Dec. 29, 1942. E. O. BEARDSLEY ET AL 2,306,422

MULLING APPARATUS

Filed Aug. 30, 1940 3 Sheets-Sheet 1

Fig. 1

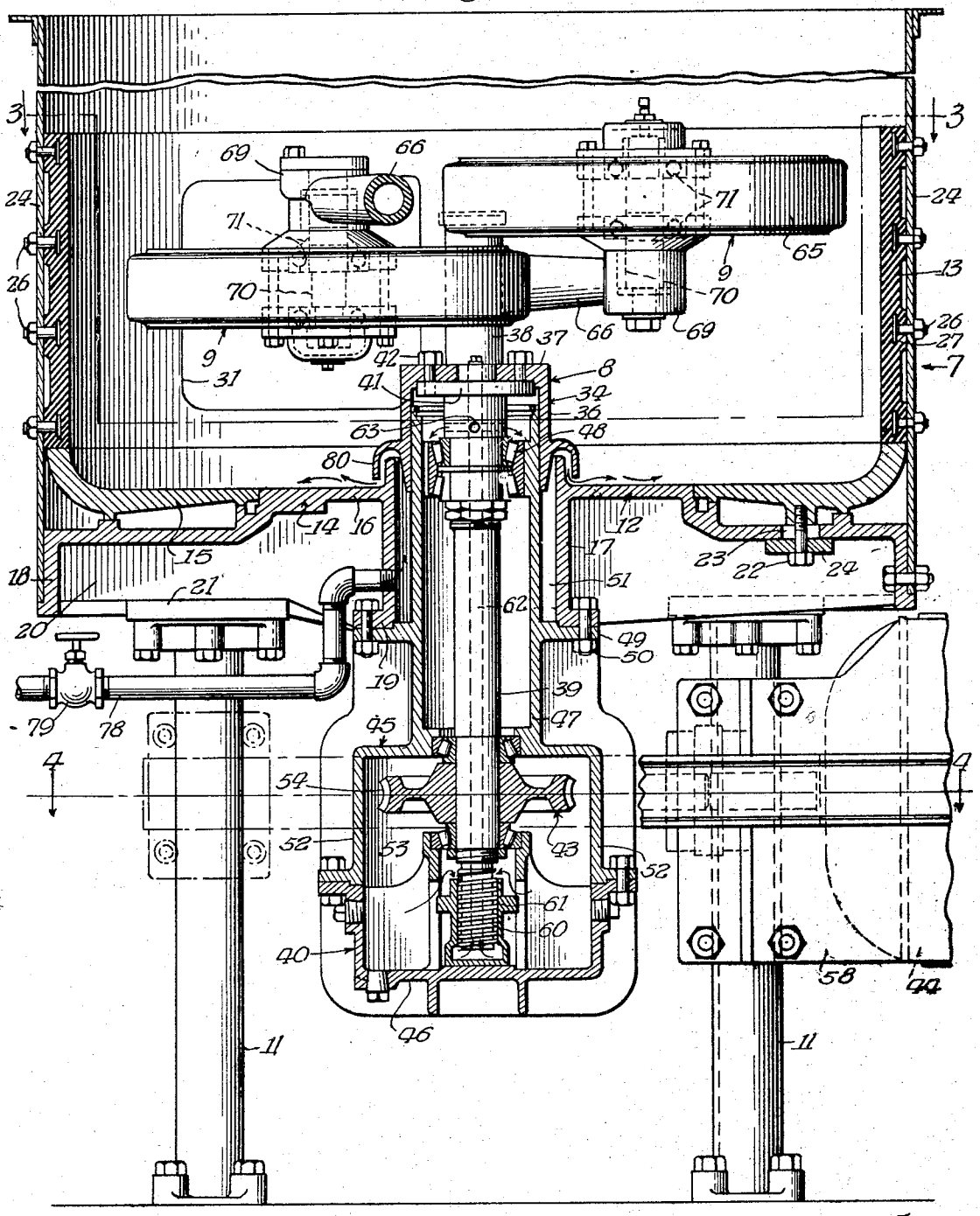

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Fig. 2

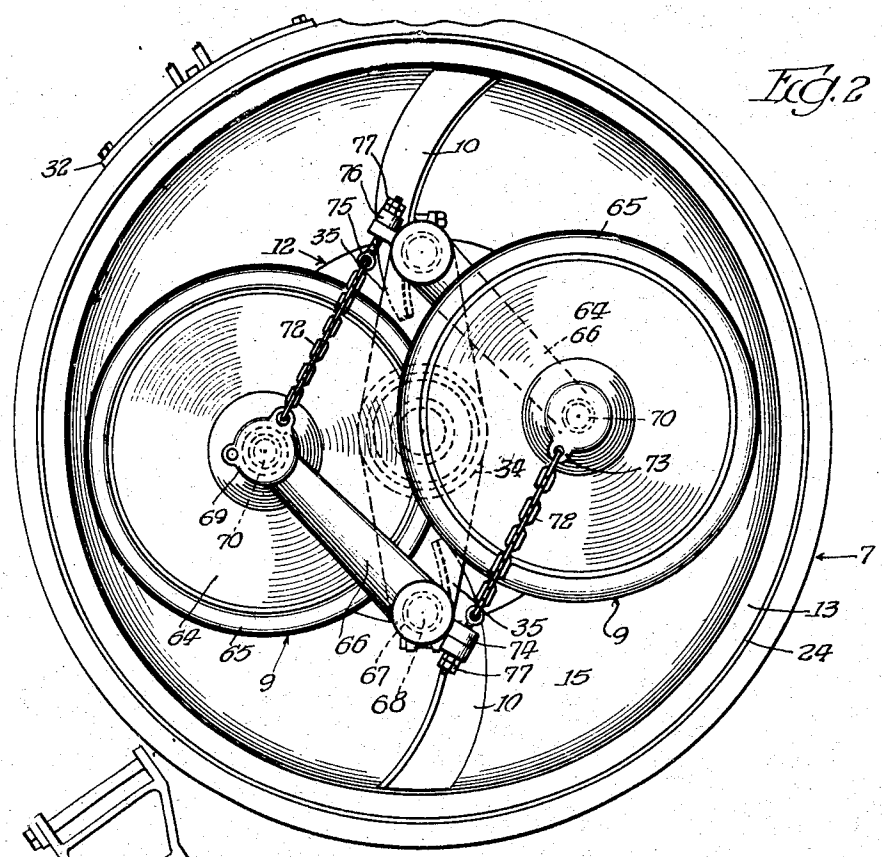

Fig. 3

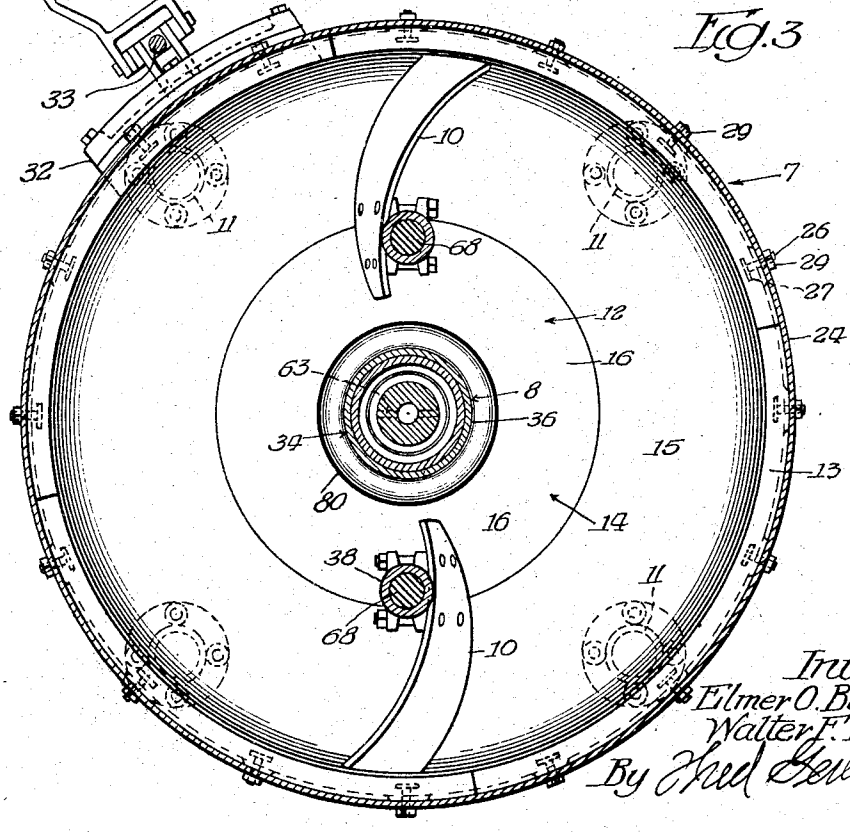

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FIG. 4

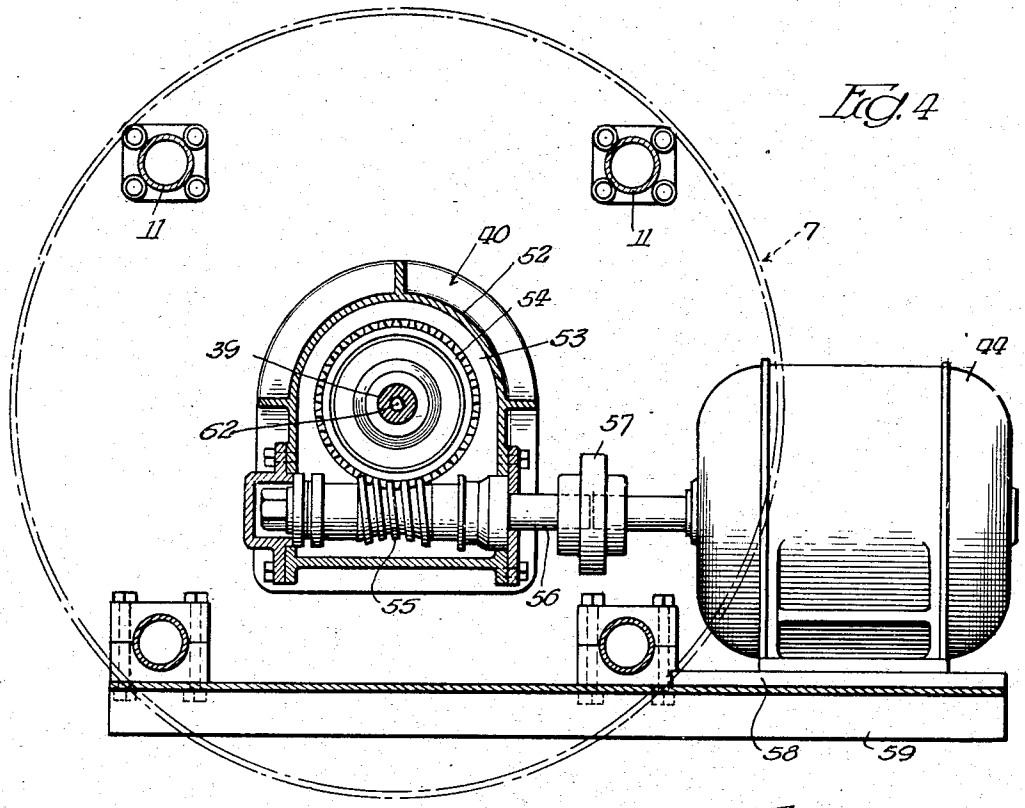


FIG 6

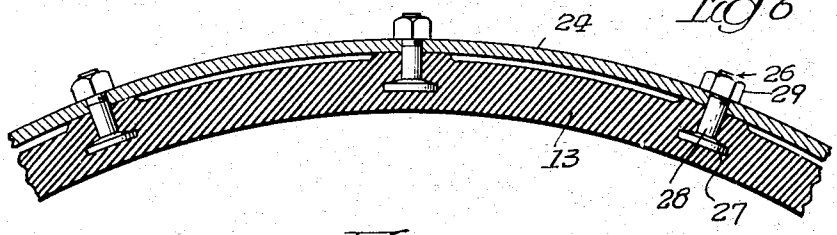
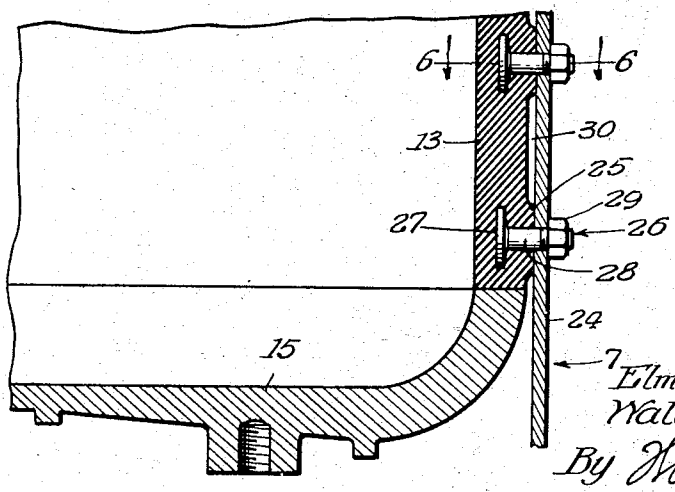


FIG. 5



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UNITED STATES PATENT OFFICE

2,306,422

MULLING APPARATUS

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Application August 30, 1940, Serial No. 354,814

14 Claims. (Cl. 83—45)

The present invention relates generally to apparatus for mulling or conditioning granular material. More particularly the invention relates to that type of mulling apparatus which is especially designed or adapted for use in a foundry or like establishment in connection with the mulling, mixing or conditioning of molding sand and, as its main or principal parts, comprises (1) a bowl-like sand retaining receptacle which is suitably supported above the floor of the foundry in which the apparatus is used and embodies a circular disk-like bottom and an annular side wall around and extending upwardly from the margin of the bottom; (2) a rotary horizontally extending crosshead which is disposed in the central portion of the receptacle and is driven at a comparatively high speed by power means such as an electric motor and speed-reducing gearing beneath the receptacle; (3) a plurality of rotary mulling elements which are carried by the crosshead and are adapted during drive of the latter to travel in a circular course around the inner face of the receptacle side wall and at the same time to spin or roll and effect mulling of the sand by squeezing it against the annular side wall; and (4) a set of plow-like deflectors which are carried by the crosshead in front of the mulling elements and operate during a mulling operation to deflect the sand in the receptacle upwardly and outwardly against the receptacle side wall and into the path of the rotary mulling elements.

One object of the invention is to provide a mulling apparatus of this type which is more practical and efficient than previously designed apparatus of the same general character and, in addition has materially longer life.

Another object of the invention is to provide a mulling apparatus of the type under consideration in which the receptacle side wall about which the mulling elements travel during operation of the apparatus, is in the form of a liner and is removably secured within a cylindrical shell so that it may be removed and replaced in the event of wear.

Another object of the invention is to provide a mulling apparatus of the last-mentioned type and character in which the removable liner constituting the annular side wall of the receptacle, is formed of tough vulcanized rubber or like resilient friction material. By forming the liner of tough vulcanized rubber or the like, the tendency of the batch or mass of sand in the receptacle to work or travel around the receptacle in connection with operation of the apparatus, is greatly reduced. In addition, it is unnecessary in certain instances to employ scrapers for scraping the sand from the inner face of the receptacle side wall since the liner, because of its resiliency, returns to its normal position after the sand is compressed thereagainst by the elements and hence rids itself of the sand.

Another object of the invention is to provide a mulling apparatus of the aforementioned type in which the outer marginal portion of the receptacle bottom, that is, the portion over which the deflectors travel during operation of the apparatus, is separate from the inner portion and is removably held in place so that it may be removed and replaced in the event that it becomes worn or is injured or damaged as the result of pieces of scrap metal becoming lodged or wedged under the deflectors.

A further object of the invention is to provide a mulling apparatus in which the rotary mulling elements are carried by the crosshead in a novel and improved manner.

A still further object of the invention is to provide a sand mulling apparatus which is of generally new and improved construction and not only occupies but a comparatively small space but also effectively and efficiently fulfills its intended purpose.

Other objects of the invention and the various advantages and characteristics of the present mulling apparatus will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawings which accompany and form a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Figure 1 is a vertical section of a mulling apparatus embodying the invention;

Figure 2 is a plan view illustrating the arrangement and design of the mulling elements and plow-type deflectors;

Figure 3 is a horizontal section taken on the line 3—3 of Figure 1 and showing in detail the means for introducing water onto the bottom of the receptacle;

Figure 4 is a horizontal section taken on the line 4—4 of Figure 1 and illustrating the construction of the speed reducing gearing which, together with the electric motor, constitutes the power means for driving the crosshead;

Figure 5 is an enlarged fragmentary section of the side wall of the receptacle, showing the de-

sign and construction of the tough vulcanized rubber liner and disclosing the manner in which the liner is secured to the cylindrical shell that extends therearound and supports it; and

Figure 6 is a horizontal section on the line 6—6 of Figure 5.

The apparatus which is shown in the drawings constitutes the preferred form or embodiment of the invention. It is essentially designed or adapted for use in a foundry in connection wth the treatment of molding sand, serves or operates, as hereinafter described, to mull, mix or recondition the sand, and comprises a bowl-like sand retaining receptacle 7, a rotary crosshead 8, a pair of rotary mulling elements 9, and a pair of plow type deflectors 10. The crosshead is disposed in the receptacle and carries the mulling elements 9 and the deflectors 10. It is driven at a comparatively high speed, as hereinafter described and operates, during drive, to cause the mulling wheels to travel in a circular course around the receptacle and effect mulling of the sand by squeezing it against the receptacle side walls.

The receptacle 7 is supported over the floor of the foundry or other establishment in which the apparatus is employed by way of a plurality of vertically extending legs 11. It is adapted to be charged or filled with a batch of sand to be mulled or otherwise conditioned for molding purposes and comprises a circular disk-like bottom 12 and an annular upstanding side wall 13. The bottom is of composite design and consists of an inner part 14 and an outer part 15. The inner part 14 is preferably in the form of a casting and comprises a flat horizontally extending ring-shaped intermediate piece 16, a vertically extending tubular inner piece 17, and a flange-like outer piece 18. The intermediate piece 16 of the inner part 14 defines or constitutes the inner marginal portion of the receptacle bottom 12. The tubular inner piece 17 is located at the center of the receptacle and embodies at the lower end thereof an outturned annular flange 19. The upper end of the tubular inner piece 14 projects above, and is formed integrally with, the inner margin of the intermediate piece 16, as shown in Figure 1. The flange-like outer piece 18 of the inner part 14 of the receptacle bottom wall 12 extends downwardly from the outer margin of the intermediate piece 16, then outwardly and then downwards. It is formed integrally with the intermediate piece 16 and underlies and supports the outer part 15 of the receptacle bottom 12. In addition to the intermediate inner and outer pieces the inner part 14 embodies four vertically extending webs 20. The latter project radially outwards from the tubular inner piece 17 and have, on the bottom portions thereof, laterally extending pads 21 which rest on, and are bolted or otherwise fixedly secured to, the upper ends of the vertically extending legs 11. The outer part 15 of the receptacle bottom 12 defines or constitutes the outer marginal portion of the bottom. It is ring-shaped as shown in Figure 1 and is removably secured in place by an annular series of vertically extending bolts 22. The inner margin of the outer part 15 is flat and abuts against and forms an outer continuation of the intermediate piece 16 of the inner part 14 of the bottom. The outer margin of the outer part 15 is curved so that it extends outwards and then upwards. It is curved substantially quadrantally and underlies and supports the bottom margin of the annular side wall 13. The bolts 22, whereby the outer part 15 is removably secured in place, extend through radially extending slots 23 in the flange-like outer piece 18 of the inner part 14 of the receptacle bottom and are so arranged that the heads thereof are at the bottom and the threaded shanks at the top. Washers 24 overlie the heads of the bolts and are clamped thereby against the flange-like outer piece 18 of the casting formed inner part 14. The externally threaded shanks of the bolts fit within internally threaded sockets in the outer part 15 of the receptacle bottom wall. When it is necessary to replace the outer part 15 because of wear, injury or damage, it is only necessary to remove the side wall 13 and then remove the bolts 22. As soon as the bolts are removed from their normal or operative position, the outer part 15 of the receptacle bottom wall 12 is released or freed and hence may be removed merely by raising it. The receptacle side wall 13 is cylindrical and rests upon and extends upwardly from the outer margin of the outer part 15 of the receptacle bottom 12. It is formed of resilient friction material such as tough vulcanized rubber and is supported and reinforced by a cylindrical shell 24. The latter is preferably formed of rolled steel and has the lower end thereof bolted to the downwardly extending outer portion of the flange-like outer piece 18 of the inner part 14 of the receptacle bottom wall. The tough vulcanized rubber side wall 13 has a smooth inner periphery or face and embodies on its outer periphery a plurality of equidistantly spaced integral bosses 25. It is adapted to have the sand squeezed thereagainst by the mulling elements 9 and is removably secured in place by means of bolts 26. The latter project outwards from the side wall 13 and consist of heads 27 and externally threaded shanks 28. The heads are embedded in the bosses 25 on the outer periphery of the receptacle side wall, as shown in Figures 5 and 6. The shanks 28 of the bolts 26 project outwards through holes in the cylindrical shell 24 and carry nuts 29. When these nuts are tightened the tough vulcanized rubber side wall 13 of the receptacle is clamped against the cylindrical shell 24. When the nuts are removed from the shanks of the bolts 26 the annular side wall 13 of the receptacle may be removed. By reason of the fact that the receptacle side wall is formed of tough vulcanized rubber or like resilient friction material, it is wear-resisting. When the apparatus is in operation the scraper-type deflectors 10 serve, as hereinafter described, to throw the sand against the inner face of the receptacle side wall 13 and into the path of the mulling elements 9. Due to the fact that the mulling elements travel at a comparatively high speed (approximately 90 R. P. M.) there is a tendency for the mass or batch of sand to work or move around the receptacle side wall. By forming the side wall of rubber or like material having a high coefficient of friction, any tendency of the mass or batch of sand to move around the side wall during use of the apparatus is retarded or counteracted and hence quicker mulling of sand is effected. Another advantage or feature of forming the receptacle side wall 13 of tough vulcanized rubber resides in the face that it is unnecessary in certain or in most instances to employ scrapers for scraping the mulled sand from the inner face or periphery of the side wall. This is directly attributable to the fact that after squeezing of the sand against the side wall, the side wall springs back or returns to its normal position and hence rids itself of

the mulled sand. Because the side wall 13 embodies the bosses 25 on its outer periphery, there are numerous spaces 30 between such outer periphery and the inner periphery of the cylindrical shell 24. Such spaces permit the vulcanized rubber side wall 13 of the receptacle to flex inwards and outwards to a limited extent in connection with travel of the mulling elements therearound and hence result in more efficient or effective inward discharge of the mulled sand from the side wall. For convenience in installation and removal, the receptacle side wall 13 is formed of sections (see Figures 2 and 3). By reason of the fact that the shell 24 is formed of rolled steel instead of cast metal, the receptacle is extremely durable and may be manufactured or produced at a low cost. A doorway 31, through which the mulled sand may be discharged from the receptacle, is cut or otherwise formed in the receptacle side wall 13 and the shell 24. This doorway is normally closed by means of a door 32 which is hinged at one side thereof so that it may be swung outwardly into an open position in connection with discharge of the mulled sand from the receptacle and at the completion or end of a mulling operation. The door 32 is formed of an inner part of tough vulcanized rubber and an outer part of rolled steel and is shifted back and forth between its closed and open positions by means of a fluid pressure actuated cylinder-piston type device 33. When the apparatus is to be used a batch of molding sand is dumped or otherwise delivered into the receptacle and is then after mulling by the mulling elements 9, discharged via the doorway 31.

The crosshead 8 carries or supports the mulling elements 9 and the deflectors 10, as hereinbefore pointed out, and is in the form of a one-piece casting. It is positioned in the central portion of the receptacle 7 directly above the receptacle bottom 12 and consists of a hub 34 and a pair of outwardly extending legs 35. The hub of the crosshead is in the form of an inverted cup and consists of a cylindrical side wall 36 and top wall 37. The legs 35 are joined to and extend radially from the side wall 36 of the hub 34 and are positioned one diametrically opposite the other. They extend horizontally and are provided at the outer ends thereof with vertically elongated socket forming members 38. The crosshead 8 is mounted on the upper end of a vertically extending shaft 39 and is driven by the latter. The aforementioned shaft extends through the tubular inner piece 17 of the inner part 14 of the receptacle bottom and is surrounded or enclosed by a housing 40. The upper end of the shaft 39 is provided with an enlarged head 41 and this is disposed in the hub 34 of the crosshead and underlies the top wall 37 of the hub. Bolts 42 extend through said top wall 37 and the head 41 and serve fixedly to secure the crosshead to the upper end of the shaft. The shaft 39 is driven by means of speed reducing gearing 43 in the housing 40 and an electric motor 44 outside of the housing. The housing 40 is of two-piece design and consists of an upper section 45 and a lower section 46. The upper section has a tubular upper part 47. This part is of less diameter than the tubular inner piece 17 of the inner part 14 of the receptacle bottom wall 12. The upper end of the tubular part 47 extends through said tubular inner piece 17 and fits within the cylindrical side wall 36 of the crosshead hub 34. A roller bearing 48 is interposed between the upper end of the tubular upper part 47 of the upper housing section 45 and the upper end of the shaft 39 and serves as a journal for the shaft. An annular outwardly extending flange 49 is formed on the central portion of said tubular part 47 and this is connected by bolts 50 to the outwardly extending annular flange 18 at the lower end of the tubular inner piece 17 and defines, with said tubular inner piece and the upper end of the upper tubular part 47 of the upper housing section 45, an annular space 51 having a closed bottom and an open upper end. In addition to the tubular part 47, the upper section 45 of the housing 40 has an enlarged flange-equipped part 52. The lower section 46 of the housing is bolted to the flange of the part 52 and defines, with said part, a compartment 53 for the speed reducing gearing 43. Such gearing comprises a worm gear 54 and a worm 55. The worm gear is keyed or otherwise fixedly secured to the lower end of the shaft 39 and meshes with, and is driven by, the worm 55. The worm is formed as an integral part of a horizontally extending shaft 56 and this shaft is journaled in suitable bearings in the compartment 53 and projects through the lower part 52 of the upper housing section 45 and is connected by a coupling 57 to the armature shaft of the electric motor 44. A bracket 58 is carried by a channel beam 59 on two of the legs 11 for supporting the receptacle 7 and this bracket serves as a rigid support for the motor 44. When current is supplied to the motor the worm 55 is driven from the armature shaft of the motor and in turn operates to drive the worm gear 54. Drive of the worm gear serves to rotate the shaft 39 together with the crosshead 8. The bottom part of the speed reducing gearing compartment 53 is adapted to be filled with a liquid type lubricant such as oil. The lower end of the shaft 39 is provided with a male or external screw thread 60 and this fits within a sleeve 61 in the bottom of the compartment 53. The upper end of the sleeve is open so as to receive oil from the compartment 43 and the lower end of the sleeve is closed. The shaft 39 has a longitudinal bore 62 therein and this bore is open at its lower end and communicates with crossports 63 at its upper end. The crossports are formed in the upper end of the shaft 39 and are disposed above the roller bearing 48. When the shaft 39 is driven in connection with operation of the apparatus the external screw thread 60 at the lower end of the shaft 39 operates to force oil from the bottom of the compartment 53 into the bottom of the sleeve 61 and thence upward through the bore 62 to the crossports 63. The oil so forced by the screw thread 60 is discharged through the crossports 63 onto the bearing 48 and then, after lubricating the bearing, flows downwards onto the worm 55 and thence back to the compartment 53. The external screw thread 60 at the lower end of the shaft 39, the sleeve 61, the bore 62 and the crossports 63 constitute simple means for supplying the bearing 48 with oil from the bottom of the compartment 53 in the housing 40.

The mulling elements 9 are disposed in the upper portion of the receptacle 7 and are in the form of wheels. They consist of cast metal bodies 64 and solid rubber tires 65 and are carried by a pair of horizontally extending arms 66 so that they are permitted to swing outwards toward the receptacle side wall 13. The arms 66 are disposed above the crosshead 8 and project away from the outer ends of the crosshead legs 35. The inner ends of the arms 66 are fixedly secured

to a pair of vertically extending sleeve-like members 67 and these are rotatably mounted on the upper ends of a pair of shafts 68. The lower ends of such shafts fit within and project beneath the socket-like members 38 at the outer ends of the legs 36 of the crosshead. The shafts, together with the sleeve 67, form pivotal connections between the arms 66 and the crosshead whereby the arms, together with the wheel-type mulling elements 9, are permitted to swing outwards in response to centrifugal force during drive of the crosshead. The distal ends of the arms 66 are provided with enlarged brackets 69 and these serve to support a pair of vertically extending shafts 70. The bodies 64 of the mulling elements 9 are mounted on the shafts 70 by way of ball bearings 71 to the end that the elements are permitted to rotate or freely spin with respect to the shafts 70. The solid rubber tires 65 are suitably mounted on the rim portions of the bodies 64 of the mulling elements and are adapted, during operation of the apparatus, yieldingly to engage the sand between them and the adjacent portion of the receptacle side wall and to squeeze such sand so that the grains roll relatively to one another and effect a substantially uniform distribution of any bonding material which is introduced into the sand either before or after the sand is delivered into the receptacle 7. As a result of the fact that the mulling elements are free to swing outwards in response to the action of centrifugal force, the sand between the tires 65 and the adjacent portion of the receptacle side wall is subjected to a pronounced squeezing action and any and all lumps therein are effectively disintegrated. The two wheel-type mulling elements 9 are disposed above the crosshead 8, as shown in Figure 2, and are vertically offset. The elements are vertically offset by arranging one of the arms 66 above the other (see Figure 1) and having the shaft 70 for the higher arm project downwardly and the shaft 70 for the other or lower arm extend upwardly. Due to the specific arrangement of the shafts the higher mulling element is disposed above its arm 66 and the lower element is disposed beneath its arm. By having the elements above the crosshead and vertically offset, large sized elements may be employed and this is essential if maximum efficiency is to be obtained, especially in a small sized apparatus. Preferably the wheel-type mulling elements 9 are of such size that the diameter thereof is approximately half the diameter of the receptacle 7. When elements of this size are used they lap one another, as shown in Figure 2. In order to restrict or limit outward swing of the two mulling elements in connection with operation of the apparatus, two chains 72 are provided. These chains extend between lugs 73 on the enlarged brackets 69 at the distal ends of the arms 66 and lugs 74 at the outer ends of the crosshead legs 35. The ends of the chains adjacent the lugs 74 embody bolts 75 and these extend through holes in the lugs 74 and have rubber bumpers 76 and lock nuts 77 for resiliently anchoring them in place.

The plow-type deflectors 10 are fixedly secured to, and project outwardly from, the lower end of the shafts 68 at the outer ends of the legs 35 of the crosshead. They are disposed in front of the mulling elements 9 and are so shaped that the entire batch or mass of sand in the receptacle is caused, during drive of the crosshead, to move upwards against the inner face of the receptacle side wall and into the path of the mulling elements. As shown in Figures 1, 2 and 3, the deflectors 10 directly overlie and are adapted to sweep over the outer part 15 of the receptacle bottom 12. The outer ends of the deflectors are vertically elongated. They are rearwardly canted and are adapted to sweep around the lower portion of the side wall 13. By having the outer part 15 of the receptacle bottom 12 removable, as hereinbefore pointed out, it is possible readily to replace such part should the latter be damaged as a result of pieces of scrap becoming lodged under the outer ends of the deflectors.

In order to permit the operator of the apparatus to moisten the sand in the receptacle during mulling thereof, a water supply pipe 78 is provided. This pipe includes a control valve 79 and leads under the receptacle bottom. It is connected at one end thereof to receive water under pressure from any suitable source of supply and has its other end connected to the tubular inner piece 17 of the inner part of the receptacle bottom 12 in such manner that it communicates with the annular or ring-shaped space 51. When the valve 79 is opened, water flows through the pipe 78 and into the space 51, then flows upwards through such space to the top of said tubular inner piece 17. At this point the water spills over the upper end of the piece 17 and flows into the central portion of the receptacle and over the receptacle bottom 12. The plow-type deflectors 10 operate, when sand is in the receptacle and in connection with the operation of the apparatus, to fling the water upwards into contact with the sand for sand-moistening purposes. It is contemplated that a portion of the water which is used for sand-moistening purposes be introduced onto the bottom of the receptacle before delivery of the sand to be mulled into the receptacle. When a small amount of water is so flowed or delivered onto the central portion of the receptacle bottom, the scrapers fling such water outwards over the outer part 15 of the receptacle bottom in such manner that any sand which has accumulated thereon is washed away or loosened. By ridding the part 15 of any packed or gummy sand prior to a mulling operation, wear of the part is reduced to a minimum. If sand were allowed to build up or accumulate on the part 15, wear of the part as well as the deflectors, would occur. By providing means for introducing water onto the central portion of the receptacle bottom so that the deflectors fling such water outwards and wash away any caked or hardened sand on the outer part 15 of the receptacle bottom, the life of the part as a whole is greatly increased. The central portion of the tubular side wall 36 of the crosshead 34 is provided with an outwardly and downwardly extending flange 80, as shown in Figure 2. This flange overlies the upper end of the tubular inner piece 17 of the central part 14 of the receptacle bottom and prevents sand, dirt or dust from entering the top of the annular space 51. By reason of the fact that the upper end of the tubular piece 17 projects above the inner part 14 there is at all times a water seal.

When it is desired to use the apparatus the electric motor 44 is started by closing the switch therefor. This results in comparatively high speed drive of the crosshead 8 and causes the mulling wheels 9 and the plow-type deflectors 10 to swing or revolve in a circular course within the receptacle. After the crosshead has been set in motion by starting of the electric motor, the valve

19 for controlling the flow of water under pressure through the pipe 18 is opened for a sufficient length of time to cause the desired and proper amount of water to flow onto the bottom wall 12 of the receptacle. As soon as the water starts to flow onto the receptacle bottom the scraper-type deflectors 10 fling such water outwards over the top face of the outer part 15 of the bottom 12 and this results in washing away and removal of any sand which has accumulated on the operating face of the part 15 of the receptacle bottom wall in connection with previous use of the apparatus. After the desired and necessary amount of water has been introduced onto the receptacle bottom, the batch of sand to be mulled is dumped or otherwise delivered into the receptacle. As the sand drops downwards toward the receptacle bottom 12, it comes in contact with the plow-type deflectors 10 and is flung outwards and upwards towards the central and upper portions of the inner periphery or surface of the tough vulcanized rubber receptacle side wall 13 and into the path of the wheel-type mulling elements 9. When the elements contact the sand on the receptacle side wall they squeeze the sand and effect not only mulling thereof but also substantially uniform distribution of any bonding material in the sand. The sand is subjected to repeated upward and outward flinging by the deflectors and squeezing or mulling by the elements 9 and in this manner it is mulled or conditioned. The deflectors 10 are so designed that they maintain substantially the entire batch or mass of sand in suspension, that is, above the receptacle bottom 12. They also so scatter the sand that the latter is appreciably aerated. If water is introduced over the bottom of the receptacle while the sand is being mulled, the deflectors fling or direct the water upwards into contact with the sand and the sand is thus moistened. At the conclusion of the mulling operation the door 32 is swung into its open position by manipulation or control of the device 33. As soon as the door reaches its fully opened position sand is discharged through the doorway 31 by the plow-like deflectors 10. Should it be necessary or desired to replace the rubber side wall 13 of the receptacle, it is only necessary to remove the nuts 29 from the shanks 28 of the bolts 26 and then remove the side wall sections from the cylindrical rolled steel shell 24. After removal of the side wall 13 a new side wall is manipulated into place. Should the outer part 15 of the receptacle bottom 12 become worn or require replacement due to injury or damage, it is only necessary to remove the bolts 22 and then lift the part 15 from the receptacle 7.

The herein described mulling apparatus effects an efficient and quick mulling of the sand and is rugged as well as durable. It may be manufactured at a comparatively low and reasonable cost due to the design and construction of the receptacle and the speed reducing gearing for driving the crosshead, and requires substantially no servicing or repair.

Whereas the apparatus has been described as adapted primarily for use in mulling or conditioning molding sand and as comprising two wheel-type mulling elements and two plow-type deflectors, it is to be understood that it may be used in connection with the conditioning or treatment of other granular material and may be built or made with a single mulling element and a single deflector or with more than two mulling elements and a corresponding number of deflectors. It is also to be understood that the invention is not to be restricted to the details set forth since these may be modified or changed within the scope of the appended claims without departinging from the spirit and scope of the invention.

Having thus described the invention, what we claim as new and desire to secure by Letters Patent is:

1. A mulling apparatus comprising a bowl-shaped receptacle adapted to contain the material to be mulled and embodying a bottom and in addition an annular side wall extending upwardly substantially vertically from the bottom having a smooth inner face, and formed of material that is resilient and has a comparatively high coefficient of friction, a mulling element in the receptacle mounted to travel in a circular course around said side wall and adapted during travel to squeeze the material between it and said side wall and thus effect mulling of the material, power means for propelling the element in said circular course, and a plow type deflector mounted in front of, and for conjoint travel with, the mulling element and arranged and shaped to deflect the material outwards against the side wall and into the path of said mulling element during a mulling operation.

2. A mulling apparatus comprising a bowl-shaped receptacle adapted to contain the material to be mulled and embodying a bottom and in addition an annuier removably mounted wall extending upwardly substantially vertically from the bottom, having a substantially smooth inner face, and formed of vulcanized rubber, a rotary mulling element in the receptacle mounted to travel in a circular course around said side wall and adapted during travel to spin and squeeze the material between it and said side wall and thus effect mulling of the material, a plow type deflector mounted in front of, and for conjoint travel with, the mulling element and adapted to deflect the material outwards against the side wall and into the path of said element during a mulling operation, and power means for propelling the element and deflector in said circular course.

3. A mulling apparatus comprising a stationary bowl-shaped receptacle adapted to contain the material to be mulled and embodying a bottom and in addition a rigid annular shell extending upwardly substantially vertically from the bottom and a removable liner type side wall extending around and fitting against the inner face of the shell, having a smooth inner face, and formed of material that is resilient and has a comparatively high coefficient of friction, a mulling element in the receptacle mounted to travel in a circular course around said side wall and adapted during travel to squeeze the material between it and said side wall and thus effect mulling of the material, power means for propelling the element in said circular course, and a plow type deflector mounted in front of, and for conjoint travel with, the mulling element and arranged and shaped to deflect the material outwards against the side wall and into the path of said mulling element during a mulling operation.

4. A mulling apparatus comprising a stationary bowl-shaped receptacle adapted to contain the material to be mulled and embodying a bottom and in addition a rigid annular shell extending upwardly substantially vertically from the bottom and a sectional liner type side wall fitting around the inner face of, and removably secured

to, the shell, having a smooth inner face, and formed of tough vulcanized rubber, a rotary mulling element in the receptacle mounted to travel in a circular course around said side wall and adapted during travel to spin and squeeze the material between it and said side wall and thus effect mulling of the material, a plow type deflector mounted in front of, and for conjoint travel with, the mulling element and adapted to deflect the material outwards against the side wall and into the path of said element during a mulling operation, and power means for propelling the element and deflector in said circular course.

5. A mulling apparatus comprising a bowl-shaped receptacle adapted to contain the material to be mulled and embodying a bottom and in addition a rigid annular shell extending upwardly substantially vertically from the bottom and an annular side wall of resilient friction material extending around the inner face of the shell and having protuberances and spaces between it and said inner shell face whereby portions thereof are permitted to flex or move back and forth to a limited extent, a mulling element in the receptacle mounted to travel in a circular course around said side wall and adapted during travel to squeeze the material between it and said side wall and thus effect mulling of the material, power means for propelling the element in said circular course, and a plow type deflector mounted in front of, and for conjoint travel with, the mulling element and arranged and shaped to deflect the material outwards against the side wall and into the path of said mulling element during a mulling operation.

6. A mulling apparatus comprising a bowl-shaped receptacle adapted to contain the material to be mulled and embodying a bottom and in addition a rigid annular shell extending upwardly substantially vertically from the bottom and an annular liner type side wall of vulcanized rubber extending around the inner face of, and removably secured to, the shell and having integral bosses and intermediate spaces between it and said inner face of the shell whereby portions thereof are permitted to flex or move inwards and outwards to a limited extent, a mulling element in the receptacle mounted to travel in a circular course around said side wall and adapted during travel to squeeze the material between it and said side wall and thus effect mulling of the material, a plow type deflector mounted in front of, and for conjoint travel with, the mulling element and adapted to deflect the material outwards against the side wall and into the path of said element during a mulling operation, and power means for propelling the element and deflector in said circular course.

7. A mulling apparatus comprising a bowl-shaped receptacle adapted to contain the material to be mulled and embodying a bottom and in addition an annular shell extending upwardly from the bottom and an annular liner type side wall of resilient friction material and sectional design extending around the inner face of the shell and having integral bosses and intermediate spaces between it and said inner face of the shell whereby portions thereof are permitted to flex or move back and forth to a limited extent, means for removably securing said side wall in place comprising bolts having the heads thereof embedded in the bosses and shanks extending through holes in the shell and provided with nuts, a mulling element in the receptacle mounted to travel in a circular course around said side wall and adapted during travel to squeeze the material between it and said side wall and thus effect mulling of the material, and power means for propelling the element in said circular course.

8. A batch type mulling apparatus comprising a stationary bowl-shaped receptacle adapted to contain the material to be mulled and embodying a circular bottom in the form of a fixed inner part and a removable ring-shaped outer part extending around the inner part and having the upper face thereof forming a continuation of the upper face of said inner part, and also embodying a separately formed annular side wall resting on and extending upwardly from the outer margin of said outer part, a mulling element in the receptacle mounted to travel in a circular course around said side wall and adapted during travel to squeeze the material between it and said side wall and thus effect mulling of the material, power means for propelling the element in said circular course, and a plow type deflector propelled by said means conjointly with said element and arranged so that it travels directly over said outer part and operates to move the material outwards and upwards against said side wall and into the path of the element.

9. A mulling apparatus comprising a stationary bowl-shaped receptacle adapted to contain the material to be mulled and embodying a circular bottom in the form of a fixed inner part comprising a flat disc-like piece and an outer downwardly and outwardly extending flange-like piece and a ring-shaped outer part around the disc-like piece of the inner part overlying and removably secured to said flange-like piece and having the upper face thereof forming a continuation of the upper face of said disc-like piece, and also embodying a separately formed annular side wall resting on and extending upwardly from the outer margin of said outer part, a rotary mulling element in the receptacle mounted to travel in a circular course around said side wall and adapted during travel to squeeze the material between it and said side wall and thus effect mulling of the material, power means for propelling the element in said circular course, and a plow-type deflector propelled by said means conjointly with said element and arranged so that it swings or travels directly over said outer part and operates to move the material outwards and upwards against said side wall and into the path of the element.

10. A mulling apparatus comprising a bowl-shaped receptacle adapted to contain the material to be mulled and embodying a circular bottom in the form of a fixed inner part comprising a substantially flat disk-like piece and a downwardly and outwardly extending outer ring-shaped flange-like piece and a ring-shaped outer part overlying and removably secured to said flange-like piece and having the upper surface thereof forming a continuation of the upper face of the disk-like piece of said inner part, and also embodying an annular shell extending upwardly from and secured to the outer margin of said flange-like piece and an annular side wall extending around and removably secured to said shell and joining and extending upwardly from the outer margin of said outer part of the bottom, a mulling element in the receptacle arranged to travel in a circular course around said side wall and adapted during travel to squeeze the material between it and said side wall and thus effect mulling of the material, means for

propelling the elements in said circular course, and a plow-like deflector propelled by said means conjointly with said element and arranged so that it swings or travels directly over said ring-shaped outer part and operates to move the material outwards and upwards against said side wall and into the path of the element.

11. A mulling apparatus comprising a bowl-like receptacle adapted to contain the material to be mulled and embodying a bottom and an annular side wall extending upwardly from the margin of the bottom, a cross-head in the central lower portion of the receptacle mounted to rotate about a vertical axis, a plurality of rotary wheel type mulling elements each having a diameter approximately half the diameter of the receptacle, said elements being carried by the cross-head so that they are disposed above the latter and adjacent said side wall and are in vertical offset as well as lapped relation with one another and being adapted during drive of the cross-head to travel in a circular course around the receptacle side wall and in addition to spin or roll and squeeze the material between them and said side wall, and power means for driving the cross-head.

12. A mulling apparatus comprising a bowl-like receptacle adapted to contain the material to be mulled and embodying a bottom and an annular side wall extending upwardly from the margin of the bottom, a cross-head in the lower central portion of the receptacle mounted to rotate about a vertical axis, a pair of opposed spaced apart horizontally extending arms disposed above the cross-head and in vertically offset relation and having certain of their ends pivotally connected to the cross-head so that they are free to swing in horizontal planes toward the receptacle side wall, the higher of the two arms having a downwardly extending shaft at its distal end and the lower of said arms having an upwardly extending shaft at its distal end, a pair of horizontally extending vertically offset wheel type mulling elements mounted one on the lower end of the first mentioned shaft and the other above the other arm on the upper end of the second mentioned shaft, and adapted during drive of the cross-head to travel in a circular course around the receptacle side wall and in addition to spin or roll and squeeze the material between them and the receptacle side wall, power means for driving the cross-head, and means connected to the cross-head for conjoint drive therewith for deflecting the material outwardly and upwardly toward said side wall and into the path of the mulling elements.

13. A mulling apparatus comprising a bowl-like receptacle adapted to contain the material to be mulled and embodying a bottom and an annular side wall extending upwardly from the margin of the bottom, an elongated cross-head in the lower central portion of the receptacle mounted to rotate about a vertical axis, a pair of opposed spaced apart horizontally extending arms disposed above the cross-head and at different elevations and having the outer ends thereof connected pivotally to the ends of the cross-head so that they are free to swing horizontally toward the receptacle side wall, the higher of said arms having a downwardly extending shaft at its inner or distal end and the lower of said arms having an upwardly extending shaft at its distal end, a pair of horizontally extending vertically offset and overlapping wheel type mulling elements of approximately one half the diameter of the receptacle, mounted one on the lower end of the first mentioned shaft and the other on the upper end of the second mentioned shaft and adapted during drive of the cross-head to travel in a circular course around the receptacle side wall and in addition to spin or roll and squeeze the material between them and the receptacle side wall, power means for driving the cross-head, and means connected to the cross-head for conjoint drive therewith for deflecting the material outwardly and upwardly toward said side wall and into the path of the mulling elements.

14. A mulling apparatus comprising a receptacle for the material to be mulled, a rotary cross-head disposed in the receptacle and having a depending drive shaft therefor extending through an opening in the receptacle bottom, a mulling element carried by the cross-head and adapted during drive of the latter to travel about the receptacle and mull the material, a vertically elongated housing with an oil sump in the bottom thereof, surrounding the shaft and having a bearing between its upper end and the upper end of the drive shaft, means for driving the shaft including a speed reducing gearing in the bottom portion of the housing, and means operative automatically during drive of the gearing to pump or flow oil from the sump to said bearing comprising a cup-shaped member surrounding the lower end of the shaft and disposed in, and adapted to receive oil from, the sump, a coacting screw thread on the lower end of the shaft and in the cup shaped member, and a duct extending longitudinally through the shaft and having the lower end thereof opening at the bottom of the cup-shaped member and its upper end communicating with the upper end of the housing at a point above said bearing.

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