Jan. 21, 1930. A. HENDERSON 1,744,309

MAKING CEMENTITIOUS ARTICLES

Filed Dec. 21, 1927 4 Sheets-Sheet 1

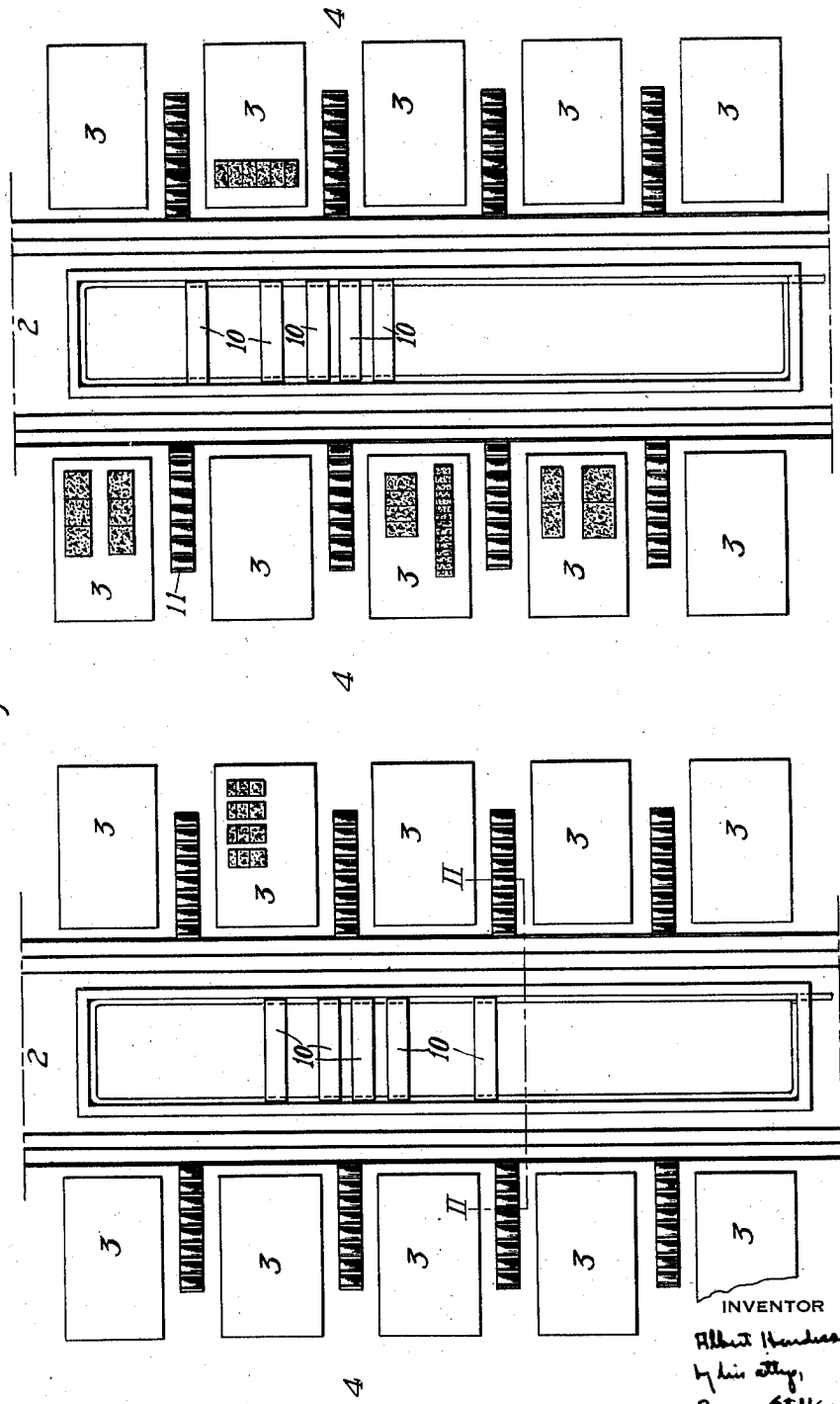



Fig. 1

INVENTOR

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by his atty,

Byrnes, Stillman & Rounds

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MAKING CEMENTITIOUS ARTICLES

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Fig. 2

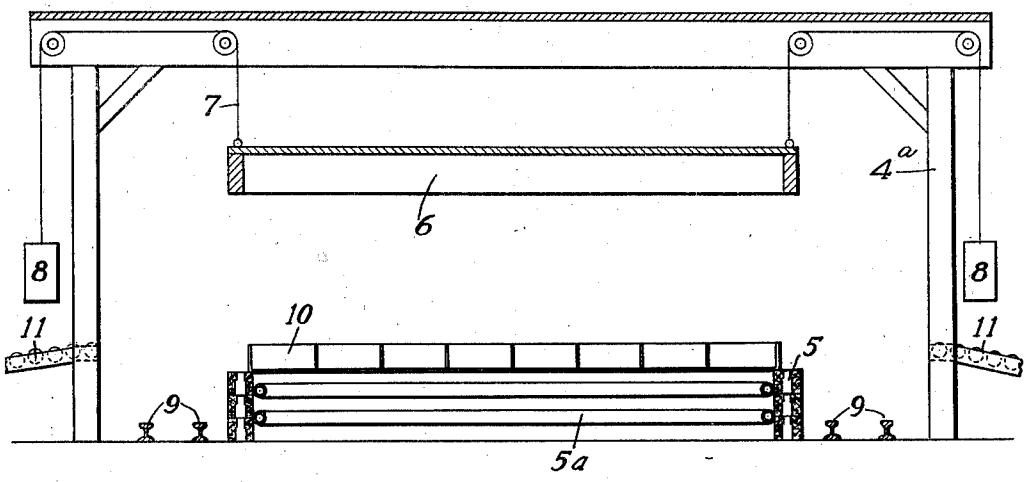



Fig. 5

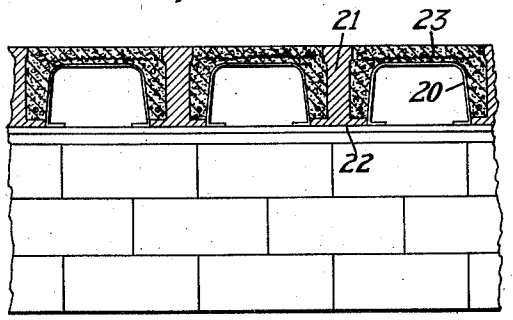



Fig. 4

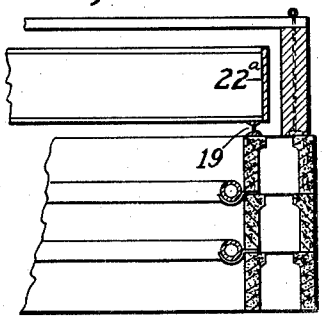



Fig. 7

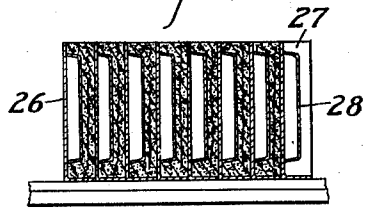
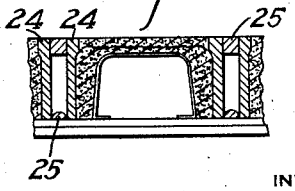



Fig. 6




INVENTOR

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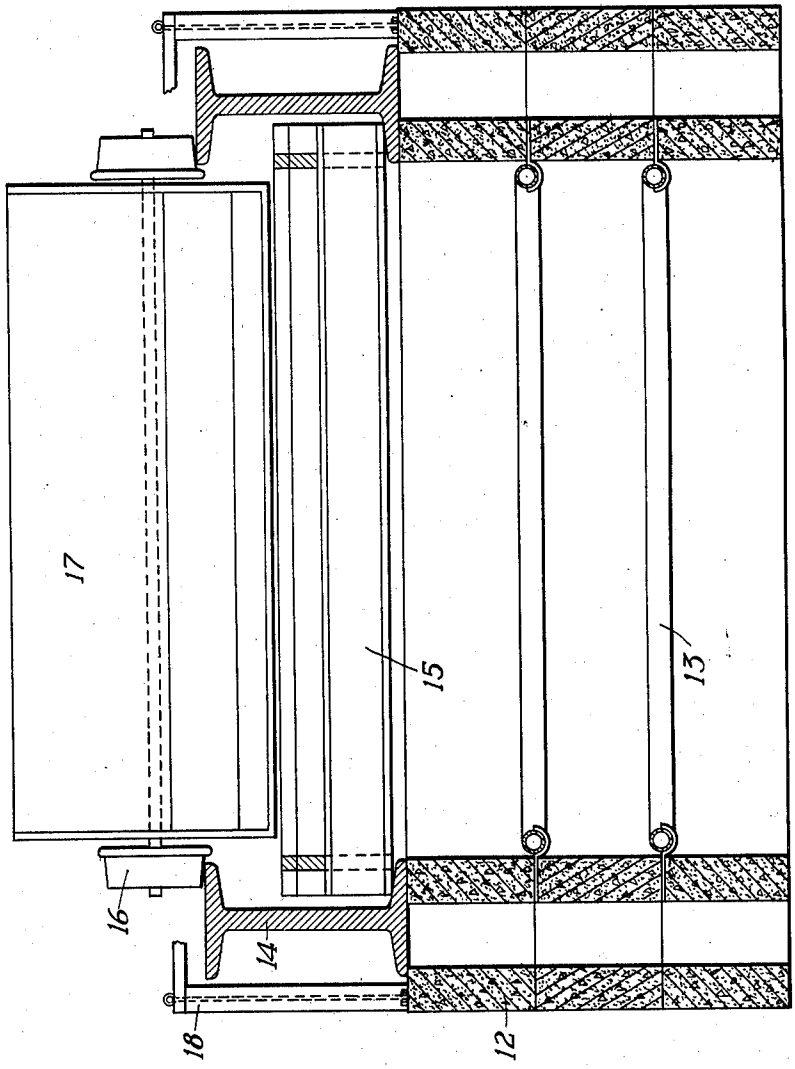
Dyrus, Stebbins & Pamelee

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Fig. 3




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Jan. 21, 1930. A. HENDERSON 1,744,309

MAKING CEMENTITIOUS ARTICLES

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Fig. 9

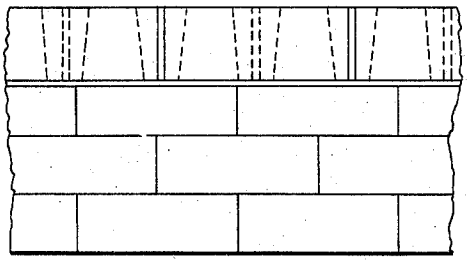


Fig. 8

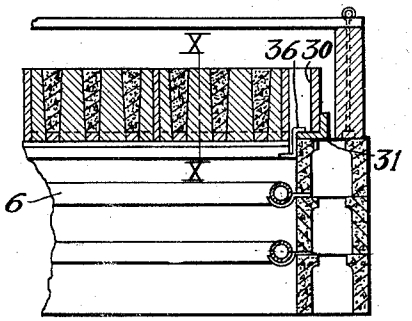



Fig. 10

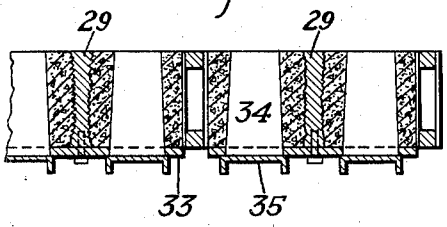



Fig. 11

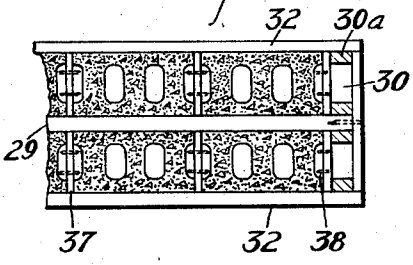



Fig. 12

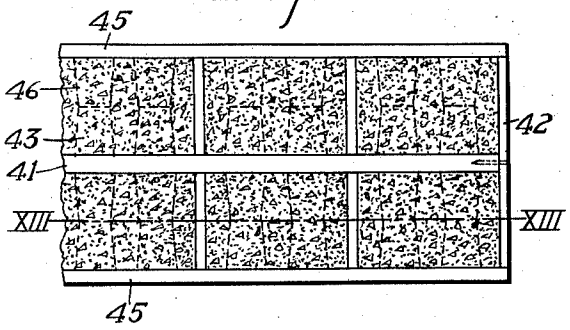



Fig. 14

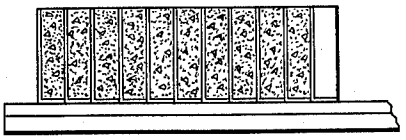


Fig. 15

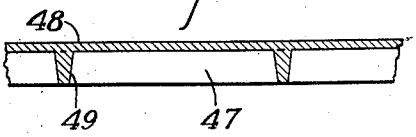
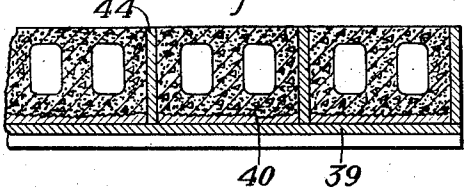



Fig. 13




INVENTOR

Albert Henderson

by his attys,

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Patented Jan. 21, 1930

1,744,309

# UNITED STATES PATENT OFFICE

ALBERT HENDERSON, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO HENDERSON & HATCHER, INC., OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF DELAWARE

## MAKING CEMENTITIOUS ARTICLES

Application filed December 21, 1927. Serial No. 241,650.

This invention relates to the making of cementitious articles and provides an improved method and apparatus whereby such articles may be made at a minimum of expense and with unusually high quality. By the term "articles" as herein used, I intend to include only cementitious bodies which are adapted to be transported after manufacture to a place of use as distinguished from cementitious bodies, such as curbs, pavements, etc., which are cast in situ.

There are two general methods of making cementitious bodies, one of them being by mixing a fluid cementitious mix and pouring it into a mold; the other being by tamping a considerably drier mix into the mold. The general process of manufacturing poured articles comprising filling the molds at a pouring station and transporting them to a curing chamber where they are subjected to heat for a sufficient length of time to cause setting.

The tamped articles are made in a pressing or tamping machine, and are there stripped of the mold and taken to the curing chamber on pallets.

In either case, there is a material disadvantage in moving the articles from the point of formation to the curing chamber. The cementitious mix for the poured articles is so fluid that there is danger of spilling a part of the material from the mold, thus resulting in non-uniform articles. Another disadvantage lies in the fact that the molds frequently are not level when they are positioned in the curing chamber with the result that the finished articles are imperfect. In the case of a block or slab, this results in the top and bottom faces lying at an angle to one another instead of being truly parallel. In making articles by the tamping or pressing method, there is danger of breaking some of the articles during transportation, thus increasing the expense. In either method the cost of handling is high. I provide for forming a cementitious article and curing the same without movement thereof from the position where it was formed. To this end I provide one or more molds in a curing chamber and fill them with a cementitious mix without movement of the mold, after which the mold or molds are covered and subjected to a curing heat.

In the making of cored articles, provision is made for withdrawing the cores, either partially or entirely, after the articles have attained their initial set. This is of value in that it permits the atmosphere in the curing chamber to circulate through the cored openings, thus obtaining more uniform and rapid curing of the articles.

The setting of cement may be said to occur in two stages. The initial setting is a matter of hours and as soon as it is completed the article is self-sustaining. However, it requires a further ageing of some days or weeks before the article develops its maximum strength. Unless the articles are carefully handled before the ageing period has advanced, there is danger of breakage. I provide a storage space adjacent the curing chamber and a conveyor extending from the curing chamber to this storage space so that the cured articles may be transported to the storage space with a minimum of difficulty, and are allowed to age and develop their final strength.

Since the articles are cured at the point where they are formed, gang forms may be employed. There is no practical limitation on the weight of these forms since they need not be transported. It is therefore possible to provide a long curing chamber with a large number of forms placed side by side, and to supply the cementitious mix at the points desired along the curing chamber. A hopper running on wheels may be employed and used to fill successive forms.

Material economies in equipment and space may be effected by employing form members adapted to be arranged side by side, each member in itself being an incomplete form but cooperating with an adjacent member to form a complete form.

In the accompanying drawings illustrating the present preferred embodiment of my invention as applied to the manufacture of various types of articles,

Figure 1 is a top plan view, largely dia-

grammatic, of a plant constructed according to my invention,

Figure 2 is a vertical section taken on the line II—II of Figure 1,

Figure 3 is a view to enlarged scale of a modified form of a curing chamber,

Figure 4 is a still further modified view corresponding to Figure 3 but being partly broken away and showing another manner of supporting the forms in the curing chamber,

Figure 5 is a longitudinal section through the curing chamber showing one form of form for making slabs,

Figure 6 is a similar view showing a modified slab form,

Figure 7 is a similar view showing the casting of slabs on edge,

Figure 8 is a view corresponding to Figure 4 but showing cored forms for making concrete blocks,

Figure 9 is a transverse view corresponding to Figure 8 and showing the forms in elevation,

Figure 10 is a section taken on the line X—X of Figure 8,

Figure 11 is a top plan view of the forms shown in Figure 8,

Figure 12 is a top plan view of a modified form of forms for making cored articles,

Figure 13 is a section taken on the line XIII—XIII of Figure 12,

Figure 14 is a view taken longitudinally of the curing chamber and showing a form of form for casting solid flat slabs, and

Figure 15 is a longitudinal, horizontal section taken through one of the form members shown in Figure 14.

Figures 1 and 2 illustrate a plant for making cementitious articles, comprising two main bays 2, each having storage spaces 3 along each side for finished articles. Roadways 4 are provided alongside each row of storage spaces so that material in the storage spaces can be readily transferred to trucks.

Each bay 2 comprises a building $4^a$ housing a long curing chamber 5. The curing chamber 5 is open at the top and is provided with steam heating pipes $5^a$ so that when the chamber is covered the desired temperature conditions for curing the articles may be maintained in the chamber. The curing chamber is provided with a cover which is preferably made in a plurality of sections 6 suspended by cables 7 from the roof of the building $4^a$ and provided with counterweights 8 so that each section may be readily raised or lowered, as desired.

Tracks 9 run along each side of the curing chamber so that cementitious material can be transported to any point therealong.

The side walls of the curing chamber 5 support gang forms 10. These forms are filled with material carried thereto by trucks on the tracks 9, and after being filled are not moved until the articles have been cured. The forms are filled and then screeded, after which the covers 6 are lowered into place and steam is admitted to the pipes $5^a$ to raise the curing chamber to the desired temperature. After the curing has been completed, the covers 6 are removed and the cured articles are transferred to the storage yards 3. Roller conveyors 11 are provided so that the articles may be lifted directly from the forms and placed thereon for delivery to the storage spaces. The articles do not develop their maximum strength until after considerable ageing, and it is therefore important to minimize handling of the articles before this ageing has been effected. With a plant layout such as shown in Figures 1 and 2, the articles may be readily taken from the forms to the storage yard with a minimum of expense and breakage.

Since the forms 10 are not moved after they are filled, there is no danger of the material being partly spilled, thus reducing the volume of the articles, or of the forms being slightly tilted, thus producing articles which are out of square.

Figure 3 shows a modified form of curing chamber wherein the chamber proper is built up of side walls 12 provided with heating pipes 13. I beams 14 are placed on top of the side walls 12 and the forms 15 are supported on the lower side flanges by these I beams. The upper flanges of the I beams constitute tracks for a wheeled carriage 16 carrying a hopper 17 which may be filled with the cementitious mix from a mix at the end of the curing chamber and then moved along the curing chamber so as to fill the forms therein. The cover is indicated at 18. After the forms have been filled the carriage 16 is moved to the end of the chamber and the covers 18 are lowered into place.

Figures 4 to 15 inclusive, show various types of forms which may be employed. Figures 4 and 5 show a curing chamber having rails 19 supporting forms for the making of slabs which are generally U shaped in cross section. These forms comprise cores 20 and T shaped members 21 having bases 22 which extend from one core 20 to another and serve to hold them in spaced relation. The upstanding leg of each T member 21 constitutes a side wall portion for each form. As will be seen from Figure 5, the T shaped members 21 each constitute a part of two adjacent forms. After the form members 20 and 21 have been assembled, end members $22^a$ are secured in place and the cementitious material is then poured. Reinforcing 23 may be put in place during the pouring if desired.

The core members 20 are of thin metal and are open at the bottom so that the heat of the curing chamber is efficiently transferred to the poured cement, thus reducing the time required for curing.

After the curing has been completed, the T member at the end of the filled set of forms is slid sidewise on the rails 19, thus making the cured article at the end of the string accessible for handling. After this end article has been removed the next T shaped form member 21 is slid out of the way and a second article in the string is removed, this process being continuned until all of the articles have been taken away.

Figure 6 shows a modified form for slabs wherein the side forming members 24 are held in spaced relation by members 25. With this construction circulation of heated air above the articles is made possible.

Figure 7 shows a set of forms for casting slabs on edge. Each form 26 is generally L shaped in cross section and is provided with ends 27 so as to make, in effect, an open sided box. When these boxes are placed side by side, as shown in Figure 7, they cooperate to form complete forms. Each box is provided with a fixed core 28 so as to make the slab generally U shape.

Figures 8 to 10 inclusive, show gang forms for the manufacture of concrete blocks. The forms proper each comprise a central stringer 29 which, as shown in Figure 10, may be shaped to provide rock or other ornamental faces on the blocks. The stringers 29 are secured at each end to cross members 30 which rest on rails 31 on the sides of the curing chamber. The rails 31 are made of angles which are so spaced as to just receive the forms between them, thus accurately positioning the forms in the chamber. The cross members 30 maintain the stringers 29 truly vertical and are provided with end faces $30^a$ against which stringers 32, forming the outer walls of the forms, may be placed.

The form bottoms are made of cross members 33 secured to the stringers 29 and have spaced openings therein for the reception of cores 34. The cores 34 are secured to cross members 35 which depend from hangers 36 engaging the rails 31. As shown in Figure 11, the cores are shaped at intervals to separate the blocks in a course one from another, as indicated at 37. At each end of the form the cross members 30 are provided with cores 38 which are secured in place, but the intermediate cores are all connected to the cross members 35.

After these forms have been assembled and the material has been poured, the cover is lowered and curing commences. After the articles have attained their initial set, the hooks 36 are removed thus leaving the cross members 35 unsupported. The cross members 35 are forced down until they rest on the upper steam pipe $5^a$. Since the cores are tapered, this leaves an opening around each core so that the heated gases may circulate through the cored openings. With this arrangement uniformly sized and shaped blocks may be manufactured at a minimum of expense.

Figures 12 and 13 show a form wherein the cores are in the horizontal direction. This type of form comprises bottom stringers 39 which may have rock or other ornamental faces 40 formed thereon. A central vertical stringer 41 having cross members 42 secured to the ends thereof is placed on the supporting rails and a bottom member 39 is placed on either side thereof. A stringer 41 carries spaced horizontally extending cores 43. The stringers 39 carry upstanding division walls 44 defining the ends of the articles being cast. A stringer 45 carrying cores 46 adapted to abut the cores 43 is placed at either side of the unit. The complete assemblage is shown in Figure 12. After the material has been poured, and has attained its initial set, the stringers 45 may be pulled sidewise and then the bottom members 39 may be pulled away from the central stringer 41. In this way the cores are removed from the articles and further curing is effected with free circulation of air through the cored openings.

Figures 14 and 15 show forms for the casting of solid slabs. These forms are similar to those of Figure 7 except that they are not provided with cores. Figure 15 shows a longitudinal section through one of the form members. The form members comprises a bottom wall 47, a vertical longitudinal wall 48 and walls 49 which divide each form member into a plurality of open sided boxes. The forms herein illustrated may be filled with a fluid cementitious mix which is poured into place, or a stiffer mix adapted for tamping or vibrating so as to properly fill the forms, may be employed.

The various forms employed for making the different articles may be readily handled, as the form members need not be lifted, but can be slid along the supporting rails so as to make the cast articles accessible for removal. When assembling the form members, it is only necessary to slide them together. This does away with a great deal of heavy labor and materially speeds up the process.

Where the forms are filled with a mix which is stiff enough to be vibrated or tamped into position, it is not necessary to wait until the articles have acquired their initial set before removing the cores, as the mix is stiff enough to be self-sustaining after it has been properly compacted by the tamping or vibrating operation. In certain cases it may be advantageous to employ tamping or vibrating rather than to use a mix which is thin enough to be poured as the cores can be dropped almost immediately after the articles have been formed by the tamping or vibrating method, thereby doing away with the necessity of raising the cover. Where a poured mix is employed, the cover of the

curing chamber will be lowered during the period in which the mix acquires its initial set and must thereafter be raised in an amount sufficient to give access to the coring structure.

While I have illustrated and described the preferred form of my invention, it will be understood that it is not thus limited, but may be otherwise practiced or embodied within the scope of the following claims.

I claim:

1. The method of making cementitious articles, which includes filling a mold with a cementitious mix and, with substantially no movement of the mold, applying heat in such manner that the entire mold is surrounded with a heated atmosphere, thus curing the article therein.

2. The method of making cementitious articles, which includes providing in a curing chamber a mold with a core, filling the mold with a cementitious mix, withdrawing the core after the mix has set sufficiently to be self-sustaining, and curing the article thus formed while it remains in the mold.

3. The method of making cementitious articles, which includes providing in a curing chamber a mold having walls and a core, filling the mold with a cementitious mix, withdrawing the core and removing a mold wall after the article thus formed has set sufficiently to be self-sustaining, and curing the article while it remains in the mold.

4. The method of making cementitious articles, which includes providing in a curing chamber a mold having walls, filling the mold with a cementitious mix, removing a mold wall after the mix has set sufficiently to be self-sustaining, and curing the article thus formed while it remains in the mold.

5. Apparatus for making cementitious articles, including a mold having a bottom and side walls adapted for the formation of a cementitious article, a curing chamber completely surrounding the mold, and means for supplying a cementitious mix to the mold while it is in the curing chamber, whereby movement of the mold from the time it is filled until the article therein is cured is avoided.

6. Apparatus for making cementitious articles, including a mold having a bottom and side walls for the formation of a cementitious article, a curing chamber, the mold being supported by the walls of the curing chamber so as to lie between the top and the bottom thereof, the curing chamber completely surrounding the mold, and means for supplying a cementitious mix to the mold while it is positioned in the curing chamber, whereby movement of the mold from the time it is filled until the article therein is cured is avoided.

7. The method of making cementitious articles, which includes providing in a curing chamber a mold with a core, filling the mold with a cementitious mix, permitting the mix to set sufficiently to be self-sustaining and then so moving the core that it is out of contact with the formed article, and curing the formed article while it remains in the mold.

In testimony whereof I have hereunto set my hand.

ALBERT HENDERSON.