Oct. 27, 1953 H. J. B. HERBRUGGEN 2,656,575

CORE BLOWING APPARATUS

Filed March 25, 1950 4 Sheets-Sheet 1

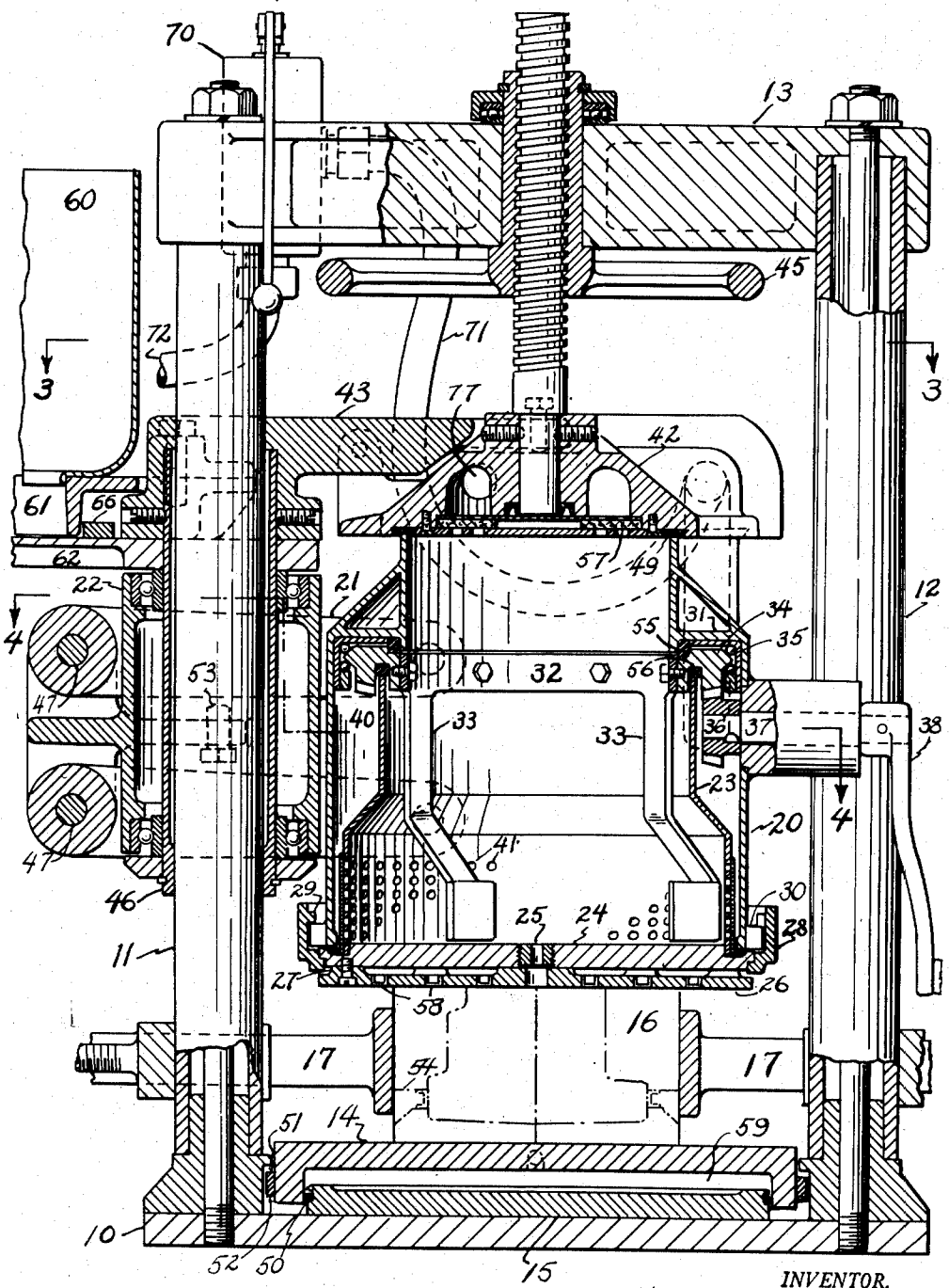

Fig 1

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CORE BLOWING APPARATUS

Filed March 25, 1950 4 Sheets-Sheet 2

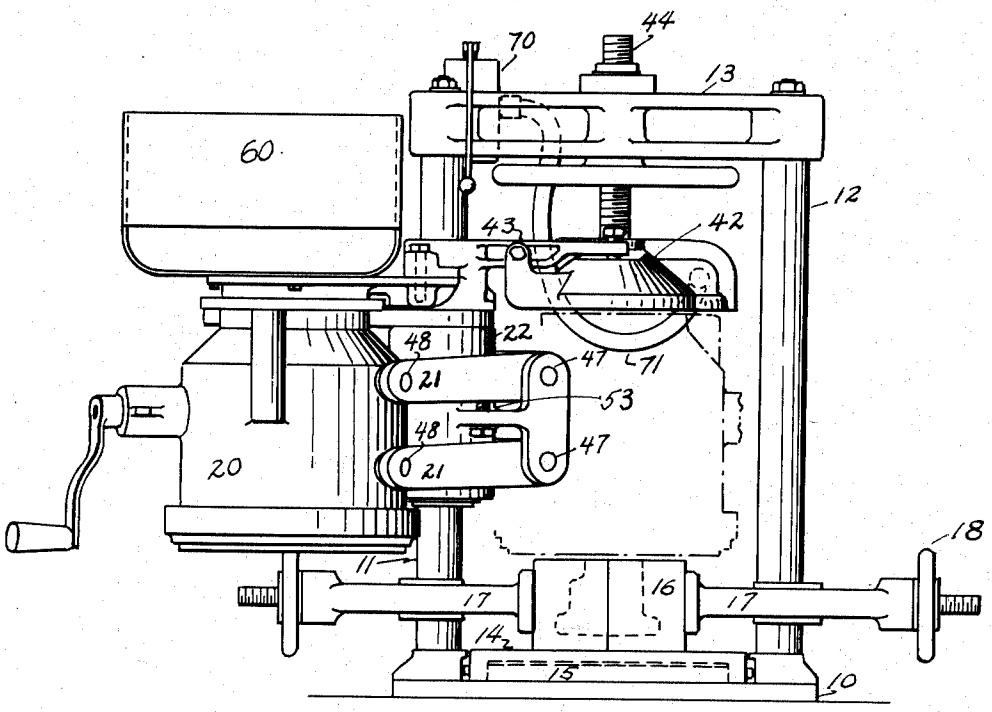

Fig 2

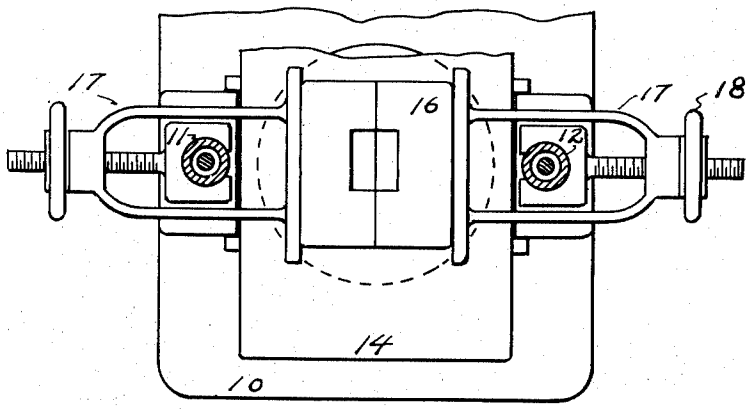

Fig 6

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CORE BLOWING APPARATUS

Filed March 25, 1950 4 Sheets-Sheet 3

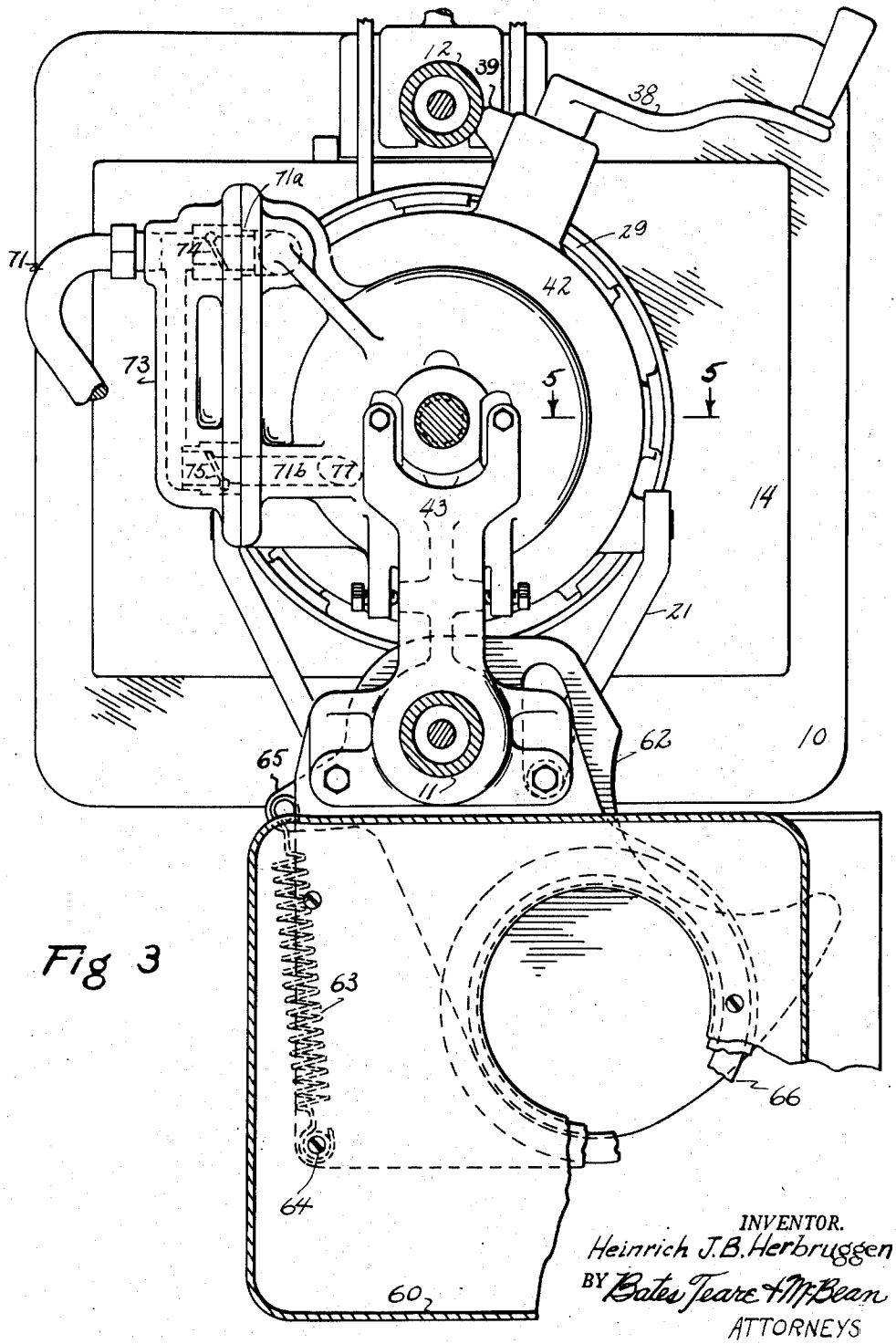

Fig 3

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CORE BLOWING APPARATUS

Filed March 25, 1950 4 Sheets-Sheet 4

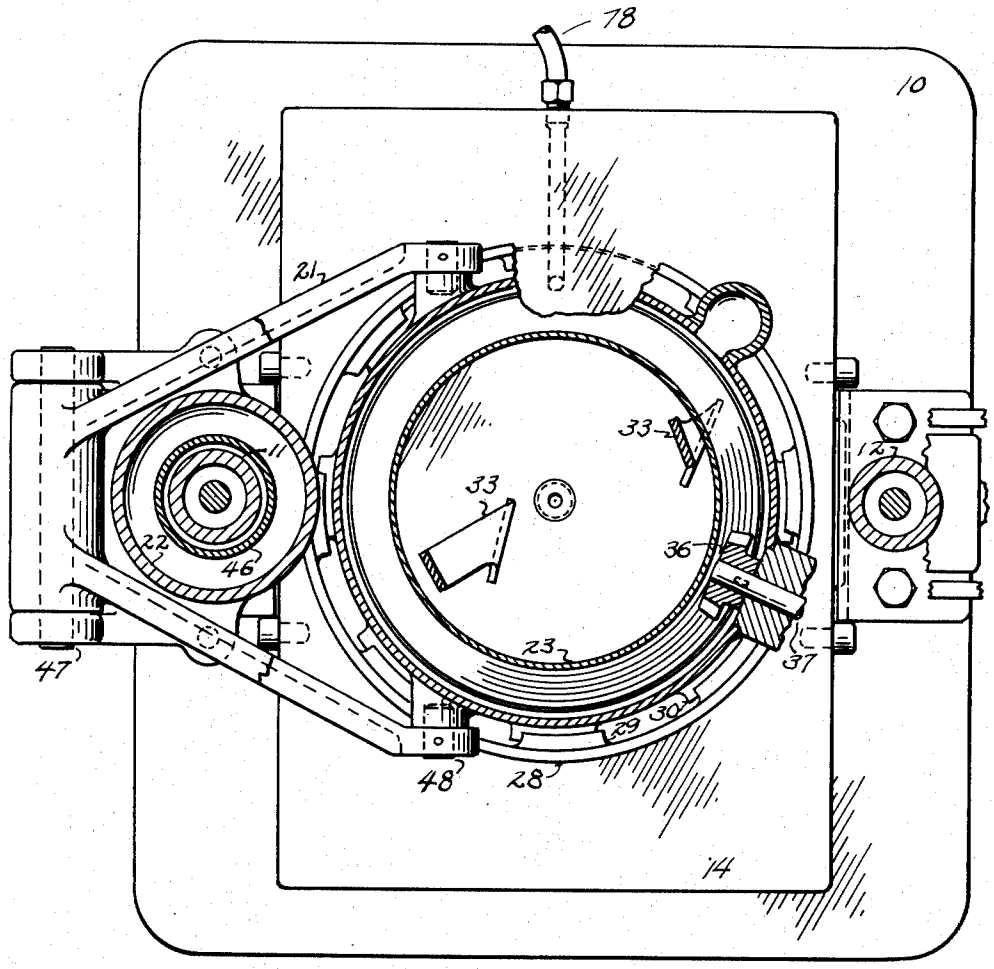

Fig 4

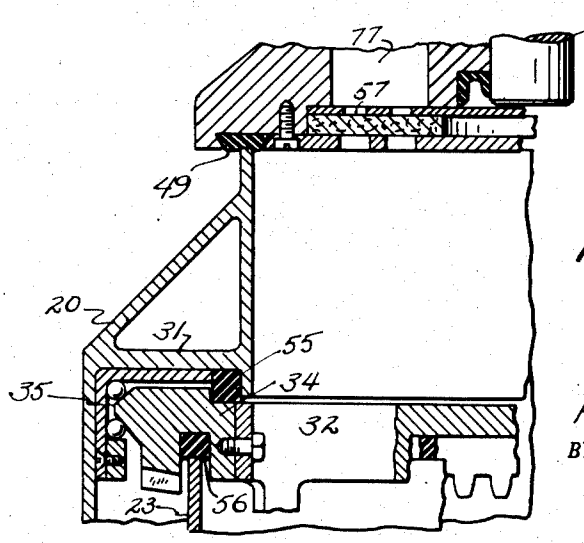

Fig 5

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2,656,575

CORE BLOWING APPARATUS

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5 Claims. (Cl. 22—10)

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This invention relates to machines for making sand cores, and more particularly to machines of the type in which a mold or core substance, such as sand and the like, is forced into a mold or core box by combined pneumatic and agitator action.

Mold or core making machines of this type operate on the principle of feeding the sand or other mold substance into a container or sand transfer member above a table upon which a core box or mold is placed and then charging the sand transfer member with an air stream, under pressure, to force the sand through apertures in a base plate of the transfer member into corresponding apertures and cavities in the core box.

Some types of core blowing apparatus operate solely on the principle of pneumatic action to force a mass of sand through blow holes into a core box and present difficulties in operation of the apparatus and result in unsatisfactory cores. These unsatisfactory results can be ascribed to the fact that the pneumatic action in combination with the blow holes results in a localized action near the blow holes leaving a certain amount of dead weight sand in the sand transfer member, which is never blown into the core box. The air does not have a chance to mix with the sand and convey it through the blow hole into the core box, and the result is an imperfect transfer of sand into the core box resulting in craters and voids within the core.

Other types of core blowing apparatus utilize, in addition to the pneumatic action, some form of mechanical agitation or scraping within the sand transfer member. The purpose of the usual mechanical agitator in this type of apparatus is to scrape across the blow holes, thereby scraping cratered or dead weight sand into the core box. Such action, however, usually results in slugs or lumps of sand passing into the core box and prevents the attainment of the uniform density throughout the core which is ultimately desired.

In addition to the resulting non-uniform density in the core member, the construction of the usual apparatus employing mechanical agitator is such that the agitator interferes with the charging of the sand transfer chamber and hinders the smooth flow of the sand or mold substance during the combined blowing and agitating action due to the fact that the drive shaft and associated driving members are usually located within the sand chamber.

Operation of these known types of apparatus

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depends to a large extent upon the flowability of the sand or mold substance because they operate generally upon the principle of introducing air into the top of the sand chamber and compressing the sand to force it into the core box. The sand mass within the chamber is thus compacted under the air pressure and does not have the flowability to pass readily through the small blow holes smoothly, nor to accommodate the cavities in the core box. Users of such types of apparatus have been limited to a sand or mold substance which is made to be blown by the particular machine in use, because, in order to prevent the compacting of the sand mass within the chamber under air pressure, it is necessary that the sand not have an appreciable amount of green bond strength and that the moisture of the sand be kept within a narrow range.

To offset the compacting of the sand and the so-called dead weight sand within the sand chamber, some of the known types of apparatus have been using sand chambers having more than one blow hole or entry chamber into the core box. However, in order to use such an apparatus for different sizes and shapes of core boxes, it is necessary to provide special blow plates for the sand chambers, depending on the type of core box to be filled. These blow plates are expensive and the time required to change them in some cases is longer than the time required to blow the cores. Even though such apparatus were designed to operate with a single blow hole and a proper sand mixture were introduced into the sand chamber to prevent compacting, it would be necessary to build a rather large and bulky sand chamber in order to properly transfer all of the sand under compacting air pressure from within the chamber to the core box. A sand chamber which is too large and bulky is awkward to handle and cannot be conveniently refilled.

Accordingly, it is an object of this invention to provide a core blowing machine having a convenient size sand chamber with a single blow hole which may be applied to any size or type of core box.

It is another object of this invention to provide a core blowing machine which operates equally well with many types of sand or mold substances.

Still another object of this invention is to provide a core blowing machine having a sand chamber which is not large and bulky and which is adapted for convenient refilling.

A further object of this invention is to provide a core blowing apparatus having a mechanical agitator which does not interfere with the filling

or blowing operations of the sand transfer member.

Briefly, in accordance with this invention, a core blowing apparatus is provided with a sand transfer member which may be positioned and clamped relative to a core box for transferring sand in a flowable mass into the core box through a single opening in the chamber under the combined action of air pressure and agitation, and is further provided with a sand storage member and means for positioning the sand transfer member relative thereto for refilling.

These and other objects and advantages of the invention will be further understood from the following description when considered in connection with the accompanying drawings.

In the drawings, Fig. 1 is a side elevation of the core blowing apparatus showing the sand transfer chamber and associated parts in section; Fig. 2 is another side elevation showing the sand transfer chamber swung into filling position adjacent a sand storage member; Fig. 3 is a top view in section of the core blowing apparatus taken along the lines 3—3 in Fig. 1 and showing the sand transfer member and the sand storage member; Fig. 4 is a top view of the core blowing apparatus taken along the line 4—4 in Fig. 1 showing the sand transfer member in section; Fig. 5 is a cut-away sectional elevation of the sand chamber taken along the lines 5—5 in Fig. 3, and Fig. 6 is a top view in section of the core blowing apparatus base showing the core box positioned between adjustable clamping members carried by the frame.

Referring now to Fig. 1, the core making apparatus of this invention is carried by a frame having a base 10 which supports a pair of standards or columns 11 and 12 having a cross-head 13 at the top. A core box or mold supporting table 14 is positioned upon the base plate 15 between the standards or columns to support a core box 16. In the event that the mold or core box is composed of vertical sections, manually operable clamps 17 are carried on the columns 11 and 12 to provide additional balanced clamping in a horizontal direction. Adjustment of these clamps is made by a hand wheel 18 operatively connected to the columns 10 and 11.

Above the core box 16 there is positioned a sand transfer member designated generally at 20 which is carried by forked arms 21 pivotally mounted upon a journal 22 carried on one of the standards or columns 11. The journal 22 and arms 21 are arranged to provide parallel vertical motion of the sand transfer member and also pivotal motion thereof about the axis of the supporting column 11.

A sand storage member 60 is carried by a supporting stool 61 which is mounted coaxially with the sand transfer member arm on the same column 11. The pivotal motion of the arms 21 about the supporting column 11 enables an operator to position the sand transfer member 20 under the sand storage member 60 or in surmounting relation with the core box 16 for core blowing purposes.

The sand transfer member 20 comprises a hollow cylindrical member open at the top and having an annular baffle 23 of lesser diameter concentrically mounted therein. The sand transfer member 20 has a removable base in the form of a blow plate 24 having an opening 25 therethrough, which communicates with the core box cavity. The baffle 23 forms a sand chamber within the sand transfer member and the space 40 between the baffle and the external wall of the sand transfer member provides an air space about the sand chamber which is defined at the top by a shoulder 31.

An agitating member 32 having stirring elements 33 is carried within the sand chamber formed by the baffle and is bolted to a ring gear 34 which is positioned within the air space 40 for rotation over the top edge of the baffle 23. A suitable anti-friction bearing 35 is interposed between the external wall of the sand transfer member and the ring gear. Sealing rings 55 and 56 are provided between the top edge of the baffle and the ring gear 34 and between an upper shoulder of the sand transfer member and the ring gear 34. A pinion 36 coacts with the ring gear 34 within the air space and is carried by a shaft 37 which extends through the external wall of the sand transfer member and which may be connected to a hand crank 38 or other source of driving power. By this arrangement, the driving mechanism for the agitator member does not interfere with the flow of sand within the chamber, and the stirring elements push the sand towards the blow hole, keeping it covered at all times.

A control valve 70 mounted on the cross head 13 may be operated to supply air under pressure through a suitable conduit 71 and check valve 74 to the annular air space 40 between the baffle 23 and external wall of the sand transfer member. The baffle 23 is provided with a plurality of perforations 41 near the base so that when air is admitted from the valve to the annular air space 40 surrounding the baffle 23, it passes through the perforations 41 into the sand chamber and through the blow hole opening 25 into the cavity of the core box 16.

A cover or head 42 is provided for the opening at the top of the sand transfer member. The cover 42 is restricted against horizontal movement by an arm 43 which is shown mounted on the supporting column 11 coaxially with the sand transfer member positioning means. The cross head 13 carries a centrally located screw or spindle 44 with a hand wheel 45. The spindle end of the screw 44 extends into the cover 42 and is rigidly secured thereto so that by rotating the hand wheel 45 manually, the cover and attached members may be raised or lowered as desired for different types and sizes of molds or core boxes.

The sand transfer member supporting arms, the sand storage member supporting stool, and the cover restraining arm are all shown coaxially mounted on a sleeve 46 on the column 11. The sand transfer member supporting arms 21 are in the form of forked arms pivotally connected by suitable means to the supporting journal at 47 and to the outside wall of the transfer member at 48. This pivotal connection of the forked supporting arms 21 allows the sand transfer member to be moved vertically parallel to the column 11.

The core box supporting table 14 acts as a cylinder head in conjunction with the air space provided between the supporting table 14 and the base plate 15 of the frame. Thus, by supplying air under pressure through a suitable valve associated with the control valve 70 to the air space between the supporting table and the base plate, the core box supporting table 14 can be moved upwardly in a direction parallel to the columns 11 and 12. Likewise, the core box 16 is moved against the blow plate 24 of the sand transfer member and a vertical motion is imparted to the

sand transfer member 20 to move it into aligned position with the cover 42 which has a sealing gasket 49 coacting with the top edge of the sand transfer member. The core box supporting table is guided in its vertical movement by an O ring gasket 50 carried in a groove in the base and movement of the table is limited by suitable stops 51 which are provided near the base of the columns 11 and 12 to engage cooperating lugs 52 extending from the core box supporting table 14. The combined action of the core box supporting table and the adjustable cover act as a means for clamping the core box and sand transfer member in operative core blowing relation.

Referring now to Fig. 2, the core making or blowing apparatus is shown in side elevation with the sand transfer member 20 swung into position under the sand storage member 60 for refilling. Thus, at the completion of the core blowing operation, the air is released from under the core box supporting table 14 and the supporting table, core box, and sand transfer member are allowed to drop away from engagement with the cover 42. The core box supporting table 14 and core box 16 drops to the extreme lower limit determined by the base 10 of the frame, while the sand transfer member 20 drops to a limiting position shown in dotted lines in Fig. 2. The latter is determined by supporting studs 53 projecting from a bracket on the sand transfer member positioning journal 22 which engage the forked supporting arms 21 to prevent downward movement thereof beyond a predetermined limit. This enables the sand transfer member to clear both the cover 42 and the core box 16.

A top view of the core blowing apparatus is shown in Fig. 3 wherein a portion of the sand storage member is cut away to show a significant feature of this invention in the form of a gate 62 covering a sand dispensing opening at the base of the sand storage member and which is operated automatically consequent upon the movement of the transfer member into and out of active position relative to the storage member. The gate 62 is mounted at one end on the sleeve 46 for pivotal motion about the supporting column 11. A spring 63, shown in dotted lines (Fig. 3) is interconnected between the sand storage member and a lever arm 65 on the gate and acts to urge the gate into a normally closed position with respect to the opening in the sand storage member.

The limiting of the lowering of the sand transfer member after the core blowing operation is completed, as heretofore pointed out, is such that when the sand transfer member is swung into operative position for refilling, it engages the gate 62 and forces it against the action of the spring 63 away from the sand dispensing opening in the sand storage member, thus allowing the sand within the storage member to flow into the sand chamber.

As the transfer member moves out from its position relative to the storage member opening, a floating ring 66 scrapes the top edges thereof and levels the sand therein. In Figs. 1 and 3, the ring 66 is shown resting on the gate 62 loosely encircling the hopper stool 61 and in concentric relation to the opening in the base of the storage member. As the sand transfer member 20 swings into position under the storage member 60, it forces the gate 62 away from the opening and allows the ring 66 to freely rest upon the top of the sand transfer member. Then, when the sand transfer member is returned to the core blowing position, the ring slides across the top edge of the transfer member scraping the top edges clean and leveling the sand therein. The return pivotal movement of the sand transfer member to the core blowing position is limited by a stop in the form of a lug 39 on the crank handle which coacts with the column 12 to properly align the sand transfer member with the cover 42 and core box 16.

The air supply for the sand chamber is best shown in Figs. 1 and 3. A source of air pressure including a supply conduit 72 is connected to a control valve 70 which selectively couples the conduit 71 to the air supply or atmosphere. The conduit 71 is connected to a head 73 on the cover 42. A passageway 71*a* connects the head with the air space 40 surrounding the sand chamber and a check valve 74 in this passageway prevents flow of air from the chamber to the head when the valve 70 is connected to the atmosphere. Another passageway 71*b* is shown connecting the conduit 71 to an exhaust port 77 in the cover 42 which communicates with the sand chamber for purposes of exhausting the chamber when the valve 71 is opened to the atmosphere after the core blowing operation is completed. The check valve 75 in this passageway prevents flow of air from the head to the sand chamber. A felt or similar type filter 57 is positioned between the sand chamber and the exhaust port to prevent the passage of sand to the atmosphere during exhaust.

Referring again to Fig. 1, in conjunction with Fig. 4, the base of the sand transfer member 20 is formed from the combination of the blow plate 24 which surmounts a spider member 26 connected at several points to the underside of the blow plate. This spider member 26 is in the form of a solid plate having upwardly extending partial flanges 27 which form the spider and through which bolts may be inserted to connect the spider to the under-surface of the blow plate 24. When connected together in surmounting relation, the blow plate 24 and spider member 26 form an open air space therebetween which communicates with venting passages 58 extending through the spider plate portion for exhausting air from the core box. Other venting passages 54 may be formed in the core box and all of the venting passages may be provided with suitable filters to prevent the passage of sand therethrough under pressure.

The blow plate 24 has a ring 28 suitably connected to its periphery which carries a number of spaced receiving lugs 29 on its inner face. Cooperating lugs 30 extend from the external wall of the sand transfer member 20 which are adapted to slidingly engage the receiving lugs 29 on the ring 28, thus forming a bayonet-type lock for the base of the sand transfer member. With this arrangement, the base of the sand transfer member may be easily removed by turning the base in a direction to unlock the interlocking lugs so that the sand chamber and the blow plate may be cleaned or subjected to other forms of maintenance.

In operation, the sand transfer member 20 is first disposed under the sand storage member 60 and filled with sand of a mixture corresponding to the type core or mold sought to be formed, and then the sand transfer member 20 is pivotally swung back within the closed frame and axially aligned with the cover 42. Next, air under pressure is applied to the space 59 between the base plate 15 of the frame and the core supporting

table 14 to lift the table and core box 16 along with the sand transfer member as a unit into snug engagement with the cover 42. The gasket 49 in the underside of the cover 42 makes an airtight seal for the sand chamber and the valve 70 is operated to introduce air into the annular air space 40 between the baffle and the external wall of the sand transfer member. The air under pressure passes through the air space 40 and through the perforations 41 in the baffle 23 into the sand chamber and acts upon the sand therein to loosen it and carry it through the blow hole opening 25 into the cavity of the mold or core box 16. At the same time the agitator member 32 is rotated by turning the hand crank 38, or by some other source of driving power connected thereto, to aid the transfer of sand into the core box cavity.

We have found that upon the foregoing operation the sand will flow readily into the mold through only a single blow hole or discharge opening in the base of the sand transfer member and that a pressure of approximately 80 to 100 lbs. per sq. inch of air provides the desired action in the chamber and allows the agitator to be readily rotated. Thus, the combined action of agitation and air flow creates in effect a fluffing or loosening of the sand after the manner of aeration which allows it to flow uniformly through the single blow plate opening into the mold or core box cavity without compacting or lumping of the sand.

At the completion of the core blowing operation, the valve 70 is operated to cut off the air supply and exhaust the sand chamber through the corresponding check valve 75 and conduit 77 in the cover 42. Then, the air is exhausted from underneath the core box supporting table 14 so that the core box 16, together with the sand transfer member 20, drops away from the engagement with the cover 42. The sand transfer member 20 may then be swung into position for refilling under the sand storage member 60 and the core blowing operation repeated on the same or different mold or core box.

The core making or blowing apparatus of this invention provides a sand transfer member of a convenient shape and size which may be adapted for use with various size and types of molds or core boxes by reason of the adjustable balanced clamping means associated with the sand transfer member cover. Furthermore, the apparatus can be used with any type of sand or mold substance whereby the combined action of fluid air pressure and agitation within the sand chamber renders the sand or mold substance within the chamber into an easily flowable mass which will readily pass through a single blow hole into the mold or core box cavities. This enables the use of inexpensive, easily changeable blow plates corresponding to the type of mold or core box used. The apparatus is further enhanced by the location of the complete agitator driving mechanism external to the sand chamber where it will not interfere with the filling or transfer of sand within the chamber.

I have shown and described what I consider the preferred embodiment of my invention along with suggestions of modified forms, and it will be obvious to those skilled in the art that other changes and modifications, particularly with respect to the detailed structure and design of the various elements of the apparatus of this invention, may be made without departing from the scope of my invention as defined by the appended claims.

I claim:

1. A core making or blowing apparatus comprising in combination, a closed frame having a base with spaced vertical columns secured together at the top through a cross head, a sand transfer member having spaced inner and outer chambers, said inner chamber being adapted to receive sand therein and having an opening at the base thereof, an annular member concentrically mounted for rotation on said sand chamber and having an agitator extending into the chamber, means for rotating said annular member operatively connected thereto in the space between said transfer member and inner sand chamber, a core box support on the base of said frame, a transfer member cover carried by the frame in spaced surmounting relation over the core box support, means connecting said transfer member to one of the frame columns including a compound pivot for positioning the transfer member vertically between the core box support and the cover, a core box support lift for clamping said transfer member and core box together against the cover in core blowing relation, means for effecting a flow of fluid air pressure through said sand chamber, a sand storage member carried by said one frame column external to the closed frame, and means for positioning said sand transfer member in operative relation over the core box support or in sand charging position relative to said storage member.

2. A core making or blowing apparatus comprising in combination, a frame, a sand transfer member having spaced inner and outer concentric chambers, said inner chamber having perforate sides and being adapted to receive sand therein, a common base for said chambers provided with an opening, means for effecting a flow of fluid air pressure from the outer chamber through the perforate sides of said inner chamber, an annular member mounted for rotation along the top peripheral edge of said inner chamber and carrying an agitator element extending into said inner chamber, means external to the outer chamber for driving said agitator member, means operatively coupling said driving means to said annular member in the space between said inner and outer chambers, a core box support below the transfer member and a transfer member cover carried by the frame above the transfer member, means pivotally connecting said transfer member to the frame for vertical positioning between the core box support and the cover, a sand storage member carried by the frame in spaced horizontal and vertical relation from the transfer member and core box support, and means for positioning said sand transfer member in operative relation over said core box support or in sand charging position relative to said storage member.

3. In a core blowing apparatus, the combination of a sand transfer member having spaced inner and outer chambers provided with a base having an opening therethrough, said inner chamber having a controlled opening for receiving sand before blowing the core and for releasing air after blowing the core, means for introducing a flow of fluid air pressure from said outer chamber into said inner chamber, means for agitating the sand within said inner chamber including an annular member concentrically mounted for rotation along the top peripheral edge of said inner chamber and carrying a stir-

ring element extending into said inner chamber, means in the space between said inner and outer chamber drivingly connecting said annular member to a drive external to said outer chamber, whereby sand may be freely agitated and blown from the inner chamber through the base opening without obstruction.

4. A core blowing apparatus comprising in combination, a closed frame having spaced vertical supports interconnected at the bottom through a core box supporting base and at the top through a crosshead, a sand transfer member having a sand receiving opening and arranged to be supported within the closed frame, a sand storage member arranged to be supported external to the closed frame, a removable cover for said transfer member opening, a journal mounted for movement along one of said vertical supports, means coupling said transfer member and said storage member to the journal, a rigid arm having one end coupled to said cover and the other end connected to said journal, a spindle carried by said crosshead for axial movement toward and away from said base and having one end connected to said cover and supporting arm, and means for positioning said spindle to adjust the distance of said journal and members coupled thereto from the core box supporting base.

5. A core making or blowing apparatus comprising in combination, a base having spaced vertically extending columns, and a crosshead interconnecting the columns at the top to form a closed overhead frame, a sand transfer member adapted to be positioned within the closed frame and including a sand chamber having a removable base provided with an opening therethrough, a stirring member operatively disposed for relative movement within the sand chamber and having a portion thereof accessible external to the sand chamber, driving means coupled to said portion of the stirring member external to the sand chamber, and means isolating said coupled driving means from the sand in the sand chamber,

means for effecting a continuous flow of air under pressure through said chamber, means carried by the base for supporting a core box within the closed frame, means for vertically positioning said core box, adjustable clamps carried by the columns and extending into the closed frame for positioning the core box on the base, a sand storage member carried by one of said columns external to the closed overhead frame, means for positioning the sand transfer member in operative relation with the core box within the closed frame or with sand storage member external to the closed frame, said means including a journal mounted for rotation about said one column and an arm pivotally connected to one end to the transfer member and at the other end to the journal to permit parallel vertical motion of the transfer member relative to the column, and a sand chamber cover movably carried by the cross head and adapted to coact with the core box vertical positioning means to clamp the sand transfer member and core box together in operative core blowing relation.

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