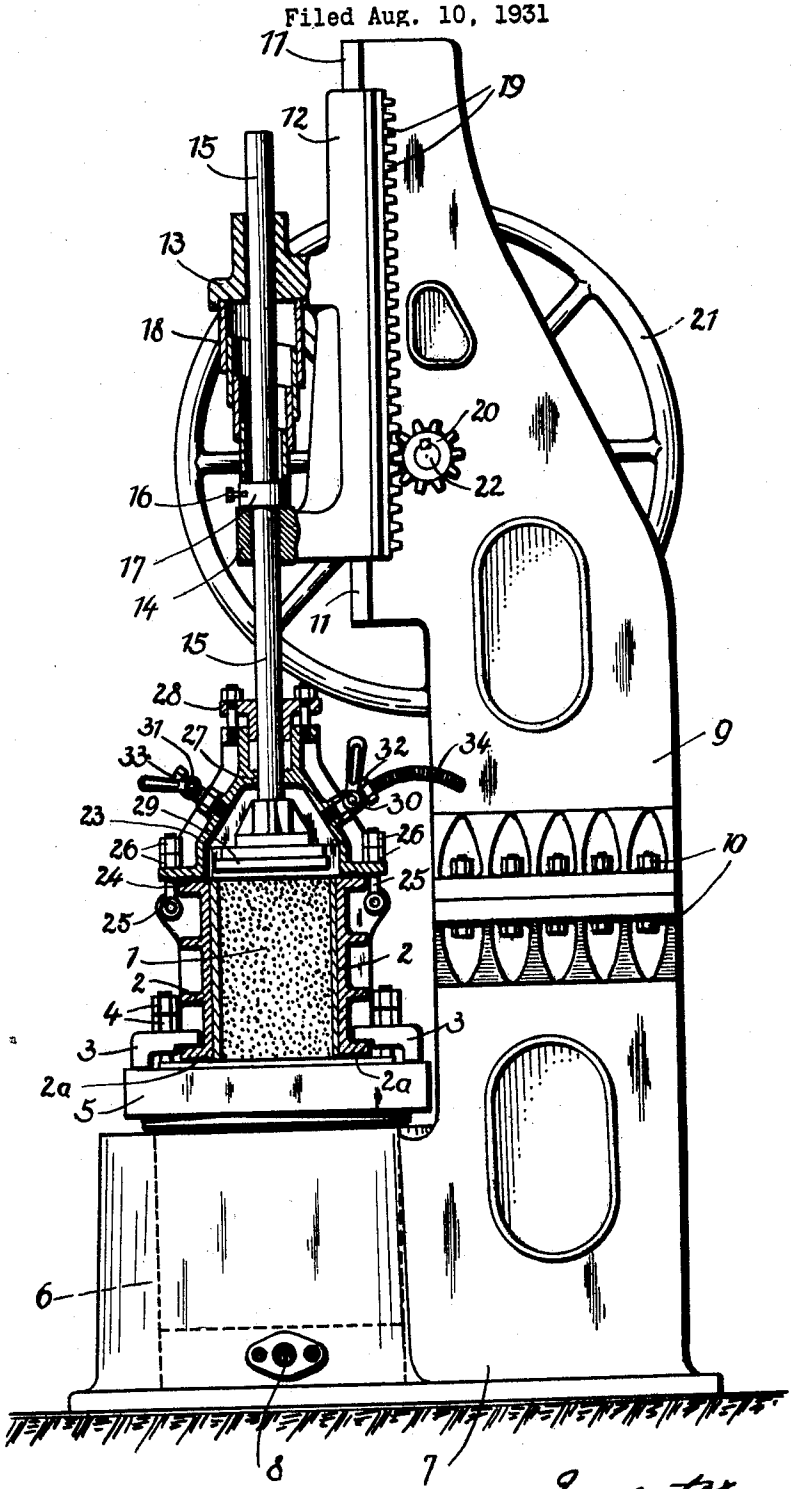
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METHOD AND APPARATUS FOR MAKING CERAMIC SHAPES

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METHOD AND APPARATUS FOR MAKING CERAMIC SHAPES

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The invention relates to the making of ceramic shapes for the manufacture of refractories and the like and especially for those processes by which a body of reduced refractory material and a bond is prepared with a small addition of a deflocculating agent and water in order to convert the mass by mechanical agitation for instance in shakers, into a temporarily plastical up to a semi-fluid stage, whereby it is to be understood that a semi-fluid mass is somewhat more viscous than the masses employed hitherto in the ordinary casting processes.

According to the above processes the vibration of the moulding mass has been carried out as far under normal air pressure. In this manner there are obtained, however, comparatively porous shapes, the moulding mass containing a certain quantity of air being enclosed by the highly viscous bond and held fastly same in the form of large bubbles.

Now, the principal objects of the invention are improvements of the above mentioned process by means of which the disadvantages hitherto met with are avoided and consequently shapes of a higher density than up to the present are obtained.

The process according to the invention consists principally therein that from a reduced refractory material and a bond preferably containing clay or consisting of clay alone together with a deflocculating agent a mass is mixed with so much water that the mass on the one hand is in a somewhat crumbly state after the mixing has been effected and on the other hand contains sufficient moisture in order to be converted on being shaken or subjected to vibrations into a plastic up to/or a semifluid condition, whereupon said mass is filled into a mould corresponding to the surface of the shapes to be made, then the air pressure in the mould is reduced and afterwards the mass is subjected to mechanical vibrations until the mass in the mould is converted as a whole into a doughly plastical or semifluid state and the cavities of the mould are fully occupied by the mass, whereupon finally the mechanical vibrations are stopped; the shapes thereupon rapidly set and are taken out of the mould. Further, according to the invention, the cavity of the mould is kept under lower air pressure not only before, but also entirely or partly during the vibrating of the mass. The vital point is, however, that the air pressure in the mould containing the mass is reduced whilst the mass is entirely in the crumbly state, in other words, before any part of the mass is converted into a doughy plastical or semifluid state.

In the case of the process according to the invention, as hereinabove described, it is in general necessary to employ a moulding mass with a content of water as high as for instance 8 percent. Although this water content is lower than in the case of ordinary casting process it is nevertheless sometimes undesirably high.

A further object of the invention are improvements of the already described known process for the making of ceramic shapes for the purpose of rendering possible a considerable reduction in the water content of the moulding mass. To this end, according to the invention, the moulding mass is subjected to compressions, preferably with a heavy or a spring weighted stamp, during the vibration process. This method permits of bringing the addition of water to the moulding mass down to about 5%.

A further object of the invention is a machine for carrying out the process according to the invention for the manufacture of shapes for making refractories and the like.

With these and other objects of the invention in view, I will now described a machine for carrying out the object of the process according to this invention which is shown on the drawing in a side-view and partly in a vertical section.

In the case of the machine, as shown on the drawing, a mould 2 serves to take the mass 1 and is arranged on the table 5 of a vibrator 6, which in the customary manner, is provided with a stamp driven by compressed air similarly to a known shaking contrivance. The mould 2 is fixed, by the insertion of a packing 2a and by means of clamps 3, and screws 4, to the table 5. The vibrator is fitted up in the frame 7 of the moulding machine on one side of which a tube 8 is arranged for connecting up the vibrator with a compressed air pipe.

On the frame of the machine further, there is fixed by means of screws 10, on the side close to the vibration table 5, an arm 9 extending upwards which has a vertical guide 11. On this guide 11 there is a gliding slide 12 which can be moved vertically and is provided on one side with two vertically spaced supporting arms 13 and 14, arranged above the mould 2. The shaft 15 of a stamp serving to compress the moulding mass into the form, is carried in the arms 13, 14, so as to be movable in a vertical direction.

On the shaft 15 there is fixed by means of the screw 16 an adjustable ring 17 which serves to support the shaft of the stamp on the lower slide

arm 14. Between this supporting ring 17 and the lower side of the upper slide arm 13 there is arranged a pressure spring 18 by means of which the stamp 15 is held in such a position that, when the shaft of the stamp is drawn off the supporting ring 17 lies against the lower slide arm 14. The slide 12 is provided on the other side with a set of teeth 19. With the teeth 19 of the slide 12, a pinion 20 engages which is fixed to an axis 22 arranged on the supporting arm 9 and which is worked by the hand wheel 21.

During the formation of the shape inside the mould, the cavity is closed above by a cover 23 which is fastened together with a packing 24 on the upper part of the mould by means of turnable threaded bolts 25 and nuts 26. The cover 23 has an opening 27 for the lower end of the shaft stamp 15, whereby a customary stuffing box 28 serves to render the joint tight between the shaft of the stamp and the cover. The shaft 15 carries finally in the interior of the mould cover a stamp plate 29 which corresponds approximately to the section of the mould cavity and is so fitted over the mould that it can be moved into the mould.

On the mould cover 23 there are, moreover, fitted two tubes 32, 33 controlled by the cocks 30, 31 of which the tube 32 serves to connect up with the flexible hose 34 of a suction air pipe line and the other tube 33 for the connecting up the interior of the mould with the outside air.

The working of the contrivance shown in the drawing for the making of a shape proceeds about as follows:

When the vibration contrivance 6 is not in action and the cover 23 has been taken off, which in this case is lifted upwards by means of the slide 12 from off the mould, a quantity of a moulding mass consisting of reduced refractory material and a bond with an addition of a deflocculating agent and water which corresponds to the weight of the shapes to be produced, and which has been mixed together in a mixer, not shown in the drawing, is filled into the mould. Thereupon, the cover 23 by moving the slide 12 downwardly by means of the hand wheel 21 is set onto the mould and then the fixing screws 26 are screwed down so that the joints between the cover and the mould are closed absolutely air-tight by means of the packing 24. Now, the shut-off cock 30 of the suction air pipe line is opened and the interior of the mould is evacuated. As soon as the air has been expelled from the form to the desired degree which can be determined without trouble by the pressure indicator fitted in the suction pipe line, then the slide 12 by means of the hand wheel 21 is moved further downwards so that the stamp 29 lies firmly on the upper side of the moulding mass and the pressure spring 18 is compressed to an extent which corresponds to the desired degree of compression of the mass inside the mould. Now the vibrator 6 is put into action and the mass inside the mould is vibrated so long until the mass has the desired condition. In this connection it is under certain circumstances necessary to move down still more the stamp slide 12 to such an extent that the mass to be moulded can be held whilst being vibrated under a uniform pressure by means of the action of the spring 18.

It may be remarked that the spring 18, of course, can be replaced by a weight fixed on the shaft 15.

When using the described machine for carrying out the process according to the invention without subjecting the moulding mass to compression during the vibration process, the compression remains then out of action, i. e. the slide 12 is not moved downwards after the cover 23 is placed on the mould 2. In order to assure a smooth surface of the shape, however, it may be advisable to merely allow the stamp plate to rest loosely on the moulding mass, this being attained by loosening the screw 16 of the adjustable ring 17.

Needless to say the cover of the mould as shown may be replaced, in the case dealt with in the foregoing paragraph, by an ordinary cover not provided with a stamp.

The preparation of the moulding mass serving to carry out the process according to the invention is effected essentially to conform with the following principles:

Example I

A mixture is prepared from:

A.—Refractory material

190 kilos of a highly burnt clay (chamotte) reduced to 5 mm. maximum grain size.

B.—Bond

5 kilos of ball clay
5 kilos of china clay, both finely ground (1 mm.).

C.—Deflocculating agents

0.3 kilos of humic acid (called "Kesseler braun")
0.02 kilo of sodium carbonate
0.01 kilo of sodium silicate.

D.—Water 10 liters

After mixing and preparing in the ordinary manner, the mass is filled into a mould, the interior of which is then evacuated whereupon the mass in the mould is vibrated and simultaneously pressed, as described hereinabove.

Example II

A mixture is prepared from:

A.—Refractory material

150 kilos of sillimanite, reduced to 3 mm.

B.—Bond

50 kilos of sillimanite flour (sieve No. 100)
20 kilos of ball clay.

C.—Deflocculating agent

0.6 kilo of tannic acid
1 liter of a solution of ammonia (25%).

D.—Water 16 liters

After mixing and preparing in an ordinary mixer, this mass may be subjected to the process described but without exerting any pressure, as it is rendered fluid enough by the vibrating to fill out the mould completely.

In this case it may be advantageous to line the mould walls with a material suitable to suck up water such as for instance sheet rock.

It may be understood, that the process is not confined to the above mentioned mixtures, but there may be used any other refractory materials being reduced to a proper grain size, such as corundum spinell, magnesite, quartzite, silicon carbide or others and the bonding material may consist of the fine'y ground part of the refractory material and may or may not con-

tain clay. As deflocculating agents may be used any of these substances hitherto known from the casting processes.

The invention as hereinabove set forth is embodied in a particular form, but may be variously embodied within the scope of the claims hereinafter made.

I claim:

1. A machine for making ceramic shapes comprising, a vibrating machine, a mould arranged on the working member of the vibrating machine, a guide arranged vertically above the mould, a slide gliding on said guide, a cover for closing up the interior of the mould and attached to the said slide, and means for evacuating the interior of the mould.

2. A machine for making ceramic shapes comprising, a vibrating machine, a mould arranged on the working member of the vibrating machine, a guide arranged vertically above the mould, a slide gliding on said guide, a stamp adapted to compress the moulding mass held in the mould on the working member of a vibrating machine, means for closing up the interior of the mould, means for pressing the stamp on the moulding mass held in the mould, and means for evacuating the interior of the mould.

3. A machine for making ceramic shapes comprising, a vibrating machine, a mould arranged on the working member of the vibrating machine, a stamp adapted to compress the mass held in the mould, a cover adapted to completely close up the interior of the mould, a vertical guide arranged above the mould, a slide glidable thereon, said stamp having a vertical shaft passing through a hole in said cover and attached glidably to said slide, and means for evacuating the interior of the mould.

4. A machine for making ceramic shapes comprising, a vibrating machine, a mould arranged on the working member of the vibrating machine, a stamp adapted to compress the mass held in the mould, a cover adapted to completely close up the interior of the mould, a vertical guide arranged above the mould, a slide glidable thereon, said stamp having a vertical shaft passing through a hole in said cover and attached glidably to said slide, a ring attached to the stamp shaft, a spring between said slide and the ring so as to press the stamp downwards elastically, and means for evacuating the interior of the mould.

5. The method of making ceramic shapes which comprises: placing the mixture to be moulded, while in a somewhat crumbly or non-fluid state but containing sufficient moisture or liquid, in mould; subjecting the mixture to mechanical vibration until the mass mixture is converted as a whole into a doughy plastical or semi-fluid state; and evacuating air or gas from the mixture while in the crumbly or non-fluid state in the mould and before it is subjected to said vibration.

6. The method of making ceramic shapes which comprises: placing the mixture to be moulded, while in a somewhat crumbly or non-fluid state but containing sufficient moisture or liquid, in mould; subjecting the mixture to mechanical vibration until the mass mixture is converted as a whole into a doughy plastical or semi-fluid state; and evacuating air or gas from the mixture both while in the crumbly or non-fluid state in the mould and before it is subjected to said vibration and also during said vibration of the mixture.

ELISABETH LUX.