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MAKING ARTICLES OF ARGILLACEOUS MATERIALS.

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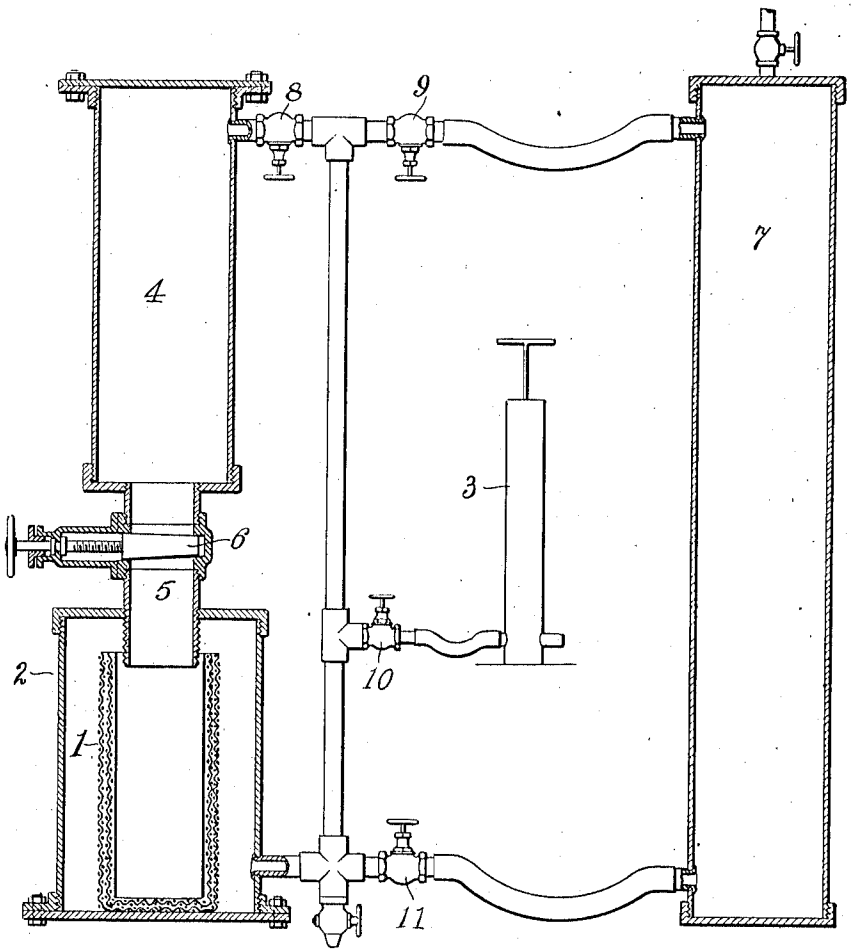


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# UNITED STATES PATENT OFFICE.

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## MAKING ARTICLES OF ARGILLACEOUS MATERIALS.

1,034,815. Specification of Letters Patent. Patented Aug. 6, 1912.

Application filed August 28, 1908. Serial No. 450,760.

*To all whom it may concern:*

Be it known that I, RALPH D. MERSHON, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Making Articles of Argillaceous Materials, of which the following is a specification.

In the manufacture of porcelain articles considerable difficulty has been experienced in preventing the formation of cracks while the article is drying. Great care must be exercised to see that the drying proceeds at a uniform rate throughout the entire body, since if the evaporation from the surface is faster than the capillary conduction of moisture from the interior the greater shrinkage of the surface portions produces strains which the low tensile strength of the clay is unable to withstand. But even when such care is used as to make the drying approximate uniformity throughout the article, it frequently happens that cracking still results, particularly in the case of an article of considerable size or one having thick walls. So far as I am aware, no adequate explanation of such cracking has been offered, nor have prior efforts to overcome the drawback been attended with material success. After careful study of the matter, and considerable experimenting, I have reached what I believe to be the true explanation of the difficulty, and practical tests of the present invention, which is based on my discovery, have been productive of results which leave practically no room for doubt as to the correctness of my theory. It is my belief that the trouble has been due to the fact that the methods hitherto employed for forming the articles cause more or less internal stress in the clay, and that in the endeavor, in drying, to relieve itself of this stress the article cracks. The method which I have devised eliminates such cracking, because the body is left perfectly free to adjust itself during all periods of the drying up to the point where the clay can no longer flow, and, therefore, results in the minimum of internal stress, if any.

In carrying out my invention in the preferred manner I employ a mold which (and this I regard as one of the most important features of the invention) will permit the free passage of water through its walls in either direction yet retain the clay in the desired shape. Such a mold may be made in various ways. For example, I have produced excellent results with a mold made of wire gauze, such as is used for window screens, lined with paper. Thus for making a porcelain cylinder I provide a gauze cylinder of the necessary size, making the same large enough to allow for the unavoidable shrinkage of the clay in drying. Several thicknesses of the gauze may be used, to give the walls of the shell sufficient stiffness and strength. The cylinder is now lined with tissue paper, or even ordinary manila wrapping paper and is then filled with dry porcelain body in finely divided or powdered condition, well shaken and pressed down to make the material as dense as may be. The mold thus filled is now immersed in water until the clay is thoroughly saturated to a plastic condition, after which the gauze cylinder with its contents is removed for drying. The drying proceeds rapidly, because of the fact that the article of argillaceous material is surrounded only by paper and netting, but without the appearance of cracks. If desired, the outer gauze shell may be removed when the drying has proceeded to the point where the clay is stiff enough to stand without distortion. The scheme thus outlined may also be employed for making more complicated shapes, by forming the outer shell of netting in the shape desired; but, in general, if this is carried too far there may be more or less trouble for the reason that before the clay has dried sufficiently to permit removal of the supporting shell there will have been considerable shrinkage; and as the shell cannot shrink with the clay, cracking or breakage will result. I overcome this difficulty, however, by making the mold, or particular parts thereof, out of material which will keep pace with the clay in shrinkage. Such a mold, or the necessary parts thereof, can be made of powdered clay lightly pressed into form and then covered with tissue paper or other suitable material, which, while allowing the passage of water, will prevent the amalgamation of the form or mold with the object being molded; or a paper form filled with dry clay. For example, a hollow cylinder of argillaceous materials may be molded as follows: In a gauze cylinder prepared as described above I place a cylinder of wood or other convenient and suitable material, wrapped with paper loosely enough to permit ultimate with-

drawal of the wooden cylinder but leaving the paper wrapping in place. The annular space thus provided in the gauze mold is now filled with powdered clay settled down to place. The wooden cylinder is then removed, the central space filled with dry powdered clay, and the whole soaked in water as before, after which it is removed from the water for drying. It is clear that in the drying the inner clay core shrinks at the same rate as the outer clay cylinder; and hence, when the outer piece is sufficiently dry and stiff the core can be dug out without disturbing the other.

In the plan described above, more or less air is left in the clay. This may at times be undesirable, but may be avoided by having the filling of the mold take place in a vacuum. For this purpose I have devised the simple and convenient apparatus illustrated herein. This apparatus is shown in vertical section in the accompanying drawing.

Referring now to the drawing, 1 indicates a foraminous mold of suitable form, inclosed in a vacuum chamber 2 connected with an air pump 3. The clay is contained in a chamber or receptacle 4 and is delivered into the mold, preferably by gravity, through a conduit 5 having a valve or gate 6. This clay receptacle is likewise connected with the air pump, as is also a chamber 7 containing water. In the pipes connecting the various chambers with the air pump are valves 8, 9, 10, 11, by which communication between the various parts of the apparatus can be controlled, as will be readily understood.

Valves 6, 8, 11, being closed and 9, 10 open, the air pump is operated, thereby exhausting the air from the water in chamber D, in order to have the water itself free from all dissolved or entrapped air. After such exhaustion, air may be readmitted to the cylinder 7, without fear of any appreciable amount of air being taken up, as water will take up air very slowly unless agitated. Valve 8 being now open and valve 9 closed, air is exhausted from chambers 2 and 4, thus removing as much of the air from the clay material as can be removed from it in a body. The air pump being kept in operation, the gate 6 is opened and the powdered clay allowed to fall slowly into the mold 1. Inasmuch as the air pump is working all the time, the particles of clay, as they fall, will be robbed of such air as clings to them, with the result that the clay is deposited in the gauze cylinder 1 practically free of all air. This having been accomplished, valves 6, 8, 9 and 10 are closed and water under atmospheric pressure is admitted into the chamber 2 from chamber 7 through valve 11, thus surrounding the gauze cylinder and its contents with water and, since a vacuum exists between the particles of clay, bringing a pressure of about fifteen pounds per square inch upon the clay, tending to make the same more compact. At the same time by capillary action, the water works in between the particles of clay, rendering it plastic. If desired, the pressure can be increased by pumping water into the chamber 2. Also, if desired, hot water can be used instead of cold, in order to obtain the greater plasticity which hot water produces in some clays. In such case, the water can be supplied from a steam boiler and will, therefore, enter the chamber 2 under a pressure equal to the boiler pressure. If this scheme is resorted to, however, care must be taken to cool down the clay cylinder or other article in chamber 2 before the pressure therein is relieved; otherwise the clay article may be ruptured by the formation of internal steam. The mold with its contents is now removed for drying as before, care being of course taken to have the drying proceed at a rate as nearly as possible uniform throughout the mass.

In the above description, reference has been made only to the use of dry clay for filling the mold; that is, putting the material into the mold dry and afterward wetting it. The clay may, however, be wet first, using sufficient water to make the mass liquid enough to be poured. However, I consider the dry way much more advantageous than the other; first, because a considerable excess of water is required to make pouring of the mixture possible, which excess has to be eventually gotten rid of; second, because it is easier, in the case of the vacuum process, to remove the air from the dry clay than from the emulsion of the same.

As previously stated, one of the most important features of the invention is the mold, which permits the free passage of water in either direction without allowing escape of the clay. Such a mold may be made of wire gauze, perforated sheet metal, or other foraminous material of suitable character, lined with paper as described, or cloth, or, in general, any material which will permit water to pass freely through it but retain the fine clay until it is sufficiently wet to keep it from escaping through the foraminous outer shell. Or, instead of using a lining of paper, cloth, etc., the shell may be dipped in a solution of boiled starch. This would leave the apertures in the shell covered with a film of starch, which would keep the powdered clay from falling through; and yet when the mold is immersed in water the starch would allow the water to pass freely through it and would eventually dissolve out.

In many cases the above described method may be used to advantage for making in-

gots, which are afterward finished by turning in a lathe, as is customary; since it is extremely difficult, with the prior methods, to form these ingots without danger of their cracking in the drying.

What I claim is:

1. The herein-described method of making articles of argillaceous materials for subsequent firing, which consists in depositing a loose mass of dry pulverulent material in a gauze mold lined with paper or fabric adapted to permit the passage of water in either direction through its walls but prevent the escape of the powdered material; immersing the mold, containing the loose uncompacted material, in water until the material is saturated to a plastic condition; and removing the gauze mold and its contents for drying.

2. The herein described method of making articles of argillaceous materials for subsequent firing which consists in depositing a loose mass of dry pulverulent material in a mold and around a suitable filler such as wood, said mold adapted to permit the passage of water in either direction but preventing the escape of powdered material; immersing the mold and core, containing the material, in water until the material is saturated to a plastic condition; removing the filler and filling the space left thereby, by a material or core having the same or approximately the same shrinkage, and drying the article and core.

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