

Oct. 19, 1937.

C. BRYNOLDT

2,096,159

METHOD AND APPARATUS FOR CONSTRUCTING CONCRETE WALLS

Filed Jan. 18, 1933

4 Sheets-Sheet 2

Fig. 2.

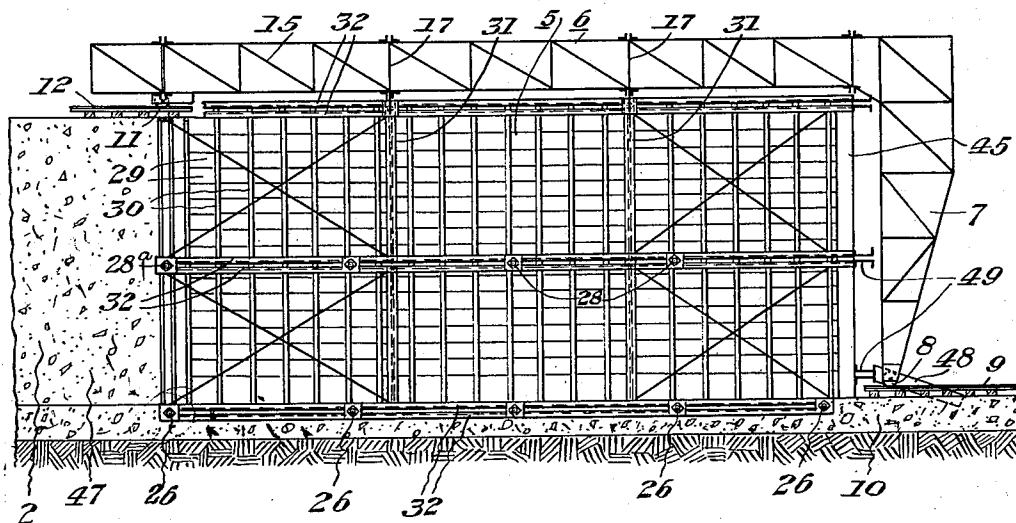
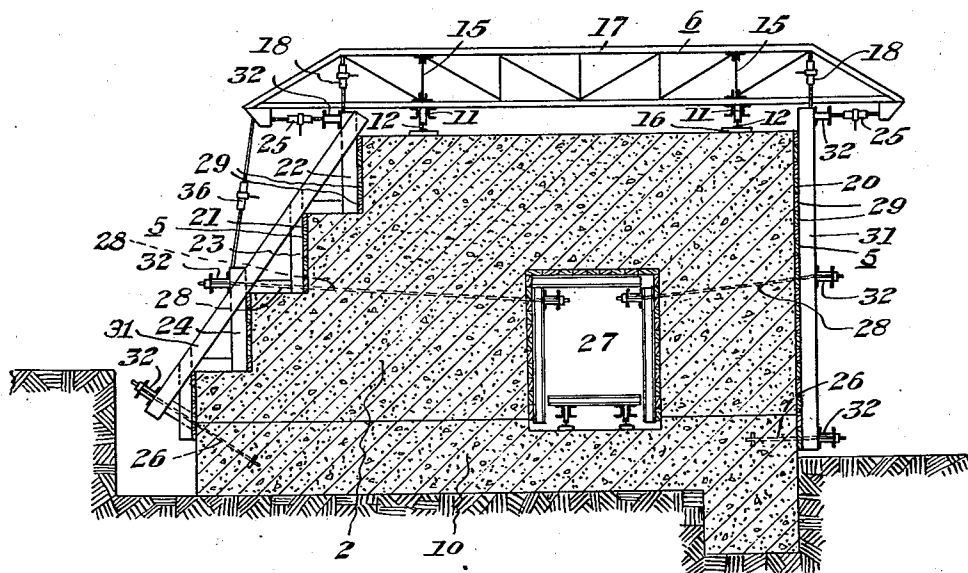


Fig. 3.



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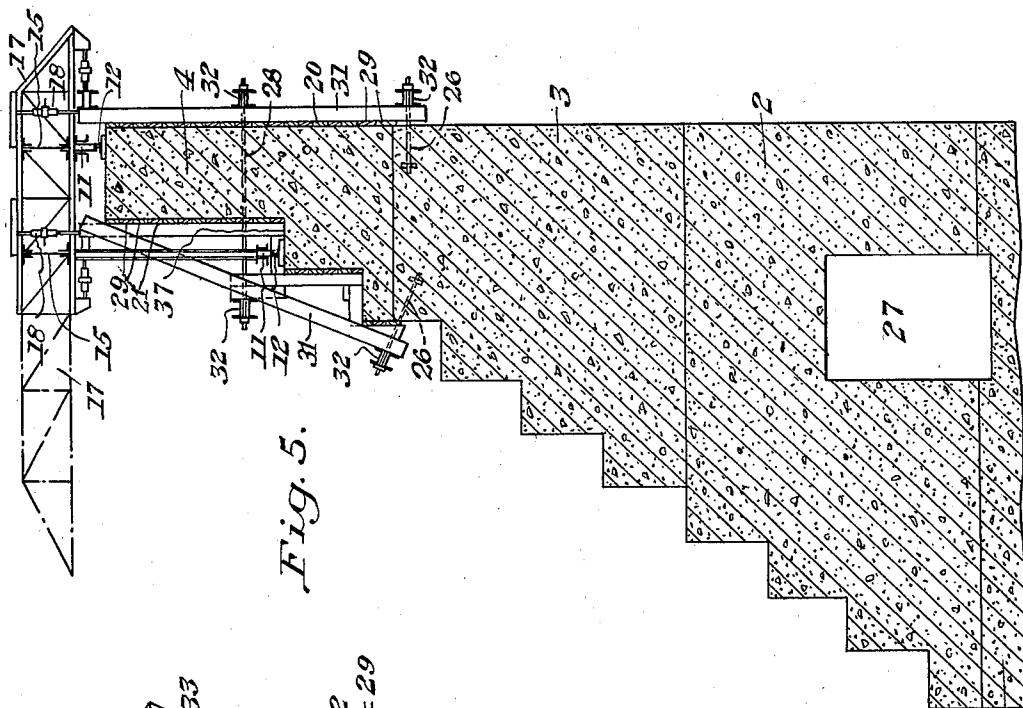


Fig. 5.

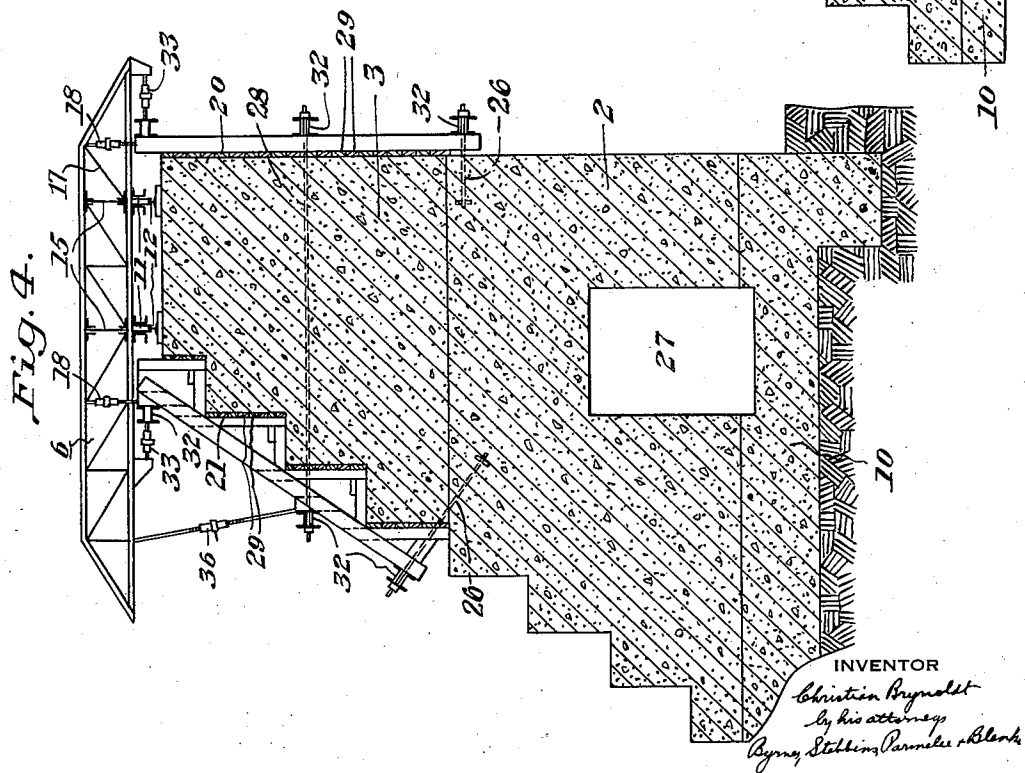


Fig. 4.

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Fig. 6.

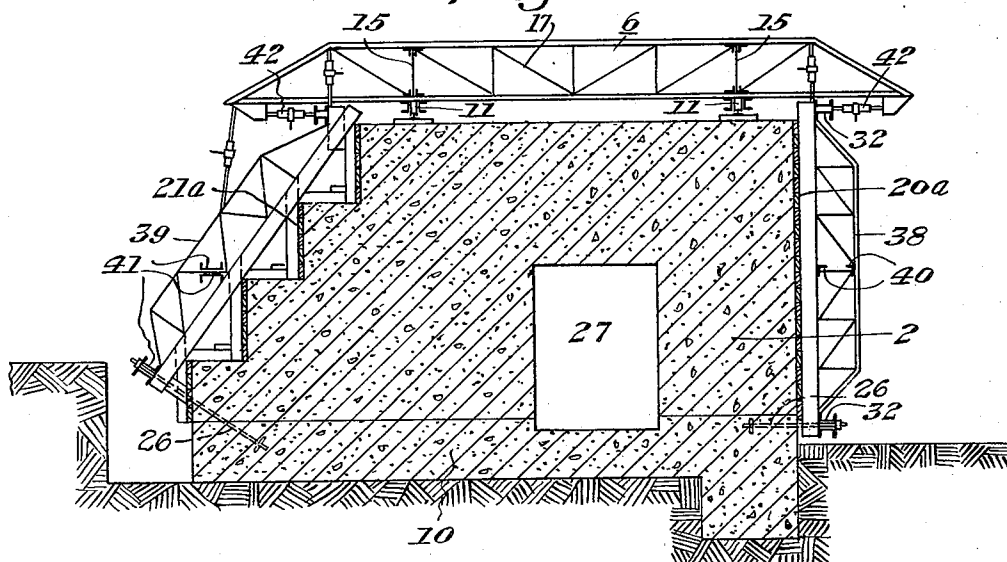
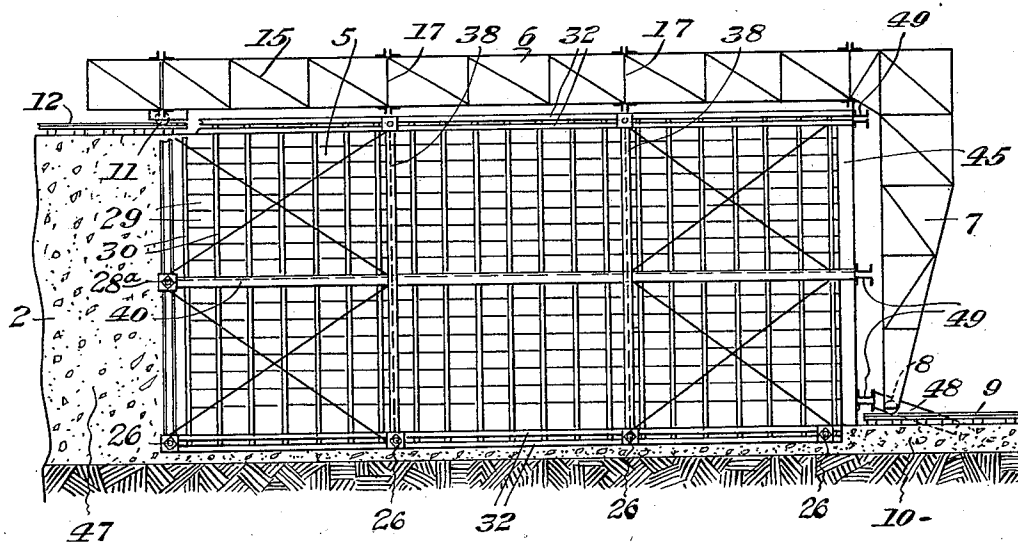


Fig. 7.



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2,096,159

METHOD AND APPARATUS FOR CON-
STRUCTING CONCRETE WALLSChristian Brynoldt, Pittsburgh, Pa., assignor to
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Application January 18, 1933, Serial No. 652,292

13 Claims. (Cl. 25—131)

This invention relates to a method and apparatus for building concrete walls either in a single lift, or in a plurality of lifts in which each lift is of less height than the total height of the wall.

The invention is particularly applicable to the building of walls of such height that the concrete of which they are constructed either cannot or should not be carried up from the footing to the top of the wall at a single operation, but should preferably be carried up to the full height in two or more operations with an interval allowed for the setting of the concrete in one section before the placing of a second section above it.

In the past it has been customary in constructing walls for canal locks and similar structures to employ a very strong trussed structure of more than the total height of the wall, the trussed structure having members on each side of the wall to support it and being capable of being moved longitudinally of the wall, so that the wall mold form attached to the structure could be shifted longitudinally of the wall to construct successive sections as the work progressed. This trussed structure to which the form was attached either rigidly or adjustably was made sufficiently strong to support the form against the pressure of the concrete within the form, the form itself not possessing sufficient rigidity to receive and hold the concrete.

When the type of trussed structure which has just been described is employed, it must remain in place until the whole height of the wall has been poured, whether the concrete is poured in a single operation or in several operations with an interval between to allow setting of the concrete. For example, if one-half or one-third of the height of the wall is poured, and this is followed after an interval for allowing the cement to set by another operation to carry the wall to its full height, the trussed structure must remain in place until the section of the wall being constructed is completed to its full height, and unless special provisions are made, the form used for pouring the lower part of the wall must remain in place until the form used in pouring the upper part of the wall has served its purpose and the cement in the upper part of the wall has set so that the form can be moved. In short, with the method which has been used heretofore, it has been necessary to carry the wall to its full height before any of the forms on a given section of the wall could be removed and re-used. This has delayed the shifting of the forms and the placing of back fill behind the wall until after a section of the wall has been built to its full height.

In accordance with the present invention, a section of the wall is cast in a form supported independently of the wall as in the prior practice. A form for an adjoining section of the wall is supported from a carrier, one end of which is sup-

ported on the previously cast section of the wall, the other end being supported independently of the wall, and the adjoining section is cast. The form carrier is then moved intermittently lengthwise of the wall and other sections are cast until the whole length of the wall is completed, the carrier during its movement being supported at one end on a previously cast section, and at the other end independently of the wall.

When it is desired to build a wall of considerable height, it is preferred to form it of several horizontal lifts, one above the other, the sections of each lift being formed in separate operations. The first lift is cast in sections while the form carrier is supported as described by moving the carrier intermittently lengthwise of the wall and casting the sections while the carrier is at rest. A second horizontal lift is cast in sections on the first lift either before or after the first lift has been completed. In forming the second lift, after the first section has been cast, the carrier is supported at one end on the previously cast section of the second lift, and at the other end on the top of the first lift. Other lifts as desired may be cast until the wall attains the desired height.

In the accompanying drawings, which illustrate several embodiments of my invention,

Figure 1 is a somewhat diagrammatic front elevation illustrating one manner of building a wall in accordance with the present invention, in which the wall is formed of three horizontal lifts, sections of each lift being cast in separate operations;

Figure 2 is a front elevation of one of the wall forms and its supporting structure;

Figure 3 is a transverse section through the wall illustrating the manner in which the first lift is cast;

Figure 4 is a transverse section through the wall illustrating the manner in which the second lift is cast;

Figure 5 is a transverse section through the wall illustrating the manner in which the third lift is cast;

Figure 6 is a transverse section through the first lift of a wall, the figure illustrating a modified type of supporting structure for the wall forms; and

Figure 7 is a front elevation of the wall shown in Figure 6 and illustrating the forms and supports therefor.

Referring more particularly to the accompanying drawings, Figure 1 illustrates one method of building a wall in accordance with the present invention. The wall is built in horizontal sections or lifts 2, 3 and 4, the lower lift 2 having been completed up to the point A, the lift 3 to the point B, and the lift 4 to the point C. The lifts are made in sections by pouring concrete into

the forms indicated generally by the reference numeral 5 and then advancing the forms longitudinally of the wall, after which another section of the lift is poured. Figure 1 illustrates three of the forms, one form being used for casting each of the lifts, although a single form might, if desired, be used for casting the different lifts, the form at various times being located in the positions indicated in the drawings. By casting the wall in horizontal lifts, the forms may be advanced as soon as the concrete has set in the sections of the lift being built, it being unnecessary to leave the form in position until all three lifts are cast, as would be the case if the form extended the full height of the wall.

Each of the forms is supported from an overhead longitudinal truss or carrier indicated generally by the reference numeral 6 which is supported at one end by a vertical truss 7, the constructions of which will be described more fully hereinafter. Wheels 8 are mounted in the lower end of the truss 7 and run on rails 9 supported on a concrete footing 10 which has been laid previously. The rear end of the truss 6 is likewise provided with wheels 11 which run on rails 12 supported on the top of a previously cast portion of the particular lift being built. Thus, the form 5 shown at the right in Figure 1 is used in building the lift 2. It is supported from the horizontal longitudinally extending truss 6. The truss 6 is supported at its front end by truss 7 which has wheels 8 resting on rails 9. The rear end of truss 6 is supported by wheels 11 resting on tracks 12 supported on a portion of lift 2 which has already been cast. When the building of the wall is first started, it is, of course, necessary to support the rear end of the truss 6 by some temporary supporting means, or by a section of the lift 2 which has been cast against forms supported independently of the wall but after the first section of the particular lift has been built, it is always supported by the top of the lift which has been cast.

Referring more particularly to Figures 2 and 3, the horizontal truss 6 comprises two trusses 15 extending longitudinally of the wall, these trusses being supported at the rear by wheels 11 running on rails 12, the rails being supported on timbers 16, and at the front by truss 7 having wheels 8 resting on rails 9. The longitudinal trusses 15 are connected at intervals by transverse trusses 17.

With this arrangement I am able to support the wall forms 20 and 21 from the transverse trusses 17 by jacks 18 so that they may be raised or lowered into the desired positions. The supporting of side forms adjustably on an overhead structure is not new in the art, but is nevertheless desirable. However, it is not essential that the longitudinal trusses 15 be placed above the work, their position being merely a matter of engineering preference. I may, for example, spread the trusses 15 far enough apart to place them outside of the wall forms 20 and 21, either above or below the level of the top of the section of the wall to be cast; or I may even incorporate them in the side forms themselves, if the feature of rendering the position of the forms adjustable with reference to the trusses be omitted. It is, however, essential to my invention that the form, during the process of shifting, be supported from opposite ends and some longitudinal member or members strong enough to sustain the load of the form when moved in this way must be used, the best loca-

tion of such members being a matter of engineering determined by circumstances. As shown in Figure 3, the form 20 extends substantially vertically, but the form 21 is provided with a series of steps 22, 23 and 24. The forms are prevented from spreading transversely of the wall by means of jacks 25 at the upper ends of the forms and by means of anchor bolts 26 at the lower ends of the forms. The wall is provided with a tunnel 27 extending therethrough. Tie rods 28 connect the forms 20 and 21 with the forms used in forming the tunnel.

The forms 20 and 21 are made of horizontal wood panels 29 (see Figure 2) reinforced by vertical wooden reinforcements 30 and 31. The forms are also reinforced by horizontal walers 32 of steel, each of the walers consisting of two channels placed back to back with a space between them for receiving the anchor bolts 26 and tie rods 28.

In Figure 4 a section of a wall is shown at which the two lifts 2 and 3 have been cast. The forms 20 and 21 are adjustable so that the space between them may be made greater or less. In this way, the forms used in making the lower lift may be brought closer together and may then be used in making the second or the third lift. In order to prevent spreading of the forms, they are maintained in positions near their tops by jacks 33 and near their bottoms by anchor bolts 26 embedded in the lower lift 2. A tie rod 35 also extends through the lift 3 and the form 21 is further maintained in position by a jack 36.

In Figure 5 there is shown a section of the wall in which all three lifts 2, 3 and 4 have been cast. The transverse trusses 17 have been shortened from the chain line position to the full line position, the trusses being made in section so that they may be easily adjusted for use on narrow walls. In this figure, instead of supporting the rear ends of both of the longitudinal trusses 15 on the top of the lift 4, only one truss is so supported, the other being supported by a rail 12 placed on a step 37 of the form 21.

Figures 6 and 7 show a modified embodiment in which the forms 20a and 21a for the sides of the wall are reinforced by trusses 38 and 39, respectively. The trusses 38 are connected by horizontally extending trusses 40 and the trusses 39 by horizontally extending trusses 41. The forms are prevented from spreading laterally in a manner similar to that described in connection with the other embodiment, by jacks 42 and anchor bolts 26. The construction shown in Figures 6 and 7 may be so designed as to eliminate the necessity of tie bolts through the wall by making the trusses strong enough. By making the trusses 40 and 41 strong enough, or increasing their number, it is possible to reduce the number of trusses or ties over the top of the wall, or even to eliminate all ties and trusses over the wall and rely on end ties or trusses and anchor bolts alone.

The wall forms are provided with bulkheads 45 as shown in Figures 1, 2 and 7, the bulkheads preventing the concrete from running out of the front end of the forms. The location of the rear ends of the forms against the previously cast section of the wall confines the concrete at that end. The concrete exerts pressure against the form both laterally and longitudinally. It is also necessary to prevent longitudinal movement of the forms due to the pressure of the concrete against the portion of the wall which has already been formed. This may be accomplished as shown in Figure 2 by the use of a tie rod 28a embedded in

a previously cast portion 47 of the wall, which tie rod is connected to one of the steel walers 32. The bulkhead 45 is maintained closed against the pressure of the concrete by braces 48 placed against the steel walers 49, the opposite end of the braces fitting into depressions in the footing.

It will be seen from the above description that in the present method it is only necessary to retain the forms in place until one section of a single lift of the wall has had time to set. If forms were used which extended the whole height of the wall, even if the wall were cast in vertical sections, it would be necessary to retain the forms in place until the top of the wall had been built. With the present method, however, the forms may be shifted in the morning of one day, filled the same day, and again shifted and filled on the following day, so that all the forms supplied to a given piece of work may, if the work be conducted expeditiously, be used once each day while the work is in progress. This results in a substantial saving in the number of forms required and enables the wall to be built much more rapidly. Furthermore, the lower lift of the wall may be back filled as soon as a portion of it has been built, it being unnecessary to wait for the completion of any section of the wall to its full height.

The forms for forming the wall are adjustable so as to accommodate them to various width walls. The particular type of forms will depend upon the particular type of wall which is to be built.

The invention is applicable not only to the building of walls of considerable height by casting superimposed horizontal lifts in separate operations, but is adapted to the construction of walls in which the entire height is cast in one lift.

I have illustrated and described several embodiments of my invention and have described the manner in which the invention may be practiced. It is to be understood, however, that the invention may be otherwise embodied or practiced within the scope of the following claims.

I claim:

1. The method of building concrete walls, which comprises pouring concrete into a wall form to form one section of a horizontal lift of less height than the total height of the wall, advancing the form, supporting it from a footing and from a previously cast portion of said lift, pouring another section of the first lift, and forming sections of a second lift on the first lift before the entire length of the first lift is completed.

2. In the method of building concrete walls, the steps comprising intermittently advancing a wall form and pouring concrete therein to form the first lift of the wall, placing a wall form above the first lift and supporting it in part from the first lift and in part from a previously cast portion of a second lift, and intermittently advancing the form and pouring concrete therein to advance the formation of the second lift.

3. The method of building concrete walls, which comprises laying a footing, supporting a wall form from the footing, pouring concrete into the form to build the first section of a first lift of less height than the total height of the wall, intermittently advancing the wall form and pouring concrete therein to form the first lift of the wall, placing a wall form above the first lift and supporting it in part from the first lift and in part from a previously cast portion of a second lift, and intermittently advancing the form and pouring concrete therein to advance the formation of the second lift.

4. Apparatus for building concrete walls, comprising a horizontal support, a vertical support connected thereto adjacent one end thereof and extending downwardly therefrom, said supports being adapted for longitudinal movement as a unit, and wall forms supported by said horizontal support, at least a portion of said vertical support lying between the longitudinal extensions of said wall forms.

5. Apparatus for building concrete walls, comprising a horizontal support, a vertical support connected thereto adjacent one end thereof and extending downwardly therefrom within the path of the wall, said supports being provided with wheels and adapted for longitudinal movement as a unit, and wall forms supported by said horizontal support.

6. In the method of building concrete walls in which a section of the wall is cast against a form supported from a carrier, the step comprising moving the carrier lengthwise of the wall while supported adjacent one end by a previously cast section of the wall and adjacent the other end independently of said section.

7. In the method of building concrete walls, the steps comprising supporting a form on a carrier, moving the carrier lengthwise of the wall while supported adjacent its ends at different elevations, and casting an adjoining section.

8. The method of building concrete walls, which comprises casting a section of the wall against a form supported by a carrier while supporting the carrier adjacent one end by a previously cast section of the wall and adjacent the other end at a lower elevation and independently of said previously cast section.

9. In a wall mold apparatus, a pair of mold forms, a horizontal longitudinally movable carrier for the mold forms, and supports adjacent the ends of the carrier, said supports lying at least in part between the longitudinal extensions of said mold forms.

10. In a wall mold apparatus, a pair of mold forms, a horizontal carrier for the mold forms, and supports adjacent the ends of the carrier, said supports terminating at their lower ends at different elevations and lying at least in part between the longitudinal extensions of said mold forms.

11. Apparatus for building concrete walls, comprising a horizontal support, vertical supports connected thereto at the front and rear ends thereof, the vertical support at the front end extending downwardly to a different elevation than the vertical support at the rear end, and wall forms supported by the horizontal support.

12. The combination in a wall mold apparatus of a supporting frame comprising a longitudinally disposed rigid top member, a rigid member depending from one end thereof and connected thereto, side wall and bulkhead forms supported by the frame, means providing lateral adjustment of the wall forms, and wheeled supports for the frame moving on tracks laid within the longitudinal planes of said wall forms.

13. A wall form apparatus comprising a rigid frame having an upwardly extending side member and a connecting top member, wheeled supports for said frame, side wall and bulkhead forms rigidly connected to the frame, and means providing lateral adjustment of the wall forms by movement of the frame side member relative to the connecting top member.

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