March 17, 1959 J. B. WINN, JR 2,877,530

MONOLITHIC WALL FORMING APPARATUS

Filed July 25, 1955 3 Sheets-Sheet 1

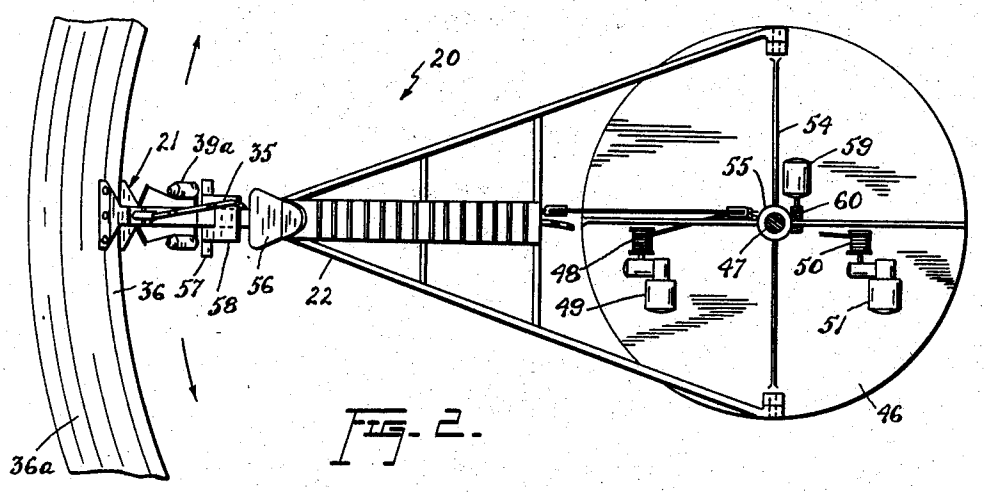


FIG. 2.

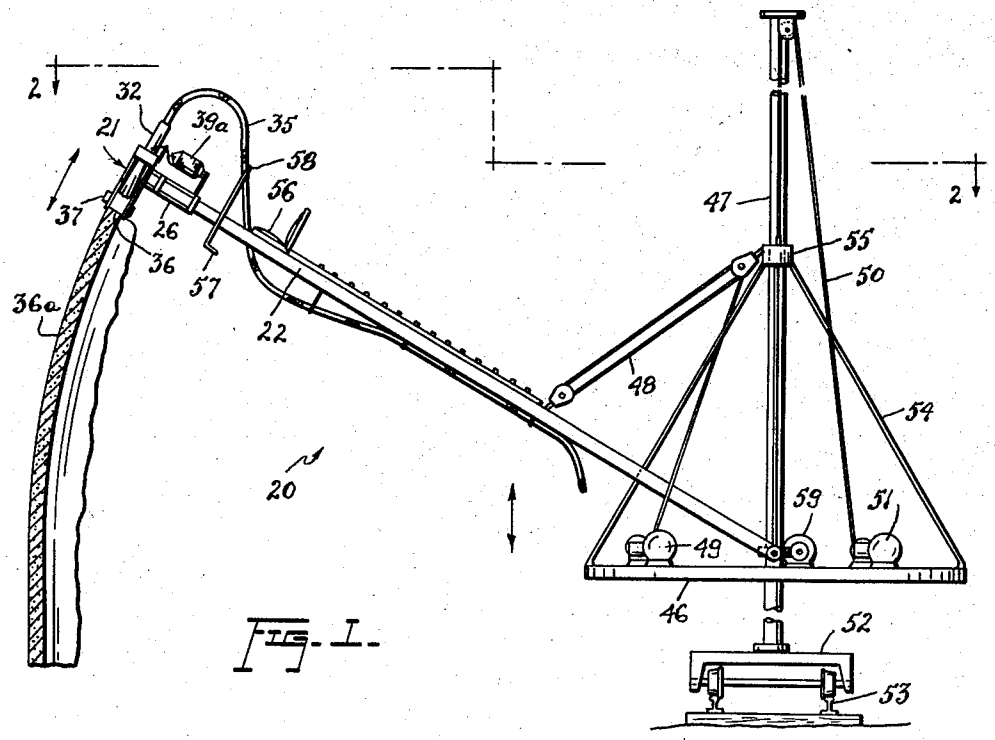


FIG. 1.

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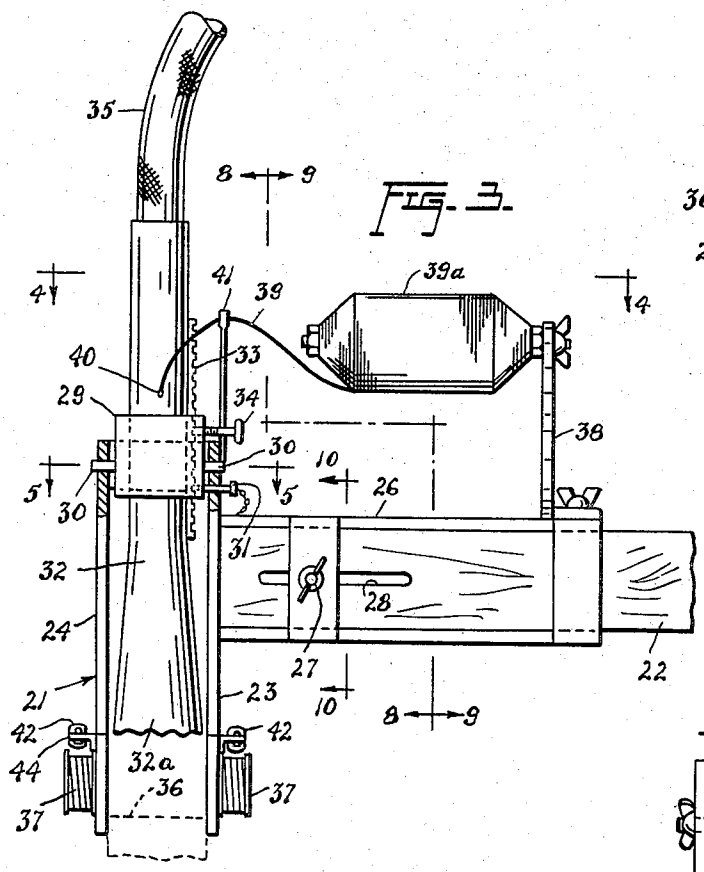


FIG. 3.

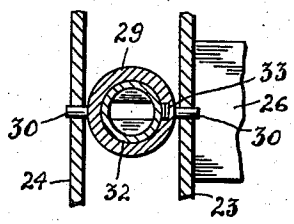


FIG. 5.

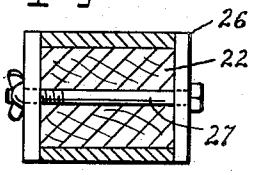


FIG. 10.

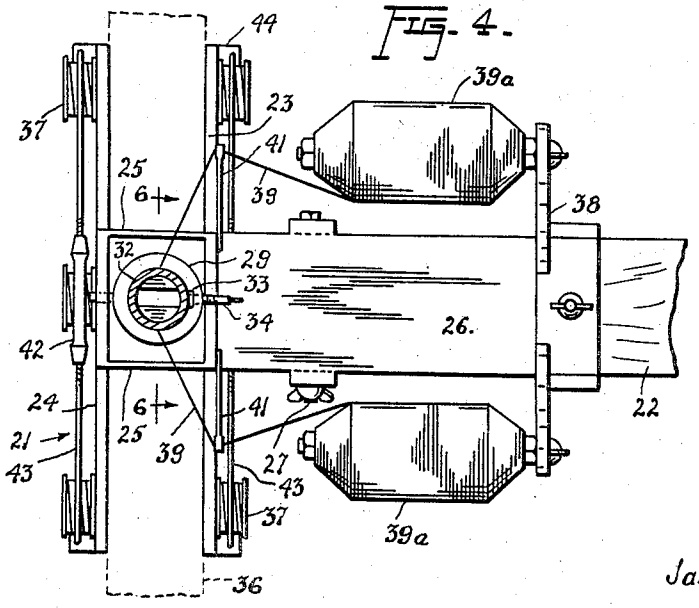


FIG. 4.

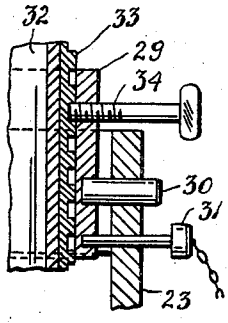


FIG. 7.

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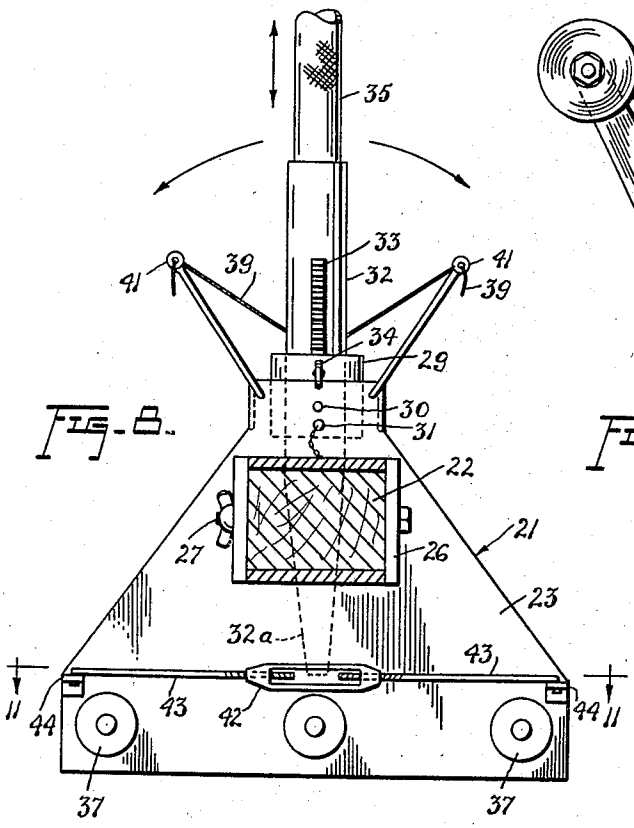


Fig. 8.

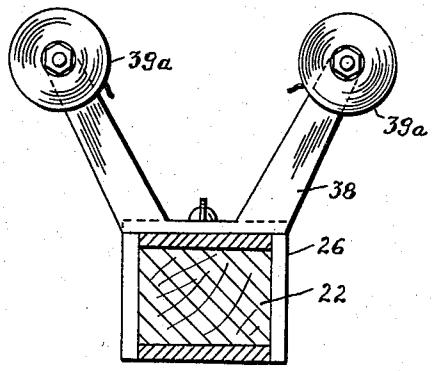


Fig. 9.

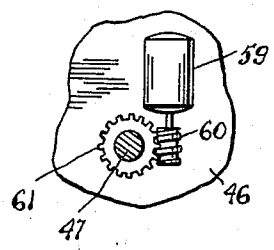
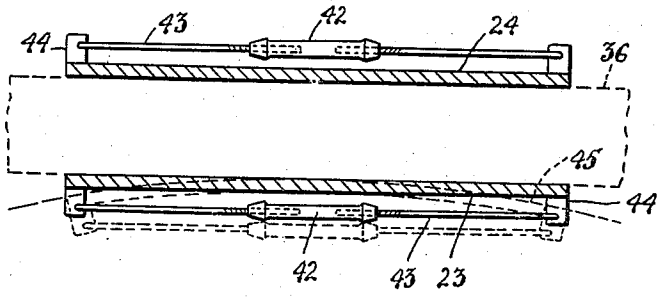


Fig. 12.

Fig. 11.



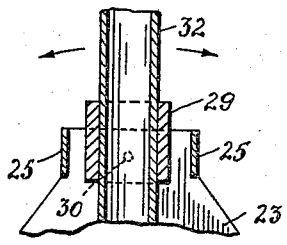


Fig. 6.

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MONOLITHIC WALL FORMING APPARATUS

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Application July 25, 1955, Serial No. 524,010

6 Claims. (Cl. 25—1)

This invention relates to new and useful improvements and structural refinements in wall forming apparatus, and the principal object of the invention is to facilitate convenient and highly expeditious formation of a monolithic wall in situ.

Specifically, the invention concerns itself with the art of building walls of concrete or similar hard-setting material in a continuous fashion whereby a movable or travelling molding head deposits and forms a layer of such material on a previously deposited layer before the latter is hard-set, so that the resultant structure is of a continuous, monolithic character. As such, the invention also contemplates the provision of means for embedding wire-like reinforcing material into the material of the wall prior to hard-setting, such means being integrated with the operation of the wall forming head so that the reinforcing material is automatically installed in place while the head travels along the wall being formed.

An important feature of the invention resides in the provision of means for movably supporting and guiding the molding head so that it is capable of forming straight, longitudinally curved as well as longitudinally and vertically curved walls. In the last named capacity, the invention is particularly well adapted for the formation of structural domes, and the like.

Another important feature of the invention resides in the provision of means for easily and conveniently manipulating the apparatus from a central control point located in close proximity to the portion of the wall under immediate construction, whereby the operator of the apparatus may efficiently manipulate the same with ease and accuracy.

With the foregoing more important objects and features in view and such other objects and features as may become apparent as this specification proceeds, the invention resides in the details of construction and arrangement of parts substantially as shown in the accompanying drawings, wherein like characters of reference are employed to designate like parts and wherein:

Figure 1 is a side elevational view of the invention in operation;

Figure 2 is a horizontal sectional view, taken substantially in the plane of the line 2—2 in Figure 1;

Figure 3 is an elevational view, on an enlarged scale, showing the molding head and a portion of its supporting boom;

Figure 4 is a sectional view, taken substantially in the plane of the line 4—4 in Figure 3;

Figure 5 is a sectional detail, taken substantially in the plane of the line 5—5 in Figure 3;

Figure 6 is a sectional view, taken substantially in the plane of the line 6—6 in Figure 4;

Figure 7 is a fragmentary sectional detail, on an enlarged scale, showing the means for mounting, adjusting and locking the nozzle;

Figure 8 is a sectional view, taken substantially in the plane of the line 8—8 in Figure 3;

Figure 9 is a sectional view, taken substantially in the plane of the line 9—9 in Figure 3;

Figure 10 is a sectional detail, taken substantially in the plane of the line 10—10 in Figure 3;

Figure 11 is a sectional view, taken substantially in the plane of the line 11—11 in Figure 8; and

Figure 12 is a fragmentary detail illustrating the means for rotating the boom.

With reference now to the accompanying drawings in detail, the invention consists of a monolithic wall forming apparatus which is designated generally by the reference numeral 20 and, broadly speaking, embodies in its construction a molding head 21 mounted at the outer end of a supporting and guiding boom 22 which is adapted, by means hereinafter described, for universal movement in both horizontal and vertical directions.

The molding head 21 embodies in its construction a pair of spaced side plates 23, 24 which are substantially triangular as is best shown in Figure 8 and which are rigidly secured together at their upper portions by cross bars 25. (See Figure 6.) The side plate 23 has a frame 26 secured thereto for attachment to the boom 22 by a cross bolt 27 extending through a slot 28 in the boom, in which manner the entire head 21 may be adjusted longitudinally inwardly and outwardly on the boom, as will be readily apparent.

A nozzle supporting annulus 29 is pivotally mounted by means of trunnions 30 in the space between the side plates 23, 24 in the region between the cross bars 25, this annulus being adapted for locking in a position wherein the axis thereof is vertical by a removable locking pin 31 extending through the plate 23. An elongated nozzle 32, having a flattened lower portion 32*a* is slidably mounted in the annulus 29 so that the nozzle may be raised or lowered with respect to the plates 23, 24 of the head 21, this being effected by providing the nozzle with a rack 33 engageable for locking purposes by a locking screw 34 provided in the annulus 29, as is best shown in Figure 7.

The nozzle 32 is adapted to receive hard-setting material such as concrete, and the like, which is delivered thereto through a flexible hose 35 attached to the upper end of the nozzle and which is discharged through the nozzle into the space between the side plates 23, 24, to effect formation of a wall. As will be readily understood, the space between the side plates 23, 24 corresponds substantially to the thickness of the wall being formed and, as the wall forming or molding operation is in progress, the relatively wide lower portions of the plates 23, 24 slide along a wall layer 36 already cast during a previous operational cycle of the apparatus so that the wall layer immediately in formation unites monolithically therewith prior to hard-setting.

To assist the desired, although not premature, hard-setting of the wall material, the molding head 21 is equipped with a plurality of electric heating units 37 which are mounted preferably at the outside of the lower portions of the side plates 23, 24 and operatively connected to a suitable source of electric current. Similarly, the hose 35 is connected to a suitable source of material supply.

Means are provided for automatically feeding wire-like reinforcing material such as wire itself, fiberglass thread, and the like, illustrated at 39 into the wall layer being formed prior to its hard-setting, such means comprising a supporting bracket 38, attached to the aforementioned frame 26 and carrying spools 39*a* of the material 39 so that the latter may be fed into the nozzle 32 through suitable openings or apertures 40 with which the side portions of the nozzle are provided. It is to be noted that the head 21 is open-ended, so to speak, for longitudinal travel along a wall being formed, and as the

head moves along the wall, the reinforcing material 39 will be automatically drawn through the apertures 40 from the spools 39*a* and embedded in the wall formation. If desired, suitable eyelet guides 41 may be attached to the side plate 23 adjacent the annulus 29 for guiding the wire-like material 39 from the spools 39*a* to the apertures 40 in the nozzle.

In the event that the apparatus is employed for molding a wall which is to be longitudinally curved, the side plates 23, 24 may be adjusted to conform to the curvature of the wall. This adjustment is effected by means of turn-buckles 42 connected to pairs of rods 43 which, in turn, are attached at their outer ends to brackets 44 on the outside of the lower portions of the plates 23, 24, as is best illustrated in Figures 8 and 11. Thus, by simply manipulating the turn-buckles 42, the plates 23, 24 may be arcuated as exemplified by the dotted lines 45.

The boom 22 supporting and guiding the molding head 21 is vertically swingable on a supporting platform 46 which, in turn, is rotatably mounted upon an upright standard 47. Vertical swinging of the boom is effected by a winch mechanism 48 operated by a motor 49 on the platform 46, as in accordance with conventional practice. The platform is also vertically slidable on the standard 47, this being effected by another winch mechanism 50 actuated by a motor 51 on the platform. The standard 47 itself is mounted upon a suitable trolley or truck 52 movable longitudinally along a track 53, all these arrangements being of a conventional nature and requiring no detailed explanation herein. However, it may be added that the platform 46 is equipped with reinforcing members 54 connected to a sleeve 55 slidable on the standard 47, as shown.

The operation of the entire apparatus is controlled from a central point, namely, the operator's seat 56 provided on the boom 22 adjacent the molding head 21, there also being provided a suitable foot rest 57 and a control panel 58 for the operator's convenience. As such, the control panel 58 is equipped with suitable means for controlling the operation of the motors 49, 51 as well as feeding of material through the hose 35 to the nozzle 32.

Having thus described the construction of the apparatus, its operation will now be explained.

As already stated, the material discharged through the nozzle 32 is deposited in the space between the side plates 23, 24 of the head 21 upon a previously laid course of wall formation, this being effected while the molding head 21 is in continuous longitudinal movement and while lower portions of the plates 23, 24 guidingly engage the wall formation already laid. Simultaneously, the wire-like reinforcing material 38 is being continuously unwound from the spools 39*a* and embedded in the wall course under construction and, by virtue of the heaters 37, rapid although not premature hard-setting of the wall material is achieved. Thus, as the head 21 travels along, a monolithic, reinforced wall structure is formed in situ.

If the wall to be formed is longitudinally straight and perpendicular, the entire apparatus including the platform 46, boom 22 and standard 47 is simply moved longitudinally along the track 53 by the trolley 52 to form one layer of the wall, whereupon the platform 46 and the boom 22 are raised on the standard 47 so that the molding head 21 is in position to form the next, overlying course of wall material.

In the event that the wall is to be longitudinally curved, the side plates 23, 24 are pre-adjusted to the appropriate degree of curvature by adjustment of the turn-buckles 42 and, as the head 21 travels along the wall, the platform 46 is rotated on the standard 47. This may be achieved by any suitable means, such as for example, by a motor 59 mounted on the platform and provided with a worm 60 meshing with a gear 61 secured to the standard, as is illustrated in Figure 12.

Finally, if the wall to be formed is longitudinally as well as vertically curved, such as for example, a structural dome shown in part at 36*a* in Figures 1 and 2, the boom 22 is progressively raised and the platform 46 rotated, while the trolley 52 remains stationary on the track 53.

In any event, the adjustment facilitated by the trunnion-mounted annulus 29 permits the entire nozzle 32 to be swung in the space between the plates 23, 24 to properly discharge the material along the wall formation and, at the same time, the adjustment afforded by the slidability of the nozzle in the annulus permits the lower end of the nozzle to be disposed at the best operational elevation above the wall formation. The adjustment of the frame 26 on the outer end of the boom 22 permits the head 21 to be set in accurate alignment with the wall formation, so that the successive layers of the wall are in proper, contiguous alignment.

As already explained, the apparatus may be used with any suitable hard-setting material other than concrete and the invention envisions the use of resinous or other plastic materials as substitutes for concrete for such purpose. Similarly, the reinforcing material 39 may be of any suitable type.

Apart from forming a monolithic wall of a single thickness as described, the invention may also be employed for formation of cavity walls, that is, double thickness walls with an air space between the two thicknesses thereof, in which instance the inner and outer sections or thicknesses of such walls may be formed in succession with the required amount of air space therebetween, and, prior to hard-setting, suitable cross ties may be inserted between the adjacent wall layers under formation to effect a unitary bond. At the same time, insulating material may be poured into the space between the inner and outer wall sections, if so desired.

While in the foregoing there has been described and shown the preferred embodiment of the invention, various modifications may become apparent to those skilled in the art to which the invention relates. Accordingly, it is not desired to limit the invention to this disclosure, and various modifications may be resorted to, such as may lie within the spirit and scope of the appended claims.

What is claimed as new is:

1. In a monolithic wall forming apparatus, the combination of a movable molding head open at the ends thereof and including inner and outer side plates affording a space therebetween corresponding substantially to the thickness of a wall to be formed, a nozzle carried by and pivotally mounted in said head in the space between said side plates, means for moving said head relative to the side plates, means for delivering hard-setting material in fluid form to said nozzle, heating means provided so said head for hard-setting the material discharged from said nozzle, and means adapted for universal movement for supporting and guiding said head in a predetermined path along a wall being formed thereby.

2. In a monolithic wall forming apparatus, the combination of a movable molding head open at the ends thereof and including inner and outer side plates affording a space therebetween corresponding substantially to the thickness of a wall to be formed, a nozzle carried by and pivotally mounted in said head in the space between said side plates for raising and lowering movement and longitudinal movement relative thereto, means carried by said head for raising and lowering said nozzle, means carried by said nozzle for delivering hard-setting material in fluid form thereto, and universally movable means for supporting and guiding said head in a predetermined path along a wall formed thereby.

3. In a monolithic wall forming apparatus, the combination of a movable molding head open at the ends thereof and including inner and outer side plates affording a space therebetween corresponding substantially to the thickness of a wall to be formed, an annulus swingably mounted between said side plates for movement in a plane parallel thereto, a nozzle slidable upwardly and downwardly in said annulus, a flexible hose connected to

said nozzle for delivering thereto hard-setting material in fluid form, and universally movable means for supporting and guiding said head in a predetermined path along a wall formed thereby.

4. The apparatus as defined in claim 3 wherein said side plates are adapted to operatively engage a wall formed thereby and together with said universally movable means constitute sole means for guiding the head along a predetermined path.

5. The apparatus as defined in claim 3 wherein said universally movable means include a boom having said head secured thereto, and means for adjusting the position of said head longitudinally on said boom.

6. The apparatus as defined in claim 3 wherein said universally movable means include a boom, a spool rotatably mounted thereon, and guide means carried by said head, said nozzle being formed in one side thereof with an aperture whereby reinforcing wire may be fed from said spool through said guide means and through the nozzle for embedding in the wall being formed by said head.

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