Jan. 17, 1933. R. W. DRESSER 1,894,676

WALL CONSTRUCTION

Filed Oct. 16, 1931 3 Sheets-Sheet 1

Fig. 1.

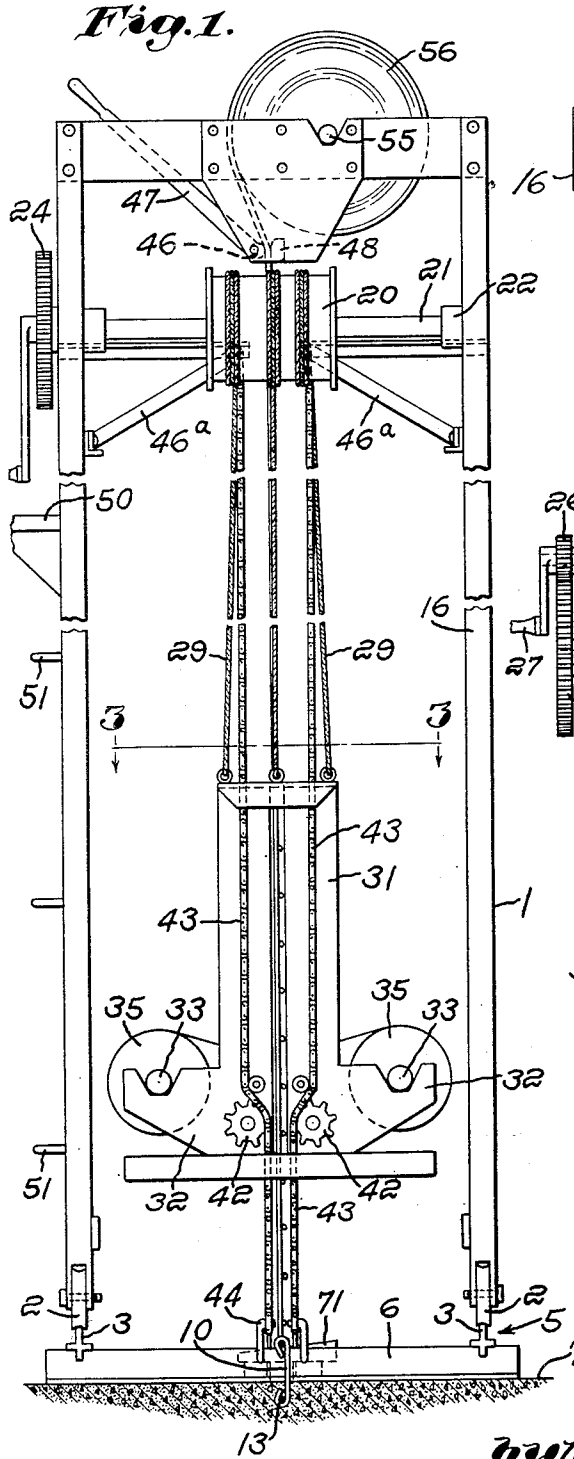


Fig. 2.

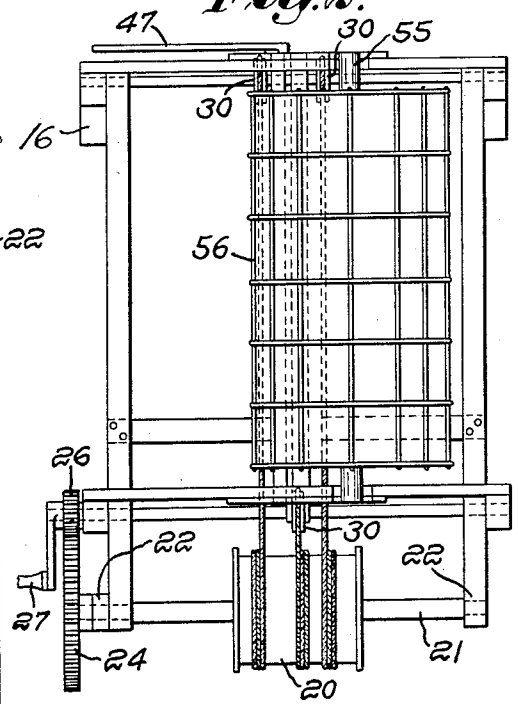
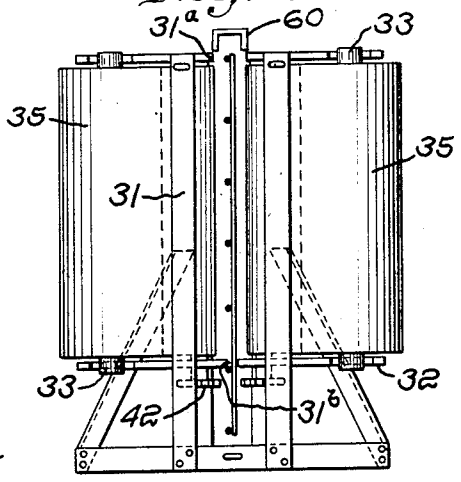


Fig. 3.



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Fig. 4.

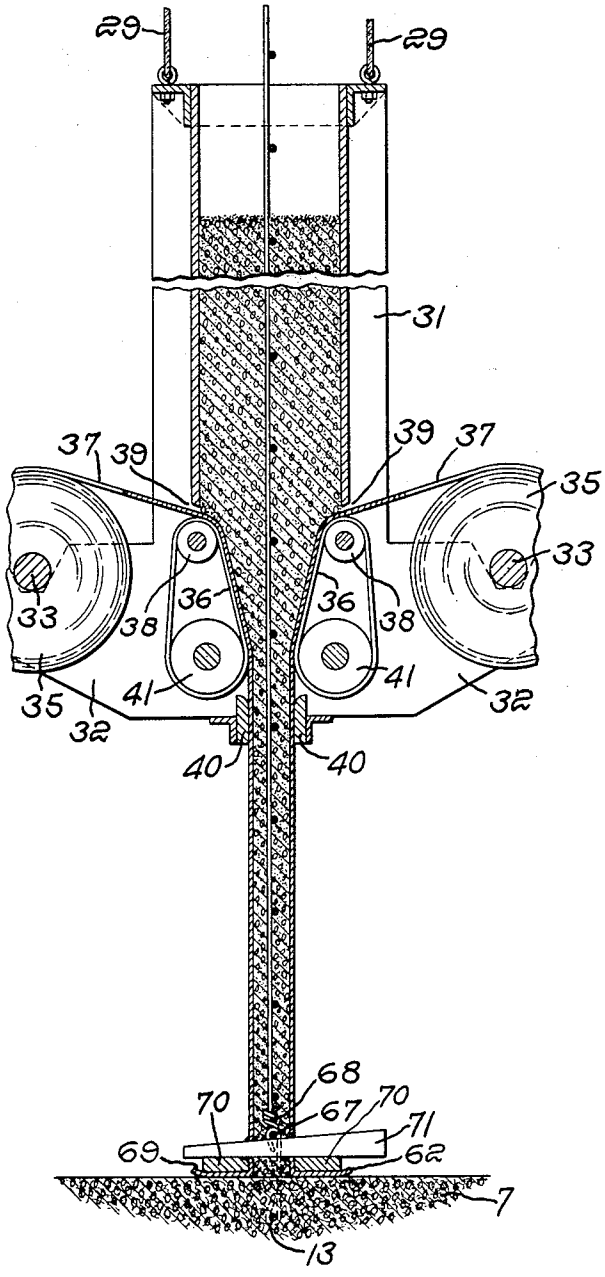


Fig. 8.

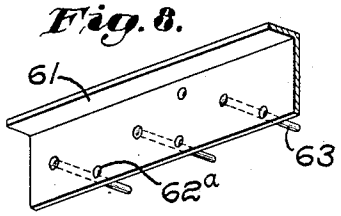


Fig. 5.

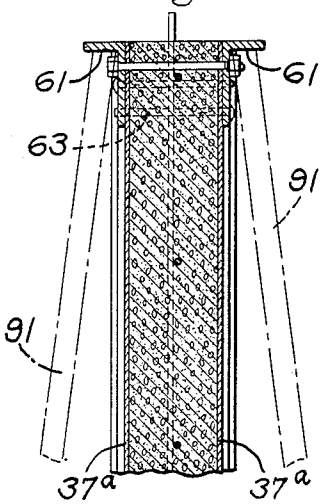
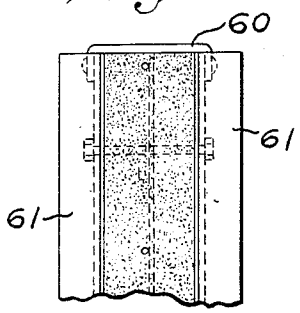


Fig. 6.



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Fig. 9.

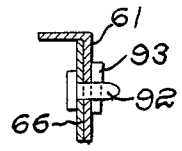


Fig. 7.

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UNITED STATES PATENT OFFICE

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WALL CONSTRUCTION

Application filed October 16, 1931. Serial No. 569,127.

This invention relates to an improved method and apparatus for wall construction and more particularly walls of cementitious material.

Heretofore walls of cementitious material have ordinarily been made by pouring into forms or by the building up of successive courses or sections or preformed cementitious block, slabs or the like.

It is the principal object of this invention to provide for forming building and like walls in place, by extrusion, preferably of cementitious material having the maximum of strength and unweakened by such high proportion of water as is required in poured walls. Other objects of the invention are to provide for forming in place cementitious walls which may be of materially less thickness than the usual cast or formed walls, to provide for compacting the cementitious material about and in intimate adhesion to an inner supporting reinforcing sheet by transverse pressure; to provide for applying to the extruded or compacted wall suitable layers of sheet material, which may be temporary, and which act to prevent the cementitious material from falling away from the inner supporting reinforcing sheet, and to do these things together and in a coordinated fashion rendering possible the rapid construction of walls in place, preferably by machinery.

Other objects of the invention are to provide for the easy and rapid formation in place of successive sections of a wall, to insure that the successive sections will be united by cementing action of their constituent material, to facilitate the adequate structural union between the inner reinforcing sheets of the successive sections; and to accomplish these things without interfering with the rapidity of formation of the wall sections severally.

In a specific instance, illustrating by way of example many features of the invention, the wall may be formed by the extrusion of plastic cementitious material upon a suitable base, such as a foundation or floor, the wall being formed by the extrusion of adjoining cementitious sections which are integrally joined to each other before the cementitious material hardens. The invention permits the employment of labor saving machinery and facilitates the rapid erection of continuous walls of reinforced cementitious material. For this purpose I preferably provide a truck carrying a frame in which a vertically movable hopper is supported. Feeding means are arranged to direct flexible sheets of material, such as sheets of paper to the opposite sides of a slot or opening at the bottom of the hopper. The lower ends of these sheets are secured to the base and as the hopper is drawn upwardly the sheets are drawn upwardly so that they are in wetted contact with either side of the cementitious material which is extruded through the opening at the bottom of the hopper. Thus the sheets provide means retaining the cementitious material in place until it has set and, in fact, aid its setting. Preferably a metal reinforcement of coarse-meshed wire may be arranged between the sheets, for example the lower end of the wire may be secured to the base upon which the wall is formed and its upper end may be carried upon a roller, suitable tension means being provided to hold the wire taut as the cementitious material is extruded thereabout. When a section of a wall has been extruded in this manner, suitable supporting elements may be arranged to retain the upper ends of the outer and/or reinforcing sheets in place. Thereupon the truck is moved to an adjoining portion of the base and the operation is repeated so that the succeeding wall section is similarly formed, the extruded cementitious material in the new wall section joining with that of the first section before the latter has hardened so that a continuous integral wall is thus built up, section by section.

In the accompanying drawings

Fig. 1 is a front elevational view of apparatus for erecting a cementitious wall;

Fig. 2 is a plan view of the apparatus shown in Fig. 1;

Fig. 3 is a section on line 3—3 of Fig. 1;

Fig. 4 is a vertical section of a portion of the mechanism showing the hopper and also showing the manner of connecting the reinforcing wire and the face sheets to the base;

Fig. 5 is a sectional view of the upper part of a wall showing the arrangement of hori-

zontal and substantially vertical supporting means therefor;

Fig. 6 is a horizontal section of an end portion of a wall showing the end reinforcement and form member therefor;

Fig. 7 is an elevational view of a wall having two sections erected and showing the apparatus in position for erecting of the third section;

Fig. 8 is a perspective detail of a supporting member; and

Fig. 9 is a sectional detail of splicing means for the same.

Referring to the accompanying drawings, the numeral 1 designates the frame of a truck, which may be supported on wheel 2 that engage the rails 3 of a temporary track 5, this track being provided with cross members or sleepers 6. The track preferably has its rails arranged upon opposite sides and at equal distances from the central plane of the wall to be erected. The wall may be erected upon any suitable base 7, as for example a poured cementitious footing. Preferably suitable double ended hook elements 10 are secured in the base 7 when the same is originally formed or at least before the erection of the wall is started. The lower ends of these hook elements may engage horizontal bars 13 embedded in the base.

The frame 1 is provided with a plurality of uprights 16 which support the various parts of the movable apparatus. A drum 20 is arranged on a horizontal shaft 21, the latter being mounted upon journals 22 at the upper part of the frame. A gear 24 on the outer end of shaft 21 is engageable by the pinion 26 operated by handcrank 27. A plurality of cables 29 extending over pulleys 30 are connected to the upper edge of a hopper casing 31. This casing is of split, boxlike form and carries opposite pairs of outstanding arms 32 upon which removable rolls 33 may be rotatably mounted. These rolls preferably carry convolutions of sheet material 35 such as a heavy paper. Below the member 31 are belts 36 having converging runs passing over upper pulleys 38 and lower pulleys 41, which define the shape of the lower part of the hopper but are spaced to provide a central opening or slot. The shafts of the pulleys or rollers 41 extend outwardly and are provided with sprockets 42. Each of the sprockets 42 engages an upwardly extending chain run 43, the lower end of which is detachably connected by a hook element 44 to a sleeper 6 of the track 5, the upper end of the chain being secured to a fixed bracket 46^a. This arrangement positively drives the belts 36, when hopper 31 is lifted.

Paper runs 37 from the paper rolls 35 are fed through slots 39 (Fig. 4) of hopper 31 and over the converging runs of the belts 36. Suitable guides 40 are arranged below the belts at either side of the hopper to engage the outer faces of the paper sheets. It is evident that when the shaft 21 and roller 20 are rotated due to turning of the crank 27 the hopper assembly including the member 31, the rolls 35 and the belts 36 may be hoisted.

A platform 50 is located at one end of the frame to support the operator when he turns the crank 27, while suitable step elements 51 permit ready access to the platform. Above the roller 20 is a removable roll 55 which may support a length of wire netting 56, being adapted to feed this netting downwardly through the hopper casing 31 and through the opening at the bottom of the hopper. The upper end of the wire run just below the roll 55 is secured in place by a self-locking cam element 46 mounted on a swinging lever 47, the cam element cooperating with a fixed abutment 48 in gripping the wire run to prevent its downward movement. The wire reinforcement preferably has a width greater than that of the hopper 31, one edge of the wire, as shown in Fig. 3, being disposed in the slot 31^a at one end of the hopper and substantially in alignment with the ends of the hopper, i. e., projecting slightly beyond the paper sheets. At the opposite end of the hopper the wire projects for a substantial distance beyond the slot 31^b, so that, as successive sections are erected, the wire reinforcing elements thereof are disposed in overlapping relationship.

Apparatus of the character described is adapted to make a wall after an end supporting and forming member 60, Fig. 6, has been erected at one end of the proposed wall, and temporarily supported by any suitable shoring members. The truck is thus placed so that frame 1 is arranged with the end of the hopper assembly juxtaposed to the end member 60, Fig. 3. The end of the wire 56 is secured to the upper ends of the double ended hooks 10 by arranging horizontal bars 67 in the upper ends of these hooks and twisting the lower ends of the wires about these bars as designated by numeral 68, Fig. 4. The resulting wire run is thus held taut in a substantially vertical plane to define the central plane of the wall. The ends of the paper runs 37 are drawn downwardly between the guides 40 and are turned outwardly as designated by numeral 69, suitable boards or strips 70 being located between the sleepers 6 upon these outturned portions of the sheets and the wedge elements 71, being driven through the paper in engagement with the lower face of bar 67 to retain the outturned ends of the paper runs in engagement with the base.

A suitable plastic cementitious mixture is supplied to the hopper casings 31. This mixture may preferably comprise a comparatively low percentage of water, for example substantially the minimum proportion of water that is necessary to impart the maximum strength to the ultimate set concrete,

such a mixture being known in the trade as a 100% mix. The guides 40 are located directly above the wedges 71 when the cementitious material is initially supplied to the hopper 31. The crank 27 is then operated to lift the hopper, thus causing the cementitious material to be extruded from the hopper due to the action of gravity and frictional engagement with the sheets 37 which converge as they move toward the lower part of the hopper. The sheets are thus drawn upwardly in contact with the cementitious material and are accurately guided by the belts 36 and members 40, the pressure of the cementitious material holding them in firm frictional engagement with the guide belts 36. Thus the sheets 37 are fed into parallel vertical planes as the cementitious material is extruded from the hopper, the transverse compacting action of the hopper on the cementitious mass preferably taking place through the medium of the sheets of paper. It will now be apparent how the extruded and transversely compacted wall formed about the central reinforcing sheet, and pressed into intimate association therewith, is suspended or hung therefrom during setting. The sheets of paper disposed on opposite faces of the wall, preferably by mechanism such as just described, serve in relation to the wall to keep the cementitious material from falling away from its central reinforcing and supporting sheet.

The hoisting mechanism may be operated quite rapidly to permit the extrusion of the entire wall section. When the mechanism has been lifted to a point corresponding to the upper edge of the wall, i. e., the upper end of the upright 60, suitable horizontal supporting elements such as angles 61 may be secured by bolts 62 to the upper end of the vertical member, these members 61 being engageable with the outer faces of the sheets 37a. Preferably members 61 are provided with rows of inwardly projecting fingers 63 (Fig. 8) that are adapted to engage complementary openings 62a in the opposite member 61, these fingers being disposed so that they may engage transverse wires of the reinforcing member properly to support the latter in place, as shown in Fig. 5. Suitable diagonal shoring elements 91 may be temporarily engaged with the outer ends of the members 61 as diagrammatically indicated in Fig. 5 and as shown in Fig. 7. Thereupon the paper sheets may be severed and the end of the reinforcing wire may be cut off leaving the upper end of the reinforced wall section in the condition illustrated in Fig. 5. Thereupon the truck carrying the frame 1 may be rolled ahead on the track to a position to make an adjoining section whereupon the process described is in general repeated, the cementitious material for the second section being extruded and integrally joined with the cementitious material of the first section. As shown in Fig. 7, the wire reinforcements overlap each other as successive sections are erected. When the second section has been extruded a second pair of horizontal supporting elements 61 may be connected to the ends of the first pair for example by means of splicing plates 66, slotted pins 92 and wedges 93 received therein, Fig. 9, and may have their outer ends shored up by temporary diagonals 91. Thereupon the frame 1 may be moved along the track to the position of the third section where it is shown in Fig. 7. After the cementitious material of the wall has had time to take a substantially permanent set, the temporary shoring members 91 may be removed and the members 61 disconnected from each other and from the upright 60, which may also be removed. When the opposite end of the wall is reached a similar form and reinforcing member may be employed. The sleepers 6 and wedges 71 may be driven out of the bottom of the wall or cut off, in the former case, the resulting openings may be filled with plastic cement to complete the wall. The paper sheets 37a may be stripped from the wall after the same has initially set, or after complete setting, or not at all.

This method of wall construction is particularly advantageous when a relatively thin continuous, reinforced wall is to be formed of cement. The provision of the movable extruding mechanism or hopper permits the erection of a wall of this type very rapidly, without requiring the prior building of elaborate temporary forms. Since pouring is not depended upon, the cementitious mixture may be relatively stiff, i. e., have a low percentage of water which is conducive to the production of cement having the maximum structural strength.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. Method of wall construction comprising the arrangement of reinforcing means in the plane of the wall, the extrusion of plastic cementitious material on opposite sides of the reinforcing means, and the applying of flexible sheets upon opposite sides of the cementitious material, and permitting the material to set between the sheets.

2. Method of wall construction which comprises supporting a reinforcing means in the intended plane of the wall, holding ends of flexible sheets at a suitable base in spaced relation at opposite sides of said reinforcing means, and extruding cementitious material between the said flexible sheets while gradually feeding the sheets into position at either side of the cementitious material.

3. Method of wall construction comprising the arrangement of reinforcement means in the plane of the wall, the extrusion of plastic cementitious material on opposite sides of the reinforcing means, the compressing of the cementitious material into intimate association with the reinforcing means and with itself, and the disposition of flexible sheets upon opposite faces of the cementitious material to hold the cementitious material from falling away from the reinforcing means during setting.

4. Method of constructing a wall in place in successive sections comprising the arrangement of a vertical reinforcing strip in the plane of the wall, the extrusion of plastic cementitious material on opposite sides of the reinforcing strip, the compressing of the cementitious material into intimate association with the reinforcing means and with itself, the disposition of flexible covering sheets on opposite faces of the cementitious material, and the repetition of these operations to form successive sections of the wall, the cementitious material of each successive section being extruded into contact with the preceding extruded section, so as to form a continuous wall.

5. Method of constructing a wall in place in successive sections, which comprises securing the lower ends of flexible sheets in spaced relation and securing the lower end of a wire reinforcement intermediate the said sheets, extruding cementitious material between the sheets and at either side of the reinforcement, progressively feeding the sheets into position at either side of the cementitious material while holding the wire reinforcement vertically intermediate the sheets, disposing supports for the thus formed plastic wall to hold it up while setting, locating other sheets and a wire reinforcement and extruding cementitious material between said other sheets and in contact with the preceding wall section to provide a successive section of a continuous wall.

6. Method of constructing a wall in place in successive sections comprising supporting a reinforcing sheet in the intended plane of the wall, extruding cementitious material on opposite sides of said sheet, leaving an edge portion of the reinforcing material extending from the thus formed wall section, disposing covering sheets on the faces of the wall section thus formed to prevent the extruded cementitious material from falling away from the reinforcing sheet during setting, supporting another reinforcing sheet in approximate prolongation of the first reinforcing sheet, and in overlapping relation with the extending edge portion thereof, and extruding cementitious material on opposite sides of said other reinforcing sheet whereby to surround the overlap of the successive reinforcing sheets with the cementitious wall material.

7. Method of wall construction in successive sections, which comprises securing the ends of flexible sheets to a suitable base in spaced parallel relation, securing the end of a wire reinforcement to the base, extruding cementitious material between the sheets and at either side of the reinforcement while gradually feeding the sheets into position at either side of the cementitious material while holding the wire reinforcement into a taut position intermediate the sheets, disposing substantially horizontal supporting elements against the outer faces of the sheets, locating vertical supports between the base and the said horizontal supporting elements, thereby forming the first section of the wall, and locating sheets and extruding cementitious material therebetween to provide a successive section of the wall.

8. Method of wall construction in successive sections, which comprises securing a reinforcement to a suitable base, securing the ends of flexible sheets to the base in spaced parallel relation, extruding cementitious material between the sheets and at either side of the reinforcement while gradually feeding the sheets into position at either side of the cementitious material, disposing substantially horizontal supporting elements against the outer faces of the sheets, locating vertical supports between the base and the said horizontal supporting elements, thereby forming the first section of the wall, and locating sheets and extruding cementitious material therebetween to provide a successive section of the wall.

9. Method of wall construction characterized by holding a reinforcing sheet in the intended plane of the wall, placing a mass of cementitious material on both sides of said reinforcing sheet, and compressing said cementitious material from both sides of the reinforcing sheet by applying pressure thereto, transverse to the reinforcing sheet through the medium of exterior flexible sheet material on each side of the cementitious mass, thereby compacting the cementitious material and attaching it to the reinforcing sheet, and disposing the exterior sheet material in the form of a protective covering for the thus-formed wall.

10. Wall forming mechanism operative to form a cementitious wall about a vertical reinforcing support sheet, having therein vertically movable means for progressively pressing a mass of cementitious material toward and into intimate association with said sheet while compacting the mass from opposite sides thereof toward said support sheet to form a dense wall having the support sheet included therein, in combination with means for applying to opposite faces of the wall protective sheets of covering material.

11. Apparatus for making a wall compris-

ing a frame, a hopper vertically movable in the frame, means for feeding sheets in converging relation to a slot in the bottom of the hopper, and means for supporting reinforcing material extending through the slot between its opposite sides.

12. Apparatus for making a wall comprising a frame, a hopper vertically movable in the frame, means for feeding sheets in converging relation to a slot in the bottom of the hopper, means for feeding reinforcing material through the slot between its opposite sides, and a truck upon which the frame is supported.

13. Apparatus for making a wall comprising a frame, a hopper vertically movable in the frame, means for feeding sheets in converging relation to a slot in the bottom of the hopper, means for feeding reinforcing material through the slot between its opposite sides, and means for simultaneously hoisting the hopper and operating both the feeding means.

14. Apparatus for making a wall comprising a frame, a hopper vertically movable in the frame, belts at the lower part of the hopper with converging surfaces but spaced to provide a slot at the bottom of the hopper, said hopper being vertically movable in the frame, hoisting mechanism for lifting the hopper, rolls carried at opposite sides of the hopper and arranged to feed flexible sheets over the belts and downwardly through the slot as the hopper is lifted, and a roll for reinforcing wire on the upper part of the frame, whereby the wire may extend through the slot intermediate said sheets.

15. Apparatus for making a wall comprising a frame, a hopper vertically movable in the frame, means for feeding sheets in converging relation to a slot in the bottom of the hopper, said means including downwardly inclined belts, pulleys supporting the belts, sprocket means associated with certain of the pulleys, fixed chain elements engaging the sprockets and adapted to cause rotation of the pulleys and movement of the belts when the hopper is moved vertically, a roll for supporting reinforcing wire disposed above the vertical path of the hopper, and means to grip a wire run depending from the roll so that the wire run may extend through the slot and be held taut when connected to a fixed base below the hopper.

16. Apparatus for making a wall comprising a frame, a hopper supported by the frame and vertically movable in relation thereto, means for feeding sheets in converging relation to a slot in the bottom of the hopper, means to support an intermediate reinforcing sheet extending through the slots between said first-named sheets, the opposite ends of the hopper having slots therein through which the reinforcing sheet may project.

17. Method of wall construction in successive sections, which comprises the extrusion of cementitious material between parallel retaining sheets and about intermediate reinforcing elements, erecting a temporary framework to support the upper ends of the sheets and the reinforcing elements for one section, arranging the reinforcing elements of one section so that they extend into the position to be occupied by the next section, extruding cementitious material between the sheets and about the reinforcing elements of successive sections in a similar manner, supporting the sheets and reinforcing elements therefor by a temporary framework, permitting the cementitious material to harden, then removing the temporary framework and stripping the sheets.

18. Apparatus for making a wall in place in successive sections comprising a device adapted upon vertical movement to extrude cementitious material on both sides of a vertical support sheet simultaneously, means for raising said device, the device being formed to surround two faces and a free vertical edge of said vertical support sheet, the device including parts acting to confine the extrusion of cementitious material to a portion of the vertical support sheet spaced from the said free edge thereof so as to leave the free edge of the support sheet unsurrounded by cementitious material for subsequent association with the next adjacent section of the wall.

19. Method of wall construction in successive sections which comprises the erection of an end reinforcing element, the extrusion of cementitious material between opposite sheets with their ends juxtaposed to the reinforcing element and about an intermediate reinforcement of meshed wire, while limiting the width of the first section thus extruded so that the wire reinforcement projects beyond the extruded cementitious material, extruding the cementitious material of a second section between a second pair of retaining sheets and about reinforcing wire in overlapped engagement with the end of the wire reinforcement for the first section, and thus proceeding to erect successive sections, permitting the cementitious material to harden, and stripping the sheets from the face of the successively formed sections.

Signed by me at Boston, Massachusetts, this 13th day of October, 1931.

REVERE W. DRESSER.