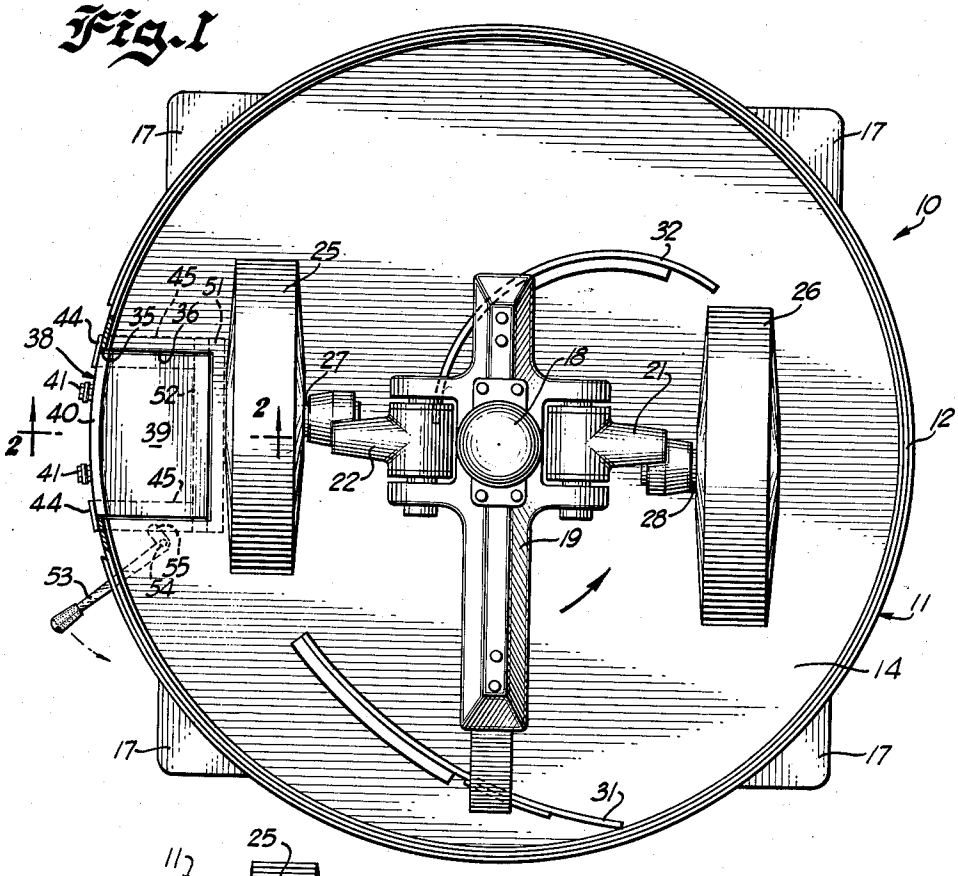
April 4, 1961 R. L. McILVAINE 2,978,147

MIXER FOR GRANULAR MATERIAL

Filed Dec. 23, 1957

Fig. 1



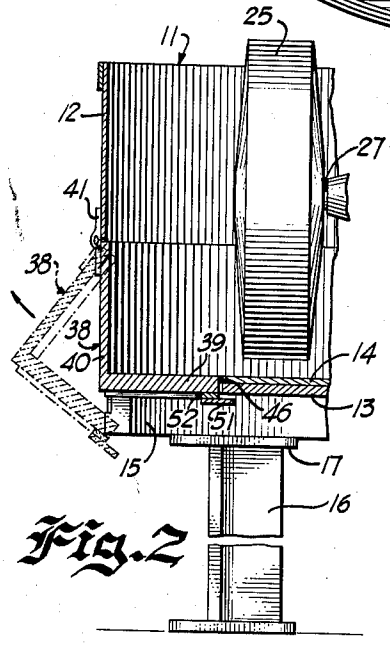


Fig. 2

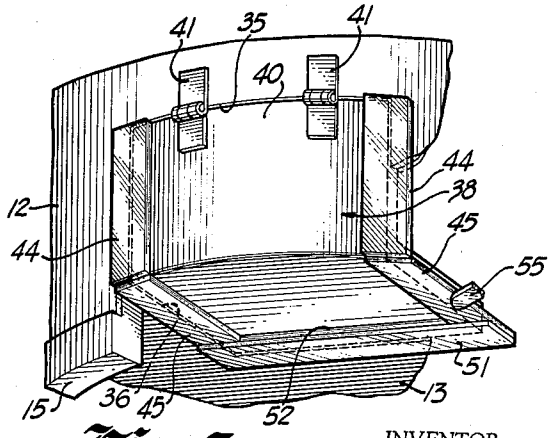


Fig. 3

INVENTOR.
ROBERT L. McILVAINE
BY
Mason, Kolehmainen, Rathburn and Wyss.
ATTORNEYS.

United States Patent Office 2,978,147
Patented Apr. 4, 1961

2,978,147

MIXER FOR GRANULAR MATERIAL

Robert L. McIlvaine, Winnetka, Ill., assignor to Herbert Simpson Corporation, Chicago, Ill., a corporation of Illinois

Filed Dec. 23, 1957, Ser. No. 704,528

3 Claims. (Cl. 222—185)

The present invention relates to mixers and more particularly to a new and improved means for evacuating mixers of the type employing rotatable mullers for mixing and mulling granular material such as the core sand which is used in casting operations.

Mixers of the type with which the present invention is particularly suited ordinarily employ a plurality of rotating mullers and plows mounted in an open-topped crib or container into which large quantities of granular material to be mulled and mixed are placed. The plows are so designed as to cause mixing of the material as they travel through it, any chunks of the material which may be present being broken up or mulled by the mullers. After the material has been satisfactorily mulled and mixed, it becomes necessary to remove the granular material from the mixer, and a principal object of the present invention is to provide a mixer employing a new and improved discharge means for enabling the rapid and facile removal of the granular material from the crib.

Another object of the present invention is to provide a new and improved discharge door and opening for use in a mixer.

A further object of the present invention is to provide a mixer of the rotatable muller type employing a new and improved discharge means which makes use of the centrifugal force of the granular material in the mixer for quickly and efficiently evacuating the material from the mixer.

Another object of the present invention is to provide a new and improved muller construction employing a door and associated doorway partially located in the bottom of the crib and partially located in a side wall of the crib, thereby to enable the rapid discharging of the granular material from the crib.

Briefly, the above and further objects are realized in accordance with the present invention by providing a particularly shaped discharge opening in the crib of a mixer of the type employing rotatable muller and mixer elements. The mixer elements are designed to cause the material in the mixer to move toward and away from the center of the crib into the paths of a plurality of muller wheels which roll along circular paths on the bottom of the crib. Therefore, in order to utilize the natural movement of the material in the mixer to enhance the efficiency of operation of the mixer during evacuation of the material from the crib, the discharge opening is formed by adjacent openings respectively disposed in the side and in the bottom of the crib. Moreover, a single door is used to close this irregularly shaped discharge opening during the mixing and mulling operation, and a novel seal is provided between the door and the crib to facilitate operation of the door.

Further objects and advantages and a better understanding of the present invention may be had from the following detailed description taken with reference to the accompanying drawings, in which:

Fig. 1 is a top plan view partially in section of a mixer embodying the present invention;

Fig. 2 is a fragmentary sectional view taken along the line 2—2 of Fig. 1; and

Fig. 3 is a fragmentary perspective view of a portion of the mixer of Fig. 1 particularly showing the discharge opening and the associated door.

Referring now to the drawings and particularly to Fig. 1 thereof, there is shown a mixer 10 comprising an open-topped cylindrically shaped crib 11 formed of a hollow cylindrical wall 12 which is suitably secured at the bottom thereof to a circular bed plate 13. On the upper flat surface of the bed plate 13 is mounted a circular wear plate 14 which is preferably constructed of hardened steel. As best shown in Figs. 2 and 3, the bed plate has a depending flange 15 including an annular recess near the top thereof in which the lower portion of the wall 12 is received. The mixer 10 is supported by four rectangularly arranged pedestals 16 which have a substantially V-shape in plan as seen in Fig. 1. The upper ends of the pedestals 16 are secured, as by welding, to a plurality of plates 17 which are secured to the lower ends of the flange 15. The pedestals 16 thus support the crib 11 at a somewhat elevated position to provide space beneath the bed plate 13 for the mounting of a motor (not shown) which drives the moving parts of the mixer 10. The rotor of this drive motor is connected by means of a suitable drive shaft 18, which is vertically journaled at the center of the crib 11, to a cross head 19 on which a plurality of rocker arms 21 and 22 are pivotally mounted. Suitable means, such, for example, as a spring (not shown) biases the rocker arms 21 and 22 toward the wear plate 14.

The granular material which may be placed in chunks into the crib 11 is broken up by a pair of muller wheels 25 and 26 which are respectively mounted in substantially diametrically opposed positions on a pair of shafts 27 and 28 which are press fitted in holes in the rocker arms 21 and 22. The principal longitudinal axes of the shafts 27 and 28 are perpendicular to the pivotal axes of the rocker arms 21 and 22 on the cross head 19. Each of the muller wheels 25 and 26 is rotatably mounted on its associated shaft 27, 28 on ball bearing assemblies suitably disposed in the muller wheels 25 and 26 (not visible in the drawing) whereby rotation of the cross head 19 about the principal longitudinal axis of the drive shaft 18 causes the muller wheels 25 and 26 to roll through the granular material. Since the wheels 25 and 26 are very heavy and are further biased toward the wear plate 14, the granular material is mashed or mulled between the wheels and the plate and any chunks of the material which may be present are broken up.

In order to thoroughly mix the granular material placed in the crib 11, a plurality of suitably shaped arcuate mixer elements or plow blades 31 and 32 are mounted on the cross head 19, the blade 31 covering the outer portion of the crib 11 and the blade 32 covering the inner portion. Moreover, the blades 31 and 32 are so shaped that as the drive shaft 18 is rotated counterclockwise, as viewed in Fig. 1, the plow blade 31, which is disposed just inside the inner wall of the crib 11, causes the granular material which is located in the outer portion of the crib to be moved toward the center thereof, and the plow blade 32, which is located near the center of the crib 11, causes the granular material which is located near the middle of the crib to move toward the periphery thereof. In the case of both plow blades, however, the trailing edges of the blades 31 and 32 are in close proximity and just ahead of a respective one of the muller wheels 25 and 26 so that as the granular material is redirected by the plows 31 and 32 to cause mixing thereof it is also fed to the muller wheels to insure a good mulling action. It will be apparent that while the granular material located in the mixer 10 moves

in both an inward and an outward direction, the overall effect of the rotation of the muller wheels 25 and 26 and the plow blades 31 and 32 is to impart a circular, counterclockwise motion (Fig. 1) to the granular material which, due to the centrifugal force which is thus exerted thereon, tends to move toward the periphery of the crib 11.

After the granular material which has been placed in the mixer 10 has been sufficiently mulled and mixed, it becomes necessary to remove the granular material from the mixer so that the material may be reused and in addition so that the mixer itself may be again used to mix and grind the next batch of material. It will be apparent that in order to insure the efficient operation of the mixer 10, the crib 11 should be completely evacuated in as short a time as possible.

Therefore, in accordance with an important aspect of the present invention there is provided a discharge opening which is disposed partially in the side and partially in the bottom of the crib 11. In this manner, as the granular material is pushed by centrifugal force and by the plow blade 32 toward the periphery of the mixer, it is forced out of the crib through the portion of the discharge opening which is located in the side wall thereof. Although all of the material could eventually be removed from the crib through an opening which was disposed only in the side wall thereof, because the plow blade 31 causes the granular material to move toward the middle of the crib, the addition of an opening in the bottom of the crib appreciably decreases the evacuation time of the mixer 10. It may be seen that in evacuating the chamber, the cross head is rotated and at first a large quantity of the material is forced out through the portion of the discharge opening in the side wall, but as the quantity of material in the crib diminishes below a certain quantity, most of the remaining material falls out through the portion of the opening in the bottom of the crib 11.

Considering in greater detail the discharge means of the present invention, there is provided in the side wall 12 of the crib 11 a somewhat rectangularly shaped opening 35 at a position adjacent to and aligned with a similar rectangularly shaped opening 36 in the plates 13 and 14. As best shown in Fig. 1, the portion 36 of the discharge opening extends toward the center of the crib 11 to a position just beyond the outer edge of the plow blade 32 so that the granular material which is directed by the blade 32 toward the periphery of the crib 11 passes directly over the opening portion 36, thereby to increase the efficiency of the evaucation operation. A generally L-shaped discharge door 38 is pivotally mounted on the wall 12 by means of a plurality of hinges 41 secured to the wall 12 directly above the discharge opening 35. Consequently, the door 38 is pivotally movable to open and close the discharge opening in the crib 11. The discharge door 38 has a flat base portion 39 and an upstanding arcuate wall portion 40 which cooperates with the portion 39 when the door is in a closed position, shown in full lines in Fig. 2, to cover both opening portions 35 and 36 of the overall discharge opening and to uncover both of these openings when the door is in an open position as shown in dotted lines in Fig. 2.

In order to provide a seal between the door 38 and the portions of the crib 11 which define the discharge opening, a pair of relatively narrow plates 44 are mounted on the upstanding arcuate portion 40 of the door 38 and overhang the edges thereof. Since the material which must be held in the crib 11 is of a coarse, granular nature, even though the door 38 fits quite loosely in the discharge opening, the plates 44 provide a satisfactory seal along the upper sides of the door. A similar set of plates 45 are provided along the side edges of the flat, bottom portion 39 of the door 38. It will be apparent that the plates 44 and 45 in addition to functioning as sealing members also act as stops to facilitate closing of the door 38. Although the sets of plates 44 and 45 satisfactorily seal the sides of the door 38 to the crib 11, a similar plate, located along the leading edge 46 of the door 38, has been found to be unsatisfactory since during the mixing operation some of the granular material becomes wedged between such a plate and the adjacent portion of the lower face of the bed plate 13. This thin layer of packed granular material remains on the bed plate 13 when the door 38 is opened and interferes with the closing of the door 38 after the crib 11 has been evacuated.

Therefore, in accordance with another feature of the present invention a seal is proved between the leading edge 46 of the door 38 and the adjacent portions of the bed and wear plates 13 and 14 by means of a narrow plate 51 secured to the bottom portion 39 of the door 38 through the medium of a spacer strip 52. Accordingly, the portion of the plate 51 which extends over the bed plate 13 is spaced at a substantial distance from it. Therefore, with the door 38 in a closed position, some of the granular material passes through the relatively large space between the edge 36 of the door 39 and the portion of the discharge opening through the plates 13 and 14 onto the shelf which is formed by the plate 51. The material in the crib, being of a granular nature, does not continue to flow out through this opening but builds up a cake of compressed material on the shelf as well as in the vertically disposed space between the edge 46 of the door and the adjacent edge of the discharge opening. Since the portion of the cake which is located on the plate 51 is quite thick, when the door 38 is opened to evacuate the crib 11, all or at least most of this cake falls off so that when the door 38 is again returned to a closed position only a small amount, if any, of the caked granular material is in a position to interfere with the closing of the door. It has been found in using apparatus constructed in accordance with the present invention that there is an insufficient amount of the cake remaining either on the plate 51 or on the bed plate 13 to interfere with the proper closing of the door 38. By using this sealing arrangement, a simple locking means, such as a lever 53 pivotally mounted by means of a pintle 54 secured to the bed plate 13, may be used for moving an integral locking member 55 beneath the adjacent plate 45 thereby to hold the door 38 in a closed position.

It will be understood that the present invention has been described in connection with a manually operable door but that suitable hydraulic or pneumatic cylinders or any other suitable means may be used for opening and closing the door and, moreover, these devices can be controlled by an automatic timing circuit which opens the door after the mixer has been operated for a predetermined time and closes it after a predetermined time has elapsed. In this manner automatic operation of the mixer 10 is effected. Also, where the door 38 is operated manually, its center of gravity is so disposed that when released it hangs in the position shown in dotted lines in Fig. 2 so that the door 38 acts as a deflector during evacuation of the crib 11 to direct the granular material below the lower portion 36 of the discharge opening so that a suitable truck or hopper placed thereunder may be used to collect the granular material evacuated through the discharge opening.

While the invention has been described by means of a particular embodiment thereof, it will be understood that those skilled in the art may make many changes and modifications without departing from the true spirit and scope of the invention, and accordingly, all such changes and modifications which fall within the true spirit and scope of this invention are intended to be covered in the appended claims.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a mixer of the type employing rotatable mullers and mixing elements to mix material, a crib including vertical side walls and a bottom wear plate secured throughout the periphery thereof to said side walls, means

defining an opening in said wear plate adjacent to one of said walls, means defining an opening in said side wall at a position adjacent to and aligned with the opening in said wear plate, a discharge door hingedly mounted on said crib above the opening in said side wall for pivotal movement on said crib, said door being substantially L-shaped in cross section and including a base portion for reception in the opening in said wear plate and an upstanding portion for reception in the opening in said side wall, a plurality of narrow plates secured to the upright portion of said door and extending beyond the vertical side edges thereof, another plurality of narrow plates secured to the bottom portion of said door and extending beyond the side edges thereof, and a narrow plate secured to said door and extending beyond the leading edge of the bottom of said door, said last-mentioned plate being spaced a substantial distance below the bottom of said door so that when said door is in a closed position said plate overlaps a portion of said wear plate and is spaced a substantial distance therefrom.

2. A closure for a discharge opening in the side and bottom of a mixer crib, comprising an L-shaped door pivotally attached to the wall of said crib above said opening, said door being dimensioned for reception in said opening, a plurality of narrow plates secured to the sides of the portion of said door receivable in the opening in the bottom of said crib, a narrow plate secured to said door and extending beyond the leading edge of the bottom of said door, said last-mentioned plate being spaced a substantially greater distance below the bottom of said door than

said plurality of narrow plates so that when said door is in a closed position said plate overlaps a portion of said wear plate and is spaced a substantial distance therefrom, and a latch mounted on said crib and movable to a position behind said door to secure it in a closed position.

3. In a mixer of the type employing rotatable mullers and mixing elements to mix material, a crib including vertical side walls and a bottom wear plate secured throughout the periphery thereof to said side walls, means defining an opening in said wear plate adjacent to one of said walls, means defining an opening in said wall at a position adjacent to and aligned with the opening in said wear plate, a discharge door hingedly mounted on said cribe above the opening in said side wall for pivotal movement on said crib, said door being substantially L-shaped in cross section and including a base portion for reception in the opening in said wear plate and an upstanding portion for reception in the opening in said side wall, and a plurality of narrow plates secured to said door and extending beyond the edges thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

2,200,825	Hund	May 14, 1940
2,303,319	Beardsley et al.	Dec. 1, 1942
2,377,307	Brown	June 5, 1945
2,471,487	Granath	May 31, 1949
2,603,381	Bilek	July 15, 1952
2,610,802	McIlvaine	Sept. 16, 1952
2,652,174	Shea	Sept. 15, 1953