

Feb. 23, 1965

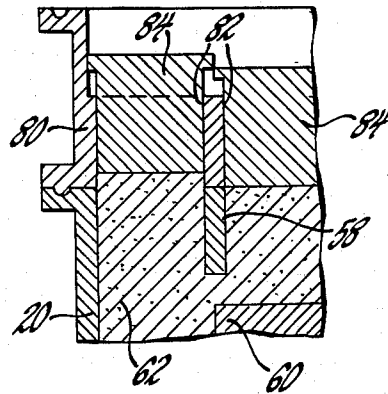
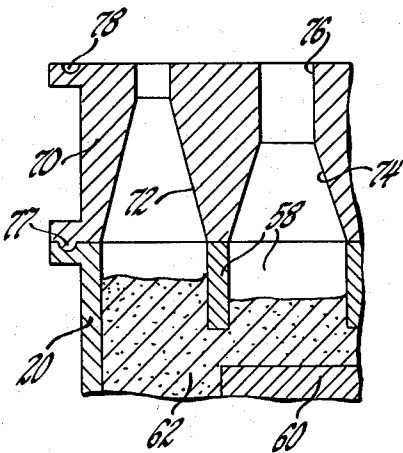
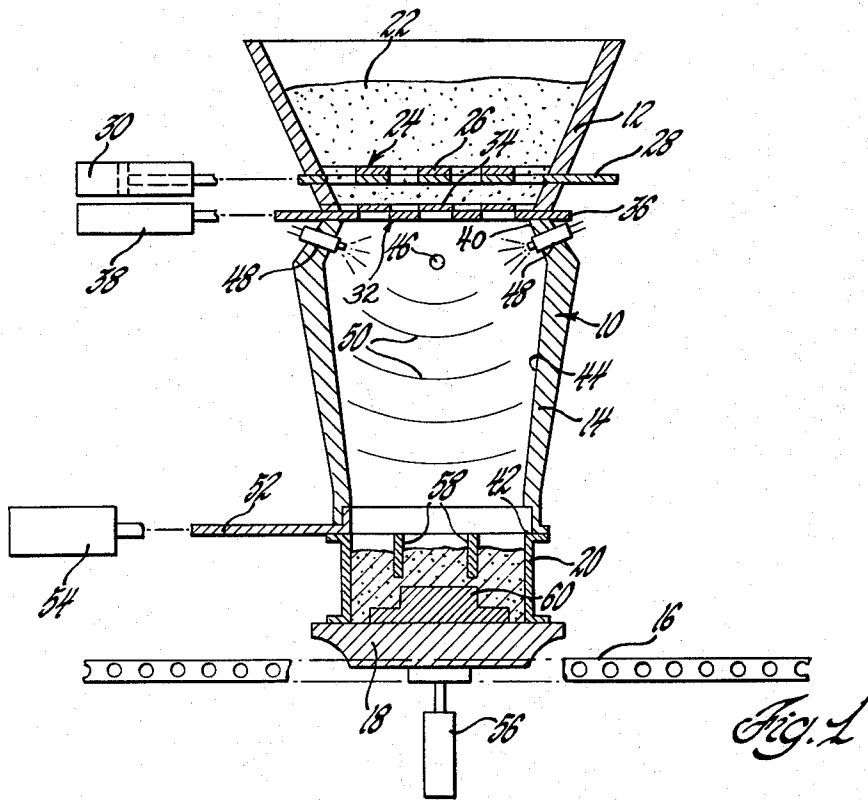
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FOUNDRY PROCESS

Filed Aug. 22, 1962

2 Sheets-Sheet 1



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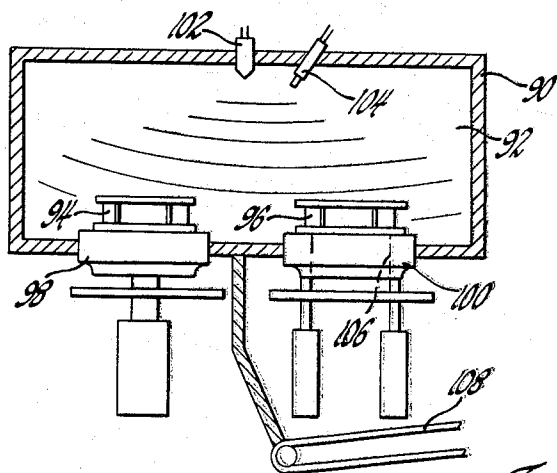


Fig. 4

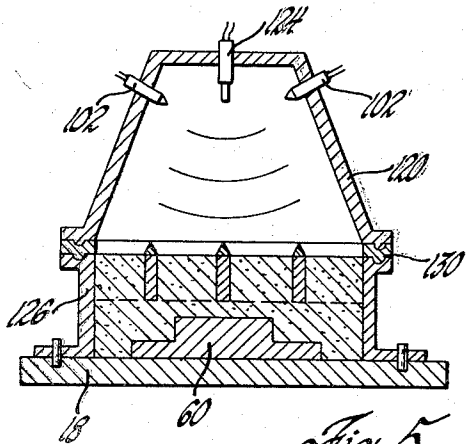


Fig. 5

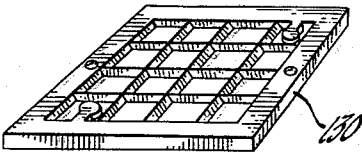


Fig. 6

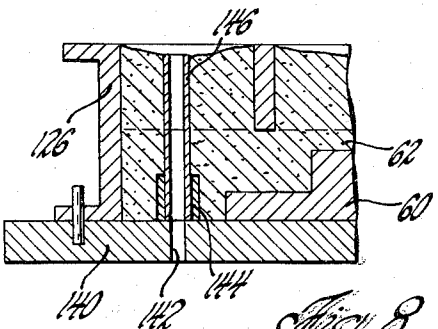


Fig. 8

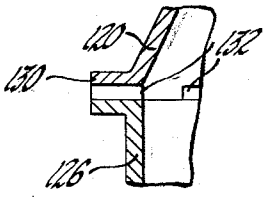


Fig. 7

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FOUNDRY PROCESS

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This invention relates to foundry equipment in general, and more particularly to means and methods for preparing molding flasks for use.

Production demands and the use of more and more automated equipment in the assembly of parts has required more advanced and faster operating procedures in the foundries. The manual labor required to fill and pack molding flasks with molding sand and to otherwise prepare them for use has been replaced by reciprocating sand hoppers, automatic conveyor systems and flask handling equipment which receive, convey, and turn over the molding flasks, shake and tamp the sand down and does just about everything required.

Although this automated foundry equipment has increased the production capacity of our foundries many times over, it is still not able to keep pace with production demands and many foundries are still required to work two or three shifts to keep up. Further, present foundry equipment is subject to failure, and mishaps which cause the whole system to shut down when anything goes wrong.

Present foundry practice makes use of conveyor systems to carry molding flasks through different stations where a pattern is positioned in the flask, molding sand is dropped over and around the pattern, the flask is screeded and then jolted to set the sand, means are used to press or squeeze the sand down about the pattern, the flask is turned over, the pattern is removed, and the mold form is blown out and repaired as necessary all before the molten metal is poured. Most of these steps occur at different stations and considerable time is lost in the transfer operation. Further, the flasks are required to be of exceptionally sturdy construction to withstand the jolting and subsequent shaker operation required, necessitating heavy duty handling equipment which is in turn subject to failure due to the grime and grit which permeates the foundry air from the molding sand.

It is an object of this invention to provide and teach a simplified foundry procedure for preparing molding flasks for use.

It is an object of this invention to provide means whereby the flask filling and packing which is required may be accomplished at one station and without exposure of the sand until it is packed and set in the flask.

It is also an object of this invention to provide a simplified and expedient means of packing molding sand in a molding flask and wherein no mechanical parts are required and any chance of failure in such regard is completely eliminated.

More specifically, it is an object of this invention to teach the method of using an explosive charge to pack molding sand in a molding flask.

Other objects of this invention, and incident to the use of an explosive charge, include simplification of the flask handling equipment, longer service life for molding flasks by eliminating jolting and shaker operations, faster and more proficient packing of flasks to eliminate later repairs, etc.

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These and other objects and advantages in the practice of this invention will be more apparent upon a reading of the following specification and with reference to the accompanying drawing wherein:

FIGURE 1 is a cross-sectional plan view of an apparatus for filling and packing mold sand in a sand retaining flask as a single station operation.

FIGURE 2 is a fragmentary cross-section view of a particular type of explosive wave force adapter usable in the practice of this invention.

FIGURE 3 is a fragmentary cross-sectional view of another form of mold sand packing adapter contemplated by this invention.

FIGURE 4 is a cross-sectional and schematic view of an apparatus for simultaneously handling both newly filled mold sand retaining flasks and those having spent sand and castings required to be removed therefrom.

FIGURE 5 is a cross-sectional plan view of a simplified apparatus for mold sand flask packing as contemplated by this invention.

FIGURE 6 is a perspective view of a special adapter for use in the practice of this invention and which is shown in use with the apparatus of FIGURE 5.

FIGURE 7 is a fragmentary cross-sectional view of an adaptation contemplated by this invention for permitting the venting of explosive and spent gases from the combustion chamber space of apparatus used in the practice of this invention.

FIGURE 8 is a fragmentary and cross-sectional view of another form of combustion chamber vent envisioned in the practice of this invention.

Referring again to past practice, it will be appreciated that separate equipment has been necessary for filling a molding flask and tamping or otherwise setting the sand about the casting pattern. The equipment has usually included a hopper to hold the molding sand and drop it into the mold flask, some means to screed or level the sand off, and separate means to shake or jolt and press the sand down around the mold pattern.

One such piece of equipment which attempts to consolidate some of these different steps makes use of a reciprocating hopper which can fill the molding flask and level the sand while the flask is in transit. However, the hopper must be spaced from the flask and drop the sand, or be removed apart therefrom before the flask is jolted to set the sand or other means are used to press the sand to the pattern shape.

FIGURE 1 shows an integrated foundry unit whereby all of these steps may be accomplished at one station and with an absolute minimum of mechanical equipment and the saving of considerable time.

The foundry unit 10 includes a hopper 12 disposed over a combustion chamber member 14. A conveyor line 16 travels under the combustion chamber 12 and a lift table 18 is provided to receive a mold sand flask 20 from the conveyor line 16 and raise it into closing engagement with the combustion chamber member 14.

The mold sand retaining hopper 12 is shown as partially filled with mold sand 22. A measuring shuttle 24 is shown to include a grate member 26 and an actuated closure 28 operated by the power cylinder 30. A release shuttle 32 is also provided and includes a similar grate 34 and closure 36 with a power actuator 38.

The combustion chamber member 14 includes an open upper end 40 over which the mold sand hopper 12 is

disposed and a lower open end 42 which is subsequently closed by the mold sand flask 20 as mentioned. Within the combustion chamber space 44 is provided an injector 46 or other means for introducing an explosive charge into the combustion space. Ignitors 48 may also be provided within the combustion space if the explosive charge requires such means of detonation. One or more such ignitors or detonators may be used as shown.

The combustion chamber 14 is intended to receive an explosive charge and, upon explosion thereof, to direct resulting wave forces, identified by the numeral 50, towards the mold sand retaining flask 20.

A screeding shuttle 52, with suitable power actuator 54, may be provided either within the lower end of the combustion chamber 14, as shown, or between the end of the combustion chamber and the mold sand flask 20, to level off any mold sand mounded on the top of the flask. Such screeding mechanism may not be necessary with a mold sand flask which does not include the reinforcing bulwark shown in the illustrated embodiment.

The lift table 18 may be part of the conveyor line 16 and include a belt or roller arrangement. It is intended to receive the mold sand flask 20 thereon and to position the flask relative to the open end of the combustion chamber. A suitable power actuator 56 is provided for raising the lift table 18 and moving the mold sand flask 20 into closing engagement with the open end of the combustion chamber.

The mold sand flask 20 shown by the drawing is of the type including a reinforcing honeycomb bulwark 58. As will be appreciated, such reinforcing bulwark is used in present mold sand flasks because of the jolting for shake-out that is presently required. It is conceivable that such bulwark would not be necessary if such shake out were not required. The pattern member 60 is disposed on the lift table 18 and is covered by mold sand 62 which has been dispensed by the hopper 12 and dropped through the combustion chamber space 44.

In practice, the mold sand 22 is retained in sufficient quantity within the hopper 12 to fill a number of mold sand flasks 20. By alternate use of the measuring shuttle 24 and release shuttle 32, a measured amount of mold sand may be dropped through the combustion chamber space 44 and into a mold sand flask 20 properly disposed under the lower open end 42 of the combustion chamber member.

It will be appreciated that the drop of this sand, of itself, serves to pack the sand about the pattern member 60 within the flask in much the same manner as would be accomplished by jolting the flask.

It is preferable that the mold sand be dropped into the mold sand retaining flask 20 after the flask has been positioned to close the combustion chamber space 44. However, the sand drop may be accomplished with the flask spaced from the lower end of the combustion chamber and allowing sufficient clearance for the screeding shuttle 52 therebetween. In such event the screeding shuttle 52 would not have to be part of the combustion chamber assembly and problems of sealing against explosive wave forces might be eliminated.

Once the sand is received in the mold sand flask 20 an explosive charge is introduced into the combustion chamber space 44 through the injector means 46 and the ignitors 48 are activated to detonate the charge and cause the generation of wave forces 50 which serve to pack the mold sand 62 about the pattern member 60 in the mold sand flask.

Although not shown, suitable exhaust vent means may be incorporated either within the combustion chamber member or through the flask to expel spent gases. Thereafter the lift table 18 is lowered to the level of the conveyor line 16 and the mold flask is moved to the next station.

It will be appreciated that the lift table 18 may be of the type which will hold the mold sand flask 20 thereon and turn the flask over before it is passed on to the con-

veyor line 16. Since this is considered to be an expedient well known within the art, details of such an arrangement have not been shown.

Referring now to FIGURE 2:

In certain instances it may be found desirable to accentuate or minimize the mold sand packing force of the explosive wave forces. This may be accomplished either as regards a whole flask area or parts thereof by interposing an adapter or intermediate member 70 between the lower end of the combustion chamber member 14 and the mold sand flask 20. This member may include separate barrels or passageways, such as 72 and 74, which are convergent or divergent to restrict or magnify the sand packing force wave received therethrough. In the present instance it will be noted that a larger access 76 is provided by the barrel or passageway 74 than is provided by the other passageway area shown.

FIGURE 2 also shows that cooperative guide ribs and grooves 77 and 78 may be provided on the flask and intermediate members or, for that matter, for centering engagement on the lower end of the combustion chamber itself.

A different means of packing the mold sand 62 about the pattern member 60 is shown by FIGURE 3. In this arrangement the intermediate member 80 includes piston cylinder areas 82 with piston means 84 provided therein. The piston members 84 are exposed to the wave forces and are acted upon to pack the mold sand about the pattern member.

It will be appreciated that in having the peripheral edges of the mold sand flask 20 received in sealing engagement with the peripheral edges of the open lower end of a combustion chamber 14 that the flask member itself is not exposed to the sand packing wave forces other than as is incident to the effect which the explosive blast has upon the sand within the flask. Accordingly, such an arrangement is not as hard on the flask members and they should have longer serviceable life. However, this does not preclude use of this mold sand packing method in a different arrangement such as, for example, that shown by FIGURE 4.

In FIGURE 4 there is shown a housing member 90 having a combustion chamber space 92 large enough to receive two or more mold sand flasks 94 and 96 wholly therewithin. The flasks are elevated on lift tables 98 and 100 which also serve to close the openings through which the flasks are raised for disposition within the combustion chamber space. An injector 102 for introducing an explosive charge and an ignitor 104 are shown disposed intermediate the two flasks to exemplify that forces from one source may be used to serve a dual function.

It will also be appreciated that the two flasks 94 and 96 need not be disposed within the combustion chamber space 92 for the same purpose; that is, one may be received for sand packing and the other for a blowout and cleaning of the flask after a part has been cast therein. In such instance, the lift table 100 might have an access opening 106 provided therethrough so that the mold sand and casting can drop through to a conveyor belt 108 which will carry the casting and spent sand away.

It will be appreciated that in having one combustion chamber area serve this dual function that conveyor lines may be routed in an endless circle for greater expediency.

The particular design of the combustion chamber area will depend principally upon the work which is required to be accomplished by the explosive wave forces generated therein. However, generally speaking, a conical-shaped combustion chamber member, such as 120, is considered most practical. This design takes natural advantage of the expansion of the explosive gases and is restrictive thereof only as a matter of introducing some direction therefor.

In the embodiment shown by FIGURE 5 a pair of injectors 122 are used with a single ignitor 124. It will be appreciated that different forms and arrangements of ignitors and injectors may be used to obtain different

wave fronts and combustion characteristics for different purposes.

Also shown by FIGURE 5, and in greater detail by FIGURE 6, is an intermediate member 130 which may be interposed between the combustion chamber member 120 and a mold sand flask 126 to deflect the sand packing wave forces past the honeycombed reinforcement provided within the mold sand flask. Such a shielding member may also be used to provide closures for the spew holes, vents or whatever else may be required to be protected within the mold being formed.

Although venting of the spent explosive gases from the combustion chamber spaces is principally a matter of production design, certain suggestions are made in regard thereto. These are principally as regards having the exhaust vent provided at either the top face of the flask or through the flask member as shown by FIGURES 7 and 8.

FIGURE 7 shows only a fragmentary section of the combustion chamber member 120 and the flask 126. The lower flange edge 130 of the flask is shown to include vent holes 132 through which spent gases may escape.

In FIGURE 8 the lift table 140 is shown to include a vent hole 142 over which is provided a vent tube 144 and with which is aligned a vent tube 146 intended to extend through the mold sand received within the mold sand retaining flask.

Although several variations and modifications of the present invention have been specifically disclosed and described, it will be appreciated that these are principally for purposes of illustrating the scope of the invention and are not to be interpreted as within the scope of the hereinafter appended claims without limitations beyond such as is expressly stated within the claims.

We claim:

1. The method of preparing a mold sand retaining flask for casting, comprising: placing a pattern member in a flask, closing the bottom of said flask and raising said flask into closing position relative to the open end of a combustion chamber member, dropping a measured load of molding sand through said combustion chamber and into said molding flask, introducing an explosive charge into said combustion chamber, igniting said explosive charge, and directing the explosive wave forces against the sand in said flask for packing said sand about said pattern member.

2. Apparatus for preparing a mold sand retaining flask for casting, and comprising: a combustion chamber member having a downwardly disposed opening provided therein, a mold sand retaining flask sized to close said opening by peripheral engagement with said chamber member thereabout, means closing the bottom of said flask and for raising said flask into sealing engagement with said chamber member, explosive wave force generating means provided in said combustion chamber space and intermediate means received between said flask and the opening in said combustion chamber member for receiving and directing explosive wave forces initiated by said generating means more proficiently into said flask and over the mold sand disposed therein.

3. The apparatus defined by claim 2 having said intermediate means formed to shield spew holes provided in said mold sand, and define areas for wave force concentration.

4. The apparatus of claim 2, including wave force vent means provided through said flask and exposed at mold sand packing level therewithin.

5. The apparatus of claim 2, including wave force vent means provided between said flask and combustion chamber member.

6. Apparatus for preparing mold sand retaining flasks for casting, and comprising: a combustion chamber member, flask handling means for disposing mold sand retaining flasks wholly within said combustion chamber mem-

ber, flask receptive areas provided within said combustion chamber member for closing the bottom of newly filled flasks and providing blowout passageways for flasks including castings, and means for generating an explosive wave force within said combustion chamber member for packing the molding sand in newly filled flasks and simultaneously blowing out the sand and castings from flasks disposed over blowout passageway areas.

7. The apparatus of claim 6, comprising: said combustion chamber member including multiple accesses for mold sand retaining flasks, said flask handling means receiving and disposing different mold sand retaining flasks through said accesses and wholly within said chamber member, said flask handling means being formed to close the bottom of newly filled mold sand retaining flasks and having blowout passageways provided there-through within those receptive of flasks including castings, means for introducing an explosive charge within said combustion chamber, and means for igniting said explosive charge to generate the explosive wave forces aforementioned.

8. Apparatus for preparing mold sand retaining flasks for continuous and cyclic use in the preparation of castings, and comprising: conveyor means for handling both newly filled mold sand retaining flasks and those having spent sand and castings provided therein, a combustion chamber member spanning both of said last mentioned conveyor means, accesses provided in said combustion chamber member and receptive of at least one of each of said newly filled and spent sand retaining flasks there-through, means closing said combustion chamber space behind said newly filled flasks introduced into said combustion chamber member, means providing a blowout passageway behind spent sand retaining flasks introduced into said combustion chamber member, an explosive charge and means for disposing said charge in said combustion chamber member, and means for igniting said explosive charge to generate explosive wave forces packing the sand in said newly filled flasks and blowing out said spent sand and casting from the other of said flasks simultaneously.

9. Apparatus for preparing a mold sand retaining flask for casting, and comprising: a combustion chamber member having an opening provided therein, means for receiving a mold sand retaining flask member having a pattern member and mold sand provided loosely about said pattern member therein, means for positioning said flask member to close said opening and for closing said flask against the escape of mold sand therethrough, means for introducing and igniting an explosive charge within said combustion chamber and over the sand in said flask for generating explosive wave forces compacting the sand about the pattern member therein, and in which the opening of the combustion chamber is in a downward direction and the positioning means is an elevating means for raising the flask to the sealing engagement with said combustion chamber.

10. Apparatus for preparing a mold sand retaining flask for casting, and comprising: a combustion chamber member having an opening provided therein, means for receiving a mold sand retaining flask member having a pattern member and mold sand provided loosely about said pattern member therein, means for positioning said flask member to close said opening and for closing said flask against the escape of mold sand therethrough, and means for introducing and igniting an explosive charge within said combustion chamber and over the sand in said flask for generating explosive wave forces compacting the sand about the pattern member therein, and in which the combustion chamber member is vertically disposed and open at opposite ends, mold sand dispensing means closing the upper open end of said combustion chamber member and having said flask positioning means adapted to raise said flask member into sealing engage-

ment with the lower open end of said combustion chamber member, and means isolating said dispensing means from said chamber member precedent to the ignition of said explosive charge.

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