March 15, 1960 F. HANSBERG 2,928,147

AGITATORLESS FOUNDRY SHOOTING DEVICE

Filed Dec. 17, 1956 2 Sheets-Sheet 1

FIG. 1

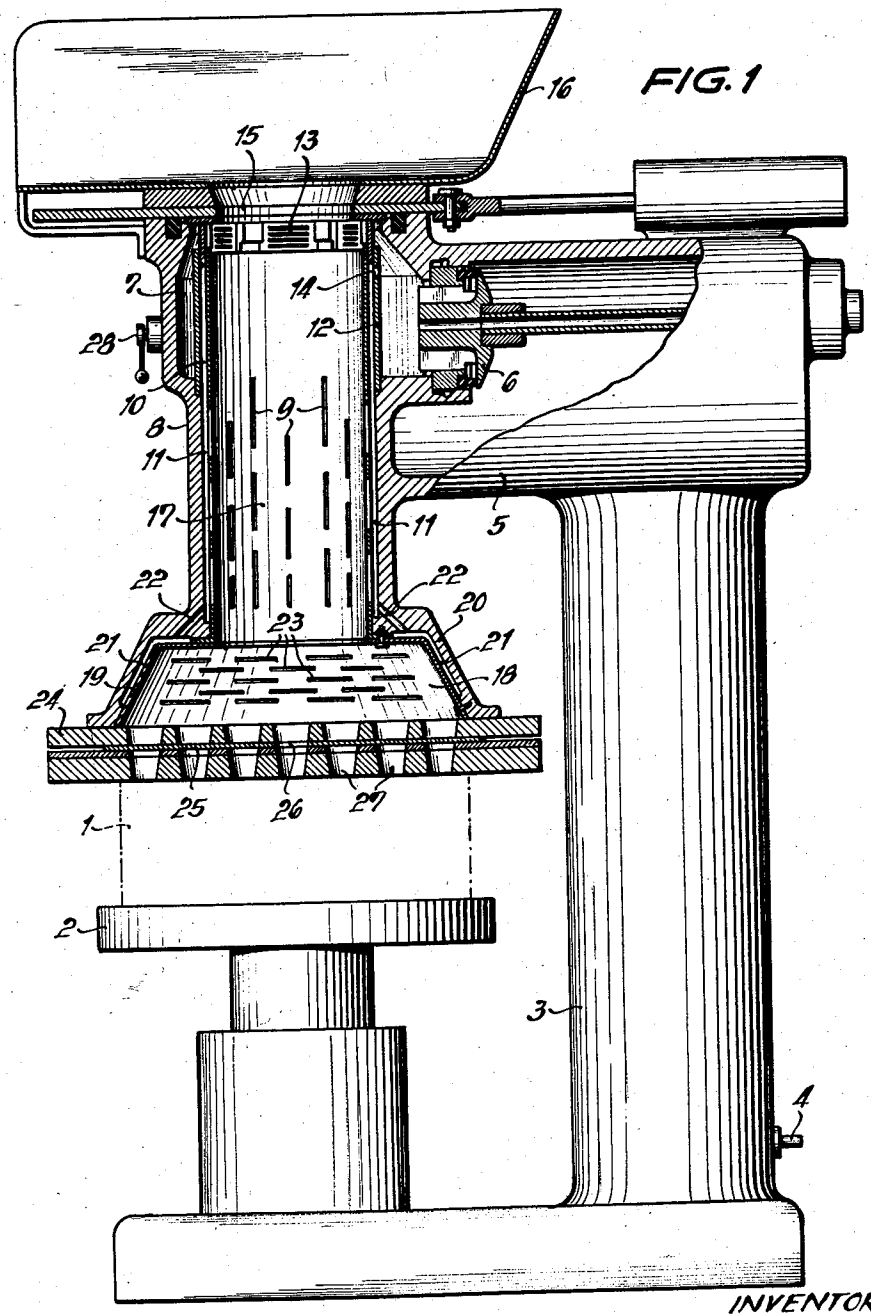

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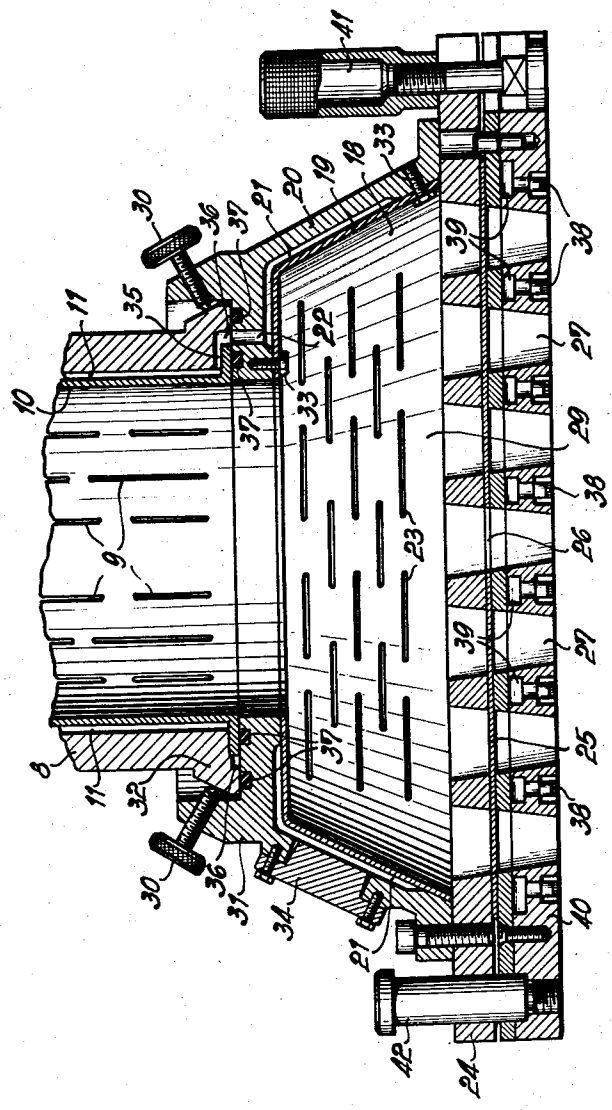
FIG. 2



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AGITATORLESS FOUNDRY SHOOTING DEVICE

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19 Claims. (Cl. 22—36)

This invention relates to an improvement in foundry machines of the type wherein the core sand or mould sand is introduced into the core boxes or mould boxes by means of compressed air or another pressure medium.

Pneumatic moulding machines for filling mould and core boxes with mould sand are known in the most varied forms of construction, and a distinction is made between two basically different types of machines and modes of operation. These are true blowing machines, which work on the mixing or blowing principle with a mixture of air and sand on the one hand, and on the other hand sand-shooting machines, in which the mould sand is simply forced abruptly into the mould box without any particular turbulence or thorough mixing with air. The characteristic features of both modes of operation are explained in the United States Patent No. 2,793,409.

In blowing machines, it is known to allow the sand container, which is provided with a comparatively narrow central blowing nozzle, to widen out in a taper towards the bottom, so as to facilitate the sliding down of the sand contents. For the purpose of highly turbulent mixing and incorporating compressed air in the supply of sand, it is also known, in blowing machines, to add the mixing air through an annular passage which is provided at the lower end of the sand container and which is equipped with an annular screening insert for this purpose.

In shooting machines, the use is known of an interchangeable sand cartridge which is adapted to the size of the core to be produced and at the lower end of which is a widened portion or socket to bridge the apertures leading into the core mould and to effect a compression of the sand in the socket. For sand-shooting machines, interchangeable nozzles and shooting heads are also known which become wider towards the end resting on the mould box where they are closed by a perforated plate, the discharge apertures or discharge slots in which are adapted in position and size to the particular core mould.

It has been found that there are limits to such a widening out of the shooting head or of the end of the sand cartridge, because the impact energy of the ramming air which acts abruptly on the head of the compact column of sand is not effective laterally to any desired extent, so that the sand in the marginal zones of the widened portion cakes and does not enter the boxes to be filled with the necessary percussion force such as is desirable for a substantially uniform compression of the core sand in the core box. These difficulties also prevent the use of the shooting machines as moulding machines for filling mould boxes having a large area, in which a sufficiently powerful compression of the sand is needed at the marginal zones as well, to prevent the sand mould from falling out of the box frame.

It is an object of the present invention to overcome these disadvantages and to facilitate the ejection of the compact mass of sand from a sand container which becomes wider towards the mould box or from a shooting head which becomes wider towards the mould box. It

provides a shooting machine which is universally suitable for the most varied applications as well as a corresponding universal shooting head.

According to the invention, the sand-shooting machine for producing foundry cores and foundry moulds, is of the type where no agitation of the sand charge takes place and wherein the compact sand is abruptly rammed out of a sand container into the boxes to be filled, by means of a comparatively small compressed air chamber, without any particular mixing or agitation with compressed air, and wherein the sand chamber becomes wider at the end facing the mould box or core box, at least in one lateral direction, and preferably on all sides, having a spaced insert which is provided in the widened portion of the sand chamber which facilitates the ejection of the compact filling of sand.

The above means are preferably associated with other means, known per se, which cause the abrupt acceleration of the compact mass of sand in the actual sand container, with the minimum expenditure of pneumatic energy. Such a means is the use of a compressed air chamber, directly adjacent the sand container, to store up ramming air directly before the sand container.

Another such means is an insert, which is mounted with clearance in the actual sand storage chamber, and which facilitates the acceleration of the compact mass of sand to be forced into the mould box or core box and is preferably provided with narrow slots. A further means is a blast valve, of large area, mounted between the compressed air storage chamber and the sand container, for the abrupt release of ramming air stored up in the compressed air chamber, which valve preferably comprises a pneumatic piston for its abrupt control. With the simultaneous use of these means, known per se, together with the apparatus of the invention, there is a particularly favourable utilization of the pneumatic energy which renders possible the production of foundry cores and foundry moulds, even when they have a large area, with only a comparatively small amount of ramming air.

In order to permit adaptation to the nature, size and shape and to the sand material of the particular core to be produced, it is usual to construct the nozzle-like discharge end of the sand container of the shooting machine in the form of a detachable and interchangeable shooting head, to which the invention relates in like manner.

According to a feature of the invention, such a shooting head for a sand-shooting machine for producing foundry cores and foundry moulds, which becomes wider, at least on one side and preferably on all sides at the end facing the mould box or core box, has an insert which is mounted with clearance in the widened portion of the shooting head and which facilitates the ejection of the compact filling of sand.

The further details of the invention relate to such devices, namely, the sand-shooting machines constructed with fixed shooting heads on the one hand and the detachable shooting heads for sand-shooting machines on the other hand.

The insert according to the invention, which facilitates the ejection of the compact filling of sand, may act in various ways, for example as a vibrator insert. Nevertheless, it has been found advantageous to provide, in the widened portion, an insert provided with small perforations, at the same time forming a preferably annular gap for the lateral compression of the compact mass of sand present in the widened portion during the abrupt acceleration process. The annular gap may be either angular, for example rectangular, or circular. Narrow slots preferably serve as small perforations, though here they are preferably arranged horizontally.

In order to obtain the lateral compression of the compact mass of sand present in the widened portion during

the abrupt acceleration process, at the correct moment in time, the admission of air laterally into the gap round the widened portion is preferably effected at the upper end of the insert in the widened portion. For this purpose, at least one, and preferably a plurality of air admission ports, which are distributed right round, may be provided at the upper end of the widened portion. The use of such a plurality of air admission ports, is advisable so as to establish in the annular gap round the widened portion, as in the actual sand container shaft, a fluido-dynamic field of pressure, substantially symmetrical to the axis of the sand container, which field does not cause any noticeable aeration of the sand contents from the side but a loosening from the walls of the widened portion. The thin air cushion which is formed in the process acts as a "lubricant" and results in the fact that even the compact sand mass in the lateral marginal zones of the widened portion enters the boxes to be filled with adequate ramming force.

When an insert is used in the actual sand container of the machine, it is particularly advantageous to take the compressed air intended for introduction into the gap round the widened portion from the lower end of the annular chamber of the sand container, which air enters the gap round the widened portion at the correct moment in time during the abrupt acceleration process, as a result. If it is a question of a sand-shooting machine having a fixed shooting head, compressed-air ports or compressed air passages may be provided for it which connect the annular chamber of the sand container shaft to the preferably annular (angled or round) gap round the widened portion in such a manner that the compressed air entering the annular shaft chamber can also enter the gap round the widened portion through the ports. If it is a question of a sand-shooting machine having an interchangeable shooting head, at least one, preferably a plurality of passages, arranged distributed right round may be provided for it, to take off compressed air from the annular sand container chamber for introduction into the gap round the widened portion of the shooting head.

At the end carrying the shooting head, the sand container may be equipped with a compressed air distributor passage, for example by turning or milling, for the passage of the compressed air from the annular chamber of the sand container into the gap round the shooting head. Such a compressed-air distributing passage may, however, also be provided additionally, or solely on the end of the shooting head at which the shooting head is held by the sand container. Annular seals are used for the lateral sealing of the compressed air passage leading from the annular chamber of the sand container to the gap round the shooting head.

One or more cleaning windows, which can be tightly closed, are provided for the actual cleaning of the gap formed by the outer wall of the widened portion and the insert in the widened portion, which windows may conveniently be provided in the outer wall of the widened portion.

The widened portion of the sand container or of the shooting head may be of any desired shape. From the point of view of work and use, a rectangular cross-section has proved advantageous, as has a circular cross-section in many cases. It also proved an advantage to construct both the wall of the widened portion and the insert provided therein in the form of a truncated pyramid or cone. A trough-shaped construction of the insert has been found to be advantageous.

The closing of the widened portion may be effected by means of a plate having specific discharge apertures which is changed for each particular application. It is an advantage however, to use a perforated plate, known per se, which may comprise air extraction passages, for the closing. For universal use, a multi-layer perforated plate is preferably used comprising an interchangeable intermediate disc which only permits the emergence of sand at the particular points desired and covers the remaining holes in the perforated plate. Thus in order to convert the machine or the shooting head for another purpose, only the thin intermediate disc need be changed. In order to simplify this exchange, the lower layer of the perforated plate may be pivoted about a pin and held by retaining screws.

Embodiments of a sand-shooting machine constructed in accordance with the invention and of a shooting head constructed in accordance with the invention are illustrated diagrammatically by way of example in the accompanying drawings, in which:

Figure 1 shows a sand-shooting machine constructed in accordance with the invention, partly in section, the parts which are not essential to explain the invention being omitted.

Figure 2 shows a modified shooting head constructed in accordance with the invention, in section.

According to Figure 1, the core box or mould box 1, indicated in chain line, rests on the pneumatically, hydraulically or mechanically raisable machine table 2. The column 3 is here constructed in the form of a compressed-air receiver and is equipped with a comparatively small compressed-air connection 4. The head 5 of the column is constructed in the form of a compressed-air storage chamber and serves to store a limited amount of ramming air. The blast valve 6 which has a large area is abruptly controlled by means of a pneumatic piston (not illustrated) and permits an equally abrupt admission of the compressed air stored up in the compressed-air storage chamber 5, through the upper annular chamber 7, into the interior of the sand container 8, in which an insert 10 is provided which is equipped with narrow slots 9 and which defines an annular chamber 11 between itself and the wall of the sand container 8. Opposite the valve entrance, the insert 10 is protected by a partition 12 which forces the greater part of the incoming compressed air to enter the interior of the insert 10 from above through the upper horizontal slots 13, and to act abruptly on the head of the compact mass of sand filling it. One or more holes 14 provided in the partition 12 allow a minor proportion of compressed air to enter the annular chamber 11 from above as a result of which the air contained therein is compressed and through the slots 9 in the insert compact column of sand is radially compressed laterally as a result of which its abrupt acceleration is facilitated. The sand container 8 may be closed at the top by a sand charging slide 15 through which sand may be charged into the chamber 17 from the trough 16.

At the bottom, the sand chamber 17 comprises a widening 18 on all sides, in which an insert 19 is likewise provided, which leaves a gap 21 between itself and the wall 20 of the widened portion, which gap is here annular. Narrow horizontal slots 23, similar to the vertical slots 9, are provided in the side walls of the insert 19. The proportion of compressed air entering the annular chamber 11 of the sand container from the compressed air storage chamber 5, through the quick-acting blast valve 6 and through the holes 14, passes through the holes 22 distributed round the lower end of the sand container 8, and enters the gap 21 round the widened portion from above and compresses the compact sand present in the widened portion 18 laterally through the narrow slots 23 and thus facilitates the abrupt acceleration of the compact mass of sand present in the widened portion 18. The lower end of the widened portion 18 which, like its insert 19, is constructed in the form of a truncated pyramid or cone, is closed by a perforated plate 24 which is here of the multi-layer type and which has an interchangeable intermediate disc 25, which here only permits the emergence of sand in the middle 26 and covers the other holes 27 in the perforated plate.

The individual operations such as filling with sand,

raising the table, shooting and lowering the table are controlled by a central control valve 28.

According to Figure 2 the shooting head 29 is clamped by means of retaining screws 30 at its upper end 31 to the lower end 32 of the sand container 8 which here again comprises an insert 10 provided with narrow vertical slots 9 and leaving an annular chamber 11 between itself and the sand container 8.

Towards its lower end, the shooting head 29 again has a portion 18 which is widened on all sides, and in which an insert 19 is likewise provided which leaves a gap 21 between itself and the wall 20 of the widened portion, which gap is here annular. Narrow horizontal slots 23 similar to the vertical slots 9 are provided in the side walls of the insert 19. The trough-like insert 19 which is constructed in the form of a truncated pyramid, is here fixed to the wall 20 of the widened portion 18 of the shooting head 29 by means of a plurality of screws 33, only two of which are shown in the drawing however. The insert 19, which is provided with the small perforations 23, consists, like the insert 10 in the sand container, of thin sheet metal and it may be shaped, for example by welding together or pressing. Cleaning windows 34, which can be closed, are provided in the wall 20 of the widened portion, only one of them being illustrated here.

Distributed round the upper end 31 of the shooting head 29 or of its widened portion 18 are passages 22, only one of which is illustrated here. The sand container 8 likewise comprises air passages 35 which are distributed round its lower end 32 and which are interconnected by means of a compressed-air distributor passage 36. The passages 22 in the shooting head 29 may likewise be interconnected by means of a corresponding compressed-air distributor passage. Such compressed-air distributor passages may be annular millings or turnings about 2 to 3 mm. deep. Such a compressed-air distributor passage 36 may also be machined subsequently in the lower end 32 of a sand-shooting machine which is in service, by means of a simple milling device. The shooting head 29 comprises two annular seals 37 which seal off the compressed-air path 35—36—22 from the annular chamber 11 in the sand container to the gap 21 round the shooting head laterally. As a result, during the abrupt acceleration process, the proportion of compressed air entering the annular chamber 11 of the sand container from above, passes through the passages 35 and the compressed-air distributor passage 36 and then through the passages 22 from above into the gap 21 round the widened portion and compresses the compact sand present in the widened portion 18 laterally through the narrow slots 23, and as a result facilitates the abrupt acceleration of the compact mass of sand present in the shooting head 29 or in its widened portion 18.

The lower end of the shooting head 29, or of its widened portion 18 is closed by a perforated plate 24 which is here of the multi-layer type and which comprises air extraction nozzles 38 and air extraction passages 39, only two of each of which are illustrated. The multi-layer perforated plate 24 comprises an intermediate disc 25 which is between two layers of plate and which may be specially constructed for each particular task and be interchangeable. In the drawing, the intermediate disc 25 only permits the emergence of sand in the middle 26 and covers the other holes 27 in the perforated plate. In order to change the intermediate disc 25 and also for cleaning, the lower plate layer 40 can be swung about the pin 41 after removing the retaining screws 42 only one of which is illustrated.

Such a shooting head 29 can be used for the most varied tasks and also for the production of moulds and is thus a universal shooting head which replaces many of the special shooting heads which were hitherto constructed in the most varied forms and had to be kept in stock.

I claim:

1. A foundry shooting head for a foundry shooting machine of the kind employing compressed air for ramming cores and filling mold boxes with molding sand substantially free of entrained air and including a frame structure including a sand storage container of substantially uniform cross section having at its top a wide air inlet for admitting a supply of compressed ramming air to act abruptly upon the top of the supply of sand and an open lower end, said head comprising fastening means for securing the head to said open lower container end, a chamber for a supply of sand to be compactly rammed having at its top a sand inlet opening and a laterally extended and enlarged hollow sand distributing base portion expanding and enlarging said storage container substantially abruptly at the lower open end thereof, a bottom plate having at least one sand outlet therein, a lining member having perforations and disposed within the laterally extended and enlarged inner space defined by said hollow sand distributing base portion spaced apart from the wall thereof, and means for supplying pressure air to the inner space between said base portion wall and said perforated lining member to propel by the impact of pressure air acting through the perforations of said lining member the compact sand load contained in the hollow space defined by said sand distribuing base porion during the ramming operation and to eject the said load through the outlet in the bottom plate.

2. A head according to claim 1 wherein said perforations in said lining member are in the form of narrow slots.

3. A head according to claim 1 wherein the wall of said sand distributing base portion defining said inner space between the base portion wall and the lining member includes at least one closeable opening leading into said space for cleaning the same.

4. A head according to claim 1 wherein said bottom plate of said base portion is composed of at least two layers, each having a plurality of sand outlets in latticed arrangement and an intermediate exchangeable shield to obturate selected sand outlets in said layers.

5. A foundry shooting head according to claim 1 wherein said means for supplying pressure air to said inner space comprise a container wall portion including at least one opening at the upper end of said inner space between said wall of the base portion and said lining member for supplying compressed air into said space from the top thereof.

6. A head according to claim 2 wherein said narrow slots are horizontally disposed in the wall of said lining member.

7. A head according to claim 5 wherein said space is an annular space having several openings circumferentially arranged at the upper end of said space facing the top of the container for supplying the compressed air into said space in a flow from the top toward the base thereof.

8. A head according to claim 7 wherein an annular air distributing conduit is arranged at the top end of said head interconnecting said air supply openings.

9. A head according to claim 8 wherein said annular air conduit is a one-sidedly open channel grooved in the top face of said head.

10. A head according to claim 9 wherein at least one annular packing seal is provided adjacent to said air channel encompassing the same.

11. A foundry shooting machine of the kind employing compressed air for ramming cores and filling mold boxes with mold sand substantially free of entrained air, said machine comprising a frame structure including a sand chamber having a wide air inlet at the top thereof for admitting a supply of compressed ramming air to act abruptly upon the top of a supply of sand in the chamber and a perforated lining insert disposed in said chamber spaced apart from the inner wall thereof, said insert defining the chamber space available for a supply of sand to be compactly rammed, the space defined by the inner chamber wall and the insert including at least one air

opening at the upper part of said space for supplying compressed air into said space from the top thereof, a storage chamber for pressure air positoned near said air inlet of said sand chamber and communicating therewith and with said opening leading into the space between the insert and the chamber wall, an air inlet shooting valve positioned near said air inlet for controlling the rapid admission of compressed air from said storage chamber to the interior of said sand chamber and of said space, said sand chamber having an open lower end, fastening means at said lower end to secure a removable air fed foundry shooting head thereon, said shooting head being widened toward its base and open at both ends and including a perforated lining member spaced apart from the inner wall of the head, and at least one air opening formed at the base end of the space between said chamber wall and said lining insert for supplying compressed air from said space to said shooting head and the space between said lining member and the inner wall of the head to propel and eject the compact sand load contained in said head during the ramming operation, and valve control means for rapidly opening and re-closing said air inlet shooting valve.

12. A machine according to claim 11 wherein said space between the chamber wall and the insert has several openings circumferentially arranged at said base end of said space for supplying compressed air from said space to said shooting head to propel and eject the compact sand load contained in said head during the ramming operation.

13. A machine according to claim 12 wherein said air openings are arranged in the base face of said sand chamber and a one-sidedly open annular air distributing channel is grooved in the base face of said sand chamber interconnecting said air openings.

14. A core and molding box filling machine of the kind wherein a compacted supply of molding sand is rammed by pressure air abruptly admitted to and acting upon the top of the supply of sand into a box to be filled, said machine comprising a sand container having an upper portion of uniform cross section and a widely flared open ended base portion, a perforated liner fitted in said base portion spaced apart equidistant from the flared container wall to define a circumferential air duct, a wide-aperture air inlet valve near the top of the container, and pressure air conduit means communicating with said air inlet valve and said air duct for supplying pressure air to said top of the container and said duct whereby the impact of the pressure air acting upon the top of said supply of sand and through said perforations propels the supply of sand out of said container.

15. A core and molding box filling machine of the kind wherein a compacted supply of molding sand is rammed by pressure air abruptly admitted to and acting upon the top of the supply of sand into a box to be filled, said machine comprising a sand container having an upper portion of uniform cross section and a widely flared open ended base portion, a first perforated liner fitted in said container portion of uniform cross-section spaced apart from the container wall to define a first circumferential duct, a second perforated liner fitted in said flared container portion spaced apart equidistant from the container wall to define a second circumferential duct, conduit means interconnecting said ducts, a wide-aperture air inlet valve arranged near the top of the container and communicating therewith, and air pressure conduit means communicating with said air inlet valve and said first duct for supplying pressure air simultaneously to said top of the container and said air ducts whereby the impact of pressure air acting upon the top of said supply of sand in downward direction and upon the side of the supply of sand laterally through the perforations in said liners propels the entire supply of sand out of the container without material penetration of pressure air into the supply of sand.

16. A machine according to claim 15 wherein said container comprises two sections, one constituting said portion of uniform cross-section and the other said flared portion, and fastening means for detachably securing together said two portions.

17. A machine according to claim 15 wherein said conduit means comprise several air conduits circumferentially arranged between said ducts and defining a circular communication between them, surrounding the interior of said sand chamber.

18. A foundry shooting machine according to claim 15 wherein the perforations in said first liner and in said second liner are in the form of narrow slots.

19. A foundry shooting machine according to claim 18 wherein the narrow slots in said first liner are vertically arranged and the narrow slots in said second liner are horizontally arranged.

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