Dec. 15, 1925. 1,566,263

A. G. W. WEDBERG

APPARATUS FOR MOLDING HOLLOW CONCRETE WALLS

Original Filed May 3, 1920 2 Sheets-Sheet 1

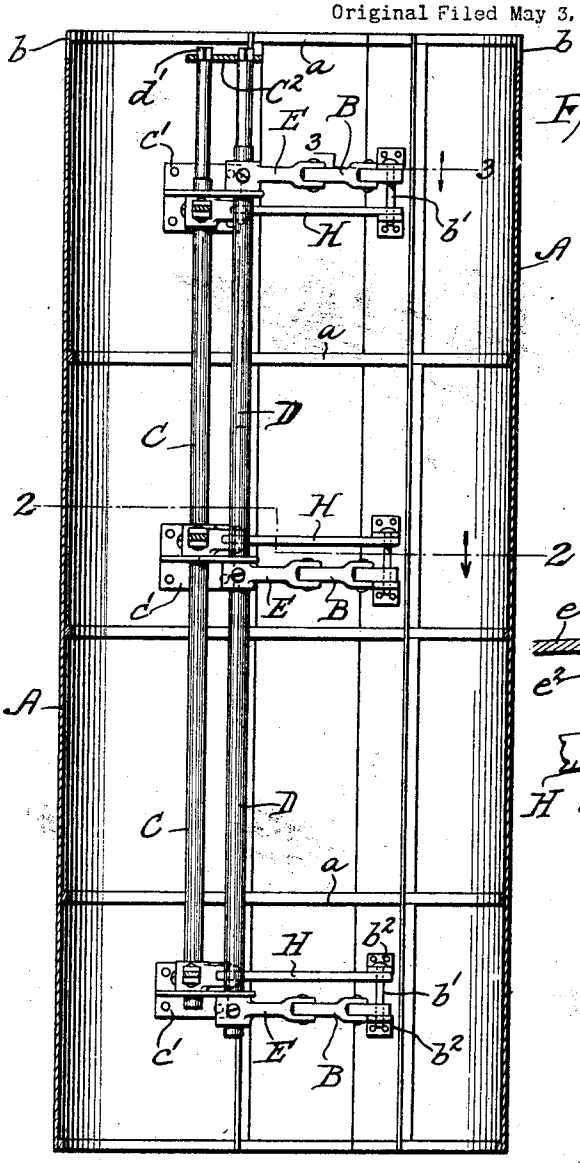


Fig. 1.

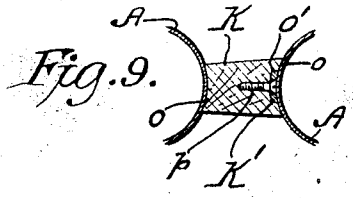


Fig. 9.

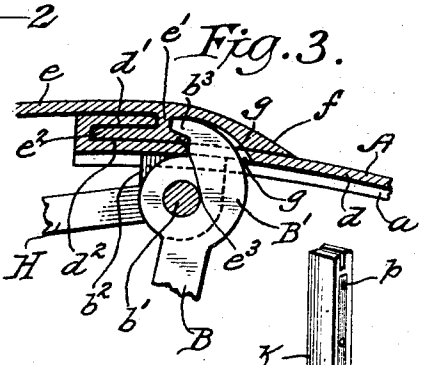


Fig. 3.

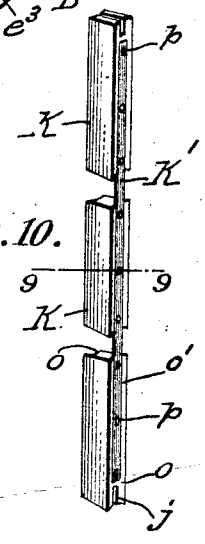


Fig. 10.

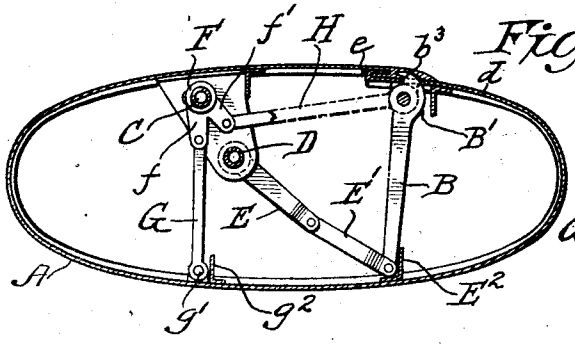


Fig. 2.

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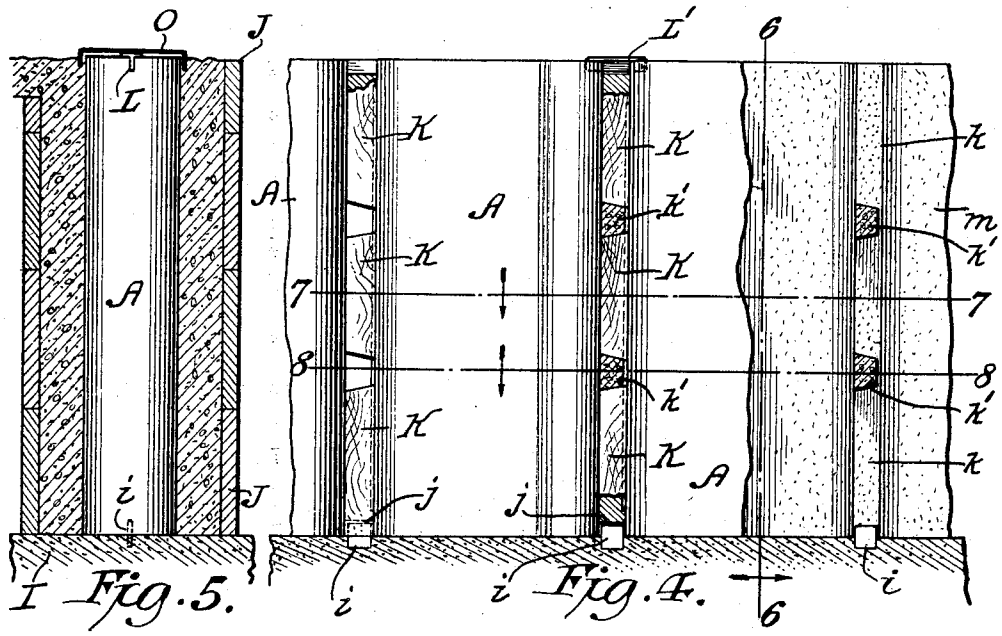
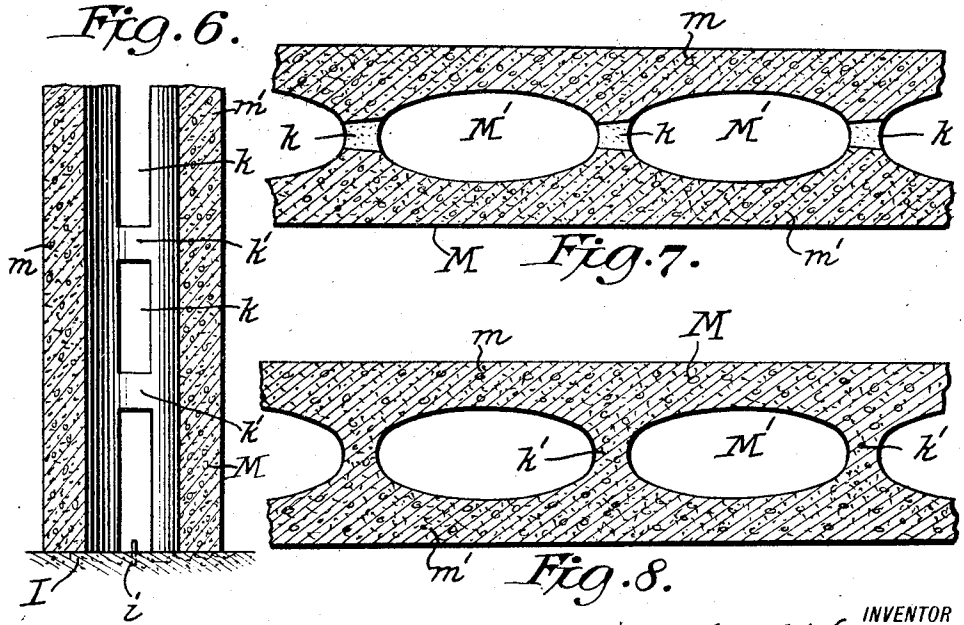


Fig. 6.



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1,566,263

UNITED STATES PATENT OFFICE.

AXEL G. W. WEDBERG, OF FLORAL PARK, LONG ISLAND, NEW YORK.

APPARATUS FOR MOLDING HOLLOW CONCRETE WALLS.

Application filed May 3, 1920, Serial No. 378,533. Renewed November 22, 1921. Serial No. 517,152.

To all whom it may concern:

Be it known that I, AXEL G. W. WEDBERG, a subject of Sweden, residing at Floral Park, Long Island, State of New York, have invented a certain new and useful Apparatus for Molding Hollow Concrete Walls, of which the following is a specification.

This invention is a process of and apparatus for molding hollow concrete walls, the object being primarily to economically produce a monolithic structure characterized by dead air spaces or chambers for heat and cold insulation purposes and wherein certain strata of concrete at the inner surface and the outer surface of the wall are joined in such a way as to add stability to the wall and at the same time minimize the filtration of moisture through the material composing the wall.

In carrying into practice the process of this invention, there is utilized a plurality of collapsible forms assembled in a certain order within a space bounded by an exterior form, said collapsible forms being positioned to leave spaces between the margins of the collpasible forms and within the exterior form, which spaces are charged with concrete material in such manner as to result in the production of an inner concrete strata and an outer concrete strata, the two strata being joined, and the whole producing a section of a wall of definite thickness, height and length. After molding such a wall section, the interior forms are collapsed so as to free or release the same from the molded wall section, and they are raised to definite positions and again assembled so that a further section of the wall is molded upon the wall section first molded, and these operations are repeated until the several walls are completed.

According to the mode of procedure, I employ spacers for separating the collapsible forms, said spacers being positioned intermediate the edge portions of the forms and said spacers being separated relatively to each other and mechanically connected for handling as a unit, said spacers operating to mold webs which join the inner and outer strata of the wall. These spacers are intended to be displaced after the operation of molding the wall shall have been completed, and this results in concrete webs of narrow cross section, the same being advantageous for the reason that the quantity of concrete in the webs is minimized so as to reduce the filtration of moisture through the wall in rainy or damp weather.

Another part of the invention consists in the collapsible form the body of which is a continuous sheet, or substantially continuous, sheet of metal of a desired cross section, and with the marginal portions in overlapping relation. Within the space bounded by the metal body is encased an operating mechanism embodying a plurality of rock shafts, certain levers, and links, so connected and arranged as to rigidly lock the metallic body when in operative position, and which mechanism can be operated easily so as to slide one marginal portion of the body upon the other marginal portion, thereby reducing the cross sectional dimensions of the form as an entirety and permitting it to be released from surface contact with the molded wall, to the end that said form may be withdrawn from the wall or shifted therein as the work of molding the wall may require.

Other purposes and functions of the invention will appear from the following description taken in connection with the drawings, wherein—

Figure 1 is a vertical sectional elevation of a collapsible form embodying this invention.

Figure 2 is a sectional plan view thereof in the plane of the dotted line 2—2 of Figure 1.

Figure 3 is a sectional plan view on the line 3—3 of Figure 1 of a part of the collapsible form at the overlapping part of its metal body, showing on an enlarged scale the locking means for said lapping part thereof.

Figure 4 is a sectional side elevation illustrating at different sections the formation of a hollow concrete wall as the product of the method in accordance with this invention.

Figure 5 is a cross section showing the collapsible form within an exterior form for molding the concrete wall.

Figure 6 is a vertical cross section on the line 6—6 of Figure 4 showing the completed wall.

Figures 7 and 8 are horizontal sectional views of the completed wall in the planes of the dotted lines 7—7 and 8—8 respectively of Figure 4.

Figure 9 is a horizontal detail section illustrating the relation of a spacer to two adjacent collapsible forms.

Figure 10 is a detail perspective view of a series of the connected spacers.

In carrying my invention into practice, it is preferred to employ collapsible forms, a preferred construction being shown in Figures 1, 2 and 3. Said form embodies a continuous shell or casing A, composed preferably of a continuous, or substantially continuous, metal sheet, the same being of a length suitable for the purpose and of a desired cross section, such as the oval cross section illustrated in Figure 2. The shell is stiffened by the employment of a number of metallic straps, *a*, positioned internally and at suitable intervals, said straps being suitably affixed to the metal body. The shell is open at the top and bottom and in the top edge thereof is provided a plurality of notches *b*. The marginal edges of the shell are positioned in lapping contact as shown in Figure 2 and more clearly indicated in Figure 3, the said lapping edges being formed in a particular way to provide for the required collapsing of the form in order to free it from surface contact with the molded concrete. As shown in Figure 3, the edge *d* is folded or doubled backwardly upon itself so as to produce an over-hanging lip *d'* with an intermediate space d^2, whereas the other margin or edge *e* of the metal shell is formed with a rib *e*, the latter being provided with a web e^2 and with a lip e^3. The ribbed part *e'* of the margin *e* extends inwardly so as to position the web e^2 in the space d^2 between the overhanging lip *d'* and the marginal edge *d*, thus affording the desired overlap of one part *e* to the other part *d* of the shell, the construction and arrangement being such as to allow the one part to have a limited sliding movement relatively to the other part provided said overlapping parts are free from restraint. The marginal part *e* is extended well beyond the web *e'* so as to result in a nose *f* which is tapering and has a desired close contact with the marginal part *d*, and in this marginal part *d* adjacent the line of overlap is a plurality of slots *g*, the latter accommodating the cam heads B' of a plurality of locking levers B. These levers are positioned interiorly of the collapsible form, at suitable intervals in the length thereof, each lever being pivoted on a fulcrum bolt *b'* supported in brackets b^2 fixed to the inside of the sheet metal body A. The cam head B' of each lever terminates in a hook b^3 which, in the operative position of the lever shown in Figures 2 and 3, is forced through the slot *g*, so that the hook is in contact with the lip e^3 of marginal part *e*, and as a result of pivoting the lever to the marginal part *d*, said lever B and its cam head B' operates to lock the two parts *d*, *e*, from sliding movement relatively to each other.

The levers B form parts of a system of locking devices positioned interiorly of the metal shell for internally stiffening said shell so as to resist the compression of the concrete material in the process of molding the hollow wall. Associated with the system of locking devices just referred to are a plurality of rock shafts C, D, independent of each other and mounted for rotative movement in appropriate brackets, *c'*, fixed at desired intervals to the interior of the shell A. Said rock shafts extend lengthwise of the shell, for nearly the length thereof, and at the upper end of each shaft it is provided with means, such as the polygonal stud *d'*, and with a crank C^2, for the purpose of applying power to said shafts, and each of them, so as to rotate the shaft C or D in the bearings. As shown in Figure 1, the crank C^2 it fitted to the studs *d'* of the two shafts, and remains applied to said shafts below the top edge of the shell, so as to preclude rotative movement of said shafts.

The rock shaft D is provided at intervals corresponding to the spacing apart of levers B, with crank arms E, to the outer ends of which are pivoted links E', the other ends of which links are pivoted to the outer ends of said levers B.

The levers B and links E' are adapted to have thrust bearing contact with a ledge afforded by an angle iron E^2 attached to the inside of the shell A, and as the lever B is pivoted at *b'* to one side of the shell, whereas the thrust bearing afforded by the angle iron E^2 is on the opposite side of the shell, the levers B, cranks E, and links E' afford means for stiffening the shell internally thereof.

The other rock shaft C is provided at intervals with double cranks F, each having two arms *f f'*. To one arm *f* of each double crank F is pivoted one end of a lever G, the other end of which is pivoted at *g'* to one side of the shell, said pivoted end of the lever having in the operative position shown in Figure 2 a thrust bearing against an angle iron g^2 fixedly attached to the inside of the shell. To the other arm *f'* of each double crank F is pivoted one end of a link H, the other end of which link is mounted on the bolt *b'* of one lever B. As will be noted by reference to Figure 2, the rock shaft C is mounted on the shell at one side thereof, whereas the levers G are pivoted at *g'* to the opposite side of the shell, and, further, said rock shaft C is connected by the levers G and the links H with the opposite side wall of the shell so that the levers B, E, the links E' G and H and the two rock shafts constitute a plurality of devices distributed or spaced within the shell for amply stiffening the latter internally thereof

against the compressure effect of the concrete material in the process of molding the hollow wall.

The rock shafts and the parts associated therewith afford means for quickly and easily releasing the form so as to secure a relative sliding movement of one marginal part *e* to the other marginal part *d*, and to attain this function the operator rotates shaft D so as to break the toggle afforded by arms E, links E′ and levers B, the effect of which is to withdraw the cam heads B′ from the lip e^3, and thereafter the operator applies the crank to the shaft C and rotates the latter, thus releasing the levers G and links H from the locking effect of the toggle G H. The rotation of the shafts C D successively and the operation of the parts associated therewith imparts sliding movement of the marginal part *e* to the other corresponding part *d* of the shell A, whereby said shell is so reduced in its cross sectional dimension as to release said shell from surface contact from the molded material.

A desired number of the collapsible forms heretofore described are utilized in the process of molding a hollow wall according to this invention and substantially as depicted in Figures 4 and 8 inclusive of the drawings.

According to this part of the invention, a foundation I is first provided in any way known to the art, it being usual to mold the foundation I from concrete material in a well known manner. During the installation of the concrete foundation, it is preferred to attach to the top edge thereof a plurality of narrow centering members, *i*, the same being shown in Figures 4, 5 and 6 as thin metal strips, the said strips being partially embedded in the concrete material of the foundation so as to allow the top edge of the centering strips to project for an appreciable distance above the top edge of said foundation I, said strips *i* being positioned substantially centrally with reference to the top face of said foundation, see Figure 4.

A desired number of collapsible forms, each of the character heretofore described, are positioned within an external mold, J, the same being constructed as usual in the art of molding concrete.

As shown, the external mold extends upwardly from the foundation to a suitable height, equal say to the height of the first story of the building to be erected, and, further, said external mold is equal in length to the foundation, although the dimensions are not material.

Positioned within the external mold J are a desired number of the collapsible forms A, the same resting upon the foundation.

The collapsible forms are spaced relatively to each other, and are spaced, also, with respect to the side walls of the external mold, the effect of which spacing of the forms relatively to the external mold is to produce the external strata and the internal strata of concrete requisite for the production of the wall, whereas the spacing of the forms relatively to each other results in the molding of the concrete to produce bridge members, the latter operating to join the outer and inner strata of the concrete wall, see Figures 6, 7 and 8.

The spacing of the collapsible forms in the desired order within the external mold is effected by spacer blocks K interposed between the narrow portions of the oval forms, see Figure 9. A row of these spacer blocks is employed between two adjacent forms, see the left hand portion of Figure 4, and for convenience in handling the row of spacer blocks to enable the row to be positioned as a unit within the external mold, the blocks of said row are mechanically connected by a metal strip K′, see Figure 10.

The blocks are wedge shaped in cross section, each block being provided in its longitudinal faces with concave seats *o*, the curvature of which conforms to the radius of the metal shells A of the collapsible forms at the narrow end portions thereof, see Figure 9. The mechanical bond K′ in the form of a strip is fitted in a recess *o′* provided in one concave face of each block K, in order that said strip K′ may be arranged flush with the blocks of the row, and said blocks K and the bonding strip are fastened together by suitable means, such as by the screws *p*, whereby the blocks of each row are adapted to be handled as a unit.

The row of blocks K operate primarily to space the collapsible forms, and in addition to this function said blocks serve the purpose of retaining the forms in operative positions within the external mold, for the reason that the cross sectionally curved end portions of said forms are in contact with the concave seats *o* of said blocks K, see Figure 9, thus positioning the forms A accurately within the external mold prior to pouring and tamping the concrete.

The row of blocks are required to be positioned and retained accurately within the external mold J, and to this end the lowermost block of each row is provided with a notch or recess *j*, see Figures 4 and 10, which notch or recess receives the centering member *i* attached to the foundation I.

The vertical series of wedge shaped spacer blocks K occupies the space between the narrow portions of two adjacent forms A, the spacer blocks in each vertical series being separated with reference to each other, see Figures 4 and 10. The spacer blocks K are displaceable from the concrete material after molding and setting of such material, the effect of which is to leave slots *k* in the webs *k′* which join the inner strata *m* to the outer strata *m′* of the material comprising

the hollow wall M, see Figures 6 to 8 inclusive.

After placing the desired number of collapsible forms A in position within the external mold, and prior to dumping in the mixed concrete material, it is preferred to fixedly lock said collapsible forms in position by the employment of a top locking member, shown in Figures 4 and 5 as a T shaped bar L which is received in the notches *b* provided in the top edges of the collapsible forms. This locking member is flush with the top edges of the collapsible forms, or substantially so, and over each form A is positioned a cover O, the latter closing the chamber of said collapsible form so as to preclude the entry of concrete material into the form.

The operation of molding a hollow wall of concrete material is as follows:—After the centering strips *i* are molded in the foundation, the external mold J is erected thereon, and the desired number of collapsible forms A and the required rows of spacer blocks K, are placed within said external mold, said spacer blocks K being positioned between the forms A and in contact therewith so as to accurately locate the collapsible forms within the external mold and to retain said forms in operative positions within said mold J. The row of spacer blocks are located by the strips *i* on the foundation, and are retained in place by said strips *i*. The forms are locked together at their upper ends by the T bar L, and covers O are placed upon the upper ends of said forms A. Concrete material is now deposited in the mold so as to fill the spaces intervening the external mold and the forms A, and also to fill the spaces between the forms A except where the concrete is excluded by the spacing blocks K, the concrete being tamped as is usual. The concrete material is allowed to stand for a proper time in order that it may set and harden, after which the T bar L is removed and the forms A are collapsed, whereupon the external mold is removed, and thereupon said external mold and the forms A may be reset for molding the second story of the building according to the procedure herein disclosed; but prior to resetting the forms for molding the upper story or stories, keys L′ are set in the slots of the concrete, said keys serving the purpose of a support for the forms A when placed in position upon the part of the wall previously molded; the keys L′ being so positioned upon the concrete as to support the forms A in a manner to preclude the concrete poured for molding the upper story from passing below the keys and into the spaces M′ of the hollow wall.

The operation of molding a wall as herein described produces a hollow wall characterized by air spaces or chambers M′ and composed of an outer strata *m* and an inner strata *m′* of concrete material, which strata are joined by webs *k′*. When the wall is set and the forms A are withdrawn, the wedge shaped blocks K should be driven out of the concrete material in the web *k′*, such displacement of the blocks resulting in the formation of slots *k* in the connecting webs *k′* between the inner and outer strata of material. The presence of these slots is desirable for the reason that they reduce the volume of concrete material in the connecting webs *k*, thus minimizing the seepage of moisture through the concrete material in wet weather. It is not desired to restrict the invention to the use of displaceable spacer blocks between the collapsible forms for the reason that I may, in some cases, omit said spacer blocks and resort to the employment of metallic bridge pieces as the connecting means between the outer strata and the inner strata of the concrete material.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent is:

1. A collapsible form for molding hollow concrete walls embodying a body formed of a substantially continuous shell, and means on the edge portions of said body for limiting the movement of said edge portions so as to preclude a relative separating movement between said edge portions and the formation of an opening or space intermediate said edge portions, in combination with operating means for expanding and contracting said body.

2. A collapsible form for molding hollow concrete walls embodying a body, the margins of which are flanged and overlapped to preclude a relative separating movement and to secure a limited sliding movement by which the form is expanded and collapsed, in combination with operating means positioned internally of the body and including elements by which the lapped edges are restrained from sliding movement.

3. A collapsible form for molding hollow concrete walls embodying a body the margins of which are flanged and overlapped to preclude a relative separating movement and to secure a limited sliding movement by which the form is expanded and collapsed, in combination with a plurality of levers for locking said lapping edge portions against relative movement, and a system of toggle devices for internally stiffening the body and for actuating said levers to lock and release the lapped edge portions of the body.

4. A collapsible form for molding hollow concrete walls embodying a body the margins of which are flanged and overlapped to preclude a relative separating movement and to secure a limited sliding movement by

which the form is expanded and collapsed, in combination with a plurality of rock shafts, a plurality of locking elements operated by one of said shafts for locking and releasing the lapping edge portions of the body, and a plurality of toggle devices operated by the other rock shaft for expanding and contracting the body.

5. In an apparatus for molding hollow concrete walls, the combination with an external mold, and collapsible forms within said mold, of spacer elements free from mechanical attachment to said collapsible forms, said spacer elements being positioned for surface contact with adjacent collapsible forms.

6. In an apparatus for molding hollow concrete walls, the combination with an external mold, and a plurality of collapsible forms positioned within said mold, of a row of spacer elements in contact with said collapsible forms, the elements of said row being separated one from the other to allow the formation of bridge members in molding the wall from concrete.

7. In an apparatus for molding hollow concrete walls, the combination with an external mold, and a plurality of collapsible forms positioned within said mold, of a row of spacer elements positioned within the mold and in contact with adjacent forms, and means for mechanically connecting the spacer elements of said row.

8. In an apparatus for molding hollow concrete walls, the combination with an external mold, and a plurality of collapsible forms positioned within said mold, of a connected row of spacer elements, and means contacting with a spacer element of said row for initially locating the row of spacer elements with reference to the positions to be occupied by the collapsible forms.

9. In an apparatus for molding hollow concrete walls, the combination with an external mold, and a plurality of collapsible forms positioned within said mold, of a row of spacer elements positioned intermediate said forms, each spacer element being provided with a seat conforming to the cross sectional contour of the form and in contact therewith.

10. In an apparatus for molding hollow concrete walls, the combination with an external mold, and a plurality of collapsible forms positioned within said mold, of a row of spacer elements positioned within the mold and intermediate said forms, said spacer elements being in contact with said forms and operating to retain the latter within the mold during the period of charging said mold with concrete, and means for locating said row of spacer elements within said external mold.

11. In an apparatus for molding hollow concrete walls, the combination with an external mold, and collapsible forms positioned therein, of a spacer-locating strip arranged within the external mold at the bottom thereof, and a connected row of spacer blocks the lower one of which is notched for engagement with said spacer-locating strip, said spacer blocks contacting said collapsible forms.

12. In an apparatus for molding hollow concrete walls, the combination with an external mold, and a plurality of collapsible forms positioned within said mold, of a row of spacer elements separated one from the other, and a strip attached to said spacer elements and connecting the same to the end that the row of spacer elements are adapted to be handled as a unit.

13. In an apparatus for molding hollow concrete walls, the combination with an external mold, and a plurality of collapsible forms positioned within said mold, of a row of connected spacer blocks, the lower one of which is provided with a notch, and a fixed positioning member extending into said notch for locating the row of spacer blocks within the mold.

14. In an apparatus for molding hollow concrete walls, the combination with an external mold, and a plurality of collapsible forms positioned therein, of a row of spacer elements in contact with said forms and for locating the latter with reference to the external mold, and bars for locking the forms in position relatively to the external mold.

15. In an apparatus of the class described, the combination with an external mold, and a plurality of forms positioned therein to produce a mold space, of a spacer carrying member, means for locating said spacer carrying member in definite relation to said forms, and a plurality of spacer elements supported by said spacer carrying member.

16. In an apparatus of the class described, the combination with an external mold, and a plurality of forms positioned therein to produce a mold space, of web molding elements positioned intermediate said forms, said web molding elements being connected together in a relatively separated position by a strip to leave openings intermediate said web molding elements, said openings being in communication with the mold space.

17. In an apparatus of the class described, the combination with an external mold, and a plurality of forms positioned therein to produce a mold space, of web molding elements positioned intermediate said forms, said web molding elements being wedge shaped in cross section and being connected together in a relatively spaced position by a strip to leave openings intermediate said elements.

In testimony whereof, I have signed my name hereto this 28 day of April, 1920.

AXEL G. W. WEDBERG.