June 30, 1931. W. M. MEACHAM 1,811,950

METHOD OF AND APPARATUS FOR PRESSURE CONCRETE MOLDING

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FIG. 1.

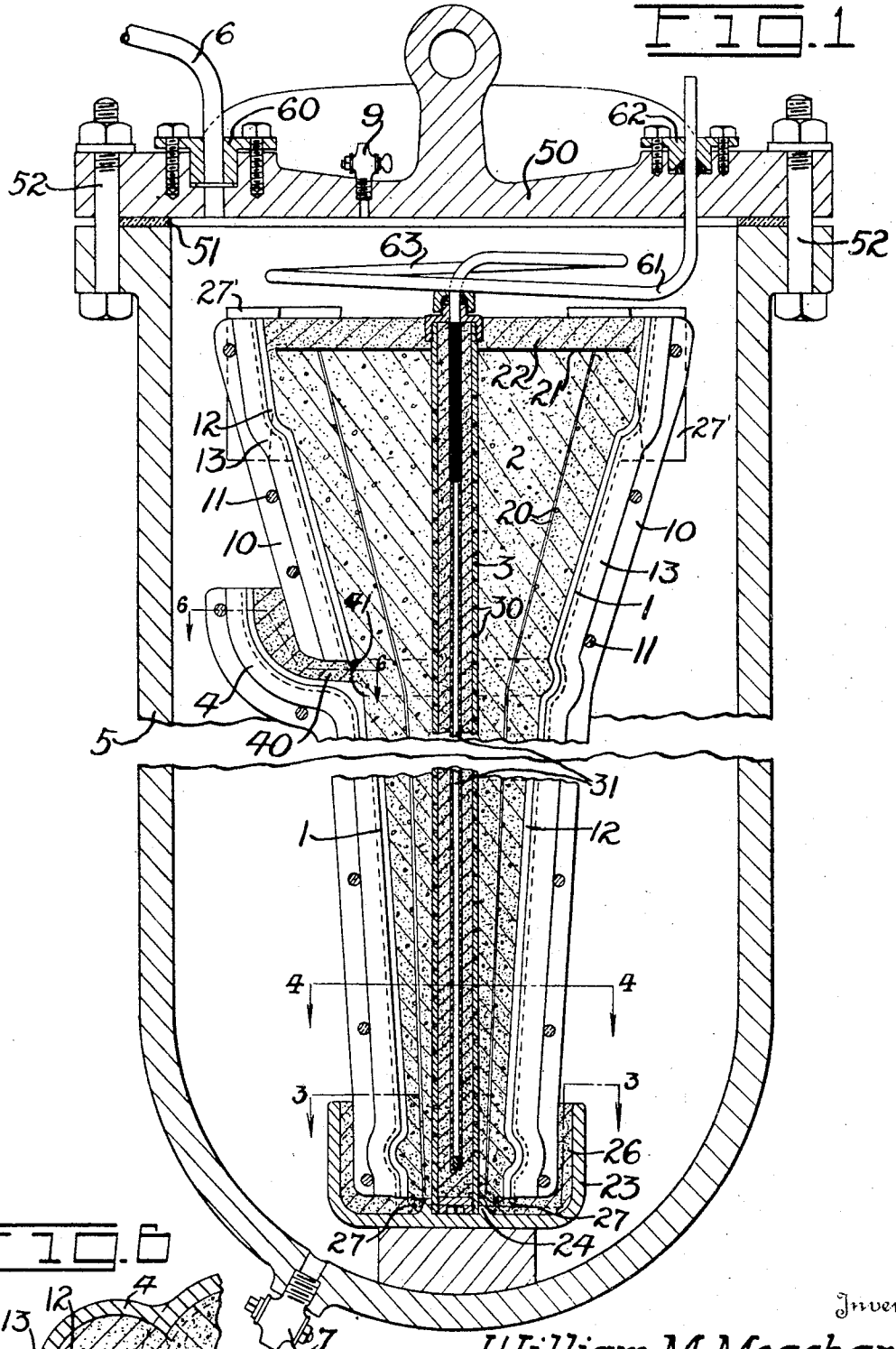
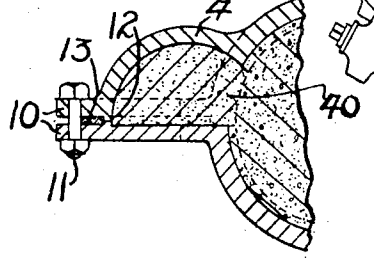


FIG. 6.



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Fig. 2

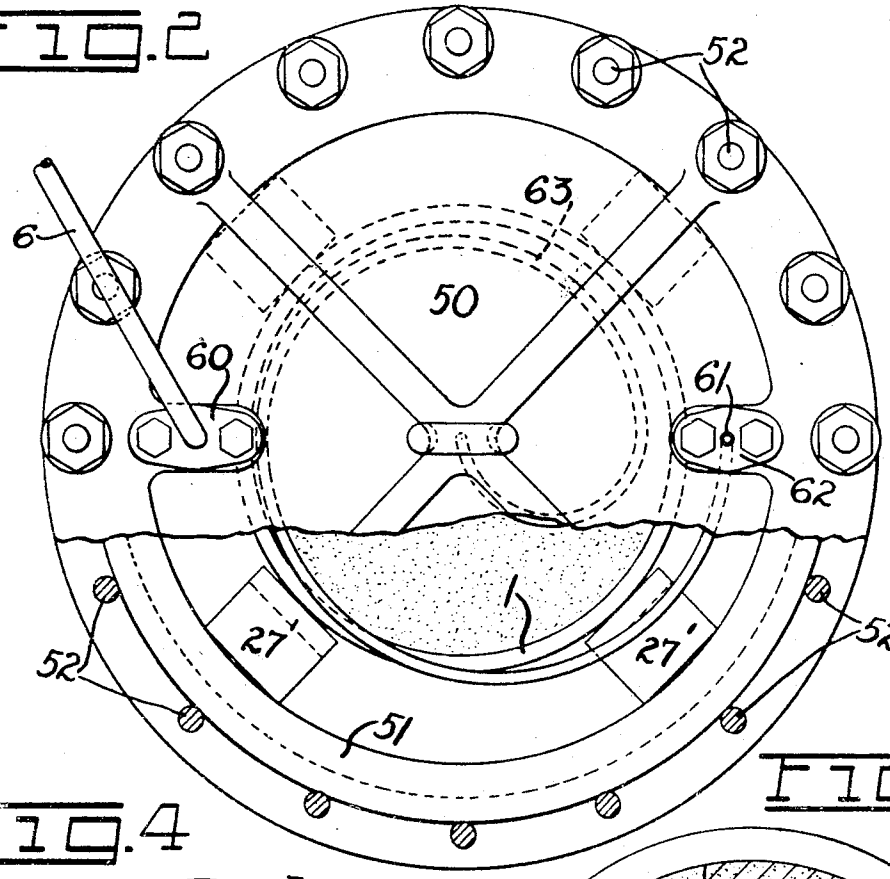


Fig. 3

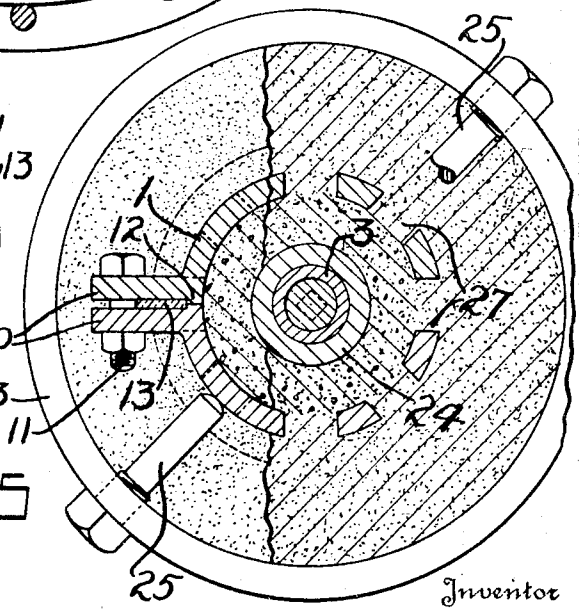


Fig. 4

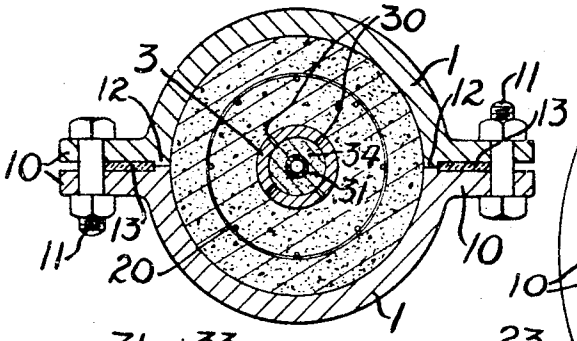
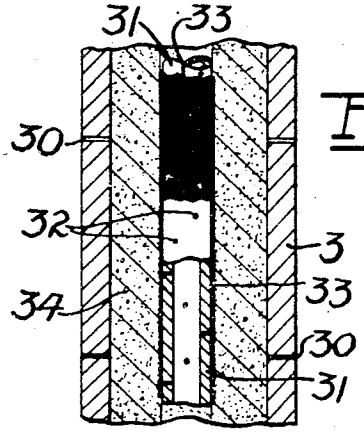


Fig. 5



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FIG. 7

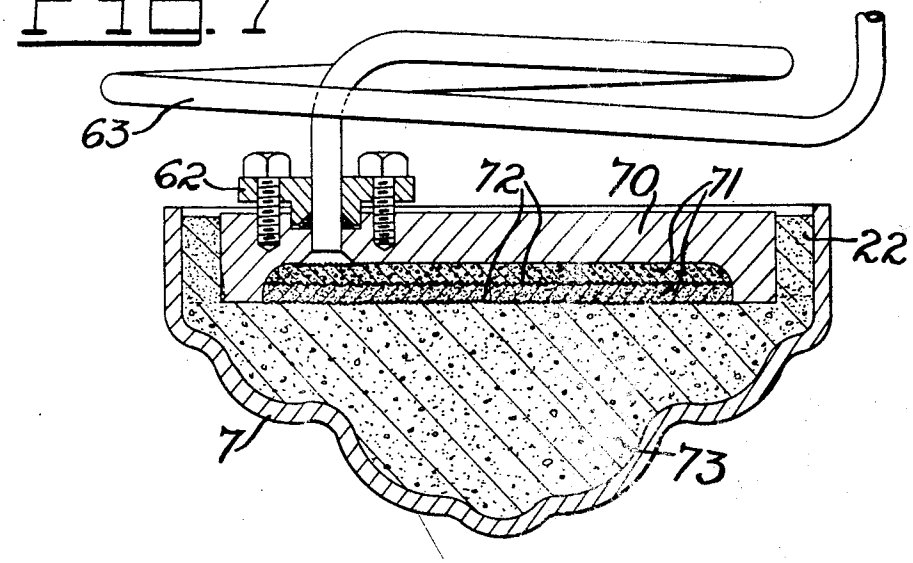
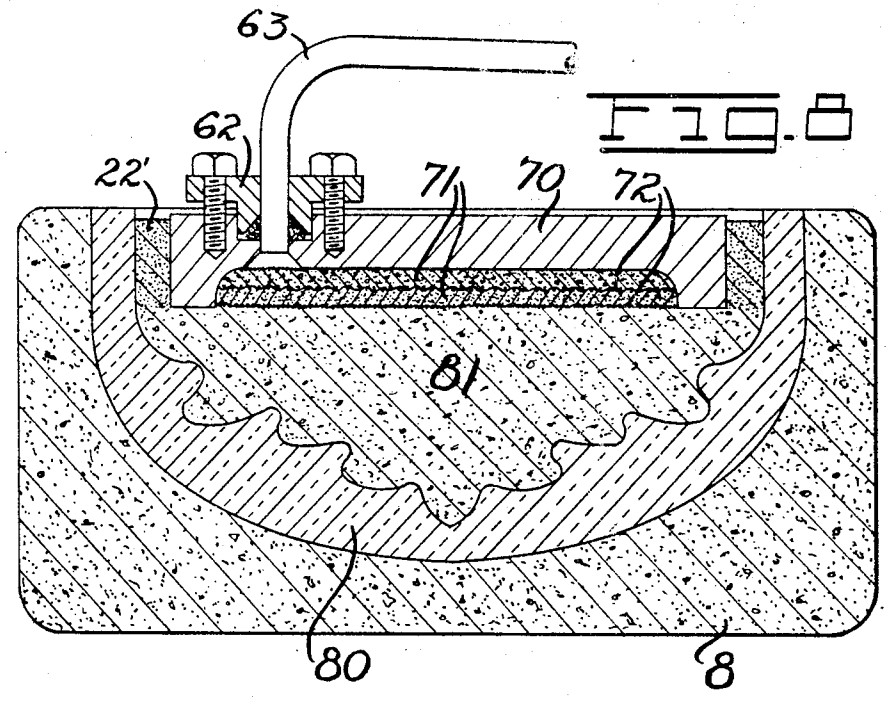


FIG. 8



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Patented June 30, 1931 1,811,950

UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR PRESSURE CONCRETE MOLDING

Application filed August 11, 1928. Serial No. 298,944.

My invention relates to the casting of concrete by the use of molds and the elimination of surplus water therefrom by the application of pressure thereto. It consists of a method of carrying this out and of an apparatus for use in carrying out the method.

The object of my invention is to improve the methods of pressure casting of concrete, and to provide an apparatus operable by a method wherein it is not necessary to give the molds unusual strength to thereby resist the high pressures employed, and to make certain that a minimum desired compression of the concrete has been produced throughout its entire mass. As the strength of concrete is not substantially increased by being subjected to pressure for longer than twenty minutes, it is desired that a pressure process be such as can be applied to simple molds which can be set aside for the time required for the concrete to set and the pressure equipment used on other molds. Such a process is here described.

In the accompanying drawings I have shown an apparatus which may be effectively used to carry out my method.

Figure 1 is a central vertical section of a typical apparatus which has been chosen as suitable for illustrating my invention.

Figure 2 is an upper end view with the head broken away at one side.

Figure 3 is a transverse section taken on the plane of the broken line 3—3 of Figure 1.

Figure 4 is a section on the line 4—4 of Figure 1.

Figure 5 is a longitudinal section of a short portion of the water collecting and drainage pipe.

Figure 6 shows by a detail in sectional plan view on line 6—6 of Figure 1, the manner whereby pressure may be applied to central or intermediate portions of the objects being cast.

Figure 7 illustrates the use of a different type of mold, which may be made of a relatively weak material, and yet permit the application of heavy pressures to the concrete.

Figure 8 is a mold of the same type as that of Figure 7, except that the use of a mold of elastic or flexible material is contemplated, whereby undercut articles may be made.

It is a well recognized fact that concrete to which sufficient pressure has been applied to expel the surplus water while yet in a plastic state, is stronger and more dense than concrete from which the surplus water has not been removed. The application of pressure to concrete, as it has usually been practised, has involved the use of strong and expensive molds, capable of resisting these pressures, which has increased the cost of the product. It is one aim of my invention to make it possible to use molds of a cheaper type of construction, thereby decreasing the cost of the product.

The central feature, wherein my present invention differs from former methods, is that the strains produced by the pressure employed are not resisted by the mold itself, but by a container or pressure chamber into which the mold is placed, the mold itself being exteriorly subjected to substantially the same pressure as is applied to the concrete within it. In consequence, it need not be of any greater strength than would be needed when molding under atmospheric pressure.

While I shall herein use the term "concrete", as descriptive of the material employed, it is intended that this be given a generic meaning and scope which will include any material which is mixed in a plastic state and which "sets" or hardens by the lapse of time. Gypsum products are a good example of such other materials.

For the purposes of illustrating my invention, I have shown in Figures 1 to 6 inclusive, an apparatus designed for casting a post with a central channel or duct, such, for instance, as would well serve as a lamp post. Any

object capable of being cast in a mold may be made by my process.

For casting such an object, a two-part mold may be used. A higher division of the mold may be employed when this is desirable. The two halves, 1, are made of such interior shape as is dictated by the shape of the desired product. The halves may be joined and secured together by means of flanges 10 and bolts 11. In the mold illustrated there has been provided at the inner edge of the flange 10, a narrow marginal flange 12, which flanges of the two halves form the contacting surfaces between the two halves. There is thus formed an exteriorly opening crack or trough for the reception of a packing gasket 13.

Placed preferably as nearly as is feasible at the central axis of the body being cast, is a water and air collecting and discharging pipe, which is of composite construction. An approved construction is as follows: An outer pipe 3 has a great many small holes 30 in its wall, distributed throughout substantially its entire length. They have been omitted for short distances at its ends.

Within the pipe 3, but enough smaller to leave a considerable space between them, is a small pipe 31, which also has its sides perforated, as by holes 32. Wrapped about the inner pipe 31 is a layer of filtering or screening material 33, such as wire or fabric cloth, and between the inner pipe 31 and pipe 3 is a layer of packed sand or other granular material, through which water will pass. The composite pipe described is placed centrally of the flask or mold and the concrete poured about it. When the concrete casting has set and has been taken from the mold the cap and bottom plug are removed from pipe 3, releasing the sand and pipe 31 which is removed. Pipe 3 remains in the casting. Reinforcing material, as for example, wires 20, may be placed in the mold.

The lower open end of the flask or mold is placed in a cup or bowl 23, which may have a socket for the reception of pipe 3, formed by a low flange 24. Centering bolts, such as 25, (see Figure 3) may be used to hold and center the cup relative to the flask. When the flask is in casting position and is filled with concrete, the bowl 23 is filled with a thick liquid grouting 26. Notches 27 in the lower edge of the flask or mold insure free pressure communicating channels between the cup 23 and the interior of the flask. Spacing blocks 27′ secure central placing of the upper end of the mold 1 in pressure chamber 5.

At as many points as may be deemed necessary between the ends of the mold, pressure channels may be provided, through which pressure from without the mold may act upon the material within the mold. I have shown one such. This consists of a bracket-like or corbeled flange 4 forming a cup or trough, which is in free communication with the interior of the flask through a slot or hole 40. I prefer to provide a projecting rib 41 to form a weakened or breakage line so that the sprue formed in the cup 4 may be cleanly broken off.

A mold or flask of this type is placed within a container or pressure chamber 5, which is provided with a removable head 50, the joint being made tight as by the use of a gasket 51 and clamping bolts 52. A pipe 6 permits the introduction of a fluid under pressure, as for instance, water, to the interior of the pressure chamber. A packing joint 60 is used to secure tightness. A pipe 61 passing through a packing joint in the head is connected to form an extension of the drain pipe 31. A coil 63 formed in this pipe provides flexibility needed in applying and removing the head. Coil 63 can be disconnected from head by loosening packing joint 62 in head. A water drain cock 7 permits draining of the pressure chamber.

In Figure 7 is shown a mold of quite different shape and superficial construction in which the same principles are employed. In this, 7 represents the mold proper, that is, the shape-forming member, and 73 the body to be cast in the mold. In this case a head 70 is provided with means, as packing joint 62, whereby the under surface of the cap or plate 70 may be connected with the water drainage pipe 63. The under surface of plate 70 is hollowed and receives the water collecting drainage elements, such as fabric elements (wire or cloth) 72 and sand or other granular material 71.

The apparatus of Figure 8 is the same, except that by the use of a flexible and elastic mold 80, composed of rubber or gelatine compounds or equivalent materials, castings as 81, having undercut elements, may be made. The member 8 is a base or form member for holding the resilient mold 80. These two figures represent the mold which is designed to be enclosed in a pressure chamber similar to 5 of Figure 1.

In both Figures 7 and 8, 22 and 22′ represent rings of grouting through which pressure of the fluid in the pressure container is transmitted to the plastic concrete or cementitious compound from which the articles 73 and 81 are to be made. A mold of this type is placed in a pressure container and treated exactly as is the mold of Figure 1.

The operation of device such as shown and the method employed in pressure casting an article is as follows: The mold is assembled as illustrated and placed in the pressure chamber, either before or after filling it with concrete. Grouting is placed in all openings, as cup 23, bracket or corbel 4, and at the upper end. In the latter place I would use a layer 21 of separating and sealing material, such, for instance, as greased paper or thin metal sheet, below the layer 22 of grouting.

The purpose of the separating and sealing material is that the sealing grout can be readily separated from the concrete casting and also as a following up sealing diaphragm. The purpose of the grout in the grout pockets is to make a seal and keep the water in case 5 away from the concrete, also to replace the shrinkage in the concrete casting due to compression. While I prefer to use grouting as described, this is not a real essential of the process.

The head 50 is secured on the chamber 5 and water pumped through the pipe 6 until the desired pressure is reached. Air is exhausted through cock 9. This pressure acts upon the plastic concrete to compress it. Surplus water flows to the composite central pipe and is carried off through the pipe 61. Because the pressure fluid entirely surrounds the flask or mold, there are no great unbalanced pressures acting thereon to strain it. It may therefore be made of relatively weak and cheap construction. The only part of the apparatus subjected to any material strain is the pressure chamber 5.

By employing the expedient of enclosing the entire mold in a pressure chamber the mold is not subjected to a disruptive strain, which makes it possible to use forms of construction which would be impossible if pressure was applied in the customary manner, that is, to the interior only of the mold. Particularly is this advantage obvious in enabling the use of molds of relatively little strength and of cheap construction. This is due to the application of approximately the same pressure to the interior and exterior of the mold. The pressure used may be any the pressure chamber will stand, as only the pressure chamber is materially stressed thereby.

In any method of making pressure concrete, drainage of water forced from the concrete by the pressure applied thereto is essential. In this invention, such drainage is provided for in a special and very efficient manner by the pipe 31 and its associated parts.

What I claim as my invention is:

1. The method of molding concrete under pressure, which consists in applying pressure to the exterior of the mold at the same time pressure is applied to the concrete in the mold, and placing the concrete in the mold in communication with a lesser pressure.

2. The method of molding concrete under pressure which consists in placing the entire mold within a pressure chamber and applying pressure thereto to substantially equalize the pressures acting within and without the mold, and affording communication with the interior of the mold at atmospheric or other low pressure.

3. The method of molding concrete under pressure, which consists in applying pressure to the exterior of the mold at the same time pressure is applied to the concrete in the mold, and at the same time draining surplus water from the body concrete.

4. The method of molding concrete under pressure which consists in immersing the entire mold within a body of water allowing communication between the water and the concrete within the mold, and applying pressure thereto to substantially equalize the pressures acting within and without the mold, meanwhile forcing and removing surplus water from within the body of concrete by the pressure thereon.

5. The method of molding concrete under pressure which consists in applying pressure directly to the concrete in the mold, at distributed points thereof, and at the same time to the exterior of the mold, supplying surplus grouting externally of the concrete in the mold at such points, the pressure acting upon the concrete through such grouting, and placing the interior of the concrete mass in communication with a lesser pressure.

6. An apparatus for molding concrete under pressure comprising a mold having openings distributed thereover, whereby fluid pressure exteriorly applied may be more effectively applied to the mass of the concrete in the mold, placing the concrete in the mold in communication with a lesser pressure, and means at such openings for retaining a bed of surplus grouting between the concrete in the mold and the pressure medium.

7. The method of molding concrete under pressure which consists in applying pressure to the concrete in the mold, placing the interior of the concrete within the mold in communication with a lesser pressure, supplying surplus grouting at points which are directly exposed to the pressure fluid and separating this surplus grouting from the body of the mold by a thin layer of material which will not unite with the concrete, to thereby provide a plane of cleavage.

8. An apparatus for molding concrete comprising a flask in which to mold the desired object, a pressure chamber adapted to receive therein the entire flask, the flask having openings whereby the pressure within the chamber is impressed upon the plastic mass within the flask, and means communicating with the interior of the flask to place the same under reduced pressure.

9. An apparatus for molding concrete objects comprising a mold, a pressure chamber adapted to receive the mold, means for applying pressure to the interior of said pressure chamber, the mold having openings permitting application of pressure within the chamber to the mass within the mold, and a water drain at lower pressure communicating with the interior of the mold.

10. An apparatus for molding concrete under pressure comprising a pressure chamber adapted to receive the concrete-forming mold, a removable head for said chamber,

means for introducing a fluid under pressure to the interior of said chamber, the mold having openings for the communication to the mass therein of the pressure within the chamber, and means embedded within the concrete in the mold for placing the same in communication with a lesser pressure.

Signed at Seatle, King County, State of Washington, this 3rd day of August, 1928.

WILLIAM M. MEACHAM.