbefore includes finally an electric-hydraulic system operating in a manner known per se for automatic drive and regulation of the plant so as to cause it to operate substantially in the following manner from a starting position assumed to be that all of the pairs of rails of the hardening chamber are fully occupied by trucks 26 and that their load of shaped slabs and the condition at the loading station is that which is shown in FIG. 2.

The shaped slabs 28 are advanced along the bench 44 from the slab shaping machine not shown and are transferred upon a truck 26 which stands ready on the bench 43. Simultaneously with this transfer the hydraulically operated elevator 48 lifts another truck 26 from on the return carriage 50 up to the same level as the truck on bench 43. When the carriage on the bench 43 has been filled with shaped slabs the hydraulic cylinder 82 of the slide 70 receives pressure fluid and causes the slide to move to the right as illustrated in FIGS. 1 and 2. When slide 70 moves, the front and rear stops 80 engage the rear frame portions of the two trucks and the loaded truck is transferred to the elevator 32 of the hardening chamber through the wall opening 30 simultaneously with the other truck being brought into position of readiness on the bench 43. By determining the spacing between the slabs 28 on the bench 44 the operation described can be conducted undisturbed as will be understood easily.

When the elevator 32 has received the truck 26 in the assumed starting position a hydraulic feeding device mounted on the elevator receives pressure fluid and causes the truck to be transferred on an unchanged level over to the lowest of the stories formed by the pairs of rails 22 in the hardening chamber 12. This story is, however, according to the assumption fully occupied by trucks and as a consequence of the transfer of the truck just mentioned, the rearmost truck on the story is pushed off of the rails onto the other elevator 34 standing here ready. Upon completed transfer of said truck onto the elevator 34 the hydraulic device 88 thereof receives pressure fluid and the truck is advanced further at the same level to the discharge bed formed by the rails 90 (FIG. 3). In this position of the truck the tongs 100 are operated and the slabs 28 are lifted in stacked condition over to the feed board 102 for further transfer by means of the band 106 to a storage space, for example.

During the time the operation described hereinbefore has taken place the return carriage 50 has been displaced from the position shown in the FIGS. 1 and 2 to the receiving position at the discharge station shown in FIG. 3. In this receiving position the hydraulic device 98 of the discharge station receives pressure fluid and the inner ends of the rails 90 are lowered so as to cause the truck 26 to rest with its side portions on the support rails 68 of the return carriage 50. Hereby the motor 66 of the return carriage gets an impulse starting the return movement of the carriage to the loading station (FIG. 2).

At the loading station the hydraulic elevator 48 has by this time been lowered to the position shown on the left-hand part of FIG. 1, where the transverse rails 58 of the elevator are located on such a level that the roller members 24 of the truck 26 now arriving from the discharge station will be stopped immediately above the rails. This will cause the truck, when the elevator performs its lifting movement, to occupy the position shown in FIG. 2 which means the position of readiness for a new cycle of operation. In this connection it should be mentioned that the truck 26, as will be easily understood, continuously carries the plates 46 forming support for the shaped slabs until the final discharge step. These plates remain on the truck until the position on the feed bench 43 is reached, where the plates are pushed off by a fresh supply of shaped slabs from the bench 44 and received in a plate collecting device not shown in the drawings for return to the slab shaping machine.

A new cycle of operation is then completed which differs from the cycle described earlier only in that the truck 26 which is transferred to the elevator 32 of the hardening chamber is lifted by said elevator to the next higher located story formed by rails 22 and there is advanced onto the rails of said story simultaneously with a truck standing at the opposite end of the story being transferred onto the discharge elevator 34 which by being synchronized with the first mentioned elevator 32 has been conducted upwards to the receiving position at the story now in consideration.

Every new cycle of operation includes that one truck 26 is introduced onto and a second truck is discharged from a story located at an each time higher level until the uppermost story has been reached when the next following cycle will become the same as the first described one, etc., so as to create a continuous hardening cycle by which each finished slab has been subjected to a hardening process of substantially the same duration.

In the embodiment illustrated in the accompanying drawings of the hardening plant the front and rear wall 16 and 18, respectively of the chamber are constructed

of rigid walls with base openings **30** so that the hardening chamber above said openings constitutes a closed space permitting the utilization of the heat as well as the moisture produced during the hardening operation. A corresponding possibility should of course be obtained if one or both of the elevators **32**, **34** were positioned outside the hardening chamber **12** and the walls **16** and/or **18** were formed as shutter walls with intake and discharge openings **30** displaceable at different levels corresponding to the various stories of pairs of rails in the hardening chamber.

In addition to the advantages set forth earlier, the construction of the hardening chamber described hereinbefore prevents drafts or other injurious air currents which are developed in the types of hardening chambers hitherto known.

While one more or less specific embodiment of the invention has been shown and described, it is to be understood that this is for purpose of illustration only and that the invention is not to be limited thereby, but its scope is to be determined by the appended claims.

What we claim is:

1. A plant for treating shaped slabs comprising a treating chamber, a plurality of spaced pairs of rack means mounted within said treating chamber, said treating chamber having at least one opening in each end of a size to accommodate a truck means and a slab to be treated, a pair of elevators within said treating chamber with one elevator located adjacent each end thereof, means for synchronizing the movement of said elevators for simultaneous operation to substantially the same level, a loading station located exteriorly of said treating chamber adjacent to one end thereof, a discharge station located exteriorly of said treating chamber adjacent to the opposite end thereof, a plurality of truck means, means for locating one of said truck means in said loading station in a position to receive at least one shaped slab to be treated, means for moving said truck means with the shaped slab thereon onto one of said elevators, means for moving said truck means and slab onto a selected

pair of rack means, the moving of the truck means onto the rack means causing a second truck means to be discharged onto the other of said elevators when said rack means is full, means for discharging said second truck means onto said discharge station, means in said discharge station for unloading said truck means, and means for returning the unloaded truck means from the discharge station to the loading station, whereby shaped slabs can be continuously introduced into and discharged from said treating chamber during the treating process and each of said shaped slabs will be treated for substantially the same length of time.

2. The plant of claim **1** in which each truck means has a frame with lateral portions having bearings forming roller members.

3. The plant of claim **1** including a hydraulically operated pair of tongs mounted on said discharge station and providing means for removing the slabs carried by the truck and transferring them to a conveyor device.

4. The plant of claim **3**, characterized by the said pair of tongs being operable so as to stack the slabs removed from the trucks above one another to a pile prior to the transfer of said slabs to the conveyor device.

References Cited

UNITED STATES PATENTS

371,785	10/1887	Plummer	214—16.4
1,490,235	4/1924	Smith et al.	214—6
2,095,151	10/1937	O'Connor et al.	214—16.4
2,502,940	4/1950	Gelbman	214—16.4
2,864,515	12/1958	Marshall	214—16.1
2,961,810	11/1960	Johnson et al.	214—6
2,997,187	8/1961	Burt.	
3,036,690	5/1962	Kirchhofer	214—16.4

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