

G. S. MUMFORD.
METHOD OF MAKING CONCRETE WALLS.
APPLICATION FILED NOV. 12, 1912.

1,096,792.

Patented May 12, 1914

2 SHEETS—SHEET 2.

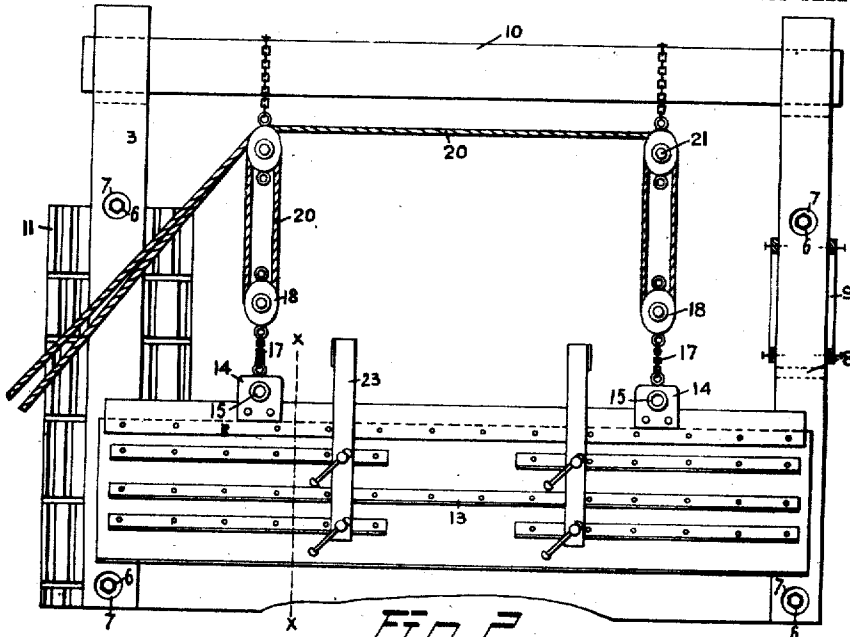


Fig. 2.

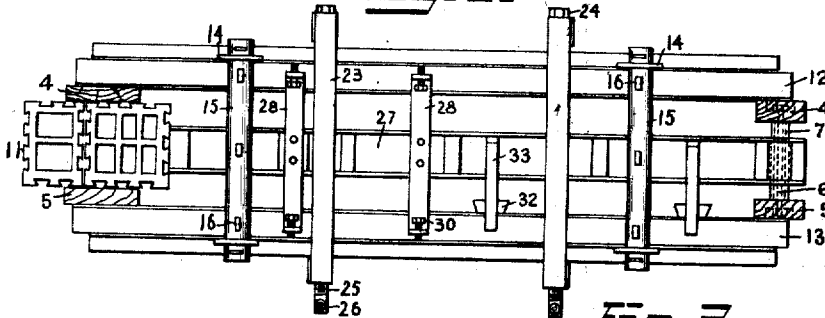


Fig. 3.

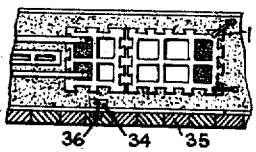


Fig. 6.

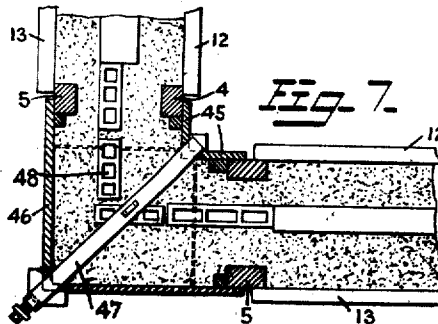


Fig. 7.

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METHOD OF MAKING CONCRETE WALLS.

1,096,792.

Specification of Letters Patent.

Patented May 12, 1914.

Application filed November 12, 1912. Serial No. 730,846.

To all whom it may concern:

Be it known that I, GURDON S. MUMFORD, a citizen of the United States, residing at Garden City, in the county of Nassau and State of New York, have invented certain new and useful Improvements in Methods of Making Concrete Walls, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a method of constructing concrete walls, and with regard to certain more specific features thereof, to the construction of concrete walls of houses, factories and the like.

One of the objects of the present invention is to provide a simple and practical method of building walls of the above character.

A further object is to provide a method of building concrete walls which will require a minimum amount of time and dispense with the use of skilled labor.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the several steps and the relation and order of one or more of such steps with relation to each of the others thereof, which will be exemplified in the method hereinafter disclosed, and the scope of the application of each of which will be indicated in the following claims.

In the accompanying drawings wherein is shown one of the various possible embodiments of this invention, Figure 1 is an elevational view largely diagrammatic showing a wall in the course of construction; Fig. 2 is a detailed elevation of a portion of the molding apparatus; Fig. 3 is a plan view partially in section of the apparatus shown in Fig. 2; Figs. 4 and 5 are sectional views taken on the line X—X of Fig. 2, looking to the left and right respectively. Fig. 6 is a vertical section taken on the line Y—Y Fig. 1; Fig. 7 is a sectional plan view showing the construction of a corner of the building; and Fig. 8 is a detailed sectional view of the finished wall, with a brick veneer applied thereto.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to the drawings, and more particularly to Fig. 1, there is denoted at 1

a concrete foundation wall of the building. Erected at suitable intervals along the sides of the wall are concrete piers 2 with vertical rabbets or clencher grooves, indicated by dotted lines, rising to a height of six or eight feet, or substantially to the ground line of the building. These piers are preferably placed about twenty feet apart, although if it were found that a column to be subsequently erected thereupon would interfere with doors or windows in the side wall of the building, they may be placed at a greater or lesser distance apart without materially affecting the operation of the apparatus. These piers are constructed in any desired manner, preferably by pouring concrete and grouting into a box mold of the desired shape. Erected upon each of these piers 2 is a wooden frame-work or guide-way 3 comprising two flat beams 4 and 5 bolted together at intervals by means of tie-bolts 6 (Fig. 3) passing through pipes 7 acting as spacers. The heads of the bolt 6 are counter-sunk in the beams 4 and 5 to prevent interference with the operation of the mold, as will be hereinafter more fully described. Upon tightening the bolt the beams 4 and 5 will be drawn together but are held the desired distance apart by means of horizontal wooden braces 8 and diagonal cross braces 9 which are loosely nailed on, whereby they may be removed as the wall is built (Fig. 2). Connecting the tops of the guide-ways 3 of two adjacent piers is a transverse supporting member 10 from which the mold is suspended. Lateral braces or guy ropes may be applied for greater stability, if desired, as when constructing a wall three or four stories high. These guide-ways are previously constructed as a complete frame, and erected as a unit, being held in position by sway braces either from a temporary scaffold or the ground; one of their functions being to provide an absolute plumb and alinement and gage in advance for all portions of the wall. After the frame-work 3 has been erected, plumbed and braced in vertical position, columns 11 of hollow tile, which are more or less filled with cement mortar with reinforcing rods and have incorporated between their horizontal joints, projecting metal lugs to further bond the wall, are built between the sets of beams 4 and 5. As these columns are erected the braces 8 and 9 are removed. The pipes 7 surrounding the bolt 6, how-

ever, are permitted to remain, the tile being cut away as may be necessary to surround the same. While erecting the columns 11 on the adjacent piers, as shown in Fig. 1, a molding device such as shown in Figs. 2 and 3, is applied to the opposite sides of the piers 2. If structural conditions permit, the central column may be omitted if desired. This molding device comprises two flat members 12 and 13 usually about twenty feet long and two to four feet high. These members are preferably of wood lined with sheet metal, and are provided with suitable braces and angle-irons to insure greater strength and stability. The upper edge of these members is provided with ears 14 through which freely passes a tie-bar 15. This tie-bar is provided with eye-bolts 16 for attaching chains 17 connecting with a pulley 18. Hoisting ropes 20 are rigged through these pulleys as well as pulleys 21 hung from the supporting member 10 and are connected with a hoisting device 22 of any desired style.

In order to prevent the spreading of the side molds 12 and 13 while constructing the wall, clamping devices as shown in Fig. 5 are provided at two or more points intermediate the ends of the mold. These clamping devices comprise an inverted U-shaped frame member 23 constructed in a substantial manner to resist strains exerted thereon, each being provided at one side with fixed stop members 24 engaging the side mold 12, while at the opposite side are threaded members 25 provided with operating handles 26 whereby the members 12 and 13 may be moved relatively toward each other. Devices corresponding to the members 25 may be substituted for the stops 24, if desired, although it is believed to be more advantageous to employ the construction herein shown, for the reason that the clamping devices may be operated from one side, thus doing away with both outside and inside scaffolding.

In constructing concrete walls it has been found from experience that it is desirable to provide vertical airspaces dividing the wall into inner and outer shells. This air space not only prevents condensation upon the inner wall of the house, but also acts as insulation for both heat and cold. It also provides spaces for piping and heating and ventilating means. This air space is made by using a rectangular slightly tapered sheet metal core 27 supported from spanners 28 resting upon the top of the side molds 12 and 13. Adjusting means 30 passing through the upturned ends of the spanner 28 co-act with lugs 31 upon the side members 12 and 13 in order that the core may be properly centered or moved to one side or the other if it is found desirable to make one wall thicker than the other.

When it is desired to apply a brick veneer 35 to the outer surface of the concrete wall, additional core members 32 (Fig. 3) are used. These core members 32 are wedge-shaped blocks of wood or metal supported from spanners 33 resting upon the upper surface of the core 27 and the outer side member 13 and positioned by a downward projecting lug or bend at end of spanner. This is raised as the wall is built and leaves a wedge-shaped vertical rabbet 34 in the outer surface of the finished wall at regular intervals. When the brick veneer 35 (see Fig. 8) is applied thereto, tie-members 36 are cemented into this groove at one end and between the layers of brick at its outer end, thus firmly tying the brick to the concrete wall.

In constructing a wall of two or more stories in height, it will be found desirable to use a connecting wall girder arrangement by means of reinforcing such as twisted metal bars 37 between the several tile columns 11. In order to secure these bars more strongly in the columns 11, and to afford a positive support for the wall girder, the columns are constructed with offset portions 38, in the plane of the walls at regular intervals, into which down-turned ends 40 of the tie members 37 are cemented. These reinforced members in connection with the tile columns will prevent expansion and contraction of the walls, tie the upper and lower double walls together, and span all openings. In these tie members on their center line, thin hollow tile members 41 having vertically disposed openings are placed on edge, their function being to permit air circulation from above and below the wall girder and thus prevent condensation on the inside of the wall. It is readily seen that unrestricted air circulation is permitted vertically, but is limited horizontally by the tile columns, as it is desired to prevent the whole interior air strata from being affected by local conditions, such as a storm driving toward one side of the building.

When inserting windows and doors 42 in the side wall of the building, the core 27 is removed and a brick or tile foundation 43 is laid in the last positioned layer of concrete. The window frame is then placed upon this brick foundation 43 and surrounded by a brick wall 44. The side molds are then raised to the proper elevation and soft concrete poured in around the frame, thus securely positioning the frame in proper place.

In constructing a corner such as shown in Fig. 7, the uprights are first built upon a corner pier and a special angular mold comprising inner and outer walls 45 and 46 co-acting with the uprights is placed in the position shown. The angular members 45 and 46 are connected by a clamping device 47 which is adapted to be raised with the co-

acting side molds 12 and 13. Instead of using a core member to provide the air space between the inner and outer walls, flat hollow tiles 48 may be positioned on end one above the other as the concrete is poured in between the sides of the mold. It is of course to be understood that the angle of the mold members 45 and 46 is not to be limited to a right angle.

10 The method of operation of the above described apparatus is substantially as follows:—After constructing the cellar piers 2, the vertical guide-frames 3 are erected thereon between the inner sides of which are placed the tile columns 11. While only one frame is shown in operation in Fig. 1, it is of course to be understood that several of these frames may be used simultaneously to construct the several units of which the wall is composed. The molding frame with the core is placed on the cellar wall 1 and clamped in position by means of the clamping device shown in Fig. 5. Concrete and grouting is then poured in between the side walls 12 and 13. After allowing the concrete to harden for two or three hours, or as conditions may require, the clamping members 25 are loosened and the hoisting device 22 operated to raise the mold, together with its core 27. After reaching the tops of the piers 2, the ends of the sides of the mold 12 and 13 co-act with the uprights as shown in Fig. 3. The operation is repeated until the wall is completed, after which the frames 35 are removed, the gaps left by them mortared up, and the sides of the wall veneered either with brick or plaster, according to the style of architecture. It has been found in practice that even a wet concrete in sections of limited vertical height gains sufficient cohesive strength shortly after initial set to prevent its collapse outwardly if supported at the bottom and the side molds are moved without engaging or jarring the wall. These conditions are fulfilled by the guide-frames which automatically prevent the mold hitting against the wall, and the hoisting apparatus which permits a smooth even pressure to be exerted to disengage the tapered core before the concrete has contracted upon it sufficiently to cause friction. The preferred practice is to disengage the inner and outer molds and raise the mold frame a distance of one foot as speedily as setting up conditions permit. This tends to protect the top of the cast from the sun or wind and to expose the bottom, thus causing the concrete to dry out and harden first at the bottom, thereby gaining strength speedily where it is most needed for rapid and economical operation in the building process. A sufficient time is then allowed to elapse, during which the mold frame is entirely supported from above. The mold frame is then raised to its new position which permits its members

to lap the previous cast some five or six inches, and re-clamped.

It is thus seen that in carrying out this invention, after the guide frames are once erected, the use of skilled labor of any kind is eliminated, for the form or frame-work and the finished wall cannot deviate from its original setting, nor can it injure the green wall in any way. In other words, the apparatus is almost automatic in its action, requiring only muscular labor to operate the clamps and hoists, has a minimum of material and operating parts, and the resultant wall combines extreme rigidity and strength with perfect insulating qualities.

It is thus seen that this invention provides a simple and practical method of constructing reinforced concrete walls, accomplishing, among others, all of the objects and advantages above set forth.

As many changes could be made in carrying out the above method, and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

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

1. The herein described method of constructing concrete walls which consists in forming piers at regular intervals on the base of the wall, erecting removable guideways on said piers, constructing permanent columns between some of said guideways, casting the wall progressively between said columns in molding devices sliding on said guideways and subsequently removing said guideways and devices.

2. The herein described method of constructing concrete walls which consists in forming base piers at intervals, erecting a removable guideway upon said piers, constructing a permanent column between some of said guideways and in contact therewith, casting in a mold a double wall between said columns, raising the mold progressively as the sections of the wall harden until completed, removing the mold and guideways therefrom, and mortaring up the apertures left by the guideways to finish the outer surface of the wall.

3. The herein described method of constructing concrete walls which consists in forming base piers at intervals, erecting a

removable guideway upon said piers, constructing hollow columns between said guideways, connecting said columns by reinforced hollow girders extending horizontally therebetween, casting a double wall between said columns and the horizontal girders with a core mold which is progressively raised as the wall hardens, and removing the mold and guideways therefrom,

4. The herein described method of constructing concrete walls which consists in erecting removable cross braced guideway-frames upon piers or a base-course, so positioned that, either wholly or in part, said guideway-frames project within the surface planes of the wall to be cast, and have their outside surfaces flush or level with the surfaces of said wall, erecting between said frames a column of bonded and grooved masonry blocks, connecting the several sets of said guideway-frames by longitudinal members, applying to said guideway-frames side-mold members supported from said longitudinal members, sliding upon said frames which act in a guiding relation thereto, holding said side molds rigidly against said guide-frames, casting a double wall between and around said masonry column with core-mold members by means of progressively raising said side molds and core-molds, removing said molds and guideways, and filling up remaining grooves in the wall.

5. The herein described method of constructing concrete walls which consists in erecting removable cross braced guideway-frames upon piers or a base-course, so positioned that, either wholly or in part, said guideway-frames project within the bonding surface planes of the wall to be cast and have their outside surfaces flush or level with the surfaces of the resulting cast, connecting the several sets of guideway-frames with longitudinal members, applying to said

guideway-frames side mold members supported from said longitudinal members and sliding upon said guide-way frames which act in a guiding relation thereto, holding said side mold members rigidly against said guide-frames, casting the wall by means of progressively raising said side mold members, removing portions of bracing of said guideway-frames as the wall progresses, finally removing said guideway-frames, and filling up remaining grooves in the wall.

6. The herein described method of constructing concrete walls which consists in erecting a plurality of removable guideways, constructing permanent columns between and in contact with said guideways, casting the wall progressively between said columns, one section in advance of another in molding devices sliding on said guideways, and subsequently removing said guideways from adjacent said columns and mortaring up the recesses formed in the wall surface thereby.

7. The herein described method of constructing concrete walls which consists in erecting permanent columns of masonry construction presenting artificially formed bonding surfaces adapted to engage with the wall formed on all sides thereof, erecting removable framed guideways adjacent and substantially in contact with said columns, progressively raising a mold on the outer side of said framed uprights and simultaneously casting the wall in the mold between the columns, and subsequently removing said guideways and filling the apertures formed thereby.

In testimony whereof I affix my signature, in the presence of two witnesses.

GURDON SALTONSTALL MUMFORD.

Witnesses:

HELEN M. SEAMANS,
P. A. BLAIR.

It is hereby certified that in Letters Patent No. 1,096,792, granted May 12, 1914, upon the application of Gurdon Saltonstall Mumford, of Garden City, New York, for an improvement in "Methods of Making Concrete Walls," an error appears in the printed specification requiring correction as follows: Page 4, lines 38-39, for the word "bonding" read *bounding*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of June, A. D., 1914.

[SEAL.]

J. T. NEWTON,

Acting Commissioner of Patents.