May 17, 1938. W. H. NICHOLLS, SR 2,117,977

SAND MULLING MACHINE

Filed June 9, 1937 2 Sheets-Sheet 1

Fig. 1.

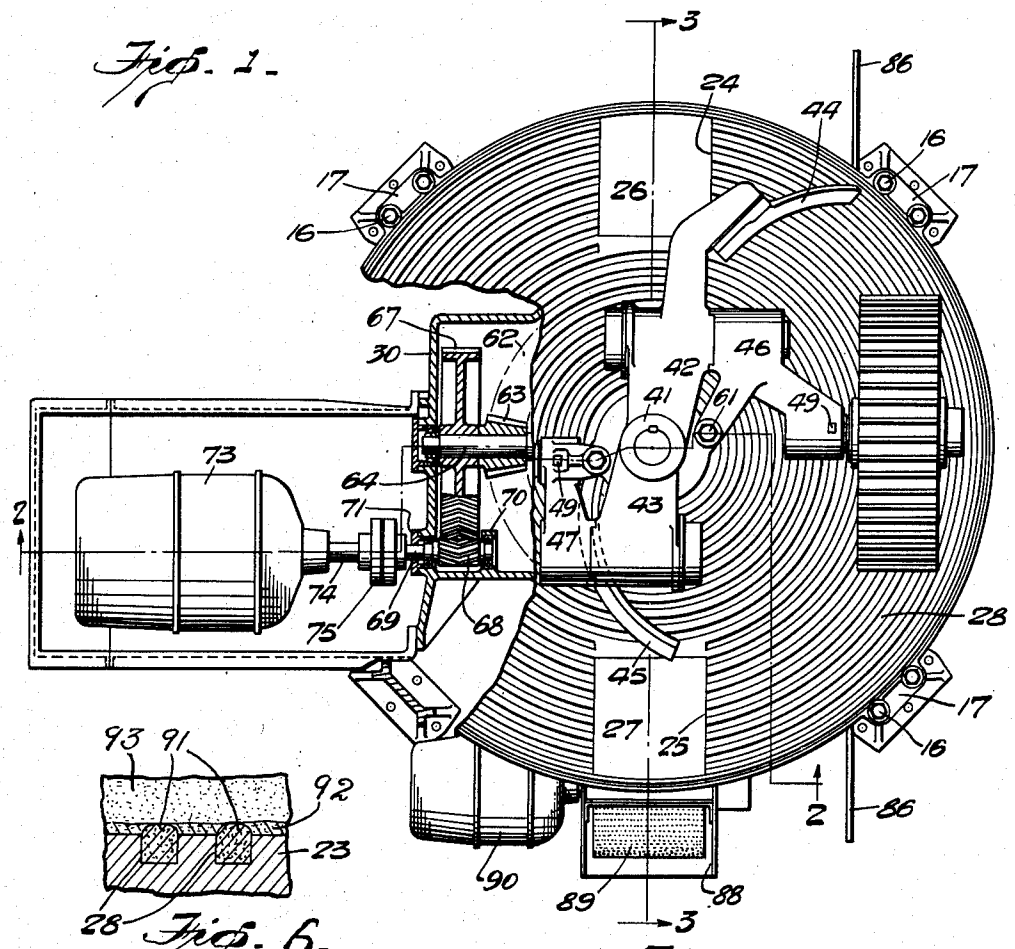
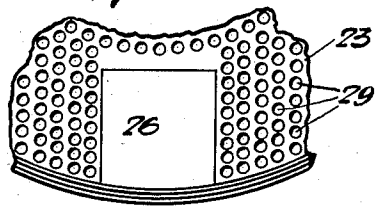


Fig. 6.

Fig. 5.



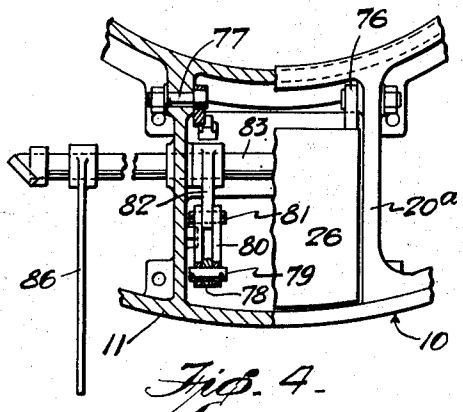


Fig. 4.

Inventor

William H. Nicholls, Sr., deceased

by William H. Nicholls, Jr.

Administrator.

By Ernest S. Mechlin

Attorney

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SAND MULLING MACHINE

Filed June 9, 1937 2 Sheets-Sheet 2

Fig. 2.

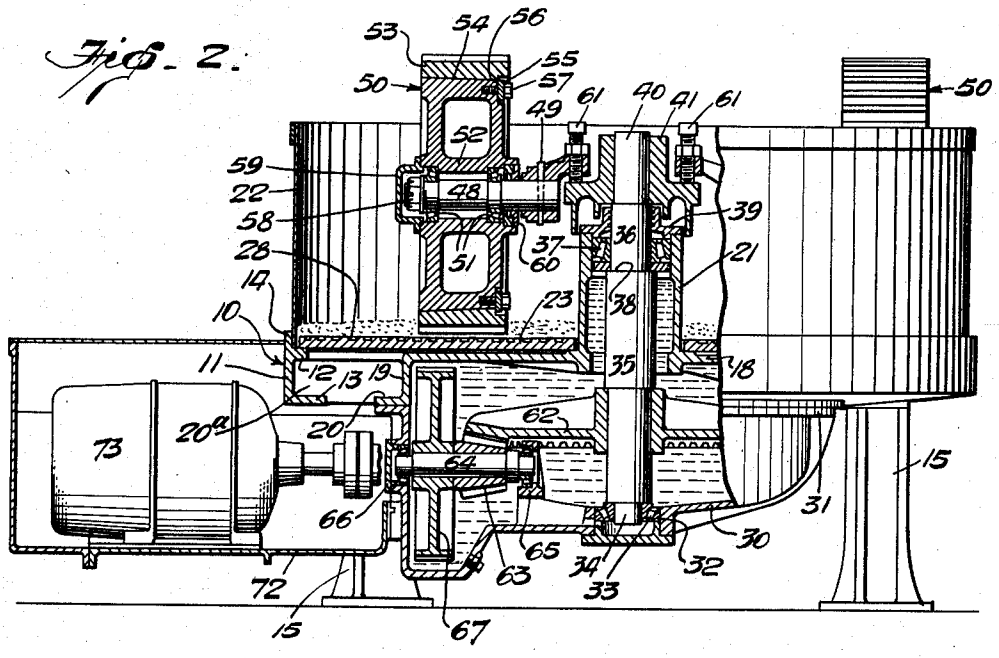
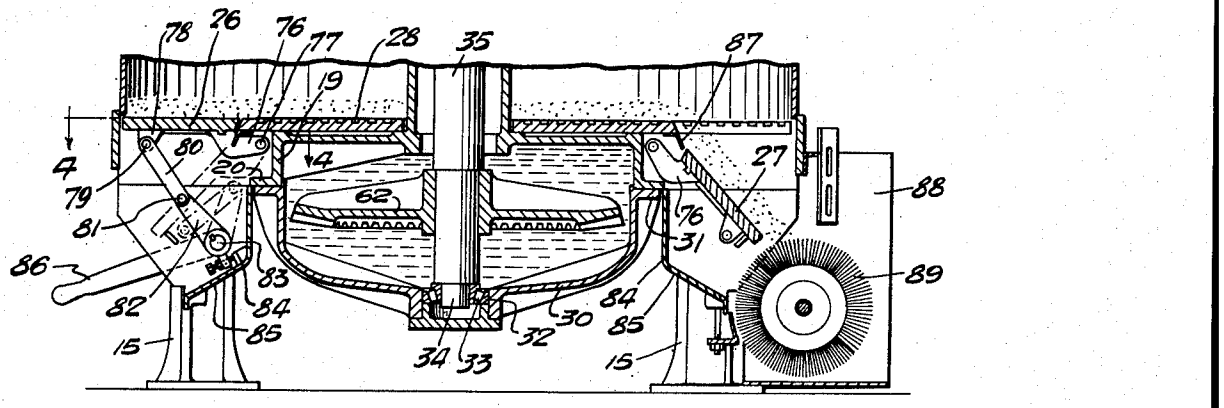


Fig. 3.



Inventor

William H Nicholls, Sr., deceased,

by William H. Nicholls, Jr.

Administrator

By Ernest S. Mechlin

Attorney

Patented May 17, 1938 2,117,977

UNITED STATES PATENT OFFICE

2,117,977

SAND MULLING MACHINE

William H. Nicholls, Sr., deceased, late of Roslyn, N. Y., by William H. Nicholls, Jr., administrator, Roslyn, N. Y., assignor to National Engineering Company, Chicago, Ill., a corporation of Illinois

Application June 9, 1937, Serial No. 147,336

15 Claims. (Cl. 22—89)

The invention relates to foundry equipment, particularly to means for preparing sand used in forming molds, and is an improvement over the disclosure in Patent No. 1,636,384 granted July 19, 1927 to William H. Nicholls and is also a continuation in part of the application of William H. Nicholls for Sand mulling and aerating machines, filed November 25th, 1935 and given Serial No. 51,540.

It is well known that machines of this general type embody rollers which are driven over the bottom of a mulling basin for the purpose of crushing or crumbling any lumps of sand, intermingling clay with the sand while crushing both, and thereby working or what might be called kneading the sand or sand and clay mixture so that the entire mass thereof will be thoroughly broken up and reduced to a condition of fineness appropriate for use in forming molds. However, the known machines of this general character possess several disadvantages. For one thing, such machines are commonly designed to be stationarily mounted, another objection is that the abrading action on the bottom of the mulling basin results in serious wear, even to such an extent that destruction and consequent replacement is necessary in a camparatively short time. Furthermore, the usual machines have inadequate means for preventing ingress of dust and grit to the operating parts with the result that bearings, shafts, gearing and any other elements involved become scored and worn in an excessively short time, thereby necessitating frequent repairs and replacement of such parts.

It is with the above facts in view that the present invention has been devised, an important object of which is to provide a mulling machine of compact form and of such construction in other respects that it may be portable, that is to say capable of being lifted and moved about by a traveling crane or the like from one location to another within a foundry so that the machine may be disposed at a point most convenient to the place where molding is to be done.

Another important object of the invention is to provide a machine of this character of such construction and arrangement as to maintain what might be called a cushion of sand which remains stationary upon the bottom of the basin while the rollers travel in their orbits and which therefore avoids any material degree of friction and abrasion on the bottom of the basin, the life of the machine being consequently greatly prolonged.

A more specific object of the invention is to provide a mulling machine embodying rollers traveling in different circular orbits, at least one of the rollers having its periphery circumferentially or transversely grooved so that the roller will have a greatly increased mulling or crumbling action on the sand or sand and clay mixture.

Another specific object of the invention, and one of tremendous importance, is to provide a mulling machine in which the bottom of the basin is formed with a series of concentric grooves or a plurality of recesses within which the sand or sand and clay mixture will pack and acquire a substantially rock-like hardness, the sand, moreover, according to its natural tendency, projecting above the top surface of the basin bottom and consequently defining ridges between which loose sand is entrapped and therefore held stationary, all the friction and abrasive action taking place upon the sand itself instead of on the bottom of the basin.

Another important object of the invention is to provide a sand muller in which the operating mechanism, that is to say shafting and gearing, runs in oil so as to maintain thorough lubrication of all the moving parts, the oil chamber and other elements being housed or encased so as to effectually prevent ingress or access of dust or grit to the moving parts.

Yet another object of the invention is to provide a sand muller having the bottom of its basin provided with selectively openable doors one of which will simply permit discharge of the sand and the other of which causes the sand to pass to a diffusing and aerating mechanism, novel means being, moreover, provided for maintaining the doors closed without any necessity for the provision of latches or the like.

An additional object is to provide a machine of the character set forth and for the purpose specified which will be not only continuous and efficient in its operation but which will also be comparatively simple and inexpensive to make, easy to use, positive in action, and a general improvement in the art.

To the attainment of the foregoing and other objects and advantages, the invention preferably consists in the details of construction and the arrangement and combination of parts to be hereinafter more fully described and claimed, and illustrated in the accompanying drawings in which:

Figure 1 is a plan view of the machine with parts broken away and in section and with the cover of the motor chamber removed,

Figure 2 is a vertical longitudinal section taken on the line 2—2 of Figure 1,

Figure 3 is a vertical cross section taken on the line 3—3 of Figure 1,

Figure 4 is a fragmentary detail section, taken on the line 4—4 of Figure 3, with a portion shown in plan,

Figure 5 is a fragmentary plan view of the bottom of the basin showing a modified construction,

Figure 6 is a fragmentary enlarged detail section illustrating the sand packed in the grooves and showing the action.

Referring more particularly to the drawings the machine is shown as comprising a relatively stationary frame indicated as a whole by the numeral 10, which frame is of circular form and includes an outer channel shaped ring member 11 having upper and lower horizontal inwardly extending flanges 12 and 13, respectively, and an upstanding flange 14. This frame is supported upon legs 15 appropriately secured to the outer ring member 11 as for instance by being attached by bolts 16 to outwardly projecting lugs 17 on the member 11. The frame also includes a disk-like inner member 18 having a downwardly extending marginal portion 19 from the lower edge of which projects an outstanding flange 20. The member 11 and depending marginal portion 19 of the disk 18 are connected at intervals by bridge pieces 20a. Rising from the center of the disk member 18 is a cylindrical sleeve 21. Located within the confines of the upstanding flange 14 and seating upon the horizontal flange 12 of the ring member 11 is a cylindrical shell 22 constituting the side wall of the mulling basin.

An important feature of the invention is the construction of the bottom of the basin, the bottom being formed as a disk 23 seating upon the upper horizontal flange 12 within the confines of the shell 22 and upon the disk member 18 adjacent the upstanding sleeve 21 thereon, the disk 23 being necessarily centrally apertured as shown. This disk 23 is formed at diametrically opposite points with discharge openings 24 and 25 normally closed by doors 26 and 27, respectively, operated by means to be described. The top surface of the disk 23 may be formed with a series of concentric grooves 28, as well illustrated particularly in Figures 1 to 3 inclusive or may be provided with a plurality of recesses 29, as shown in Figure 5, these recesses being represented therein as circular in shape though they could have some other configuration if desired. The purpose of providing either grooves or recesses will be hereinafter explained.

Located beneath the relatively stationary frame 10 is a depending casing 30 having an outstanding marginal flange 31 at its upper edge secured by any desired means to the flange 20. Secured within an opening at the bottom of substantially the center of the casing 30 is a sleeve member 32 within which is located a roller step bearing structure 33 which journally supports a reduced extension 34 on the lower end of a vertical shaft 35 which extends axially of the sleeve 21 and which has a reduced upper portion 36 journally mounted within a roller bearing structure 37 located within the upper end of the sleeve 21, the shoulder 38 defined by the provision of the reduced portion 36 serving to maintain the bearing structure 37 in position so that it cannot drop down. Surrounding the reduced portion 36 of the shaft is a suitably packed cap 39 overlying the upper edge of the sleeve 21 for the purpose of excluding dust and grit from the bearing structure 37 and the interior of the sleeve 21 and consequently the interior of the casing 30.

Above the reduced portion 36 the shaft 35 terminates in a still further reduced extremity 40 upon which is keyed, or otherwise appropriately secured, a supporting member 41 having diametrically extending arms 42 and 43 to the outer end of the former of which is secured a scraper blade 44 adapted to move over the bottom 23 of the basin at the outer portion thereof. The support 41 also carries a scraper blade 45 likewise movable over the bottom of the basin but in a circular path inwardly of the path of the scraper 44.

Pivoted at the intermediate portion of the arm 42 and at the end portion of the arm 43, for vertical rocking movement, are arms 46 and 47, respectively, carrying shafts 48 secured thereto as for instance by means of keys 49. Rotatably mounted on these shafts are rollers indicated as a whole by the numeral 50, roller bearing structures 51 being interposed between the shafts and the inner portions or hubs 52 of the rollers. Each roller has a preferably hardened steel, removable, transversely or circumferentially grooved rim 53 fitting snugly about the inner or hub portion and prevented from displacement in one direction by the provision of a taper 54 at the contacting surfaces and prevented from displacement in the opposite direction by rings 55 overlying the inner faces of the hub portions and engaging against shoulders 56 formed by recessing or countersinking the inner peripheries of the rim members to receive the rings 55. The rings 55 are held in place as by screw studs 57 which enter suitably tapped holes in the inner faces of the hub portions of the rollers. The rollers are prevented from displacement in one direction by the outer edges or the ends of the arms 46 and 47 and from displacement in the other direction by means of nuts 58 screwed onto the ends of the shafts 48. Dust and grit are prevented from access to the outer bearings 51 by caps 59 suitably secured to the inner or hub portions of the rollers and enclosing the outer ends of the shafts with the nuts thereon, while ingress of dust or grit to the inner bearings 51 is prevented by suitably packed washers 60 surrounding the shafts 48 and recessed into the inner faces of the hubs or inner portions 52 of the rollers. This dust excluding means is clearly shown in Figure 2. As mentioned above the arms 46 and 47 are capable of vertical rocking movement and to limit their downward movement for controlling the lowermost points to which the rollers may descend, for the purpose of maintaining them spaced somewhat above the basin bottom 23, there are provided set screws 61 threaded through the inner portions of the arms 46 and 47 and abuttingly engageable upon the top of the supporting member 41.

In order to rotate the support 41 and thereby cause the rollers 50 to roll in circular paths within the basin the shaft 35 must be rotated and it is therefore shown as having secured to it a bevel gear 62 located within the casing 30. Meshing with this gear is a relatively small bevel gear 63 mounted on a shaft 64 having one end journaled within a roller bearing structure in an upstanding support 65 rising from the bottom of the casing 30 and having its other end journally supported by a roller bearing structure mounted within a cap or sleeve member 66 suitably secured within an opening in one side of the casing 30, all as clearly shown in Figures 1 and 2. The shaft 64 carries a relatively large gear 67 located within

the casing 30 and meshing with a relatively small gear 68 mounted on a shaft 69 journaled in roller bearing structures one of which is mounted within a support 70 on the interior of the casing 30 and the other of which is mounted within a cap or sleeve 71 secured within an opening in the outer side or end of the casing 30, as clearly shown in Figure 1. Suitably secured at this side or end of the casing 30 is a housing 72 within which is located an electric motor 73 of appropriate horsepower and type having its shaft 74 connected by a coupling 75 with the shaft 69. By virtue of the provision of the relatively small gear 68 driven directly by the motor, the relatively large gear 67, small bevel gear 63 and relatively large bevel gear 62, there will be adequate speed reduction so that the shaft 35 will be rotated at the proper speed to cause the rollers 50 to travel at the most efficient speed for crushing, mixing and kneading sand or a sand and clay mixture placed within the basin. It is intended that the casing 30 and also the sleeve 21 be entirely filled with oil so that the drive mechanism, other than the motor itself, will operate always in oil, thereby effecting thorough lubrication and consequently preventing wear, it being obvious that the splashing thereof as well as its natural tendency to creep will keep all the roller bearing structures lubricated. It will be noted that provision has been made at every point to exclude dust or grit from the bearings and the interior of the oil chamber.

As mentioned above, the bottom of the basin is formed with outlet openings 24 and 25 closed by doors 26 and 27, respectively, a selected one of which may be opened to permit discharge of material from the basin. While these doors are shown in Figures 1 and 3 as having their top surfaces smooth, it is obvious that they may be grooved to correspond with the concentric grooving in the bottom 23 of the basin or may be recessed in the same manner as the bottom of the basin as disclosed in Figure 5. As the mounting and operating means for both doors is the same a description of one will suffice. Considering the door 26, and referring particularly to Figures 3 and 4, it will be observed that it is located above the space between a pair of the bridge pieces 20a and is formed at its underside with a pair of downwardly and rearwardly extending ears 76 disposed inwardly of the bridge pieces and pivoted thereto as for instance by bolts 77 so that the door may have vertical swinging movement. Near its outer end or edge the door is provided with another ear 78 to which is pivoted at 79 links 80 in turn pivoted at 81 to an arm 82 fast on a rock shaft 83 journaled through suitable bearings and extending through at least one side of a guide pan 84 located beneath the door opening and having an inclined bottom 85 for conducting the mulled material away from the machine when it is discharged therefrom. An operating lever 86 is provided for rocking the shaft 83 and consequently opening and closing the door 26. When the lever is in lowered position the pivots 79 and 81 and the shaft 83 are out of alinement, the pivot 81 being located outwardly of the others, thereby forming a toggle which will positively hold the door closed until the lever 86 is moved upwardly so as to turn the shaft 83 and move the arm 82 to break the toggle. At the inner edge of each door opening there is provided a deflector 87 which will conduct the sand onto the top of the door, when the latter is open, and prevent it from falling behind the door.

At the outlet of the guide pan 84 beneath the door 27 there may be provided an aerating and diffusing unit of the same general construction disclosed in the patent mentioned in the forepart of this specification, such unit comprising a suitable casing 88 within which is rotatably mounted a brush 89 located in position to receive the mulled material discharged through the door opening 25, this brush being driven as for instance by a suitable electric motor 90. After the material within the basin has been moved it may be discharged through the opening 24 by moving the door 26 downwardly or if it is desired to aerate and diffuse it the door 26 may be kept closed and the door 27 opened to permit the material to pass onto the rotating brush 89 which will kick it off or diffuse and consequently aerate it.

As mentioned above, the grooves 28 or the plurality of recesses 29 in the bottom of the basin, constitute a feature of great importance. When sand or sand and clay mixture is dumped into the basin preparatory to mulling, it is apparent that the sand or mixture will fill the grooves 28 or recesses 29, as the case may be. When the motor 73 is placed in operation it will rotate the gears 68, 67, 63, and 62, thereby rotating the shaft 36 and support 41 which carries the arms 42 and 43 to which the arms 46 and 47 are pivotally connected. The result of this is that the rollers 50 will be caused to roll over the bottom of the muller basin. The theory is, and practice has proved its correctness, that the sand or mixture filling the grooves 28 or recesses 29 will be packed by the rotating rollers to a rock-like hardness. Moreover, it has been found that the sand packed within and filling the grooves or recesses will project above them and thus define circular ridges or a plurality of knob-like protuberances, as shown at 91 in Figure 6, between which a thin layer 92 of loose sand will be entrapped and maintained substantially stationary, friction or rubbing taking place between the loose sand 93 and the layer 92 so that there will be no abrasion of the bottom 23 of the basin. The importance of this is obviously that it will be unnecessary to replace the basin bottom at any time or at very infrequent intervals at most.

It will be observed that the rollers 50 are located at different distances from the shaft 35 so as to define two separate paths of movement. It is also to be noted that the horizontal axes of the rollers are not in alinement and that as a consequence there will be a sweeping action of the grooved rollers in intersecting relation to the grooves 28 in that form of the invention in which such grooves are provided. This sweeping action is bound to improve the efficiency and rapidity of the mulling action so that the lumpy sand or sand and clay mixture will be more effectually and rapidly broken up and mixed or kneaded. The scrapers 44 and 45 likewise move in different circular orbits and serve to sweep and turn the sand and direct it outwardly toward the shell 22 of the basin so that when either the door 26 or the door 27 is opened, whichever is preferred depending upon whether diffusion or aeration are or are not desired, the material will be discharged.

From the foregoing description and a study of the drawings it will be apparent that there has thus been provided a comparatively simple and inexpensive machine which will efficiently perform the purpose for which it is intended. Ample provision has been made to effect con-

stant lubrication of the working parts and to exclude dust and grit therefrom so that wear will be reduced to the minimum. The prevention of abrasion and consequent wearing out of the basin bottom has also been accomplished. Another feature of advantage is that by the provision of the speed reduction drive mechanism the whole machine can be made very compact so as to be capable of being carried about by a suitable crane from one place to another in a foundry where its use is desired. To explain this last mentioned feature, it should be stated that usually a machine of this general type is installed in a plant in a permanent manner, which is to say that a permanent concrete foundation is provided somewhere on which the machine is mounted, the drive being likewise set on a fixed concrete foundation adjacent to the machine. The portability mentioned involves the provision of a sub-base on which the machine and its drive would be mounted, the combination of the two being considered a unit which, it is repeated, could be readily moved about by a crane or the like. In other words no permanent foundation is required as the machine may be set either on an already existing concrete floor or on any other level area sufficient in size. It is thought from the above that the construction, operation and advantages will be readily apparent to one skilled in the art without further explanation.

While there has been shown and described a preferred embodiment of the invention it should be understood that the right is reserved to make such changes in the details of construction as well as the arrangement and combination of parts as will not depart from the salient features of the invention or the scope of the claims hereunto appended.

The invention having been described, what is claimed is:

1. A sand mulling machine comprising a mulling basin having a side wall and a bottom provided with a discharge door, said basin being adapted to be charged with sand, a plurality of rollers mounted in said basin for travel over the bottom thereof, said bottom being recessed to define pockets for receiving sand to be packed by the action of the rollers whereby the sand within the recesses will be compacted and will project above the bottom and constitute means for maintaining loose sand in a stationary condition between said pockets.

2. A sand mulling machine comprising a mulling basin including a side wall and a bottom provided with a discharge door, a plurality of rollers mounted within the basin for travel over the bottom thereof, said bottom being formed with grooves within which sand will be packed to hardness by the action of the rollers and above which the packed sand will extend to define ridges constituting retaining means for loose sand between the ridges whereby said loose sand entrapped between the ridges will remain substantially stationary to protect the bottom of the basin against abrasion.

3. A sand mulling machine comprising a mulling basin including a side wall, a bottom, means provided in the bottom for discharging the contents of the basin, a plurality of rollers mounted within the basin for travel over the bottom thereof in different orbital paths, said bottom having grooves formed therein within which sand introduced within the basin will be packed to hardness by the action of the rollers and above which the packed sand will extend to define ridges constituting retaining means for loose sand therebetween to form a layer of sand in stationary condition between the ridges for preventing abrasion of the bottom of the basin, at least one of the rollers having its periphery grooved.

4. A sand mulling machine comprising a mulling basin including a side wall, a bottom, means within the bottom for discharging the same, a plurality of rollers mounted within the basin for travel over the bottom thereof, said bottom being formed with grooves within which sand will be packed to hardness by the action of the rollers and above which the packed sand will extend to define ridges constituting retaining means for loose sand between the ridges whereby said loose sand entrapped between the ridges will remain substantially stationary during the travel of the rollers to form a protective coating for the bottom of the basin, said grooves being circular.

5. A sand mulling machine comprising a mulling basin including a side wall, a bottom, means within the bottom for discharging the same, a plurality of rollers mounted within the basin for travel over the bottom thereof, said bottom being formed with grooves within which sand will be packed to hardness by the action of the rollers and above which the packed sand will extend to define ridges constituting retaining means for loose sand between the ridges whereby said loose sand entrapped between the ridges will remain substantially stationary during the travel of the rollers to form a protective coating for the bottom of the basin, said grooves being circular and arranged in concentric relation.

6. A sand mulling machine comprising a mulling basin including a side wall, a bottom, means within the bottom for discharging the same, a plurality of rollers mounted within the basin for travel over the bottom thereof, said bottom being formed with grooves within which sand will be packed to hardness by the action of the rollers and above which the packed sand will extend to define ridges constituting retaining means for loose sand between the ridges whereby said loose sand entrapped between the ridges will remain substantially stationary during the travel of the rollers to form a protective coating for the bottom of the basin, said grooves being circular and arranged in concentric relation, and said rollers having their axes out of alinement and travelling in different circular orbits for effecting a sweeping action across the ridges.

7. A sand mulling machine comprising a mulling basin including a side wall, a bottom, means within the bottom for discharging the same, a plurality of rollers mounted within the basin for travel over the bottom thereof, said bottom being formed with grooves within which sand will be packed to hardness by the action of the rollers and above which the packed sand will extend to define ridges constituting retaining means for loose sand between the ridges whereby said loose sand entrapped between the ridges will remain substantially stationary during the travel of the rollers to form a protective coating for the bottom of the basin, said grooves being circular and arranged in concentric relation, said rollers having their axes out of alinement and travelling in different circular orbits for effecting a sweeping action across the ridges, and at least one of said rollers having its periphery formed with grooves.

8. A sand mulling machine comprising a mulling basin having a side wall, a bottom and means for discharging its contents, a vertical driven shaft journaled at the center of the basin, a supporting structure carried by said shaft, and a plurality of vertically swingable cylindrical rollers journally mounted on said supporting structure at different radial distances from the shaft, the bottom of the basin being formed with a plurality of recesses within which sand will be packed by the rollers to form projections extending above the top surface of the bottom serving to entrap sand between them and define a compact stationary protective layer for the bottom of the basin, the axes of said rollers being out of alinement so that the rollers will exert a sweeping action on the loose sand above said layer outwardly toward the wall of the basin.

9. A sand mulling machine comprising a mulling basin having a side wall and a bottom provided with a discharge door, a vertical driven shaft journaled at the center of the basin, a supporting structure carried by said shaft, and a plurality of vertically swingable cylindrical rollers journally mounted on said supporting structure at different distances from said shaft and travelling in different circular orbits over the bottom of the basin, the bottom of the basin being formed with a series of concentric circular grooves concentric with said shaft within which sand will be packed by the rollers to form ridges extending above the top surface of the bottom and serving to entrap sand between them for defining a stationary layer of compacted sand protecting the bottom of the basin against abrasion, the orbits of said rollers being eccentric with respect to the grooves so that the rollers will exert a sweeping action on loose sand above said layer outwardly toward the wall of the basin.

10. A sand mulling machine comprising a supporting frame including connected outer and inner members, a cylindrical shell mounted on the outer member, a disk supported on both members, said shell and disk defining, respectively, the side wall and bottom of a basin, an oil filled casing mounted beneath said inner member, a step bearing within said casing, an upstanding sleeve rising from said inner member and containing a bearing, a vertical shaft having its lower end journaled within said step bearing and its upper end journaled through and extending above said second named bearing, a dust excluding cap closing the top of said sleeve, a supporting structure secured upon the upper end of said shaft, arms swingably mounted on said supporting structure, shafts carried by said arms, rollers journaled on said second named shafts, dust excluding caps secured to the outer faces of said rollers and covering the outer ends of said second named shafts, dust excluding elements disposed against the inner faces of said rollers, a gear on said shaft within said casing, and means located exteriorly of the casing for driving said gear.

11. A sand mulling machine comprising a supporting frame including connected outer and inner members, a cylindrical shell mounted on the outer member, a disk supported on both members, said shell and disk defining, respectively, the side wall and bottom of a basin, an oil filled casing mounted beneath said inner member, a step bearing within said casing, an upstanding sleeve rising from said inner member and containing a bearing, a vertical shaft having its lower end journaled within said step bearing and its upper end journaled through and extending above said second named bearing, a dust excluding cap closing the top of said sleeve, a supporting structure secured upon the upper end of said shaft, arms swingably mounted on said supporting structure, shafts carried by said arms, rollers journaled on said second named shafts, dust excluding caps secured to the outer faces of said rollers and covering the outer ends of said second named shafts, dust excluding elements disposed against the inner faces of said rollers, a gear on said shaft within said casing, a motor mounted exteriorly of said casing and supported thereby and by said frame and having its shaft entering said casing, dust excluding packing means surrounding the motor shaft for preventing access of dust to said casing and preventing leakage of oil therefrom, and reduction gearing driven by said motor shaft for rotating said first named gear.

12. A sand mulling machine comprising a supporting frame including connected outer and inner members, a cylindrical shell mounted on the outer member, a disk supported on both members, said shell and disk defining, respectively, the side wall and bottom of a basin, an oil filled casing mounted beneath said inner member, a step bearing within said casing, an upstanding sleeve rising from said inner member and containing a bearing, a vertical shaft having its lower end journaled within said step bearing and its upper end journaled through and extending above said second named bearing, a dust excluding cap closing the top of said sleeve, a supporting structure secured upon the upper end of said shaft, arms swingably mounted on said supporting structure, shafts carried by said arms, rollers journaled on said second named shafts, dust excluding caps secured to the outer faces of said rollers and covering the outer ends of said second named shafts, dust excluding elements disposed against the inner faces of said rollers, a gear on said shaft within said casing, a housing located beside said casing and secured thereto and to said frame, an electric motor mounted within said housing, a motor driven shaft entering said casing and packed at its point of entry thereinto to prevent access of dust to the casing and leakage of oil therefrom, a pinion on said motor driven shaft, a countershaft journaled within the casing carrying a relatively large gear meshing with said pinion and carrying a pinion meshing with said first named gear.

13. A sand mulling machine comprising a supporting frame including connected outer and inner members, a cylindrical shell mounted on the outer member, a disk supported on both members, said shell and disk defining, respectively, the side wall and bottom of a basin, an oil filled casing mounted beneath said inner member, a step bearing within said casing, an upstanding sleeve rising from said inner member and containing a bearing, a vertical shaft having its lower end journaled within said step bearing and its upper end journaled through and extending above said second named bearing, a dust excluding cap closing the top of said sleeve, a supporting structure secured upon the upper end of said shaft, arms swingably mounted on said supporting structure, shafts carried by said arms, rollers journaled on said second named shafts, dust excluding caps secured to the outer faces of said rollers and covering the outer ends of said second named shafts, dust excluding elements disposed against the in-

ner faces of said rollers, a gear on said shaft within said casing, a housing located beside said casing and secured thereto and to said frame, an electric motor mounted within said housing, a motor driven shaft entering said casing and packed at its point of entry thereinto to prevent access of dust to the casing and leakage of oil therefrom, a pinion on said motor driven shaft, a countershaft journaled within the casing carrying a relatively large gear meshing with said pinion and carrying a pinion meshing with said first named gear, the basin with the parts movable therein, together with the casing and motor housing constituting a compact unit portable from place to place where its use may be needed.

14. A sand mulling machine comprising a supporting frame structure, a basin carried thereby and including a cylindrical side wall member and a bottom, a bearing structure rising from the center of the frame structure, a casing secured underneath the frame, a step bearing within the bottom of said casing, a vertical shaft having its lower end journaled in said step bearing and having its upper portion extending through and above said bearing structure, means for preventing access of dust and grit to said bearing structure, roller members carried by the projecting upper end of said shaft, and travelling in different circular orbits over the bottom of the basin, a bevel gear on said shaft within said casing, a countershaft journaled in the casing and carrying a bevel pinion meshing with said bevel gear, a spur gear on said countershaft, a motor located at one side of the casing, a driven shaft connected with the motor shaft and extending into said casing, and a spur pinion on said driven shaft meshing with said spur gear, said casing being filled with oil whereby said shafts and gears will run in oil.

15. A sand mulling machine comprising a supporting frame structure, a basin mounted thereon and including a cylindrical wall and a disk shaped bottom, a vertical driven shaft at the center of the basin, a support carried by said shaft, vertically swingable rollers carried by said support and movable over the bottom of the basin in different orbital paths, said bottom of the basin being formed with a discharge opening, a door pivoted at its inner corners to the supporting frame structure and normally closing said opening, a rock shaft journaled in the supporting frame structure and carrying an operating lever and a crank arm, and links pivotally connected with said crank arm and with the underside of the door near the outer end thereof, the axis of the rock shaft, the pivotal connection of the links with said crank arm and the pivotal connection of the links with the door being out of alinement when the door is closed, the crank arm and links constituting a toggle which must be broken inwardly to effect opening of the door by means of the lever.

WILLIAM H. NICHOLLS, JR.,
Administrator of the Estate of William H. Nicholls, Sr., Deceased.