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3,479,704

POST FORMING MACHINE

Filed May 5, 1966

2 Sheets-Sheet 1

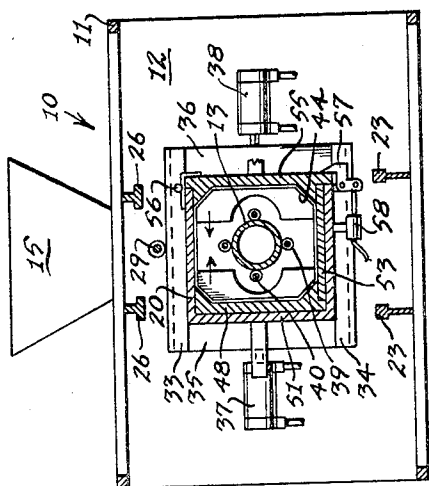


Fig. 2

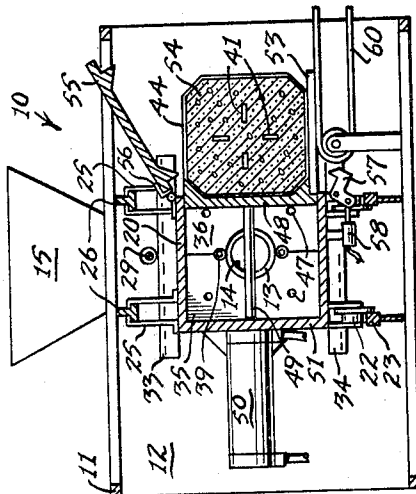


Fig. 4

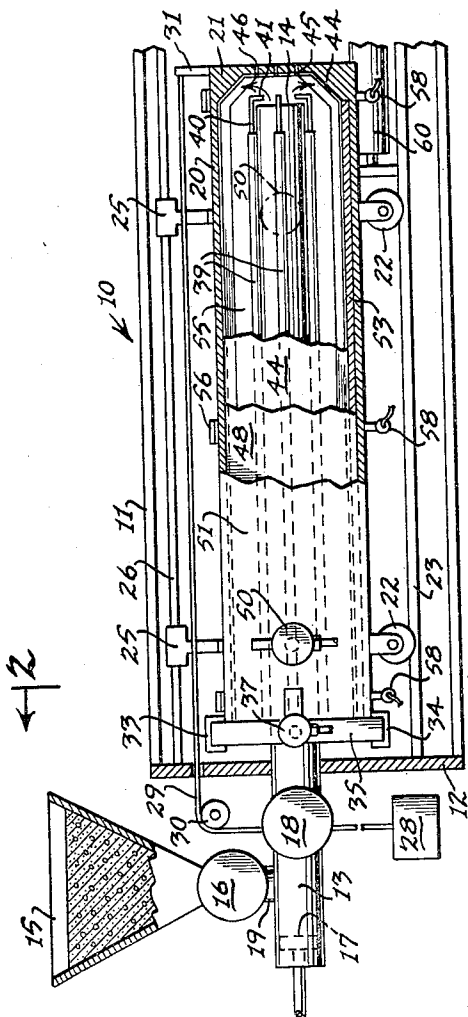


Fig. 1

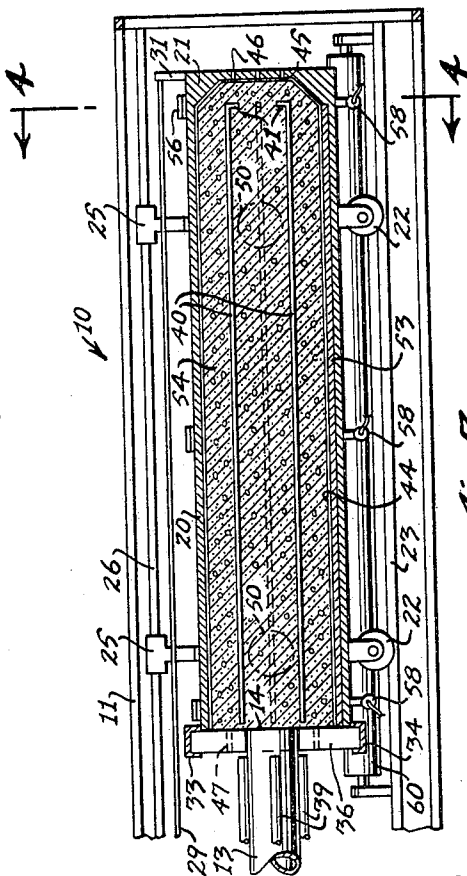


Fig. 3

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2 Sheets-Sheet 2

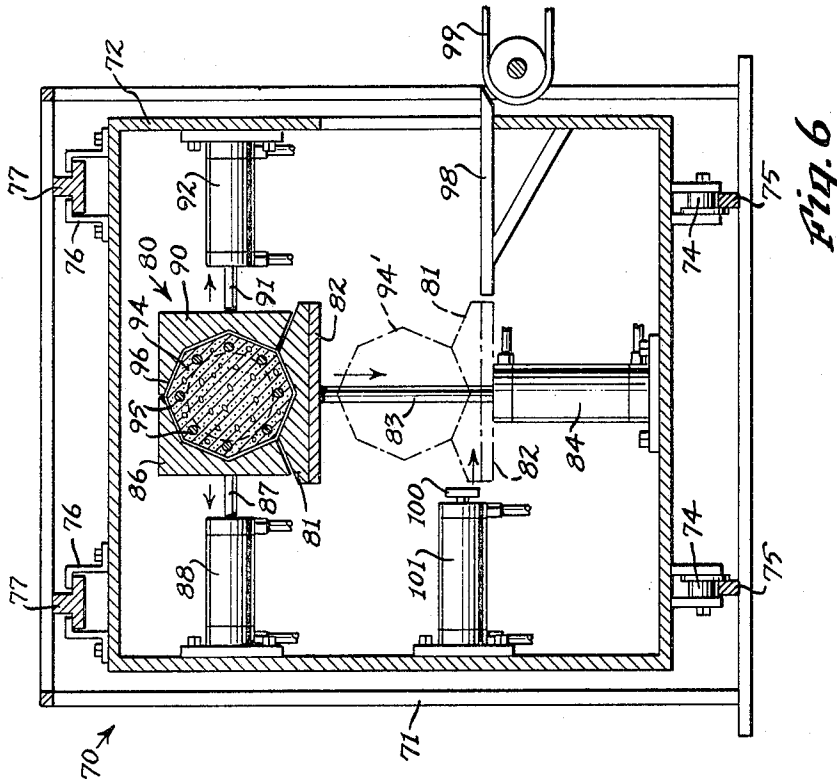


Fig. 6

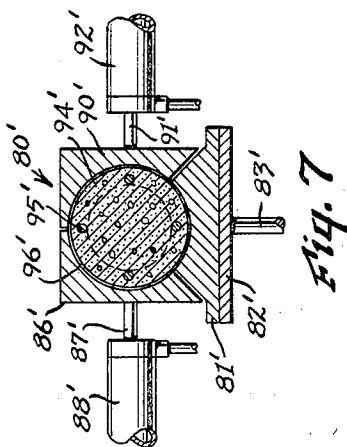


Fig. 7

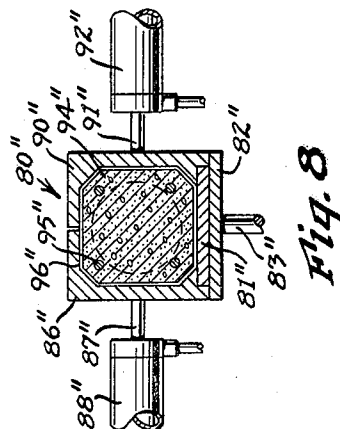


Fig. 8

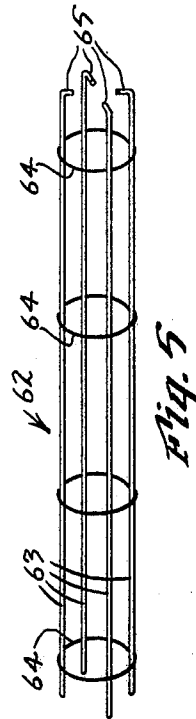


Fig. 5

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POST FORMING MACHINE
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U.S. Cl. 25—41

8 Claims

ABSTRACT OF THE DISCLOSURE

A post forming machine including an elongated, hollow mold having a closed end and an open end, a flexible liner having a closed end and an open end adapted to conform to the interior dimensions of the mold, and an elongated fluid concrete discharge conduit extending through the open ends of the mold and liner, and substantially the length of the mold in its initial position, with the discharge end of the conduit being adjacent the closed end of the mold, and means for forcing fluid concrete through the discharge conduit so that the accumulation of concrete against the closed end of the mold forces the mold and liner longitudinally away from the discharge conduit to gradually fill the mold with concrete.

SUMMARY OF THE INVENTION

This invention relates to a machine for the manufacture of concrete posts, beams, piling, poles or similar objects.

The machine includes means for discharging fluid concrete under pressure into a reusable mold which is lined with a flexible liner, such as plastic, paper or similar material. Reinforcing steel rods may be mounted within the mold to move with the mold as the concrete is discharged into the mold. After the mold and flexible liner are completely filled with the fluid concrete, which may or may not contain reinforcing rods, the molded specimen within the liner is ejected from the mold very soon after the specimen has attained its molded form. The shape of the specimen is maintained by the confinement within the flexible liner.

Because of the use of the flexible liner within the mold, no stripping, cleaning, or oiling of the mold walls, nor vibration of the fluid concrete is necessary in the manufacture of the concrete specimens. The mold may be opened and closed automatically, and the specimen ejected by means of hydraulic or pneumatic cylinders or electromagnets. The concrete specimen can be handled immediately after it has been molded.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of the left-hand portion of the machine, disclosing the mold in its initial position, with parts broken away;

FIG. 2 is a section taken along the line 2—2 of FIG. 1 showing the mold gates open;

FIG. 3 is a side elevation of the right-hand portion of the machine with the mold disclosed in section in its final position;

FIG. 4 is a section taken along the line 4—4 of FIG. 3, disclosing the specimen being discharged from the mold;

FIG. 5 is a perspective view of a modified form of the reinforcing rods;

FIG. 6 is a transverse elevational section of a modified form of the machine;

FIG. 7 is a fragmentary transverse sectional elevation similar to FIG. 6, but disclosing a mold having a different cross-sectional shape; and

FIG. 8 is a view similar to FIG. 7 disclosing another mold shape.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to FIGS. 1—4, the machine 10 made in accordance with this invention includes an elongated frame 11 having a left end or rear member or wall 12 supporting an elongated tubular fluid concrete discharge pipe or conduit 13. The discharge pipe 13 extends from outside the rear wall 12 longitudinally forward through the frame 11 where it terminates in a discharge outlet 14. A fluid concrete hopper 15 is mounted outside the rear wall 12 and communicates through a valve 16 to the rear portion of the concrete pipe 13. A piston 17 extends through the rear of the concrete discharge pipe 13 and is adapted to be moved reciprocally and longitudinally of the pipe 13 by any convenient means, not shown. Another valve 18 may be mounted in the discharge pipe 13 between the rear wall 12 and the intersection of the pipe 13 with the hopper outlet pipe 19.

Disposed concentrically around the concrete discharge pipe 13 in an initial position, as disclosed in FIG. 1, is a concrete post mold 20 having a cross section of any desired shape, such as the square cross section with chamfered edged disclosed in FIGS. 2 and 4. The mold 20 has its right or front end closed by wall 21, and its left or rear end open to receive the discharge pipe 13.

The mold 20 is mounted within the frame 11 to move longitudinally relative to the concrete discharge pipe 13. In order to effect this movement, wheels, or rollers, 22 are fixed to the bottom of the mold 20 and adapted to roll along the longitudinally disposed rails 23.

The mold 20 may be guided in its longitudinal travel by means of guide brackets 25 fixed to the top of the mold 20 and cooperating with the upper longitudinal rails 26.

The mold 20 is normally held in its initial position by a counterweight 28 suspended by cable 28 about pulley 30 and extending longitudinally through the rear end wall 12 to its opposite end which is fixed to a plate 31 or other fixture projecting upwardly from the front end of the mold 20.

Upper and lower tracts 33 and 34 respectively, are mounted transversely upon the upper and lower edges of the open rear end of the mold 20, to support, for transverse reciprocable movement, opposed gates 35 and 36. The gates 35 and 36 are provided with opposed semi-circular openings to receive the discharge pipe 13 when closed, as disclosed in FIG. 4. The gates 35 and 36 may be reciprocally moved by any convenient means, such as the hydraulic cylinders 37 and 38, as best disclosed in FIG. 2.

In a preferred form of the machine 10, any desired number of elongated tubes 39, four of which are shown in the drawings, are fixed to the discharge pipe 13. These tubes 39 extend substantially the length of the portion of the discharge pipe 13 within the mold 20 in its initial position, and are equally spaced around the circumference of the pipe 13. Received within each tube 39 is an elongated steel reinforcing rod 40 having its outer, or right end, 41 bent at 90° to the main portion of the rod 40. Disclosed in FIG. 1, the bent end portions 41 extend radially inward across the discharge outlet 14 of the concrete pipe 13. The reinforcing rods 40 are free to slide longitudinally of the tubes 39.

Disposed over the open discharge outlet 14, the major portion of discharge pipe 13, the reinforcing rods 40 and receiving tubes 39, is a flexible liner 44 having a closed end and an open end. The liner 44 is preferably of a thin plastic or paper material having the general shape of the interior of the mold 20, so that when the

liner 44 is completely filled with concrete, it conforms to the interior surface of the mold 20. The right closed end of the flexible liner 44 is provided with openings 45 through which air is expelled as the liner 44 is filled with concrete. In a similar manner, the right end wall 21 of mold 20 and the gates 35 and 36 may be provided with air expulsion openings 46 and 47, respectively.

As best disclosed in FIGS. 2 and 4, the mold 20 is provided with an interior moveable ram wall 48 connected to a piston rod 49 which is reciprocally moved by the hydraulic cylinder 50 mounted upon the corresponding fixed side wall 51 of the mold 20. Adapted to move with the ram wall 48 at the bottom thereof is a horizontally disposed pallet 53 upon which the liner 44 filled with the concrete specimen 54 is carried.

The opposite side or swing wall 55 of the mold 20, that is, opposite from the ram wall 48, is pivotally mounted by hinges 56 to the top wall of the mold 20 to swing outward and upward as the concrete specimen 54 is thrust toward the swing wall 55 by the ram wall 48. The swing wall 55 is held in its closed operative position by means of pivoted latches 57 controlled by solenoids 58.

Mounted laterally adjacent the swing wall 55 of the mold 20 in its forward or final position is any means for conveniently receiving the pallet 53 supporting the specimen 54 and liner 44, such as an endless conveyor belt 60, as best disclosed in FIGS. 3 and 4.

The operation of the apparatus 10 disclosed in FIGS. 1-4 is as follows:

Before the mold 20 is moved to its initial position disclosed in FIG. 1, reinforcing rods 40 are inserted into the corresponding tubes 39 so that their bent ends 41 are disposed radially inward across and proximate to the discharge outlet 14. After the reinforcing rods 40 are in position around the discharge pipe 13, the open end of the flexible liner 44 is pulled over the discharge outlet 14 and over the bent ends 41 of the reinforcing rods 40. The liner 44 is moved rearwardly to envelope the discharge pipe 13 and tubes 39, as well as reinforcing rods 40, until the closed end of the liner 44 is closely adjacent to or against the bent ends 41 at the discharge outlet 14. Since the diameter or cross sectional dimensions of the liner 44 is the same as the cross sectional dimensions of concrete specimen 54 to be formed in the mold 20, then the cross sectional dimensions of the liner 44 are also approximately equal to the inner cross sectional dimensions of the mold 20. Therefore, the liner 44 will lie in a collapsed enveloping position over and surrounding both the discharge pipe 13, the reinforcing rods 40, and reinforcing rod tubes 39, until the fluid concrete is extruded from the open discharge outlet 14, to fill the inner space defined by the liner 44, and to move the liner 44 and the reinforcing rods 40 away from the discharge pipe 13.

As the flexible liner 44 is filled, it assumes the shape of the inside wall of the mold, as clearly shown in FIG. 3. The mold 20, together with the liner 44 and reinforcing rods 40, is gradually moved forward toward the right of FIG. 1. The concrete gradually accumulates within the liner 44 behind the discharge outlet 14. Since this accumulated concrete creates a greater resistance to the flow of additional concrete, than does the closed end of the mold 20, then the mold 20 is moved gradually from its original position in FIG. 1 toward its ultimate position in FIG. 3.

The fluid concrete is fed through the discharge pipe 13 by means of the ram 17, when the valve 18 is opened. Concrete is supplied to the discharge pipe 13 through the open valve 16 and outlet pipe 19 from the hopper 15.

As the fluid concrete passing through the discharge outlet 14 moves the mold 20, liner 44 and reinforcing rods 40 forward, the counterweight 28 is elevated and maintains uniform pressure against the discharging fluid concrete, to assure the formation of a homogeneous specimen 54.

When the mold 20 has reached its final position in FIG. 3, pneumatic or hydraulic cylinders 37 and 38 (FIG. 2) are actuated to move the gates 35 and 36 toward their closed position against the discharge pipe 13, to close the rear end of the mold 20. The mold 20 will then remain stationary until the remaining space in the flexible liner 44 and the mold 20 is filled with concrete. The purpose of the gates 35 and 36 is to prevent the expulsion of any concrete from the mold 20.

The openings 45 in the liner 44, openings 46 in the end mold wall 21, and openings 47 in the gates 35 and 36, permit the expulsion of air trapped within the liner 44 and the mold 20 during the filling process.

After the liner 44 is filled to form the specimen 54, electromagnetic latches 57 are energized by the respective solenoids 58 to unlock the swing wall 55. Hydraulic cylinders 50 are then actuated to extend the piston rod 49 and project the moveable ram wall 48 toward the opposite side of the mold. The moveable ram wall 48 carrying the pallet 53 and the specimen 54 within the liner 44 thrusts open the swing wall 55 until the pallet 53 moves upon the conveyor belt 60, or any other discharge station.

After the specimen 54 and pallet 53 are removed by the conveyor belt 60, the ram wall 48 is retracted by the hydraulic cylinder 50 to its original position disclosed in FIG. 2, and the swing wall 55 drops to its closed position by gravity. The de-energization of the solenoid 58 will permit the latches 57 to latch the swing wall 55 in closed molding position. The gates 35 and 36 are opened, and the process for making a new specimen is repeated.

FIG. 5 discloses an optional type of reinforcing steel rod assembly 62, in which a plurality, for example four, reinforcing rods 63, identical in shape to those disclosed in FIG. 1, are held in the circular configuration disclosed in FIG. 5, by a series of circular wires or binding rods 64 secured to the reinforcing rods 63, such as by spot welding. The prefabricated rod assembly 62, in which the diameter of the binding rods 64 is slightly greater than the outer diameter of the discharge pipe 13, is telescopically moved over the discharge pipe 13, until the 90° bent ends 65 of the reinforcing rods 63 are adjacent to, and extend radially inwardly across the discharge outlet 14. It will be understood that the tubes 39 are not employed when the modified reinforcing assembly 62 is used. As the fluid concrete is discharged from the discharge outlet 64, the concrete will engage the bent ends 65 of the rod assembly 62, and will carry the assembly 62 along with the concrete away from the discharge pipe 13, in the same manner as the reinforcing rods of FIG. 1 are projected from their corresponding tubes 39.

Although the mold 20 disclosed in FIGS. 1-4 is shaped to form a concrete specimen 54 of substantially square cross-section with chamfered edges, nevertheless, it will be understood that molds 20 of other cross sectional shapes may be employed.

FIG. 6 discloses a modified concrete post forming machine 70 including a stationary frame 71 and a moveable frame 72. The moveable frame 72 is provided with depending wheels 74 riding on longitudinal rails 75 fixed to the bottom of the frame 71 for relative longitudinal movement. The moveable frame 12 may also be provided with upper guide brackets 76 to ride along the overhead rails 77 fixed to the stationary frame 71.

Supported within the moveable frame 72 to move therewith is a modified form of mold 80. The mold 80 includes a bottom wall or pallet 81 mounted upon a platform 82 supported upon a vertically reciprocable piston rod 83 in hydraulic cylinder 84, fixed to the bottom of the moveable frame 72. The mold 80 also includes a left side wall 86 supported by horizontally reciprocable piston rod 87 within hydraulic cylinder 88 fixed to the left side of the moveable frame 72. The mold 80 is completed by the right side wall 90 fixed to horizontally reciprocable piston rod 91 carried in the hydraulic cylinder 92 fixed to the right side of the moveable frame 72.

The three mold walls 81, 86 and 90 are shown in a closed operative position to define the cross section of a form for an elongated concrete member, such as the specimen 94 including reinforcing rods 95. The particular cross section disclosed in FIG. 6 is octagonal. The specimen 94 is contained within a flexible liner 96 which conforms to the inner diameter and length of the mold 80 in the same manner as the flexible liner 44 disclosed in FIGS. 1-4.

The process of making the concrete form 94 in the machine 70 is very similar to the process employed with the machine 10. However instead of moving only the mold 20 longitudinally relative to discharge pipe 13 in FIGS. 1-4, the entire frame 72 is moved longitudinally toward and away from a concrete discharge pipe 13 identical or similar to that disclosed in FIG. 1 so that the mold 80 in closed position (FIG. 6), will move concentrically and telescopically about the concrete discharge pipe. The length of the mold 80 is comparable to the length of the mold 20. Of course, the mold 80 must be provided with an end wall comparable to the function of the end wall 21 of FIG. 1.

As the fluid concrete is discharged from the pipe, similar to 13, into the mold 80, the liner 96, reinforcing rods 95, mold 80 and the entire frame 72 are moved relative to the discharge pipe until the mold 80 and liner 96 are completely filled with concrete. The hydraulic cylinders 88 and 92 are then actuated to retract the side mold walls 86 and 90 away from the specimen 94. Then the hydraulic cylinder 84 is actuated to lower the platform 82, pallet 81 and the completed and lined specimen 94, to the dashed line position of FIG. 6.

The pallet 81 supporting the liner-enveloped specimen 94 is then moved laterally across the stationary platform 98 to an endless conveyor belt 99 by a ram 100 actuated by hydraulic cylinder 101 fixed upon the left side of the moveable frame 72. The hydraulic cylinder 101 is located at the proper elevation so that the ram 100 will engage pallet 81 and move it over the platform 82. After the ram 100 is retracted, and the piston rods 83, 87 and 91 are projected to their original solid-line positions disclosed in FIG. 6, the mold 80 is in position for the formation of a new concrete specimen 94.

FIG. 7 discloses a mold 80' having a circular cross-section, and including the elements 81', 82', 83', 86', 87', 88', 90', 91', 92', 94', 95', and 96', identical to the corresponding numbered elements in FIG. 6.

FIG. 8 discloses another mold 80'', operating identically to the mold 80, differing only in the square cross-section of the specimen 94'', having chamfered edges. All the elements in FIG. 8 correspond to the elements in FIG. 6 and are identified by a double prime ('').

It will be understood that other molds similar to 20 and 80 of other cross sections may be employed to make corresponding concrete posts of different shapes. Moreover, it is possible to make concrete posts which are longitudinally tapered, or pointed, rather than posts of uniform cross sections.

By using the necessary electrical and mechanical equipment, the machines 10 and 70 can be operated automatically except for the initial placement of the pallet, liner and reinforcing steel rods.

I claim:

1. A machine for forming a concrete post comprising:
 - (a) an elongated hollow mold having a closed end and an open end and a plurality of elongated side walls defining the internal cross-section of said mold,
 - (b) an elongated tubular conduit having an open discharge end normally projecting within and substantially the full length of said mold so that said dis-

charge end is adjacent the closed end of said mold in an initial position,

- (c) means mounting said mold and said conduit for relative longitudinal telescoping movement,
- (d) an elongated, flexible tubular liner impermeable to air, having a closed end and an open end, said liner having substantially the same cross-sectional shape and at least the same length as said mold,
- (e) said liner being within and extending substantially the full length of said mold, so that the closed end of said liner is adjacent the closed end of said mold, said said liner surrounds said tubular conduit in said initial position,
- (f) means for forcing fluid concrete through said conduit and from said discharge end into said liner and said mold, so that the continuous discharge of said concrete forces the closed ends of said liner and said mold relatively away from the discharge end of said conduit to a filled position.

2. The invention according to claim 1 in which the closed end of said liner has holes therein for the expulsion of air.

3. The invention according to claim 1 in which at least one of said side walls is moveable away from the other walls to permit removal of a molded concrete post and liner from said mold.

4. The invention according to claim 3 further comprising ram means mounted on one of said side walls opposite from said moveable wall, and operable to thrust the molded concrete post and liner through the opening in said mold provided by the movement of said moveable wall.

5. The invention according to claim 3 in which said moveable wall is the bottom wall of said mold, and means for lowering said bottom wall supporting said concrete post in said liner to remove said post and said liner from said mold.

6. The invention according to claim 1 further comprising a plurality of reinforcing rods, each rod having one laterally bent end portion, and means mounting said reinforcing rods on said conduit within said liner for free longitudinal movement of said conduit, said bent end portions being disposed radially inwardly across said discharge end of said conduit.

7. The invention according to claim 6 in which said means for mounting said reinforcing rods comprise tubular guide members fixed to and extending longitudinally of said conduit.

8. The invention according to claim 1 comprising a pair of gates mounted on the open end of said mold for reciprocal movement toward and away from each other, and transversely of said mold, and means for actuating said gates.

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