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APPARATUS FOR CRUSHING CERAMIC POWDERS

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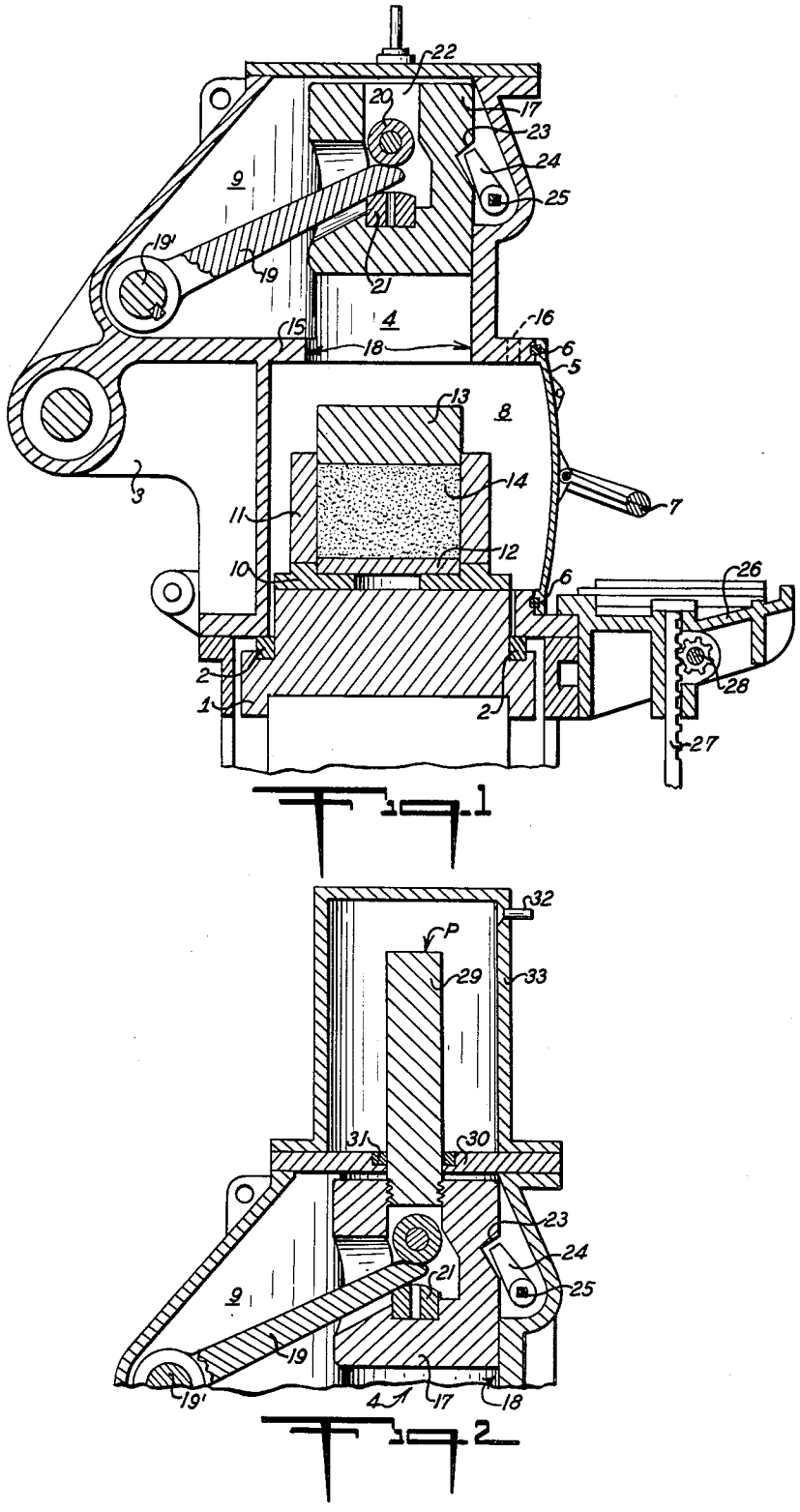

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APPARATUS FOR CRUSHING CERAMIC POWDERS

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2 Claims. (Cl. 25—86)

This invention relates to an apparatus for crushing ceramic powders by the pounding method. The various ceramic products, and more particularly fire-proof products, are usually produced by crushing humidified pulverulent masses. However, it is difficult, with such a process, to obtain high grade and density products.

In order to avoid the formation of leaves in the product, perpendicularly to the direction in which the crushing is effected, it is necessary to treat a slightly humidified powder, namely a powder containing a high proportion of baked clay which is expensive. On the other hand, it is not possible to add binders as they may disturb the baking. Mixtures which are relatively more humidified, namely containing a higher proportion of plastic clay, not only risk being formed with leaves as they are crushed, but, within the limits between which it is possible to exert a pressure without forming leaves, they have a low apparent density. In the same way, the crushing of products containing a high proportion of raw clay can be effected without the formation of leaves only if the powders are very little humidified and, in such an eventuality, the density of the products obtained is very low.

As a general rule, the principal causes of the formation of leaves, which is the chief drawback of the known crushing process, are, on the one hand, the presence of occluded air in the mass being pressed or crushed and, on the other hand, the inequalities in pressure between the surface of the mass of material which receives the pressure or crushing shocks and the opposite surface.

This invention has for its object an apparatus for crushing ceramic powders, making it possible to eliminate such drawbacks.

This process is essentially based on the fact that the crushing is effected on the ceramic powder kept in a vacuum enclosure.

The device for carrying out the process is characterized, more particularly, by the means for controlling the pounding hammer and a kind of mould allowing for a better distribution of the crushing strain on the opposite two faces.

This invention will be more readily understood from the ensuing description with reference to the accompanying drawings.

In the drawings:

Fig. 1 is a vertical section view of a particular embodiment of a device according to the invention.

Fig. 2 is a partial vertical section view of the device of Fig. 1 the upper part of which being modified.

The machine shown on Fig. 1 comprises a frame 1 on which rests, through damping joints 2, a casing 3 in which is formed the crushing chamber 4. Said chamber made of one piece is perfectly tight and can be closed by a door 5 provided with a tightening joint 6 and operated through a handle 7. The chamber 4 is divided into two parts, the lower part 8 receives the mould and the upper part 9 receives the means controlling the pounding hammer.

The base 1 carries, through a plate 10, a mould formed with a bottom 12, a peripheral wall 11 (which may be

cylindrical for instance) resting freely on said bottom and a pushing lid forming a piston.

The lower part 8 is separated from the upper part 9 by a horizontal wall in which an aperture is formed, the section area of which is the same as the pounding hammer, and which has a vacuum cock 16.

The pounding hammer 17 is guided vertically at 18 so as to fall through its own weight after it has been released from its raising and retaining device. The raising is ensured by a lever 19 keyed on a pivoting axis 19' the extremity of which is engaged between a roller 20 on which it acts in the raising step and a damping piece 21. For this purpose, the hammer 17 is formed with a recess 22 through which the extremity of the lever 19 extends and in which are secured the roller 20 and the damping piece 21. The hammer 17 has also a notch 23 adapted to cooperate with a finger 24 keyed on an axis 25 the effect of which is to retain the hammer in its high position. The pivoting of the axes 19' and 25 is controlled in synchronism through an external transmission mechanism of any type (not shown on the drawings).

The frame 1 also carries a table 26 for withdrawing the material from the mould and comprising a jack 27 actuated by a screw 28.

The device operates as follows:

The material being treated is put in 14 in the mould 11—12—13 and the door 5 of the chamber 4 is shut. Through the cock 16 the air is sucked from said chamber 4 before starting the crushing and the vacuum is maintained until the end thereof so as to continue until the end of the moulding the removal of the occluded gases from the pulverulent products.

The synchronized control means (not shown) are set into operation so that the hammer 17 may be raised by the lever 19 until the notch 23 meshes with the finger 24, then the shaft 25 causes the finger 24 to pivot, releasing the hammer 17 which falls on the lid 13.

The operation is sound-deadened by the damping joints 2 and the piece 21 which damps the fall of the lever 19.

As the peripheral wall 11 can move freely through inertia with respect to the bottom 12 of the mould, the effect of the shock of the hammer is transmitted with the same force onto said bottom 12 as onto the lid 13 which receives it directly.

When the compression stage is over, the suction is stopped and the door 5 opened and the mould is brought onto the withdrawal table 26, the jack 27 ensuring the evacuation of the compressed material.

Fig. 2 illustrates a different embodiment in which the hammer 17 is integral at its upper part with a piston 29 extending through the upper face 30 of the chamber 9 through a gland 31. Said piston is subjected either to atmospheric pressure p, or to an overpressure P provided in an enclosure 33 positioned over the lid 31 by means of a pressure source of any type connected to a nozzle 32.

The difference between the relative vacuum in the chamber 8—9 and the pressure p or P exerted on the part of the piston 29 external to the chamber 9 adds to the weight of the hammer 8 for effecting the crushing of the ceramic powder.

The removal of the gases from the ceramic powder obtained with the apparatus according to the invention makes it possible to improve the density and the homogeneousness of the products obtained. The air blisters which the paste generally contains actually prepare its separation into heterogeneous layers. On the contrary, the mass of paste obtained according to the invention has no break and will not bring about during the baking or any other treatment the defects in texture generally encountered such as the formation of leaves.

In other words, the effects of the vacuum combined with

those of the crushing ensure to the ceramic mass being treated an unusual high grade.

Of course, the invention is not limited to the various embodiments described which are given only by way of example.

What I claim is:

1. A device for crushing ceramic paste by subjecting it to rapid pounding which comprises a pounding hammer, means for imparting to said hammer a high speed reciprocating motion during which it is alternatively raised mechanically and allowed to fall by gravity a mould for containing the ceramic paste to be crushed, and a vacuum-tight enclosure entirely enclosing said pounding hammer, said means and said mould.

2. A device as in claim 1 wherein said means comprise an oscillating lever, a rock shaft on which said lever is keyed at one end, the other end of said lever operatively engaging said hammer, and a vacuum-tight seal in said enclosure through which said rock shaft extends.

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