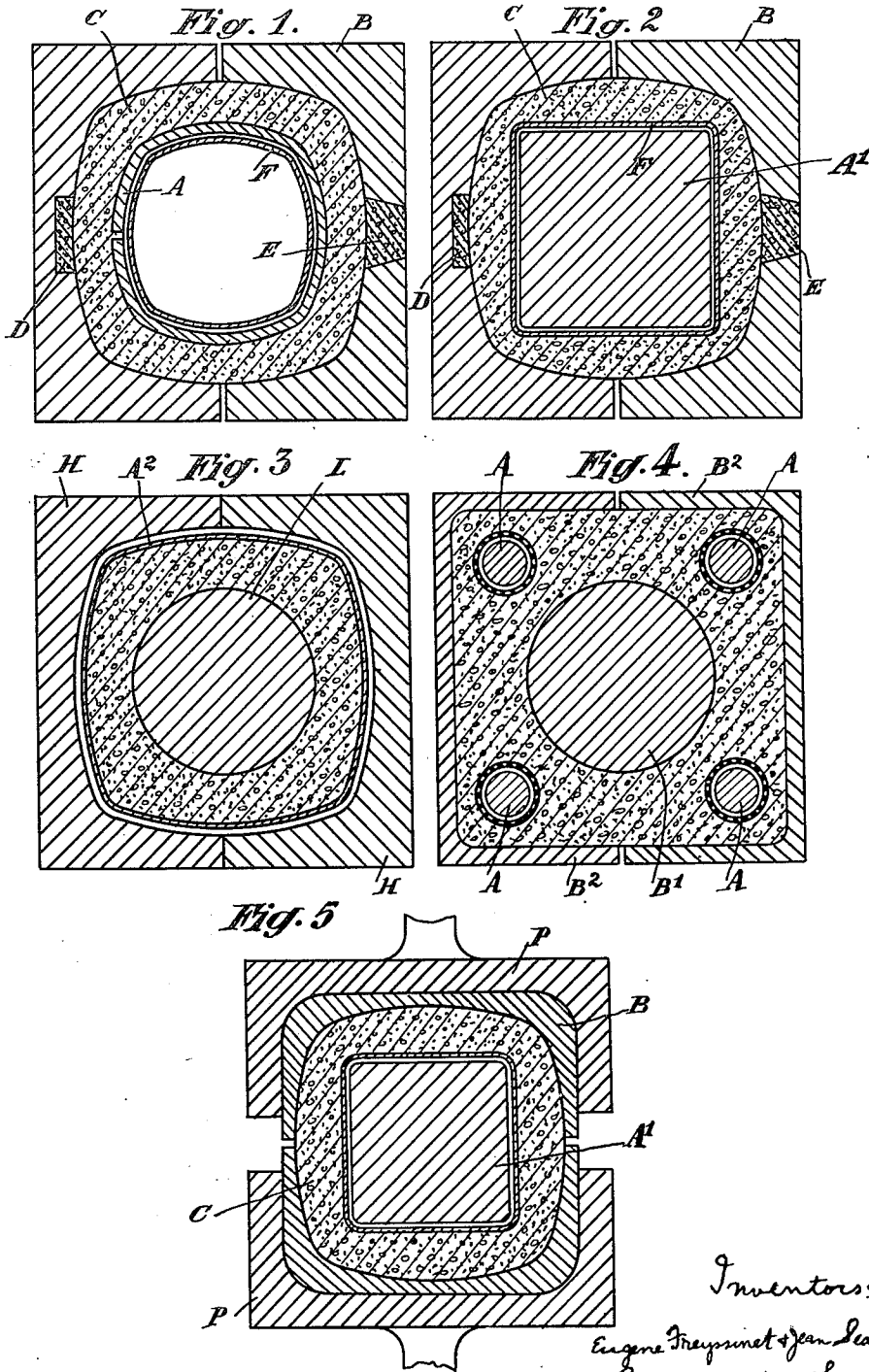


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PROCESS FOR THE MANUFACTURE OF MOLDED PIECES
OR BODIES FROM MORTARS OR CONCRETE
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PROCESS FOR THE MANUFACTURE OF
MOLDED PIECES OR BODIES FROM MO-
RTARS OR CONCRETEEugène Freyssinet, Neuilly-sur-Seine, and Jean
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4 Claims. (Cl. 25-155)

In the manufacture of molded pieces or bodies consisting of ordinary or reinforced concrete, it is quite necessary to be able to use a yielding and very fluid mixture, such a mixture is incompressible being saturated with water and even containing it in excess. This mixture readily affords the proper filling of the molds and an approved covering of the stiffening members, if this is required, and it also provides for a concrete which will withstand bending stresses better than the concrete obtained by the use of dry mixtures.

However, in order to obtain a concrete of the best quality having the maximum compactness and strength, the excess of water must be evacuated.

For this purpose, vibrations are in general used in order to cause the settling of the concrete and to evacuate a part of the excess of water from the yielding concretes, but vibration alone is not sufficient to obtain a complete settling of the concrete and a sufficient exudation of the excess of water, and will not afford the best results.

The present invention relates to the combination of vibration and pressure for the treatment of a concrete which is saturated with water and even contains it in excess, thus obtaining a greater compactness than is afforded by vibration alone, and in a much shorter time.

To obtain this result, the concrete is poured into a mold containing an elastic or expanding mandrel.

After closing the mold, it is subjected to vibration and then to compression and thus the excess of water will be rapidly evacuated through the joints of the mold, the result being a concrete of an exceptional quality.

The said process is of a general nature, and it comprises the following combination for the manufacture of pieces of molded concrete by the use of an initially incompressible mixture or one that is sufficiently moist to become fluid under the effect of vibrations and pressure:

(a) A closed mold;

(b) An elastic or expanding element adapted to compress the concrete while increasing in volume, the expansion being obtained by all known means such as pressure of a fluid, mechanical action etc;

(c) A treatment by vibrations, shocks, shaking, or the like, by which the concrete will completely settle while it is at the same time compressed and all excess of water is evacuated.

Preferred embodiment of our invention will

be hereinafter described with reference to the appended drawing, given merely by way of example, and in which:

Fig. 1 is a diagrammatical view illustrating a process of manufacturing pieces of concrete according to our invention;

Fig. 2 shows another device adapted to carry out our invention;

Fig. 3 is a similar view corresponding to the case of an external pressure being applied to the mass of concrete;

Fig. 4 illustrates a method of manufacturing pieces whose external and internal sections are different;

Fig. 5 corresponds to the case in which the mold is made of a light material and is enclosed in the movable solid pieces that serve to give it the necessary strength.

In the embodiments shown in Figs. 1 and 2, the whole of the mold consists of a mandrel A, or A', and an outer rigid mold B. In the case of Fig. 1, the hollow mandrel A is made of steel and is split along a generatrix. In the example shown the outer rigid mold is made of two parts rigidly connected together. A pouch of india rubber or other plastic material F is provided inside hollow mandrel A and can be expanded by means of a fluid under pressure.

A certain quantity of concrete is poured into the space between the mandrel A and the outer rigid wall B. As will be hereinafter explained, it has been found particularly advantageous to subject the concrete to vibrations while filling the mold. When the mold is filled and said vibrations have produced their effect, the mandrel A is caused to expand by injecting fluid under pressure into pouch F, thus moving outwardly the inner walls of the mold formed by mandrel A and subjecting the concrete to the proper pressure.

The vibrations may be produced by shaking or jarring the mold, subjecting it to a series of shocks or through any other suitable means.

In another mode of operating, shown in Fig. 2, the mandrel A¹ is compact and consists for instance of a solid mass of metal or wood, and the pouch of india-rubber is disposed around said mandrel. The process is substantially the same. When the mold has been filled, a fluid under pressure is forced into pouch F which is thus detached from the surface of mandrel A¹ and compresses the mass of concrete.

The water issues through the joints of the mold or through orifices provided for this purpose. It is further possible to use materials D placed in the mold in order to absorb the excess of water

(such as plaster), or material E for the filtration of the water expelled by the pressure and the vibration, such as pieces of porous terra cotta. The pressure can be easily regulated in order to obtain the desired result, and a slight pressure will suffice, as the vibration facilitates the action of the compression by making the particles of the mixture movable. However, the use of high pressures is advantageous in order to obtain a rapid effect and the maximum degree of compactness. Since the compression acts upon the mixture by an effect of expansion, there will be no tendency to form spaces between the particles, as occurs with the compressions hitherto in use.

It is very advantageous to subject the concrete to vibrations while filling the mold, which, as is known, will enable the mold to be filled in a ready and complete manner.

The filling of the mold while vibrations are being imparted to the concrete is particularly advantageous in order to obtain, instead of spaces of cylindrical forms, spaces of various special forms. In fact, the filling by vibrations gives to the material a sufficient consistency in order that the pressure subsequently produced by the mandrel will not substantially modify this initial form, and the hollow spaces will only be somewhat increased while retaining a section of the same appearance. It will readily be understood that this advantage is particularly important in the case illustrated in Fig. 2.

Instead of vibrating the entire mold, one can employ to advantage the process which consists in producing the pressure in the mandrel by means of a liquid under pressure, and in subjecting the concrete to vibration by imparting vibratory waves to the liquid by any suitable means such as a vibration by compressed air, by electric or hydraulic means, shocks etc.

The said mandrel may occupy any position with reference to the mold, but on hollow bodies it is usually positioned on the axis in order to leave a central space, and the pressure will act from the centre to the periphery.

Of course, instead of distorting the mandrel by an action exercised from the centre to the periphery, the same process may comprise a centripetal action and herein the elastic mandrel is mounted at the exterior and the mold in the interior and the concrete is placed between the two as shown in Fig. 3. In this event the elastic mandrel A2 need only be positioned in a leakless casing H by which it can be subjected to pressure from exterior to interior. This produces an internal space which is accurately calibrated due to the pressure of the concrete on inner core L, whilst in the preceding case the calibration was best realized for, the external form.

The central mandrel is thus adapted for the manufacture of poles or posts, while the peripheral mandrel is best adapted for the manufacture of pipes.

In the case of special shapes, the invention is applied by employing for each case a U-shaped member consisting of an external mandrel, and the space in the U is thus calibrated by the mold, or by employing an internal mandrel, and herein the external outline of the U will be calibrated by the mold.

The first case is more suitable for a water conduit, and the second is best adapted for poles.

By mounting one or more expansible mandrels A within the substance of the pieces as shown in Fig. 4, a double calibration can be effected; for

example a piece having a circular internal outline and a rectangular external outline can be produced by placing four mandrels in the corners, and they will compress the material between a cylindrical internal mold B1 and a rectangular external mold B2.

As a matter of fact, the above mentioned methods of compressing the concrete consist in displacing or deforming the wall or the walls of the mold that are formed by the mandrel or the equivalent. And it should be well understood that our invention comprises these and any other possible methods of performing that operation which are comprehended within the scope of the appended claims. The number, the shape and the arrangement of said deformable walls may be varied without departing from the principle of our invention.

When employing high pressures, it is preferable to use a light mold which would not in itself withstand the pressures exercised, and to position it during the operations in an apparatus (see for example Fig. 5) of such nature that the mold will impart to it the whole or a part of the forces in action, for instance in the movable plates P of a suitable hydraulic or mechanical press.

What we claim is:—

1. A process of manufacturing molded pieces of concrete in a mold provided with an expansible mandrel, which comprises giving said mandrel a predetermined initial shape so that its cross section is a non-circular closed line, pouring into said mold concrete containing an excess of water, subjecting the concrete to vibrations for a certain time, stopping said vibrations, and then subjecting said flexible mandrel to the action of a liquid under pressure so as to produce a compression of the concrete contained in the mold without substantially modifying the general shape initially given to the face of the molded article in contact with said flexible mandrel, while allowing water in excess to escape from said mold.

2. A process of manufacturing molded pieces of concrete in a mold having an elastically deformable wall, which comprises giving said wall a predetermined initial shape so that its cross section is a non-circular line, pouring concrete having an excess of water into said mold, subjecting the concrete to vibrations for a certain time, stopping the vibrations, and then deforming said flexible wall through the action of a fluid under pressure so as to obtain a compression of the concrete contained in the mold without substantially modifying the general shape initially given to the face of the molded article in contact with said flexible wall, while allowing water in excess to escape from said mold.

3. A process of manufacturing molded pieces of concrete in a mold having an expansible inner core which comprises giving said core a predetermined initial shape so that its cross section is a non-circular closed line, pouring concrete having an excess of water into said mold, subjecting the concrete to vibrations for a certain time, stopping the vibrations, and then expanding said flexible core through the action of a fluid under pressure so as to obtain a compression of the concrete contained in the mold without substantially modifying the general shape initially given to the face of the molded article in contact with said flexible core, while allowing water in excess to escape from said mold.

4. A process of manufacturing molded pieces of concrete in a mold provided with an expansible mandrel, which comprises giving said mandrel a predetermined initial shape so that its cross section is an angular line, pouring concrete containing an excess of water into said mold, 5
subjecting the concrete in the mold to vibration for a certain time, stopping said vibration, and then subjecting said flexible mandrel to the ac-

tion of a fluid under pressure so as to produce a compression of the concrete contained in the mold without substantially modifying the general shape initially given to the face of the molded article in contact with said expansible mandrel, 5
while allowing the excess of water in the concrete to escape from said mold.

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