March 19, 1940. W. E. S. STRONG 2,193,847

METHOD OF PRODUCING MOLDED CONCRETE PRODUCTS AND APPARATUS THEREFOR

Filed Dec. 10, 1936 2 Sheets-Sheet 1

Fig. 1.

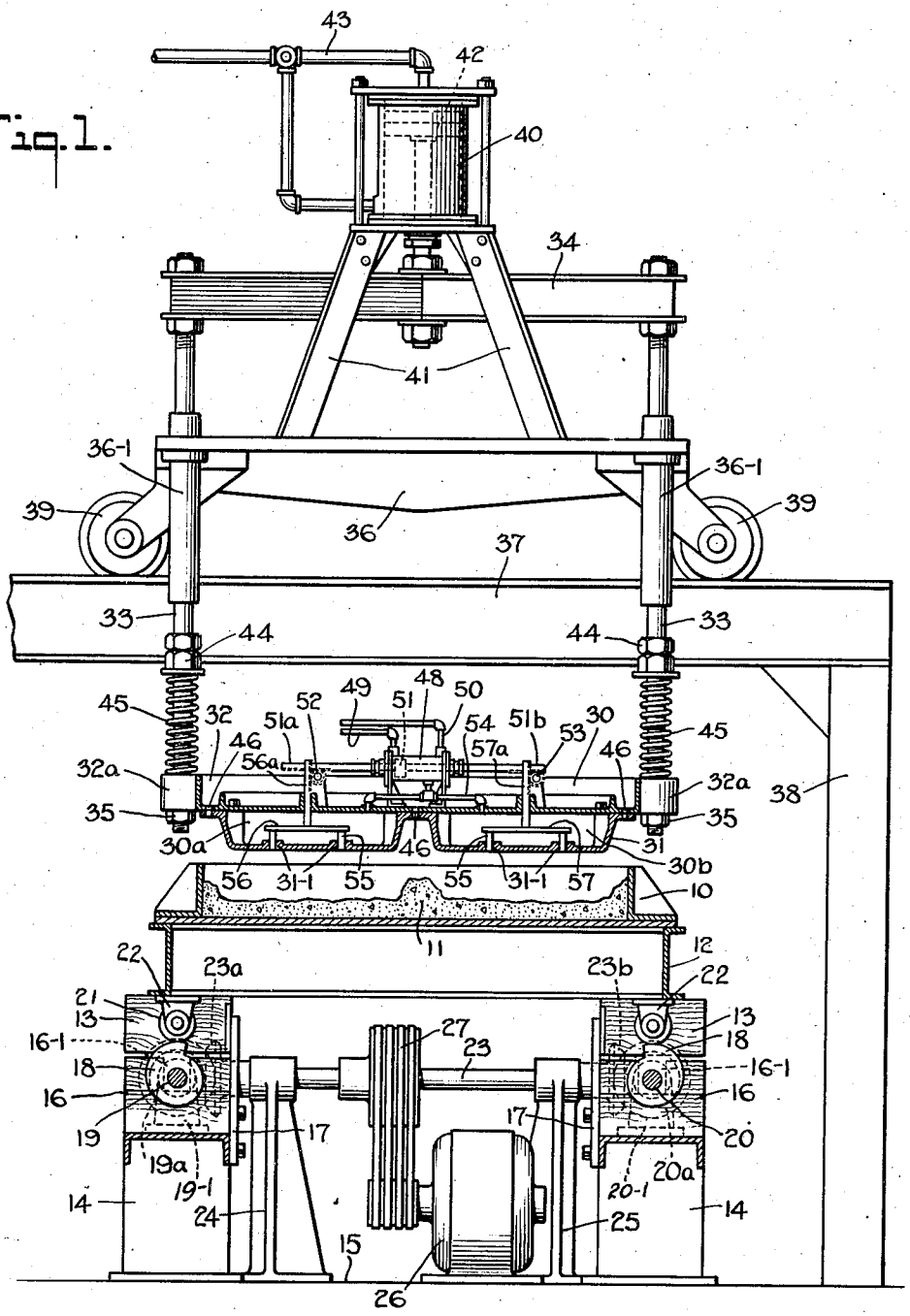

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Fig. 2.

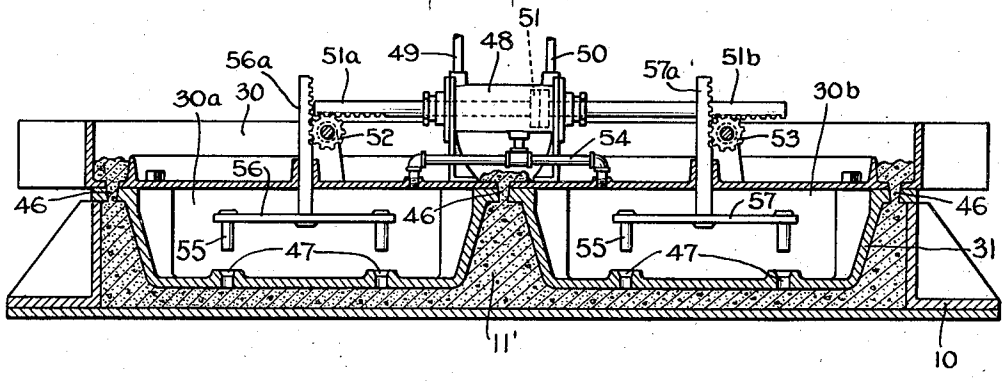


Fig. 3.

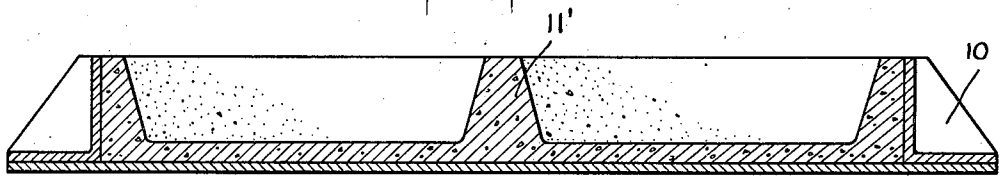


Fig. 4.

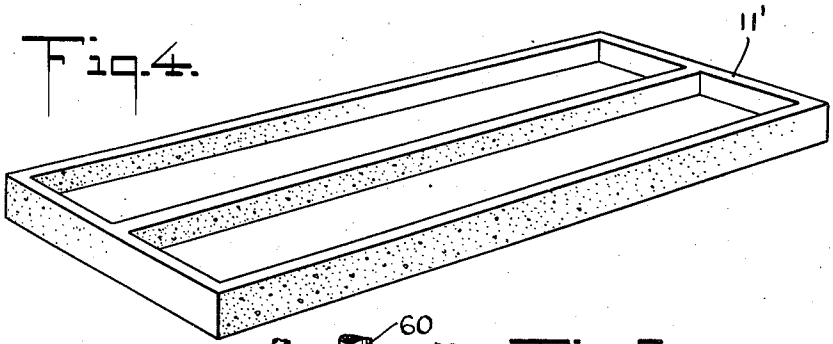
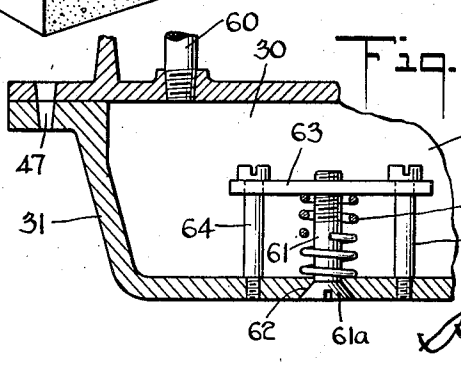


Fig. 5.



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METHOD OF PRODUCING MOLDED CONCRETE PRODUCTS AND APPARATUS THEREFOR

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Application December 10, 1936, Serial No. 115,155

3 Claims. (Cl. 25—41)

This invention relates to a method of producing molded products from concrete or a like cementitious plastic material, and is particularly applicable to the production of units, such as wall slabs, floor slabs, roof slabs, etc. for use, primarily, in building construction. The invention relates also to apparatus for accomplishing the method.

Building units, preferably of concrete, resulting from the practice of the method are characterized by an entire superficial area substantially surface finished, by an exceedingly dense homogeneous surface structure at the particular faces intended for exposure to weathering or wear, by a solid and closely knit body structure throughout, and by strength exceeding that of other types of cast or so called "vibrated" concrete.

The method of the invention involves, fundamentally, jarring of the concrete simultaneously with compression thereof within an enclosing forming chamber, whereby the desired physical characteristics are imparted to the resulting product. An important step of the method resides in the conducting of a limited quantity of the plastic cementitious material from confinement during the molding thereof.

According to preferred practice, a mold-box for retaining a charge of the plastic concrete is utilized as one part of the mold, the charge of concrete being preferably placed in the mold-box according to the general configuration of the resulting product. A forming cover is provided for the mold-box for function as the other part of the mold, and is positioned under pressure over the charge of concrete while the mold-box is being jarred, preferably in a substantially vertical plane, provision being made for the escape of surplus concrete from the confines of the cooperating mold-box and forming cover. It should be noted that the charge of plastic concrete is, in material content, sufficiently greater than the material content of the resulting molded product to insure complete filling of the molding enclosure formed by the mold box and the cooperating forming cover. The provision for escape of surplus plastic concrete during the molding process permits of the use of this charge of excessive material content.

After sufficient time has elapsed for the plastic concrete to adapt itself to the exact configuration of the mold and to obtain the desired physical treatment, usually the time period required is not more than a couple of minutes, the jarring action on the mold-box and the pressure on the forming cover are stopped, and the forming cover is removed from the mold-box.

Because of the combined jarring action and compression, all air between the form surfaces of the mold and the plastic concrete is normally driven out, resulting in the creation of a vacuum seal thereat. According to one phase of the invention provision is made for breaking the vacuum seal. This is preferably accomplished by the introduction of compressed air between the surfaces concerned.

While the present method is hereinafter described and claimed with particular emphasis on concrete as the material operated upon, it is clearly within the scope of this invention to operate upon any plastic material if advantages are to be had thereby.

In the drawings:

Fig. 1 illustrates, in front elevation a preferred embodiment of apparatus for practicing the present method according to an advantageous procedure. The mold-box assembly and forming cover are illustrated in vertical section taken adjacent the nearer end;

Fig. 2 represents an enlarged detail view of the mold assembly as illustrated in Fig. 1, at the completion of a molding operation and just prior to removal of the forming cover from the molded product. One embodiment of means for breaking the vacuum seal is particularly illustrated;

Fig. 3 is a view corresponding to Fig. 2 but illustrating the molded product after removal of the forming cover;

Fig. 4 illustrates in perspective a type of building unit produced by the apparatus of the prior figures;

Fig. 5 represents an enlarged fragmentary detail in vertical section of another embodiment of means for controlling introduction of compressed air for breaking the vacuum seal.

Referring to the drawings: at 10, see especially Fig. 1, is illustrated a mold-box of any suitable type for retaining a charge 11 of concrete or like material. The charge 11 is preferably placed in the mold-box according to the general configuration of the product to be formed, and has a material content sufficiently in excess of the material content of the resulting molded product to insure complete filling of the molding enclosure formed by the mold box and its cooperating forming cover.

The mold-box 10 is mounted for jarring action in substantially a vertical plane, and for this purpose is removably secured (by any well known

means, not shown,) to a box-frame 12 rigidly secured at its corners to respective buffer blocks 13. The mold-box assembly rests on respective foundation piers 14, rising from a floor or other supporting structure 15 and serving to support the box-frame 12 at its corners through the medium of respective buffer blocks 16 cooperating with the respective buffer blocks 13. Guide plates 17 extend, respectively, between each set of cooperating buffer blocks 13 and 16 for maintaining the jarring action of the mold-box 10 in substantially a vertical plane.

The jarring action is advantageously produced by means of spiral cams 18 mounted on the shafts 19 and 20, respectively. The shafts 19 and 20 are journaled at each end between bearing standards, see 19—1 and 20—1, respectively, and extend longitudinally between the buffer blocks 16 through suitably provided apertures 16—1. The bearing standards and buffer blocks provide in effect, a base for the mounting of the mold blocks. The respective spiral cams 18 cooperate with respective rollers 21 journaled in respective brackets 22 which depend rigidly from the underside of box-frame 12. There is preferably a spiral cam 18 and cooperating roller 21 located adjacent each of the sets of buffer blocks 13 and 16 for affording uniformity of jarring action throughout the extent of the mold-box.

The shafts 19 and 20, respectively, may be rotated by means of a shaft 23 extending latitudinally between the first mentioned shafts, and engaging therewith; the engagement being had by means of miter gears 23*a* and 23*b* rigidly carried by the ends of shaft 23, meshing, respectively, with the miter gears 19*a* and 20*a* carried by ends of the shafts 19 and 20, respectively. The shaft 23 may be journaled in the bearing standards 24 and 25, and may be actuated by any suitable means such as the electric motor 26 connected therewith by the flexible belting, as indicated generally at 27.

Rotation of the shaft 23 by the motor 26 effects rotation of the longitudinal shafts 19 and 20 and therewith the cams 18. The cams serve to alternately raise and let drop freely the mold-box 10. The downstroke of the reciprocation, represented by the alternate raising and free drop of the mold-box 10, is halted abruptly when the respective buffer blocks 13 and 16 meet. The reciprocation may be of any suitable frequency; between 400 and 600 strokes per minute is preferred for best practical results.

A forming cover, indicated generally at 30, is provided for cooperation with the mold-box 10 during the molding operation. The forming cover 30 may comprise a form plate 31 having its form surfaces die configurated according to the configuration desired for the molded product. In the present case the form plate 31 is provided with recesses on its upper surface and is secured to a cover plate 32 in an air-tight manner to produce sealed chambers 30*a* and 30*b*, utilized as hereinafter disclosed in connection with the breaking of the vacuum seal between the form surfaces and the yet plastic concrete.

For support of the forming cover 30, the supporting rods 33, depending from the ends of an X shaped floating frame 34, are slidably and adjustably secured in ears 32*a*, extending rigidly from near the corners of cover plate 32, by means of the nuts 35 cooperating with threaded ends of the stated supporting rods.

The floating frame 34 is mounted for up and down movement in a carriage 36, the supporting rods 33 passing through the sleeves 36—1 in sliding relationship therewith. The carriage 36 may be mounted for horizontal movement on the rails 37 of a stationary track structure 38 by means of the wheels 39.

A cylinder, indicated generally at 40, is rigidly mounted centrally of the carriage 36 as by means of the leg members 41. A piston 42, operable in the cylinder 40, is rigidly secured at its end to the midpoint of the floating frame 34; its operation within the cylinder 40 is controlled by compressed air admitted through the piping 43. Movement of the piston 42 effects up and down movement of the forming cover 30 relative to the mold-box 10.

The supporting rods 33 have adjustably secured thereon the nut assemblies 44 spaced apart from the nuts 35 sufficiently to allow the reception of coil springs 45 therebetween. Such coil springs serve to absorb the shock of the jarring action transmitted from the mold-box. Adjustment of the respective nuts 35 or 44 determines the degree of compression of the coil springs 45.

The piston 42, during its down stroke, exerts a constantly advancing pressure on the forming cover; the transmission of the pressure through the coil springs is such, however, as to absorb the jarring action of the mold-box as the forming cover is placed.

For carrying out the desired molding operation, the carriage 36 is positioned directly above the mold-box 10, and suitable control of admission of air to the cylinder 40 is effected to lower the forming cover 30 to placement over the mold-box. When the forming cover 30 is approximately in final placement, jarring action of the mold-box is effected through the mechanism afore described. Pressure of the forming cover into final placement is accomplished simultaneously with the jarring of the mold-box, thus insuring positive flow of the plastic concrete into full conformity with the mold, and the attainment of desired physical characteristics for the molded concrete.

For conducting surplus concrete from the confines of the mold during the molding operation, holes 46 may be provided at appropriately spaced locations along the length of the forming cover 30, note particularly Fig. 2.

The simultaneous jarring and compression of the plastic concrete in the mold normally produces a vacuum seal between the form surfaces of the form plate 31 and the yet plastic, molded product. To remove the forming cover without damage to the yet plastic product, it is necessary that the vacuum seal be broken.

For accomplishing break of the vacuum seal, compressed air is advantageously introduced between the surfaces concerned before removal of the forming cover of the mold.

A preferred type of mechanism for accomplishing introduction of compressed air as afore described is illustrated in Figs. 1 and 2.

A control-valve cylinder 48 is mounted on the cover plate 32 and is provided at its ends with the air supply piping indicated at 49 and 50, for the admission of compressed air to the interior of the cylinder. A reciprocating piston 51 having the rack ends 51*a* and 51*b* extending from the cylinder and engaging the pinions 52 and 53 respectively, is mounted for reciprocation in the cylinder 48. Passage of air from the control-valve cylinder 48, intermediate its ends, into the sealed chambers 30*a* and 30*b* is provided for by

means of the piping 54, and is controlled by the piston 51.

Passages 31—1 are provided at appropriately spaced locations in the walls of the form plate 31, communicating with the sealed chambers 30a and 30b of the forming cover 30 and opening at the form surfaces of the form plate.

Adapted to cooperate with the passages 31—1 are closure plugs 55 mounted at suitable spaced locations on the carriers 56 and 57 respectively. Centrally of the carriers 56 and 57, the racks 56a and 57a extend upwardly for engagement with the pinions 52 and 53 respectively.

By the operation of the above described mechanism, the carriers 56 and 57 are raised, thus unplugging the passages 31—1 coincidentally with the admission of compressed air to the sealed chambers 30a and 30b. Introduction of compressed air between the form surfaces of the forming plate 31 and the yet plastic, though molded concrete is thus accomplished to break the vacuum seal therebetween. Hence, the forming cover 30 may be lifted from operative position on the mold-box 10 without damage to the molded product represented at 11', Figs. 3 and 4.

During the actual molding operation the passages 47 are closed tightly by the closure plugs 55, precluding entry of plastic concrete to the sealed chambers 30a and 30b.

Another embodiment of means for introducing air between the form surfaces of the forming plate 31 and the yet plastic, molded concrete is illustrated fragmentarily in Fig. 5. Any well-known valve means may be substituted for the valve cylinder 48 in controlling admission of air through the piping 60 into the sealed chambers 30a and 30b. The passage of air to the desired locations between the aforementioned surfaces for breaking the vacuum seal thereat, is accomplished by means of check valves positioned at spaced locations along the bottom walls of the forming plate 31.

Each check valve may comprise a machine screw 61 having its head 61a fitted snugly into the passage 62 between the particular sealed chambers 30a or 30b concerned and the form surfaces of the plate 31, and having its screw-end threaded into a plate 63 slidably mounted upon the guide rods 64 and 65. A coil spring 66 interposed between the plate 63 and the lower wall of the form plate 31 insures positive closure of the passage 62 during the molding operation. When the forming cover is to be removed from the yet plastic, molded product, compressed air admitted through the piping 60 depresses the plate 63 and effects opening of the passage 62, for accomplishing breaking of the vacuum seal.

The entire molding operation inclusive of proper filling of the mold-box 10, simultaneous jarring and compression of the plastic concrete 11, break of the vacuum seal between forming cover 30 and the yet plastic, molded product 11', and removal of the forming cover 30 from the mold-box 10 and from the location of operation may be accomplished automatically in timed sequence for rapid production of molded concrete building units.

Whereas this invention has been described with respect to preferred practice of the method and preferred embodiments of the apparatus, it is to be distinctly understood that many changes may be made from time to time as the art progresses without departing from the spirit of the invention as defined in the following claims.

I claim:

1. A method of producing molded products of substantially slab formation with projections extending from a face thereof which comprises, filling an open mold-box, according to the general configuration of the said face, with a mass of plastic cementitious material whose material content is greater than the material content of the resulting product; closing the said open mold-box with a forming cover which is die configurated on its underside to form the desired projections of the said face of the product, and simultaneously jarring the mold-box in strokes alternately toward and away from the said forming cover; conducting the surplus plastic cementitious material from the mold-box during placement of said forming cover; and limiting the placement of said forming cover to a predetermined closing position with respect to said mold-box.

2. A method of forming molded products from plastic cementitious material comprising confining the material to be molded on all sides except the top; subjecting the top of the said material to the pressure of a descending forming element, and simultaneously jarring the said material; conducting a limited quantity of the said material from confinement during the pressing of the forming element onto the said material; and stopping the descent of said forming element after it has descended a predetermined distance.

3. Apparatus for producing molded products including in combination, an open mold-box; a mounting for said mold-box comprising a base, and a plurality of cams spaced apart and rotatably mounted on said base in such manner as to support the said mold-box substantially symmetrically about its periphery, said cams being operable alternately to raise the mold-box substantially vertically from the said base and to let it freely drop back thereonto; a forming cover for said mold-box, said forming cover being adapted to rest upon the walls of said mold-box for resisting pressure toward the interior thereof; mechanical means for exerting a constantly advancing pressure on said forming cover during placement thereof on said mold-box; spring elements connecting said mechanical means with said forming cover at spaced locations thereof substantially coinciding with the locations of said cams; openings through said forming cover affording passage for outward flow of surplus material from within the confines of said mold-box and said forming cover during placement of the latter; and means for rotating said cams.

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