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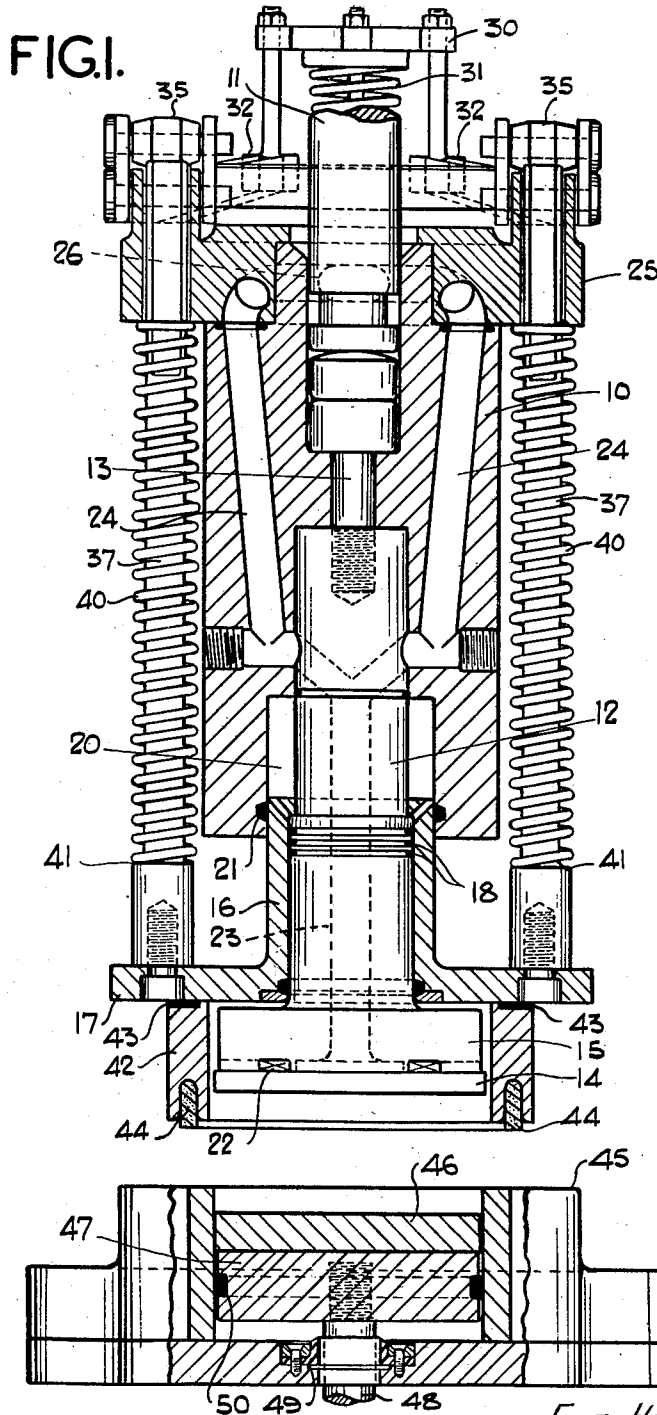
F. H. CLARK ET AL

2,586,148

MEANS FOR THE REMOVAL OF AIR FROM FINELY DIVIDED
MATERIAL BEFORE CONSOLIDATION UNDER PRESSURE

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3 Sheets-Sheet 1



INVENTORS

FRED HARRY CLARK
CHARLES ARTHUR LEES
by Walter S. Pleston
ATTORNEY

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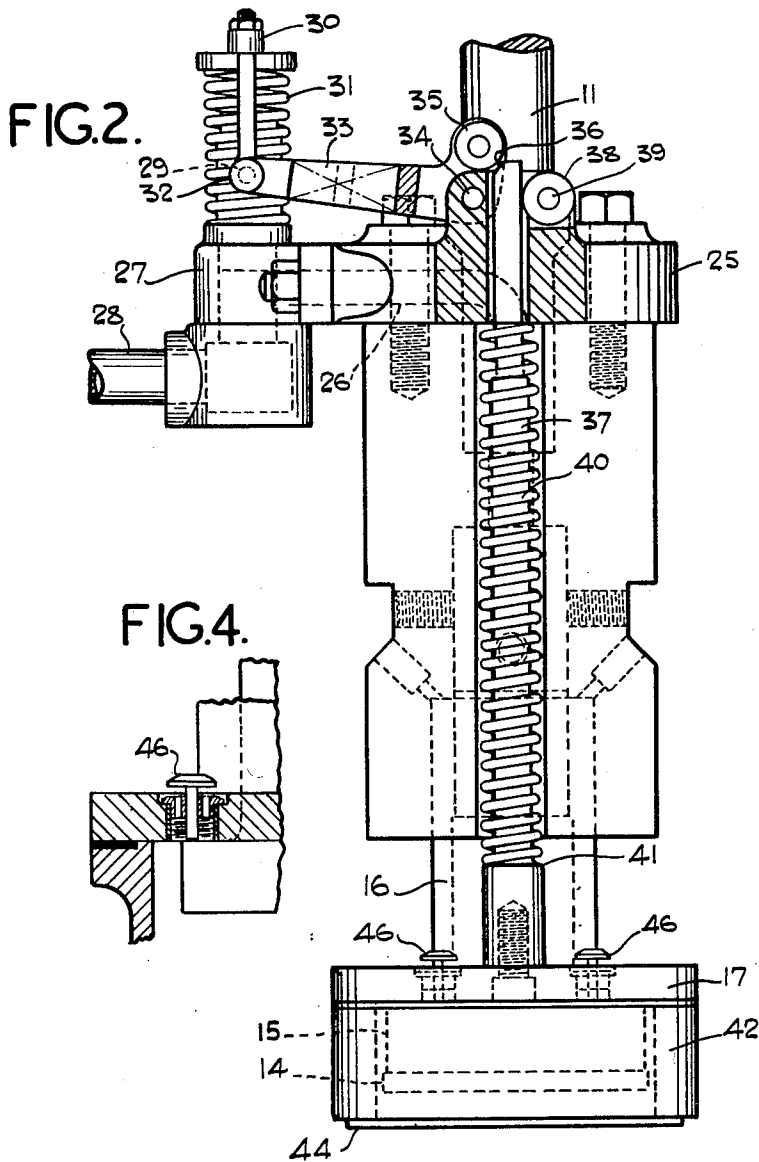
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INVENTORS
FRED HARRY CLARK
CHARLES ARTHUR LEES
by *Walter S. Heston*
ATTORNEY

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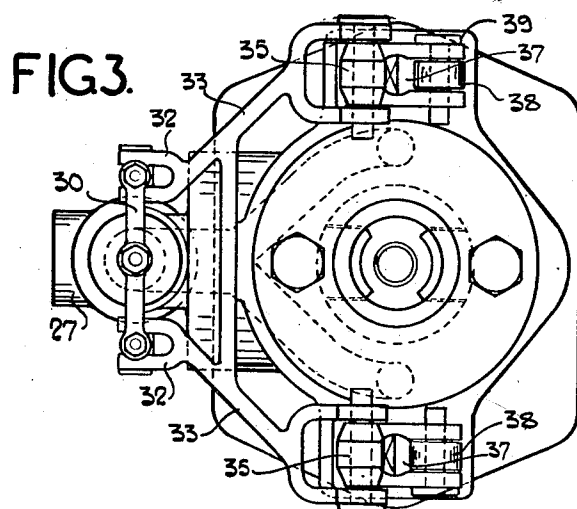
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INVENTORS

FRED HARRY CLARK

CHARLES ARTHUR LEES

by Walter S. Heston
ATTORNEY

UNITED STATES PATENT OFFICE

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MEANS FOR THE REMOVAL OF AIR FROM
FINELY DIVIDED MATERIAL BEFORE CON-
SOLIDATION UNDER PRESSUREFred Harry Clark, Kinver, and Charles Arthur
Lees, Pensnett, EnglandApplication January 4, 1950, Serial No. 136,692
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4 Claims. (Cl. 25—83)

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This invention relates to a new or improved means for the removal of air from finely divided material prior to the consolidation of the material by a pressing or like operation.

In many pressing operations, such as the moulding of bricks and tiles from powdered clay, the moulding of grinding wheels and the like from abrasive particles, or the moulding of plastic articles from moulding powder, the material is consolidated under pressure in a die or mould. When the material is introduced into the die or mould it occupies a volume which is considerably greater than and may be as much as twice that of the consolidated pressing or moulding owing to the air between the particles of the material. After the die or mould has been closed the air can only escape between the relatively moving parts of the die or mould but as these must be a good working fit there is a tendency for air to be trapped within the material and to form layers or pockets of compressed air which cause cracks and reduce the mechanical strength of the finished pressing or moulding.

According to our invention, in a press or the like in which finely divided material is consolidated under pressure in a two-part die or mould of which one part is movable relative to the other, a hollow box or sleeve is slidably mounted on one part of the mould and is adapted to come into sealing engagement with the other part before the mould is closed, the box or sleeve being connected to a source of vacuum to extract air from the mould and from between the particles of material.

In a press in which the material is compressed in a hollow stationary mould into which a die is moved downwardly by a power-operated ram the box or sleeve is conveniently mounted to slide in an airtight manner on the ram and to surround the die, the lower end of the box or sleeve engaging and making a sealing engagement with the upper end of the mould before the die enters the mould.

Preferably the connection of the box or sleeve to vacuum is effected automatically by means actuated by the movement of the ram and that connection is closed and the box or sleeve is put into communication with the atmosphere as the ram commences its return stroke to withdraw the die from the mould.

Our invention is applicable equally to hand operated presses or to power operated presses whether mechanical or hydraulic.

The details of construction of the means for carrying out our invention may vary consider-

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ably according to the type of press to which it is applied and to the nature of the work for which the press is used.

Two practical power-operated machines for the pressing of tiles and bricks and incorporating our invention are illustrated by way of example in the accompanying drawings in which:

Figure 1 is a vertical section of the operative parts of a screw press for moulding tiles.

Figure 2 is a side elevation.

Figure 3 is a plan.

Figure 4 is a fragmentary section on a larger scale of one of the atmospheric valves.

In the press shown in Figures 1 to 4, 10 is the main ram of the press which is guided for vertical movement in guide slides on the press frame in the usual way. The ram is actuated by a vertical spindle 11 of which the upper part is screw-threaded and is operated by known mechanism which is not shown as it is common to screw presses. A secondary ram 12 is fixed in the lower end of the main ram in alignment therewith, the upper end of the secondary ram being received in an axial recess in the main ram and being secured by a stud 13. The die 14 for compressing the finely divided clay is fixed to a head 15 on the lower end of the ram 12. Fitting around the lower part of the ram 12 is a sleeve 16 having on its lower end a horizontally extending flange 17 of substantial dimensions. An airtight sliding seal is made between the bore of the sleeve and the ram 12 by piston-rings 18 mounted in grooves in the ram and by felt or other packing 19 in an internal groove in the sleeve adjacent to its lower end. The lower end of the main ram 10 is recessed as shown at 20 to receive the sleeve 16, and further felt or other packing 21 located in a groove in the recess makes a sliding oiltight seal with the outer surface of the sleeve.

Horizontal air passages 22 in the head 15 are open at their outer ends and at their inner ends they lead into a vertical bore 23 in the ram 12. The upper end of this bore is in communication with two bores or passages 24 in the main ram 10 which lead into aligned passages in a head 25 fixed on the upper end of the main ram.

These passages lead by way of a horizontal passage 26 into a housing 27 for a valve which controls the connection of the passages to a pipe 28 which is connected to a vacuum pump or other source of vacuum (not shown).

The valve is normally held closed by a spring 29 which is adapted to be opened by a cross-member 30 mounted on the stem of the valve and coupled by adjustable rods 31 to spaced forks 32

on a rocking frame 33. The frame pivots about pins 34 in lugs on the head 25 and carries rollers 35 located above the pins 34 and adapted to be engaged by inclined faces 36 on the upper ends of vertical rods 37 which are slidable through vertical bores in the head. The upper ends of the rods are backed by rollers 38 with which they are in sliding engagement and which are mounted on fixed pins 39. Thus when the rods 37 are moved upwardly the inclined faces 36 engage the rollers 35 and rock the frame about the pins 34 to depress the cross-member 30 and open the valve.

The lower ends of the rods 37 are secured to the flange 17 on the sleeve 16 and coiled compression springs 40 fitting over the rods abut between the lower face of the head 25 and shoulders 41 on the rods to hold the rods and the sleeve in their lowermost position in which the flange 17 rests on the head 15 on the bottom of the ram 12. Fixed to the bottom of the flange 17 there is a hollow box member 42 of internal horizontal dimensions greater than the horizontal dimensions of the die 14 so that there is a clearance between the box and the die, and of a vertical depth such that in the normal inoperative position shown in Figure 1 the lower edge of the box lies some distance below the bottom face of the die.

The upper edge of the box is secured to the flange 17 with packing 43 between to make an airtight joint, and a groove in the lower edge of the box receives a rubber insert or sealing member 44 adapted to engage and make an airtight seal with the upper face of the mould 45 in which the clay is compressed.

Four gravity operated air valves 46 shown in detail in Figure 4 are mounted in the flange 17 as shown in Figure 2. The stems of the valves are longer than the thickness of the flange and normally the lower ends of the stems engage the upper surface of the head 15 and hold the valves in the raised open position so that the interior of the box 42 is in direct communication with atmosphere through the valves.

The mould 45 is mounted on the fixed bed or table of the press in the usual manner. A die 56 slidably mounted in the mould is backed by a block 47 mounted on the upper end of a vertically movable spindle 48 which extends through a sealing bush 49 in the fixed bottom of the mould so that the block and the die 56 can be raised to eject the compressed tile as is usual in this type of press. Felt or other packing 50 is mounted in a peripheral groove in the block 47 to bear on the walls of the mould.

In making a tile the spindle 48 is lowered until the block 48 rests on the bottom of the mould, the block making an airtight seal with the bush 49.

The mould is then filled with finely divided clay and the power means for operating the spindle 11 is set in motion. The main ram 10 is forced downwardly, taking with it the secondary ram 12 and the sleeve 16 and box 42 until the sealing insert 44 on the box engages the upper surface of the mould 45. Further downward movement of the box and sleeve is then arrested but the ram continues to move downwardly and as it moves it compresses the springs 40 which hold the box in sealing engagement with the mould. The head 15 which is carried by the secondary ram then leaves the flange 17 on the sleeve and the atmospheric valves 46 are allowed to drop on to their seats and cut off the interior

of the box from atmosphere. At the same time the head 25 is moving downwardly with the ram but the rods 37 which are fixed to the flange 17 remain stationary so that the upper ends of the rods engage the rollers 35 and rock the frame 33 to open the valve 27. The interior of the box 42 and of the mould are thus put into communication with the vacuum pump by way of the passages 22 in the head 15, the passages in the rams and in the head 25, and the valve 27, and air is drawn from the box and the mould and from amongst the particles of clay in the mould so that the clay is effectively de-aerated.

As the downward movement of the ram continues the die 14 enters the mould and compresses and consolidates the clay in the usual way.

On the upward or return stroke of the ram the head 15 moves upwardly with the ram and withdraws the die 14 from the mould, and when the upper surface of the head 15 approaches the bottom surface of the flange 17 it engages and lifts the stems of the atmospheric valves 46 so that air can enter the box 42 and break the vacuum and no resistance is offered to the box leaving the mould on the continued upward movement of the ram.

Before the box leaves the mould the relative movement between the ram and the rods 37 as the ram moves upwardly has carried the rollers 35 away from the upper ends of the rods and has allowed the spring 29 to close the valve 27 and cut off communication between the box and the vacuum pump.

The moulded tile is then ejected from the mould by upward movement of the spindle 48 which forces up the block 47 and the bottom die 56.

We claim:

1. A power-actuated press for consolidating finely divided material in a hollow mould into which a die is forced by a vertically reciprocating ram, comprising a head on the lower end of the ram, a die mounted on the lower end of the head, a sleeve mounted to slide in an airtight manner on the ram, a horizontally extending flange on the lower end of the sleeve normally resting on the head, springs urging the sleeve downwardly relative to the ram against the head, a hollow box secured to the underside of the flange and depending around the head and die, a sealing member on the bottom edge of the box adapted on a downward stroke of the ram to engage the upper end of the mould before the die enters the mould, means actuated by relative movement between the ram and the sleeve for connecting the box to a source of vacuum after the sealing member has engaged the mould and before the die enters the mould and for closing the connection to vacuum on the return stroke of the ram after the die has left the mould, and valves leading to atmosphere mounted in the flange and adapted to be held open when the flange is in engagement with the head and to close when the flange leaves the head.

2. A power-actuated press as in claim 1 in which the means for connecting the box and mould to the source of vacuum comprise vertical rods secured at their lower ends to the flange on the sleeve, a valve mounted on the upper end of the ram, a lever pivotally mounted on the upper end of the ram and coupled to the valve, rollers on the lever adapted to be engaged by the upper ends of the rods on downward movement of the ram relative to the sleeve to rock

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the lever and open the valve, and compression springs mounted on the rods between the upper part of the ram and the flange on the sleeve.

3. A power-actuated press as in claim 1 in which the means for connecting the box and mould to the source of vacuum comprise ports in the head on the lower end of the ram within the box, a normally closed valve mounted on the upper end of the ram and leading to a source of vacuum, passages in the head and ram connecting said ports and valve, and means actuated by downward movement of the ram relative to the sleeve for opening the valve.

4. A press for consolidating finely divided material in a hollow mould into which a die is forced by a ram, comprising a hollow box member mounted to slide in an airtight manner on the ram and surrounding the die, said box being open at the end next the mould and being adapted to come into sealing engagement with the mould before the die enters the mould, a connection between said box and a source of vacuum, a valve in said connection, means actuated by the movement of the ram for opening said valve after the box has come into sealing engagement

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with the mould on the operating stroke of the ram and for closing said valve on the return stroke of the ram before the box leaves the mould, and atmospheric valve means actuated by the movement of the ram for connecting the box to atmosphere on the return stroke of the ram after the vacuum valve is closed and for cutting it off from atmosphere on the operating stroke of the ram before the vacuum valve is opened.

FRED HARRY CLARK.

CHARLES ARTHUR LEES.

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