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Winter et al.

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[54] **APPARATUS FOR MANUFACTURING BLOCKS OR THE LIKE**

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[58] **Field of Search** .....25/41 J, 41 E, 41 B, 119, 45; 18/DIG 60, DIG. 62

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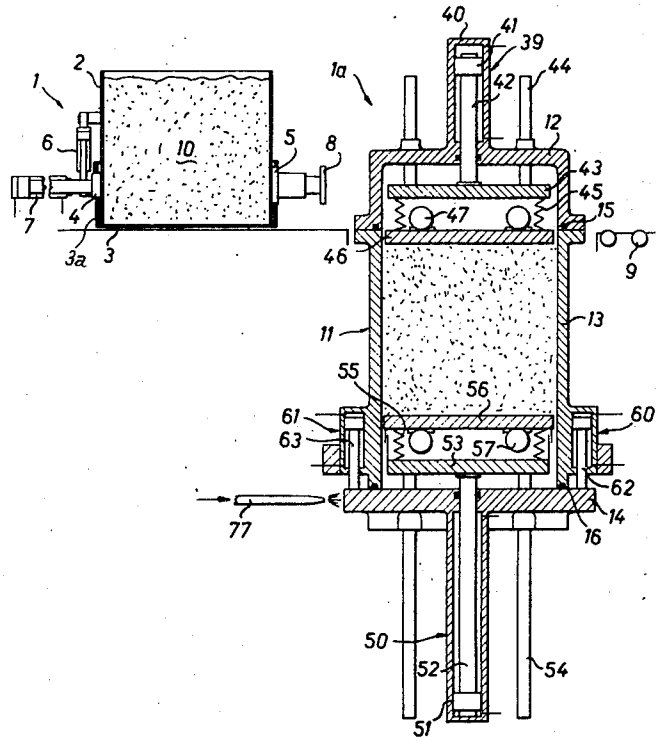
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[57] **ABSTRACT**

An apparatus for the fabrication of blocks, especially the block anodes of furnaces, formed of compacted granular material or the like, wherein a compartment is charged with a dosed quantity of material, a vacuum is generated in such compartment and the material is subjected to compaction by vibration.

9 Claims, 2 Drawing Figures



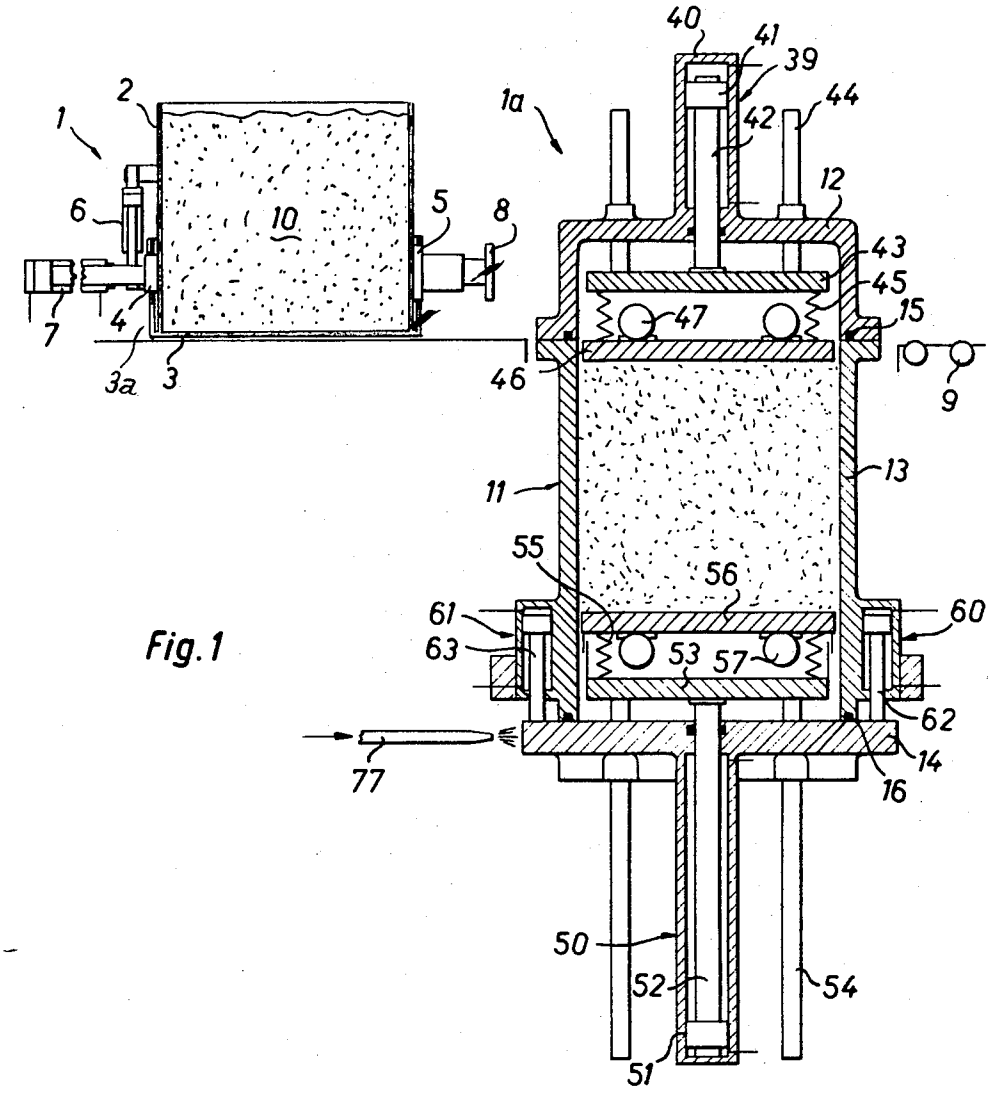


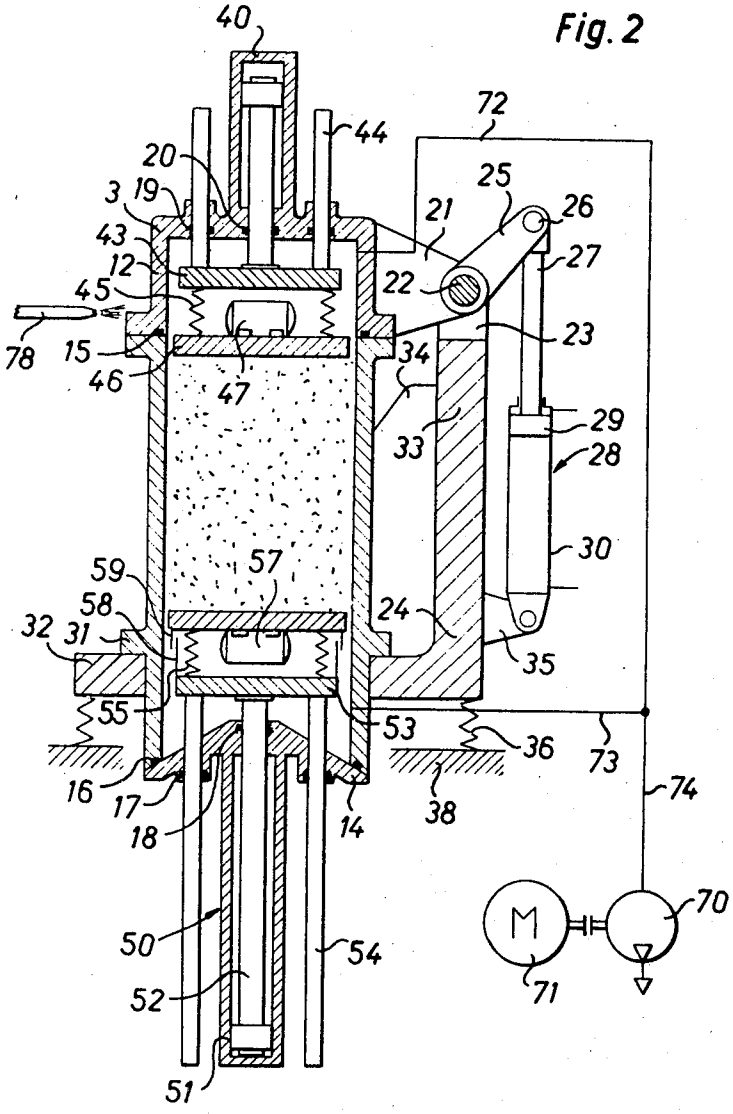
Fig. 1

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Fig. 2



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APPARATUS FOR MANUFACTURING BLOCKS OR THE LIKE

BACKGROUND OF THE INVENTION

The present invention relates to an improved method of fabricating blocks, especially block anodes by compacting granulate material or the like, and furthermore, also relates to a new and improved apparatus for the performance of the aforementioned method.

There are already known to the art different techniques and apparatus structures for the production of blocks, especially so-called block anodes as such are used, in particular, in the electric melting installations of aluminum plants, these blocks being formed from pourable materials and granulates which are admixed with a binder.

According to a first technique of the prior art, the granulate is compressed and compacted under high pressure with the aid of a mold and two press punches, wherein depending upon the construction of the equipment the mold and/or the press punch are movable. In order to intensify the process, it is furthermore known to provide vibration means at least one of the press punches and/or the mold which bring about compaction of the material prior to the terminal compaction operation which occurs under high pressure.

Furthermore, a technique is known to the art in which blocks formed of granulate material are fabricated in two operations, a pre-compacting operation and a final or terminal compacting operation.

SUMMARY OF THE INVENTION

Accordingly, it is a primary objective of the present invention to provide an improved method for the fabrication of blocks of the aforementioned type or similar articles which improves upon the existing techniques and specifically accelerates the fabrication of such blocks, produces a more uniform compaction, and reduces the quota of rejects of such blocks by preventing or reducing the amount of gas- and air inclusions within the material of the block.

Another, more specific object of the present invention relates to an improved method of, and apparatus for, the fabrication of blocks from granular material or the like which effectively overcomes the aforementioned drawbacks of the prior art techniques and structures, and specifically, wherein the blocks can be produced under improved economy, with a lower number of rejects, and at an increased production capacity.

A further object of the invention relates to an improved apparatus fro the fabrication of such blocks from granular material or the like which is relatively simple in construction, economical to manufacture, operates relatively simply and reliably, is not readily subjected to breakdown, and produces an improved quality of finished compressed article of the mentioned type.

Now, in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the inventive method for the fabrication of blocks is manifested by the features that a compartment is charged with a dosed quantity of material, a vacuum is created in the compartment, and the material is subjected to the action of vibrations.

As far as the apparatus structure of the invention is concerned, such comprises a compacting compartment for receiving the material introduced from a charging mechanism, this compacting compartment being equipped with a removable cover member. At least one compaction mechanism is installed within the internal region of the compaction compartment and a vacuum producing device communicates with this internal region of the compaction compartment for the purpose of reducing the pressure prevailing in such compartment during compaction or compressing of the material.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 is a schematic view of a preferred embodiment of inventive apparatus, partly in section, and employed for the fabrication of blocks and equipped with a suitable charging mechanism; and

FIG. 2 is a schematic view of the apparatus for the compaction of blocks depicted in FIG. 1, shown in a section similar to FIG. 1, but in a sectional view displaced through 90° from the illustration of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, in FIG. 1 there is illustrated a charging device 1 which cooperates with an apparatus 1a for the fabrication of blocks formed of compacted pourable materials or granulate. The charging device 1 will be seen to comprise a container 2 which is equipped with a trap door type or flapped-bottom or floor 3 which, for instance, is pivotally mounted at the journals or pins 4 and 5. The flap portions 3*a* of the trap door type bottom or floor 3 are actuated by means of a suitable displacement piston-cylinder arrangement 6 secured to the wall of the housing of the container 2. An additional thrust or displaceable piston-cylinder drive mechanism 7 serves to displace the container 2. An impact buffer 8 or equivalent mechanism is arranged at the side of the container 2 opposite the displacement piston-cylinder drive mechanism 7. The impact buffer 8 serves to displace the block which has been raised out of the production apparatus 1*a* onto a suitable transport or conveyor mechanism 9 from which it can be removed. The material to be compressed, generally indicated by reference character 10, is introduced in a dosed quantity to the container 2 by means of any suitable and therefore non-illustrated dosing mechanism.

Now the apparatus 1*a* which is used for the compaction of the material and for the fabrication of the blocks heretofore discussed, will be seen to essentially consist of a mold compartment 11 formed of three main components, namely a cover member 12, a compartment housing 13 and a bottom or base portion 14. Suitable seals 15 and 16 for achieving an air-tight connection are arranged at the parting surfaces of these three main components 12, 13 and 14. Additional seals 17, 18, 19 and 20 serve to seal openings appearing at the compartment 11 through which extend into the interior of such

compartment 11 certain members which will be described in greater detail hereinafter.

By referring to FIG. 2 it will be seen that an arm member 21 is arranged at the cover member 12, this arm member having a suitable bore at its free end, as shown, and through which extends a shaft 22 which, in turn, is supported in two brackets 23 of the machine frame or housing 24. A lever 25 is secured to the shaft 22, the lever having a free end which is articulated by means of a pin 26 with the piston rod 27 of a suitable displaceable piston-cylinder drive 28. The components 21, 22 and 25 form a rigid lever system rotatable about the shaft 22, by means of which the cover unit 12 can be raised into its open position. In so doing, the face of the piston 29 confronting the piston rod 27 of the cylinder-piston drive arrangement 28 can be impacted by a suitable pressurized fluid medium, so that the piston 29 will be lowered within its cylinder 30 and therefore lifts the cover unit 12. Of course, instead of the described and herein illustrated cylinder-piston drive arrangement 28, it is also possible to use any other suitable drive mechanism, such as a rotary piston drive or a spindle drive for instance.

Now the compartment housing 13 will be seen to comprise a supporting flange 31 by means of which it can bear upon the base plate 32 of the housing or frame 24. Base plate 32 and the side walls 33 of the frame or housing 24 of the machine are reinforced by appropriate ribs 34. The displaceable piston-cylinder drive unit 28 is hingedly connected by means of its cylinder 30 to an arm 35 of the sidewall 33 of the machine frame or housing 24. This machine frame 24 is supported as a unit upon a rigid support member 38 through the agency of the schematically illustrated resilient of spring elements 36.

Continuing, it will be observed that a suitable thrust or displacement piston-cylinder drive mechanism 39 is arranged at the cover member 12 of the compartment 11, the cylinder unit 40 of which is secured to the cover member 12 and the piston 41 and piston rod 42 of which carry a support plate 43. Support plate 43 is guided at the wall of the cover member 12 by guide rods 44. This support plate 43 carries suitable oscillating elements 45, springs for instance, to which there is secured the upper press plate 46. Appropriate vibrators 47 or equivalent vibrating devices are arranged at the press plate 46, which for instance can be constructed as rotating imbalances or unequal weights.

Now at the floor or bottom 14 there is secured a thrust piston-cylinder drive mechanism 50, the piston 51 and piston rod 52 of which carry a lower support plate 53. Lower support plate 53 is guided at the bottom member 14 by suitable guide rods 54 which extend through such bottom member 14, as shown. The lower support plate 53 also carries oscillating elements, such as the springs 55, upon which bears a lower press plate 56. At the underside of the press plate 56 there are attached, just as with the upper press plate 46, vibrators 57 or equivalent vibrating mechanisms. The space between the lower support plate 53 and the press plate 56 is covered in appropriate fashion by wall members 58 and 59, in order to present the penetration of granular material or the like which may drop down between the press plate 56 and the compartment wall.

Additionally, it will be observed that two further thrust piston-cylinder drives 60 and 61 are connected to the outside wall of the compartment housing 13, the piston rods 62 and 63 of which are connected with the bottom or floor portion 14.

Instead of undertaking the compaction of the material by vibrators, such compaction can also be undertaken by a pressure force exerted by the thrust piston-cylinder drives 39 and 50. That compaction of the material can also be brought about through combined use of the pressure force and the effect of the vibrators. Which type of compaction is employed depends upon the equipment construction which is available. For instance, it is possible to use an existing press having a mold, which has been modified for producing a vacuum in the compaction compartment, so that the material is compacted by the pressure forces exerted by the press punches of the press apparatus. The compacting mechanism, in such case, then consists of the pressure or press plates of the press punches.

The heretofore described apparatus structure functions as follows: Initially, with the aid of the thrust piston-cylinder drive mechanism 7 the container 2 which has been filled with a dosed quantity of granular material or the like is displaced over and into alignment with the housing of the compartment 11, the cover member 12 of which has been positioned so as to be in its open location. Thereafter, the flaps 3a of the trap door-type bottom 3 of the container 2 are opened by means of the piston-cylinder drive mechanism 6, so that the material will drop as uniformly as possible into the compartment housing 13. When this occurs, the piston-cylinder drive mechanism 50 is located in the lowered position depicted in FIG. 1.

Now the cover member 12 is closed and the compartment 11 is evacuated by means of a suitable vacuum pump 70 which communicates therewith via the conduits 72, 73 and 74, vacuum pump 70 being driven by a suitable drive motor 71. In the evacuated condition of the compartment 11 the vibrators 47 and 57 are placed into operation, so that the introduced material is compacted. Depending upon requirements, the displaceable piston-cylinder drive mechanisms 39 and 50 are also subjected to pressure in order to additionally subject the material, apart from the action of the vibrational forces, to a pressure. Due to evacuation of the compartment 11 there are practically no air-and gas inclusions in the compacted block which is formed, and because of the uniformly distributed poured material during the charging operation there is achieved a uniform compaction of the block.

Upon completion of compaction, air is admitted into the compartment 11, the cover member 12 is again raised by means of the piston-cylinder drive 28, and with the aid of the piston-cylinder drive 50 of the compacted block is raised upwardly.

In the meantime the container 2 of the charging apparatus is again filled with a dosed quantity of material to be processed. Through the action of the piston-cylinder drive 7 the container 2 is again placed over the compartment housing 13 while, at the same time, displacing the finished fabricated block via the impact or pressure buffer 8, onto the transport device 9.

By means of the piston-cylinder drives 60 and 61 the bottom or base member 14 is lowered, so that any

material which may have dropped between the lower press plate **56** and the chamber wall can be removed from below.

After the piston-cylinder drive **50** has again been lowered and the base member **14** pressed against the compartment housing **13** through the action of the piston-cylinder drive **60** and **61**, the container **2** is emptied into the compartment **11**, the compaction operation beginning again from anew. With the aid of the schematically indicated compressed air nozzles **77** and **78** it is possible to clean the sealing surfaces from any residual granulate material.

Furthermore, by referring to FIG. **2**, it will be understood that the roof-shaped construction of the bottom or base member **14** facilitates emptying of any residual granulate material. It would be possible to similarly construct in roof-like or arched fashion the sealing surfaces of the cover member **12** and the compartment housing **13**.

While there is shown and described present preferred embodiments of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims. ACCORDINGLY,

We claim:

1. An apparatus for fabricating blocks, especially block anodes, from compacted granular material or the like, comprising means providing an air-tight enclosed compaction compartment equipped with a removable cover having sealing means therein, a charging mechanism for introducing material to be compacted into said compaction compartment, said compaction compartment defining an internal space for receiving the material, at least one material compacting mechanism mounted within said internal space of said compaction compartment, said material compacting mechanism comprising at least one vibration mechanism located within said internal space of said compaction compartment, vacuum means communicating with said internal space of said compaction compartment for creating vacuum conditions therein in order to remove any gases while reducing the pressure in the material compaction compartment during the material compacting operation.

2. The apparatus as defined in claim **1**, wherein said means defining said material compaction compartment further includes a bottom member, said material compacting mechanism within said compaction compartment comprising at least one additional vibration mechanism, one of said vibration mechanisms being supported at said bottom member whereas the other of said vibration mechanisms being mounted at said cover.

3. The apparatus as defined in claim **1**, further including a cylinder-piston drive operably coupled with said material compacting mechanism for selectively subjecting the material introduced into said compaction compartment to pressure.

4. The apparatus as defined in claim **1**, wherein said means defining said compaction compartment includes a bottom member having inclined portions, said bottom member serving to seal off said compaction compartment at its lower end, and means for selectively raising and lowering said bottom member.

5. The apparatus as defined in claim **4**, wherein said means for selectively raising and lowering said bottom member comprises a cylinder-piston drive.

6. The apparatus as defined in claim **1**, further including a machine frame, drive means supported at said machine frame for raising and lowering said removable cover.

7. The apparatus as defined in claim **6**, wherein said drive means comprises a cylinder-piston drive arrangement.

8. The apparatus as defined in claim **6**, further including a rigid support member for said machine frame, and resilient means for supporting said machine frame at said rigid support member and for dampening the transmission of vibrations between said machine frame and rigid support member.

9. The apparatus as defined in claim **2**, further including resilient means cooperating with each of said vibration mechanisms for dampening the transmission of vibrations to said means providing said compaction compartment.

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