

May 26, 1942.

F. A. McCANN

2,284,332

MOLD FILLING APPARATUS

Filed Aug. 16, 1941

3 Sheets-Sheet 1

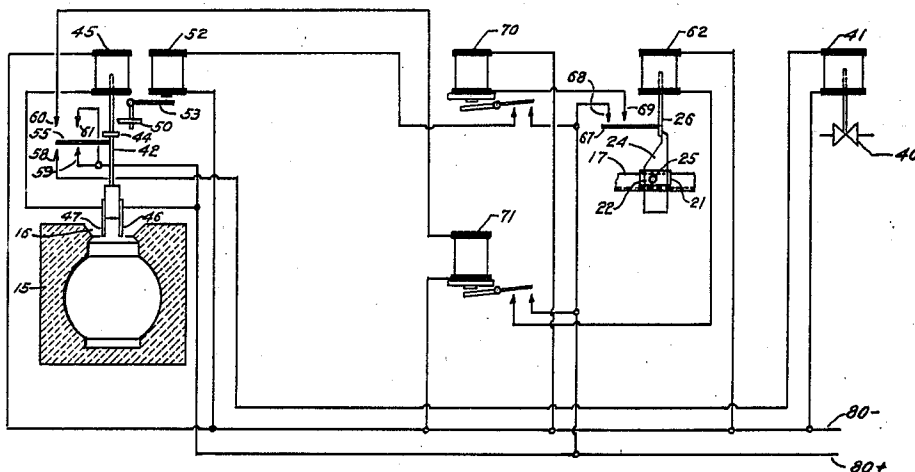


Fig. 9.

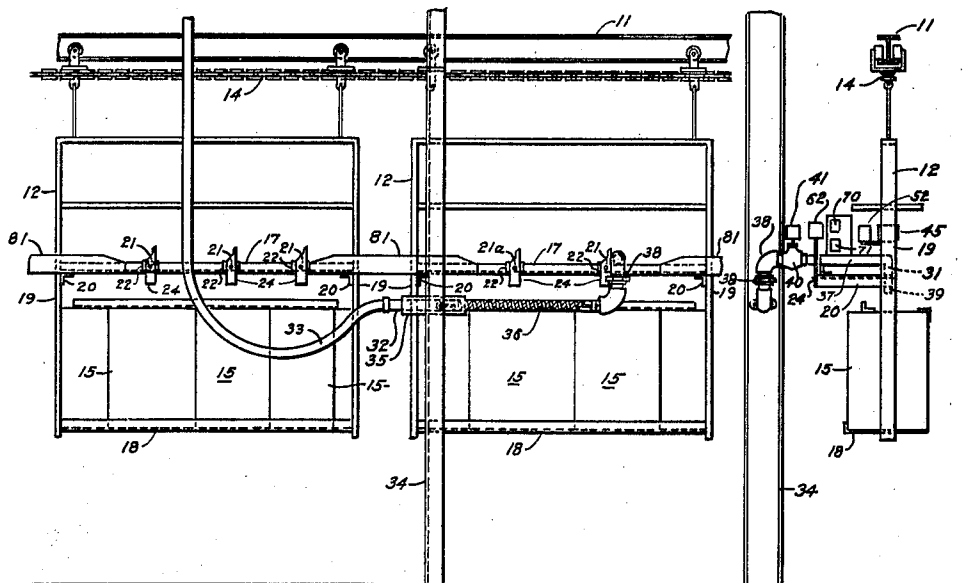


Fig. 1.

Fig. 8.

FRANKLIN A McCANN
INVENTOR.

BY *Wm. L. Hartmann*
ATTORNEY

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F. A. McCANN

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3 Sheets-Sheet 2

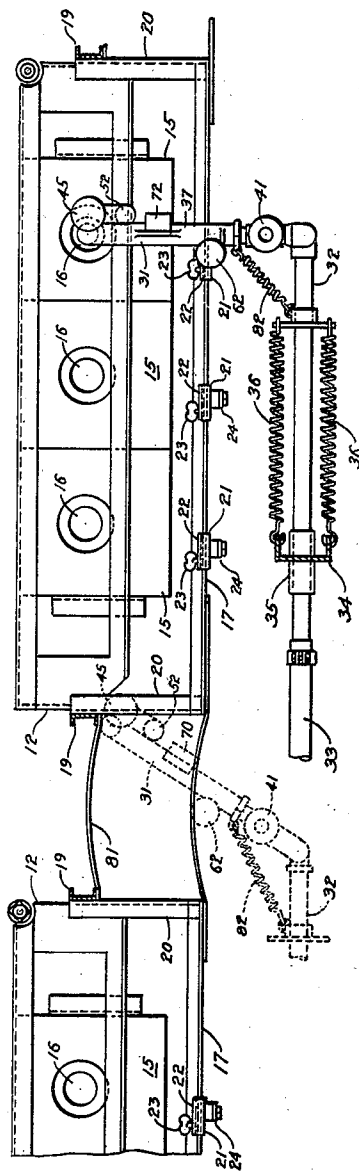


Fig. 2 -

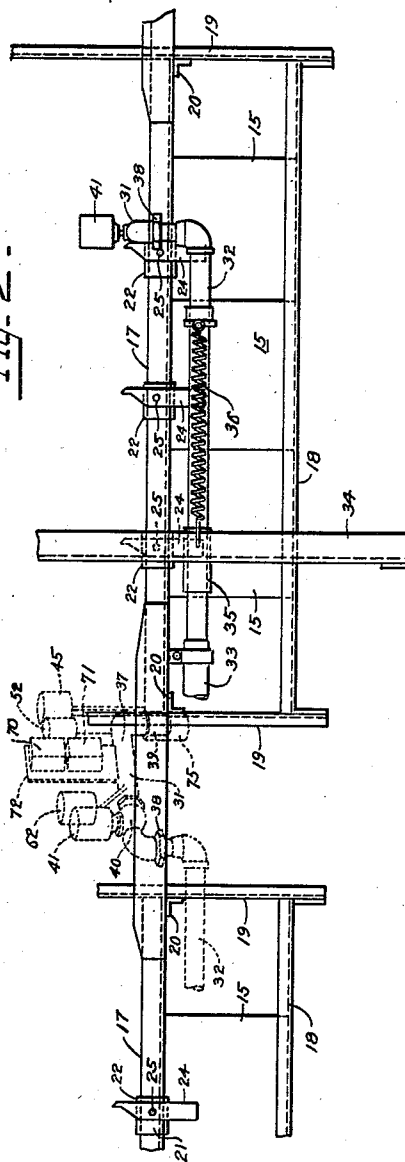


Fig. 3 -

FRANKLIN A. McCANN
INVENTOR.

BY *Myer L. Hartman*

ATTORNEY.

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F. A. McCANN

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3 Sheets-Sheet 3

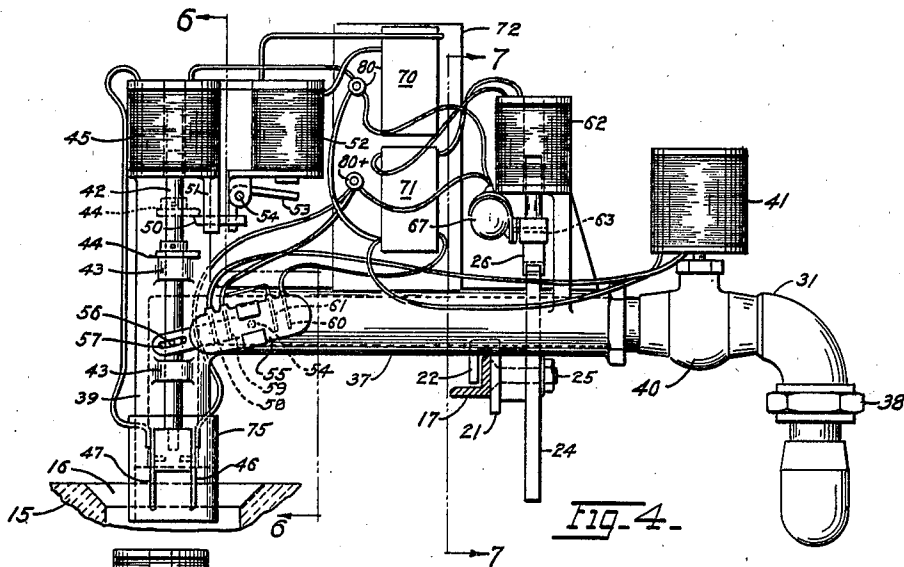


Fig. 4.

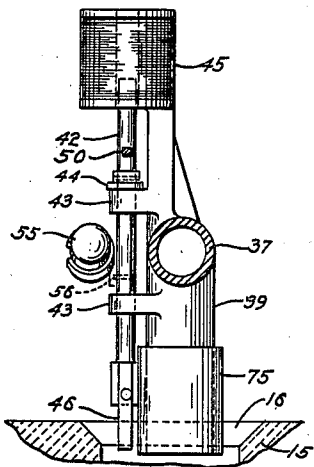


Fig. 6.

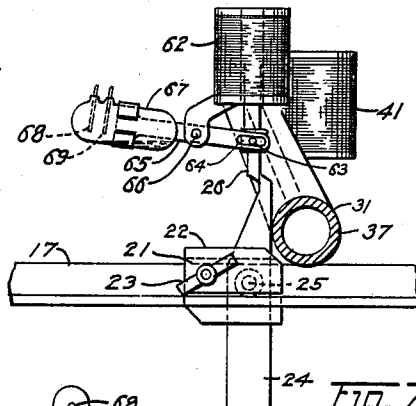


Fig. 7.

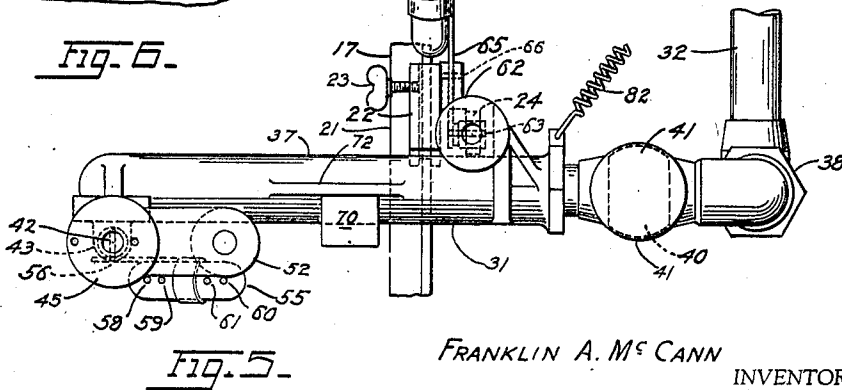


Fig. 5.

FRANKLIN A. McCANN
INVENTOR.

BY *Wm. L. Hartman*

ATTORNEY.

UNITED STATES PATENT OFFICE

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MOLD FILLING APPARATUS

Franklin A. McCann, Pasadena, Calif., assignor
to Pacific Clay Products Company, Los Angeles,
Calif., a corporation of California

Application August 16, 1941, Serial No. 407,190

9 Claims. (Cl. 25—29)

This invention relates to automatic filling of molds for forming cast ceramic ware.

In the forming of ceramic pieces by the casting process, a liquid suspension of the ceramic ingredients, commonly termed "slip," is poured into the cavity of a mold formed of an absorbent material such as plaster-of-Paris. After absorption of a part of the water and the forming of a lining of the desired thickness in the cavity, the excess liquid is poured out, and the formed piece and the mold are dried, followed by removal of the piece from the separable mold, which may then be refilled, and the cycle repeated. This series of operations is well adapted for a continuous system involving a conveyor in a closed circuit. One convenient form is an overhead rail conveyor with suspended mold-carrying cars and my invention will be described as applied to this particular form, although it may be adapted to other forms of conveyors.

Since in actual practice the pieces made are of varying sizes and of assorted volumes, the molds also vary in size, but by proper design of molds, or in the manner of placing them on the cars, the mold openings may be arranged to move under a filling spout, which is moved forward with the mold until the cavity is filled, and is then transferred back to the opening of the next mold, and so on continuously.

One object of my invention is to provide automatic filling means for ceramic molds moving continuously on conveyor cars. Another object is to provide a filling device which is automatically lowered into the neck of a mold as the mold is conveyed into the filling position. Still another object is to provide means for automatically lowering a nozzle into a mold to be filled. Another object is to provide means for raising the nozzle when the mold is filled. Another object is to provide means for opening and closing the nozzle coordinated with the in and out positions of the nozzle in relation to the opening of the mold. Another object is to provide a filling device for molds of differing capacity moving at a uniform rate past the filling station.

These and other objects are attained by my invention which will be understood by reference to the accompanying drawings, in which:

Fig. 1 is a side elevation of a portion of an overhead conveyor, with cars, molds and automatic filling device;

Fig. 2 is an enlarged plan view of two conveyor cars, with molds and automatic filling device;

Fig. 3 is a side view of the same;

Fig. 4 is a side view of the filling nozzle and associated devices;

Fig. 5 is a plan view of the same;

Fig. 6 is a cross-sectional view taken on the line 6—6 of Fig. 4;

Fig. 7 is a cross-sectional view taken on the line 7—7 of Fig. 4;

Fig. 8 is an end elevation view of a conveyor car and molds;

Fig. 9 is a diagram of the electrical circuit of my automatic filling device.

Referring to the drawings, an overhead conveyor track 11 is arranged to carry mold supporting cars 12 past a filling station, a drive chain 14 being used for continuous movement of the cars. The cars 12 carry one or more molds arranged in a row, the centers of the openings 16 of the molds 15 being arranged at a fixed distance from a back rail 17, and the tops of the molds being at substantially the same elevation above the floor. The molds are held on the car racks 18 by suitable clamping members which are arranged to avoid projections above the tops of the molds. Each car is provided with a back rail 17, which is disposed parallel to the line of travel of the cars, and is attached to end horizontal members 20 which in turn are fastened to the suspension members 19 at the ends of the cars. Upon the back rail 17 are mounted trips 21, one for each mold which is to be filled with slip. The trip 21 consists of a bifurcated member 22 adapted to straddle the back rail 17, to which it may be adjustably attached by the handscrew 23, and a trip arm 24 pivoted on the horizontal pin 25 to the back of the bifurcated member 22, so that, when its upper end is not engaged by the catch 26, the trip arm 24 may be tilted. The trip arm 24 is so mounted that its normal position is vertical, this being arranged by pivoting above the center of gravity. The trip arm 24 is adapted to cooperate with the catch 26 in holding a filling head 31 over a mold opening during the filling of that mold with the slip mixture, and also to tilt over to permit the head to slide along the top edge of the back rail 17 when the catch 26 is released coincident with the completion of the filling of that particular mold.

A filling head 31 is connected by a horizontally disposed pipe 32 and a hose 33 to a supply system under pressure for the ceramic slip used for filling the molds. A supporting post 34 is fastened rigidly in the floor adjacent the line of movement of the back rails 17 of the cars on the conveyor, and a slip collar 35 is attached to the post so that the pipe 32 slips freely through it. Tension-com-

pression springs 36 attached to the pipe 32 and to the post 34 serve to pull the head 31 back toward the post when the trip arm 24 is released, and also as shock absorber to the head by compression of the springs, so that the next succeeding trip arm may engage the head and carry it forward while filling the next succeeding mold.

The filling head 31 is connected to the horizontal pipe 32 by a swivel union 38. The filling head consists of a tubular body portion 37 having a downturned nozzle 39 which conducts the liquid slip to the molds. A quick acting valve 40, actuated by a solenoid 41 is interposed between the swivel union 38 and the body portion of the filling head, and controls the flow of slip from the pipe 32 into the molds through the nozzle 39. A rod 42 adapted to be moved vertically in bearings 43 attached to or made integral with the nozzle 39, by the solenoid 45, which is supported on the filling head body portion 37. Attached to the lower end of this rod 42 are two bare electrodes 46 and 47 positioned so that when the rod 42 is at its lowest position, fixed by the stop collar 44, the electrodes 46 and 47 dip inside the mold opening 16, and make electrical connection through the slip liquid when the mold is full. In the upper position of the rod 42, the contacts 46 and 47 are out of the mold and the stop collar 44 is engaged by a catch mechanism consisting of a catch arm 50, sliding in the support member 51 attached to the filling head body, the arm 50 being actuated by an electro-magnet 52 by means of an armature 53 pivoted to the support member, the catch arm being in operative position at all times when the magnet 52 is not energized. When the contact electrodes 46 and 47 are lifted out of the mold opening by action of the solenoid 45, they are held in the raised position by the catch 50 until the magnet 52 is energized and releases the catch.

A 4-point mercury contact switch 55 is pivoted at 54 to the filling head body 37, and adapted to be tilted by a pin 56 in the rod 42 acting in a slot 57 of the switch mounting. An electrical circuit is established between switch contact points 58 and 59 only (by mercury in the switch) when the rod 42 is in the lower position, and made between switch points 60 and 61 only when the rod 42 is in the upper position. A nozzle extension sleeve 75 attached to the rod 42 moves in and out of the mold opening with the electrodes 46 and 47. This sleeve extends below the level of the electrodes and prevents splashing, and false electrical connection between the electrodes before the mold is actually filled.

The releasing catch 26, which coacts with the trip arm 24 to hold the filling head 31 over a mold opening, is vertically movably by the solenoid 62 mounted on the body 37. Movable with the catch 26 by a pin 63 and slot connection 64 is a lever arm 65, pivoted at 66 to the body 37, and adapted to support and tilt the mercury switch 67 fastened at its end, the switch having two contact points 68 and 69. When the catch 26 is in released position, the electrical circuit is completed between the points 68 and 69 by the mercury, and this circuit is broken when the catch 26 is in the "down" position, where it holds the trip arm 24. The engaging ends of the trip arm 24 and the catch 26 are beveled so that the catch will slip over the end of the arm and then drop down behind it to provide the engagement of the two members.

Two delayed action relays 70 and 71 are also mounted on the filling head body 37. Relay 70: 75

operates in the electrical circuit with magnet 52; and relay 71 is in the circuit with the solenoid 62. Direct current distribution terminals 80+ and 80- are provided on a small panel 72 attached to the body 37.

The electric circuits are shown in the diagram Fig. 9. When the electrodes 46 and 47 are lowered into the mouth 16 of a mold, contact points 58 and 59 of the switch 55 are electrically connected, thereby energizing solenoid 41 which opens valve 40, allowing the slip to flow into the mold. When the mold is full, the slip closes the circuit between the electrodes 46 and 47, which circuit includes the solenoid 45. Solenoid 45 when energized lifts the electrodes 46 and 47 out of the slip, and simultaneously breaks the circuit between contact points 58 and 59, which thereby de-energizes the solenoid 41 and closes the valve 40 to cut off flow of slip. The upward movement of the rod 42 holding the electrodes 46 and 47 also closes the circuit between contact points 60 and 61, this circuit including the solenoid 62 and delayed action relay 71. The collar 44 also engages the catch arm 50 and holds the rod 42 in the upper position until released.

When the solenoid 62 is energized on the upward movement of the electrodes 46 and 47, the catch arm 26 is raised, releasing the stop arm 24 which holds the filling head 31 at this particular position. Simultaneously the circuit between contacts 68 and 69 is closed, and the delayed time relay 70, which after a short time interval energizes the magnet 52, thus moving the pivoted armature 53 and the catch arm 50 to release the rod 42, and the electrodes drop down into the mouth of the next mold. During the interval of time permitted by the delay action relay 70, the springs 36 pull the head 31 to the next adjacent trip 21a on the back rail 17 of the conveyor cars, thus positioning the electrodes 46 and 47 and nozzle extension 75 over the mouth of the next mold prior to lowering them. When the electrodes are in the lowered position, the contacts 58 and 59 of switch 55 are connected and the valve 40 is opened as above described, and the cycle of operations is completed and repeated.

In the arrangement shown, where the molds are carried on suspended cars, it is necessary to provide means to avoid striking the filling head by the car suspending members 19. One arrangement is shown in Figs. 2 and 3, consisting of a guard strip 81 attached to the adjoining suspending members 19, and extending between adjacent cars at the elevation of the filling head 31. A spring 82 normally holds the filling head at right angles to the pipe 32 and across the cars, but the swivel union 38 permits the head 31 to turn and follow the guard strip 81 in carrying the head from one car to the next. This is illustrated in Figs. 2 and 3 in broken outlines.

The advantages of automatically filling the molds will be apparent. The molds are always filled to an exact level, and at the same rate, so that the forming of the ceramic body is under uniform conditions. Since the automatic filling is most advantageous when used with a continuous process of forming, it has been described as applied thereto. The time interval from filling of the mold to emptying it is uniform, resulting in uniform thickness of molded pieces. There is a marked saving in labor costs, and the loss of slip is negligible as there is no spillage or overflowing of molds.

I claim:

1. A container filling head for an electrically

conductive liquid comprising a nozzle, a conduit for liquid leading to said nozzle, a valve in the conduit, electrically actuated means for opening and closing said valve, an extension to said nozzle adapted to move in and out of the container, a pair of electrodes attached to said extension, means for lowering said pair of electrodes and said extension into the container prior to opening said valve, an electric circuit including said electrodes and raising means for said electrodes, said circuit being completed by the electrically conductive liquid when its level rises sufficiently to at least partly cover the electrodes, and means for raising said pair of electrodes from the container following the completion of said electrical circuit, said electrically-actuated means opening said valve only when the electrodes are in the container and also not in contact with the conductive liquid.

2. A container filling head for an electrically conductive liquid comprising a nozzle, a conduit for liquid leading to said nozzle, a valve in the conduit, solenoid means for opening and closing said valve, an extension to said nozzle adapted to move in and out of the container, a pair of electrodes attached to said extension, solenoid means for raising said pair of electrodes and said extension from the container following completion of the filling of the container, catch means for holding said electrodes and said extension in elevated position, means for releasing said catch means to allow said pair of electrodes and said extension to drop into the opening of the container, and an electric circuit including said electrodes and said solenoid raising means, said circuit being completed by the electrically conductive liquid when its level rises in the container sufficiently to at least partly cover the electrodes, said solenoid valve actuating means opening said valve only when the electrodes are in the container and not in contact with the conductive liquid.

3. A container filling head for an electrically conductive liquid comprising a filling nozzle, a vertically movable extension on said nozzle, a pair of electrodes insertable in the opening of the container attached to said extension, electrical control means for starting and stopping the flow of liquid from said nozzle, and an electric circuit including said electrodes and said control means, said circuit being completed by the electrically conductive liquid when its level rises sufficiently to at least partly cover said electrodes, whereby the liquid flow from the nozzle is stopped.

4. Mold filling means comprising in combination, a continuously moving longitudinal conveyor; a series of molds of varied capacities carried on said conveyor through a filling zone; trip means on said conveyor corresponding to each mold to be filled adapted to engage a filling head and hold it over a mold opening; a filling head including conduit means for putting liquid into said mold opening only when the filling head is over the desired mold, and closing means to automatically shut off the liquid in said conduit means when said mold is sufficiently filled; electrical contact means coacting with the liquid when it reaches the desired in each mold adapted to actuate said valve closing means; release means acting simultaneously with said closing means to disengage said trip means; and means to longitudinally retract said filling head upon release, to a position for engagement with the next succeeding trip means, said filling head being adapted

to move with the conveyor during the filling of each mold and to be retracted to a position over the next succeeding mold on the conveyor following the completion of the filling of the previous mold.

5. Mold filling means comprising in combination, a continuously moving conveyor, a series of molds of varied capacities carried on said conveyor through a filling zone; trip means on said conveyor corresponding to each mold to be filled adapted to engage a filling head and hold it over a mold opening during filling; a filling head including conduit means for putting liquid into said mold opening; electrode means on said filling head adapted to conductively complete an electrical circuit including the liquid in the mold to actuate conduit-closing means when the mold is sufficiently filled; means to lower said electrodes into a mold opening when said conduit means is at first engaged by the trip means corresponding to the mold to be filled; closing means to automatically shut off the liquid when said mold is sufficiently filled; means to raise said electrode means out of the mold when said conduit-closing means is actuated; release means acting simultaneously with said closing means to disengage the particular trip means corresponding to the mold whose filling has just been completed; and means to retract said filling head to a position for engagement with the next succeeding trip means corresponding to the next mold to be filled.

6. Mold filling means comprising in combination, a filling head comprising a nozzle, a conduit for liquid leading to said nozzle, a valve in the conduit, electrically actuated means for opening and closing said valve, a pair of electrodes attached to said nozzle, means for lowering said pair of electrodes into the container prior to opening said valve, and means for raising said pair of electrodes from the container following the completion of an electrical circuit including said electrodes, said circuit being completed by the electrically conductive liquid when its level in the container rises sufficiently to at least partly cover said electrodes, said electrically actuated means for opening said valve being operative only when the electrodes are in the container and are also not in contact with the conductive liquid; a continuously moving conveyor, a series of molds of varied capacities carried on said conveyor through a filling zone, trip means on said conveyor corresponding to each mold to be filled adapted to engage a filling head and hold it over a mold opening, release means acting simultaneously with the shut-off of liquid through the filling head adapted to disengage said trip means, and means to retract said filling head to a position for engagement with the next succeeding trip means.

7. Mold filling means comprising in combination, a filling head comprising a nozzle, a conduit for liquid leading to said nozzle, a valve in the conduit, electrically actuated means for opening and closing said valve, a pair of electrodes attached to said nozzle, means for lowering said pair of electrodes into the container prior to opening said valve, an electric circuit including said electrodes, and raising means for said electrodes, said circuit being completed by the electrically conductive liquid when its level rises sufficiently to at least partly cover the electrodes, means for raising said pair of electrodes from the container following the completion of said electrical circuit, and an extension to said

nozzle adapted to move in and out of the container with said electrodes; said electrically-actuated means opening said valve only when the electrodes are in the container and also in contact with the conductive liquid; a continuously moving conveyor, a series of molds of varied capacities carried on said conveyor through a filling zone, trip means on said conveyor corresponding to each mold to be filled adapted to engage a filling head and hold it over a mold opening, release means acting simultaneously with the shut-off of liquid through the filling head adapted to disengage said trip means, and means to retract said filling head to a position for engagement with the next succeeding trip means.

8. Mold filling means comprising in combination, a filling head comprising a nozzle, a conduit for liquid leading to said nozzle, a valve in the conduit, solenoid means for opening and closing said valve, a pair of electrodes attached to said nozzle, solenoid means for raising said pair of electrodes from the container following completion of the filling of the container, catch means for holding said electrodes in elevated position, means for releasing said catch, means to allow said pair of electrodes to drop into the opening of the container, and an electric circuit including said electrodes and said solenoid raising means, said circuit being completed by the electrically conductive liquid when its level rises in the container sufficiently to at least partly cover the electrodes, said solenoid valve actuating means opening said valve only when the electrodes are in the container and not in contact with the conductive liquid; a continuously moving conveyor, a series of molds of varied capacities carried on said conveyor

through a filling zone; trip means on said conveyor corresponding to each mold to be filled adapted to engage a filling head and hold it over a mold opening, release means acting simultaneously with the shut-off of liquid through the filling head adapted to disengage said trip means, and means to retract said filling head to a position for engagement with the next succeeding trip means.

9. In combination, a continuously moving conveyor; a series of molds of varied capacities carried on said conveyor through a filling zone; trip means on said conveyor corresponding to each mold to be filled adapted to engage a filling head and hold it over a mold opening; a filling head including conduit means for putting liquid into said mold opening; a pair of electrodes on said filling head adapted to conductively complete an electric circuit including the liquid in the filled mold and adapted to actuate conduit-closing means when the mold is sufficiently filled; catch means for holding said electrodes in elevated position out of the mold; magnetic release means for said catch adapted to permit the electrodes to drop into a mold opening when said filling head is at first engaged by the trip means corresponding to the mold to be filled; closing means including a solenoid to shut off the liquid in said conduit means when said mold is sufficiently filled, means to raise said electrodes out of a mold opening when said conduit-closing means is actuated; release means adapted to disengage said trip means acting simultaneously with said closing means; and means to retract said conduit means to a position for engagement with the next succeeding trip means.

FRANKLIN A. McCANN.