

Nov. 28, 1933.

E. LUX ET AL

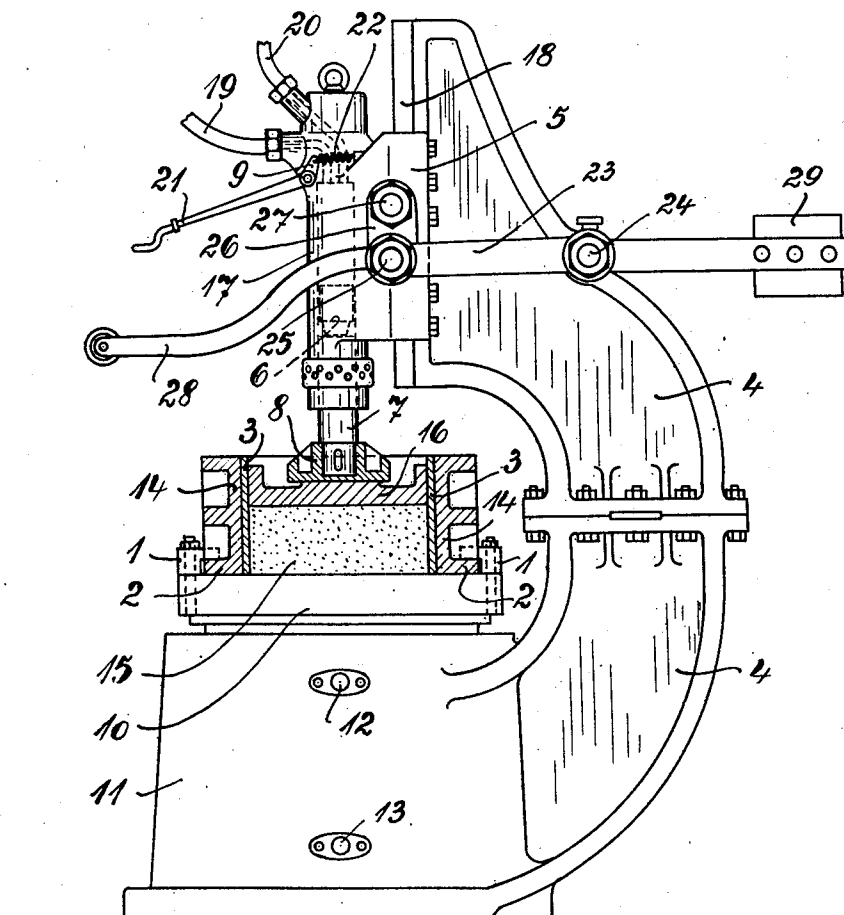
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METHOD AND APPARATUS FOR MAKING REFRACTORY BRICKS

Filed April 17, 1931

2 Sheets-Sheet 1

Fig. 1



Inventors:

Editha Ruth Lux.
Hilfelm Leung & Daniels
Charles A. Smith

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E. LUX ET AL

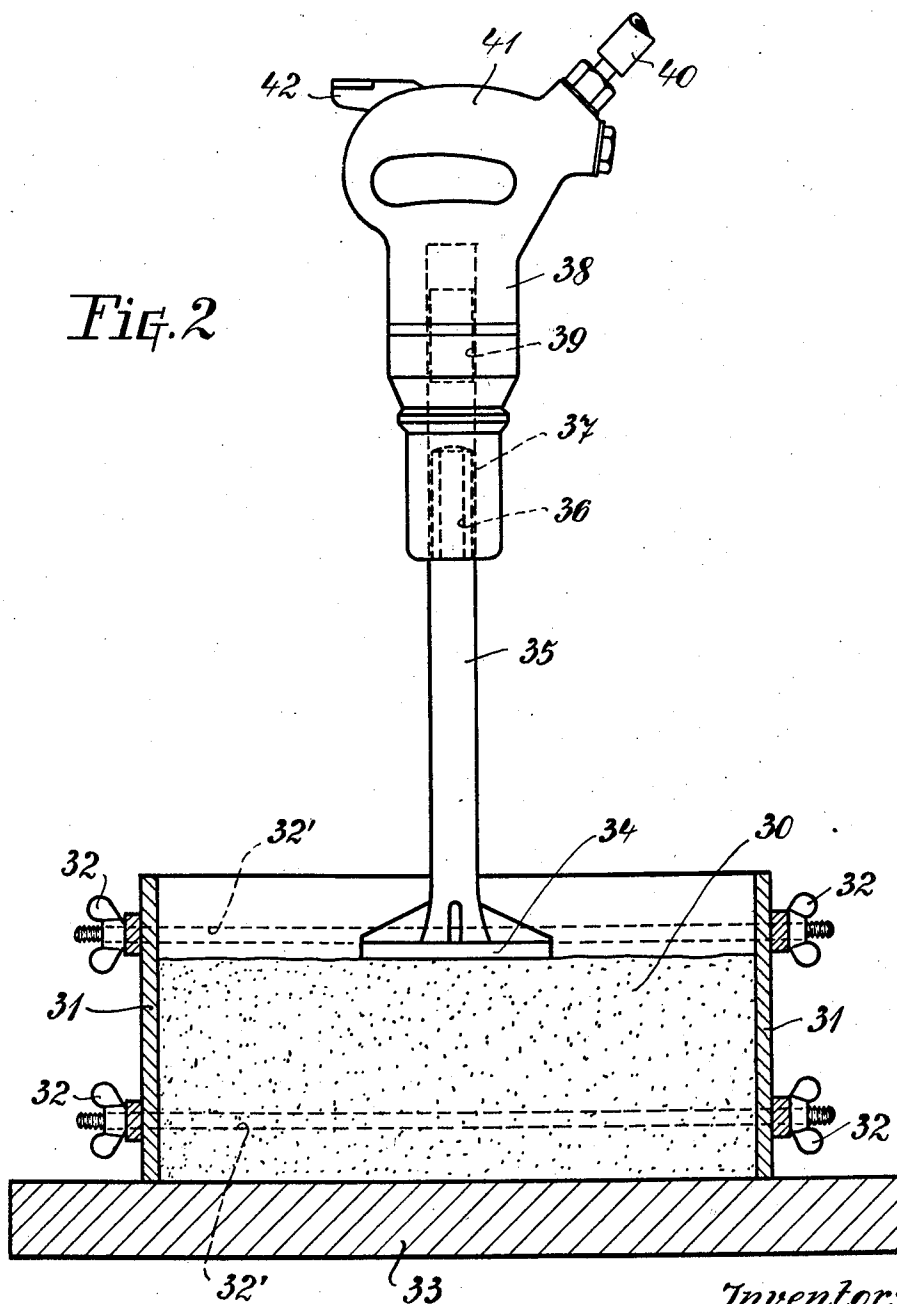
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FIG. 2



Inventors:

Editha Ruth Lux.
Hofman Reinhold Daniels.
Bernard W. W. W.

UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR MAKING
REFRACTORY BRICKS

Elisabeth Lux, Essen, and Wilhelm Heinrich Daniels and Eberhard Kühn, Dusseldorf-Heerdt, Germany, assignors, by mesne assignments, to The Koppers Company of Delaware, Pittsburgh, Pa., a corporation of Delaware

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5 Claims. (Cl. 25-41)

The present invention relates to the manufacture of shapes for making refractory bricks, these shapes being made from masses or compositions which consist of non-plastic, refractory and granular materials, such as baked clay, quartz, corundum, sillimanite, silicon carbide and the like, or mixtures of these substances besides also a little clay—but possibly none at all—and liquefying agents, such as humic acid, alkalis or the like, the whole being worked together with water.

In the manufacture of compressed shapes for making refractory bricks, the usual process of compressing the loose mass has been to ram or stamp it in a mould. By using this method however, it has not been possible to carry out the compressing of the shapes beyond a certain degree, so that the shapes were comparatively porous and their density at various places of the shape was not uniform.

The present invention now relates to improvements in the manufacture of shapes for producing refractory bricks from the above molded masses.

A primary object of the invention is a method of making compressed shapes from the said masses, wherein a molding box giving form to the bottom and sides of the shape, is filled with a weighed quantity of the above mixture worked up with water, then a weighted plate entirely or partially closing the mold, is placed on the top of the mass in the molding box whereupon this plate is set into vibration by receiving more than 2000 percussive blows per minute without the plate being lifted from the surface of the mold, until the desired compressing or impacting of the mass is obtained. Due to the action of the vibrated and weighted plate, the molding mass passes provisionally into a doughy, plastic state, in which the granular components of the mass are able to settle themselves very densely. When the desired degree of settlement or compression is reached, the vibration of the weighted plate is discontinued, whereupon the mass sets or stiffens in a relatively short time, so that the shape may easily be removed from the molding box without the risk of damage.

A further object of the invention is a method whereby the molding mass charged into the molding box is covered on top with a loaded and vibrated plate, whilst at the same time the molding box is placed upon a shaking table of usual type which vibrates with less than 2000 oscillations per minute. During this process, a particularly intense impacting of the mass takes place and

it is especially suitable for making large bricks of very irregular external form.

Another object of the invention is a method of making compressed shapes for the manufacture of refractory bricks, wherein the molding mass is covered by a plate which partially or entirely closes off the interior of the molding box and which is set into vibration, whilst at the same time the molding box itself is set into vibration by more than 2000 percussive blows per minute.

Further objects of the invention are concerned with devices for carrying out the processes above set forth.

The invention will now be explained in conjunction with the accompanying drawings which show practical examples for carrying out the process. The invention is not limited to these specific embodiments however.

Figure 1 gives a side elevation, partly in section, of a machine for carrying out the process.

Fig. 2 is a side elevational view, partly in cross-section, illustrating another embodiment of the invention for the manufacture of small shaped bricks in accordance with the method of the present invention.

In the arrangement shown, the molding mass 15 is received by a molding box 14, which is secured to the table 10 of an ordinary shaking machine 11 by means of screw clamps 1, which grip the reinforcing rib 2 of the molding box. The sides of the preferably cast-iron molding box are covered inside with an interchangeable lining sheet 3, which is preferably of steel and is to prevent the wearing of the inner walls of the molding box. The shaking table 10 of the machine 11 is provided as usual with a lifting piston, which can be raised and lowered in quick succession by means of compressed air which is led in through the pipe 12 and out through the pipe 13. The shaking machine 11 is provided at the side with a bracket 4 carrying above the molding box a vertical guide 18 for a slide 5 to which is attached a device 17, whereby the weighted plate 16 pushed into the hollow interior of the molding box 14 and closing off the top of the mass, may be set into vibration by more than 2000 percussions per minute. The device 17 is substantially the same as the usual pneumatic hammer. It comprises a piston 6, which by means of compressed air led in through the pipe 19 and out through the pipe 20, is operated in such a way that it strikes a die or stamp 7 more than 2000 times per minute. This die 7 is movably fitted into the bottom opening of

the device 17 and runs into a foot 8 which rests on the top of the weight plate 16. The device 17 is further furnished with a hand lever 21, by means of which the inlet opening for the compressed air can be opened and shut off. The control lever 21 is provided with an extension 9, to which a tension spring 22 attached to the slide 5 is secured, this spring serving to keep the hand lever 21 at the closed position when in the unloaded condition.

Vertical movement of the slide 5 and therefore of the vibration device 17 is imparted by a double lever 23, which is pivotally mounted in a bearing 24 of the bracket 4. At 25, through the medium of a resilient intermediate member 26, the double lever 23 is hingedly connected to a cam 27 of the slide 5 in such a way that when the double lever 23 is swung up and down, the slide 5 is taken along on the guide 18 at the same time. Finally, the double lever 23 is furnished at one end with a handle 28 and at the other end with a balance weight 29.

Instead of the vibration device being vertically controlled by a hand lever, it is of course also possible for it to be moved up and down by a vertical screw spindle or by a hydraulic device. In both cases an elastic, sprung intermediate member must naturally be inserted between the driving means and the device 17. Further it is also possible for the vibrations to be imparted to the weight plate by several percussion pistons, which is of great advantage when large shapes are to be made.

When using the arrangement as shown in Figure 1 for carrying out the process according to the invention, the method is as follows: The wetted and mixed mass 15 is charged into the mold 14, the vibration device 17 being meanwhile in the top position. The weight plate 16 is now pushed into the hollow space of the mold 14 after first of all levelling out the mass in the mold. Now the vibration device is lowered by means of the double lever 23 until the plunger 8 rests on the weight plate. Then the control lever 21 is actuated so that the striking piston comes into operation and the stamp or plunger 7 is set into vibration and the weight plate 16 along with it.

In the meantime the vibration device 17 is firmly borne down on the weight plate 16 by means of the double lever 23. The vibration device 17 is kept in action until the desired compressing of the mass 15 has been attained, this being preferably ascertained by the sinking of the weight plate 16 inside the molding box up to a mark applied to the inside of the mold. Then the vibration device 17 is brought to a standstill, the slide 5 raised to its top position so that the mold can now be taken apart for the removal of the shape.

In the arrangement shown, if the molding box is also to be set into vibration at the same time, the compressed air is delivered to the inlet pipe of the shaking device 11 in such a quantity that the table 10 of the shaking machine travels through the required distance.

The arrangement shown in Figure 1 may also be used for bringing about the compression by setting the molding box into vibration. In this case however the piston of the shaking device is not connected to the shaking table 10 but is so arranged that, just like the vibration device 17, it strikes against the bottom of the table 10 in such rapid succession that the table 10 receives more than 2000 blows per minute.

According to the drawings in Figure 2, the forming mass 30 is placed in a molding box 31, which is capable of being taken apart, the sides being held together by means of wing nuts 32 and screwed spindles 32'. The molding box is secured to a table plate 33 which has a flat and level top. The mass in the mold is compressed by a plate 34, which has an upwardly extending shank 35, the top end of which passes into the guide sleeve 37 of a device 38 after the nature of a pneumatic hammer. As usual, the device 38 is provided with a striking piston 39 which is driven by means of compressed air flowing in through the pipe 40. In its bottom position, the piston 39 strikes the end of the shank 35 of the plate 34. The travel of the piston is so chosen that with a certain air pressure, it imparts more than 2000 beats per minute to the end of the shank 35.

Furthermore, the device 38 is provided at the top with a handle 41 on which is arranged a finger lever 42 for actuating a valve arranged inside the handle 41 and controlling the inlet opening for the compressed air. When the device shown in Fig. 2 is used for carrying out the process according to the invention, the molder grips the shank 35 of the vibrating plunger with one hand and the handle of the pneumatic hammer with the other one and places the bottom of the plate 34 on the top of the mass inside the mold 31. Then he opens the air valve 42 and goes backwards and forwards over the surface of the mass with the vibrating stamp until the mass has passed into the desired doughy plastic state at all places and has acquired the required density. In order to obtain a flat surface on the shape it is advisable towards the end of the compressing operation, to place a plate on top of the mass in the mold and to set it into vibration for a little longer using the device shown in Figure 2. When the shape is finished, the wing nuts of the mold are slackened off and the mold taken apart.

With the arrangement as shown in Fig. 2, the plate 34 is shown flat at the underside. In certain cases however, particularly when a shape is to be built up in several layers as is the case with complicated shapes, it is advisable to provide the bottom of the ram with grooves so as to ensure a good union of the layers with each other. It is also possible to make the bottom of the ram 34 slightly conical.

Ceramic shapes produced according to the invention are preferably made from compositions which contain but little clay, e. g. less than 10% or even no clay at all. It is also of advantage to add deflocculating agents which facilitate the shaping of the mass. Below are given examples of masses free from and containing clay, which may be used to advantage in the process according to the present invention:

A. Mass free from clay.—500 kilograms of quartzite are ground in a wet pan to a grain size of 5 mm., at the maximum 3% CaO in the form of milk of lime and 1% liquor from the sulphite process of cellulose manufacture being added. The water content of the mass should be about 7%.

B. Mass containing clay.—200 kilograms of baked clay ground to a grain size of 4 mm. at the maximum are mixed in an open trough mixer with 20 kg. clay, 15 liters of water and 0.1% sodium carbonate. The mixture may be treated according to the method described.

It is to be distinctly understood that the above

process is not limited to the specific details disclosed above and we claim as part of our invention all modifications which may reasonably fall within the scope of the appended claims.

5 We claim:

1. A method of making compressed shapes of definite dimensions for the manufacture of refractory bricks from refractory and granular materials worked up with a liquid, the said materials being at least substantially free of clay, which method comprises depositing a weighed quantity of such a prepared mixture into a mold which defines the bottom and sides of the shape, placing a weighted plate on the top of the mass, setting this plate into vibration by more than 2000 percussions per minute and at the same time shaking the molding box in such a way that the latter makes less than 2000 oscillations per minute, until the desired compressing of the mass is attained and maintaining the weighted plate firmly down on the surface of the mass and against retractive movement relative thereto during the vibration of said plate on the mass.

2. A device for molding mixtures and comprising a molding box open at the top, a weighted plate movable vertically for insertion inside the molding box, means for setting this plate into vibration by more than 2000 percussions per minute, said plate being arranged relative to said vibration means so as to prevent retractive movement of it relative to the mold during the operation of the vibration means for setting the plate into vibration, and means for setting the molding box into vibration by more than 2000 percussions per minute.

3. A device for molding mixtures and comprising a molding box open at the top, a weighted plate movable vertically for insertion inside the molding box, means for setting this plate into vibration by more than 2000 percussions per minute, said plate being arranged relative to said vibration means so as to prevent retractive movement of it relative to the mold during the operation of the vibration means for setting the plate into vibration, and means for setting the

molding box into vibration by more than 2000 percussions per minute, the said weighted plate being smaller in cross-section than the cross-section of the top of the molding box.

4. A device for molding mixtures and comprising a molding box open at the top, a weighted plate movable vertically for insertion inside the molding box and means for setting this plate into vibration by more than 2000 percussions per minute, said plate being arranged relative to said vibration means so as to prevent retractive movement of it relative to the mold during the operation of the vibration means for setting the plate into vibration, and means for shaking the molding box, a support for slidably supporting said vibration means, a lever pivotally mounted on said support and hingedly connected to a cam on the vibration means whereby to raise and lower said vibration means, said lever and cam being adapted to bear the vibration means firmly down on the weight plate when lowered onto the mold.

5. A device for molding mixtures and comprising a molding box open at the top, a weighted plate movable vertically for insertion inside the molding box means for setting this plate into vibration by more than 2000 percussions per minute, said plate being arranged relative to said vibration means so as to prevent retractive movement of it relative to the mold during the operation of the vibration means for setting the plate into vibration, means for setting the molding box into vibration by more than 2000 percussions per minute, the said weighted plate being smaller in cross-section than the top opening of the molding box, a weighted plate greater in diameter than the top opening of the molding box adapted to shape the upper surface of the shape after the mass is compressed, means for setting the said larger weighted plate into vibration by more than 2000 percussions per minute.

ELISABETH LUX.

WILHELM HEINRICH DANIELS.

EBERHARD KÜHN.

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