March 4, 1969 R. E. KAWECKI 3,430,929

CONTINUOUS OPERATION MULLING APPARATUS AND METHOD FOR ACCURATELY PROPORTIONING FOUNDRY SAND INGREDIENTS

Filed Nov. 16, 1967 Sheet 1 of 3

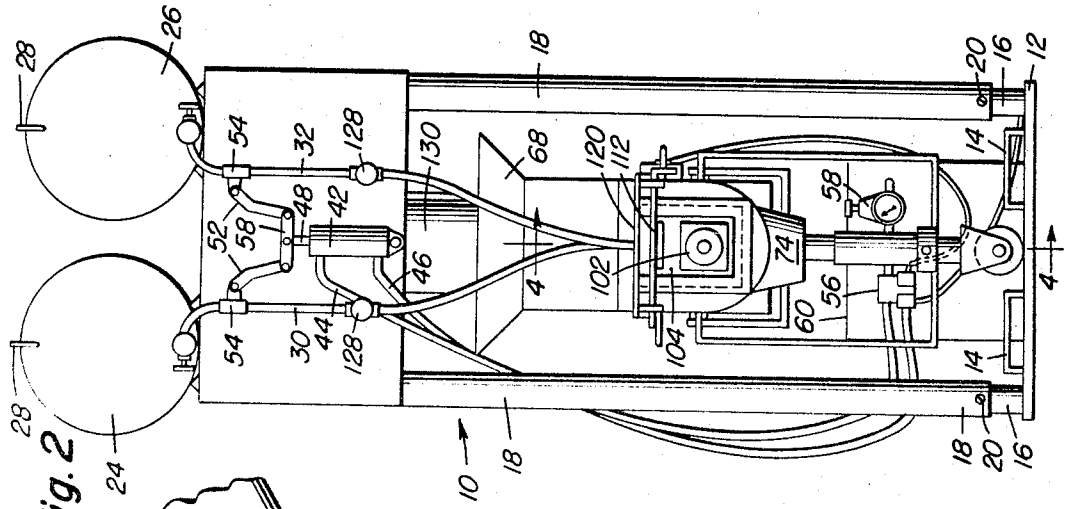

Fig. 2

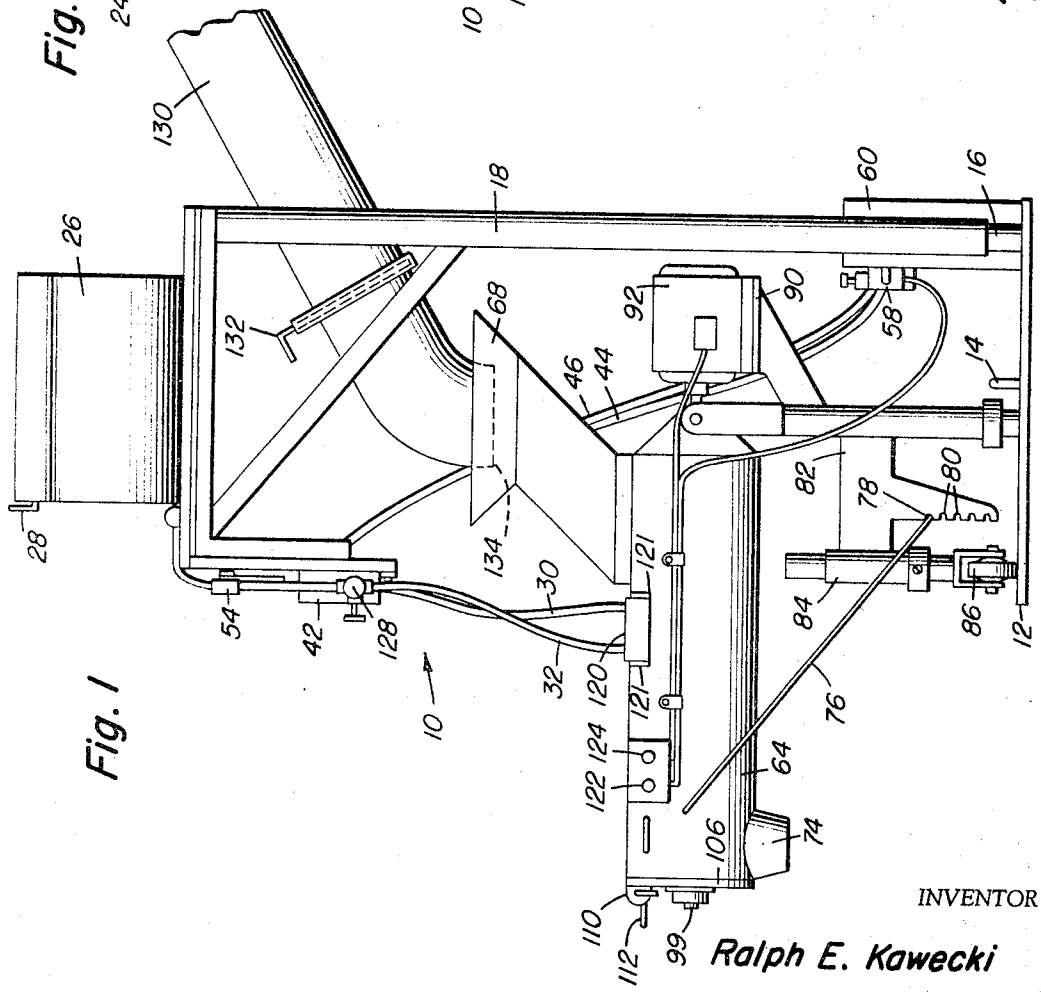

Fig. 1

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Filed Nov. 16, 1967 Sheet 2 of 3

Fig. 3

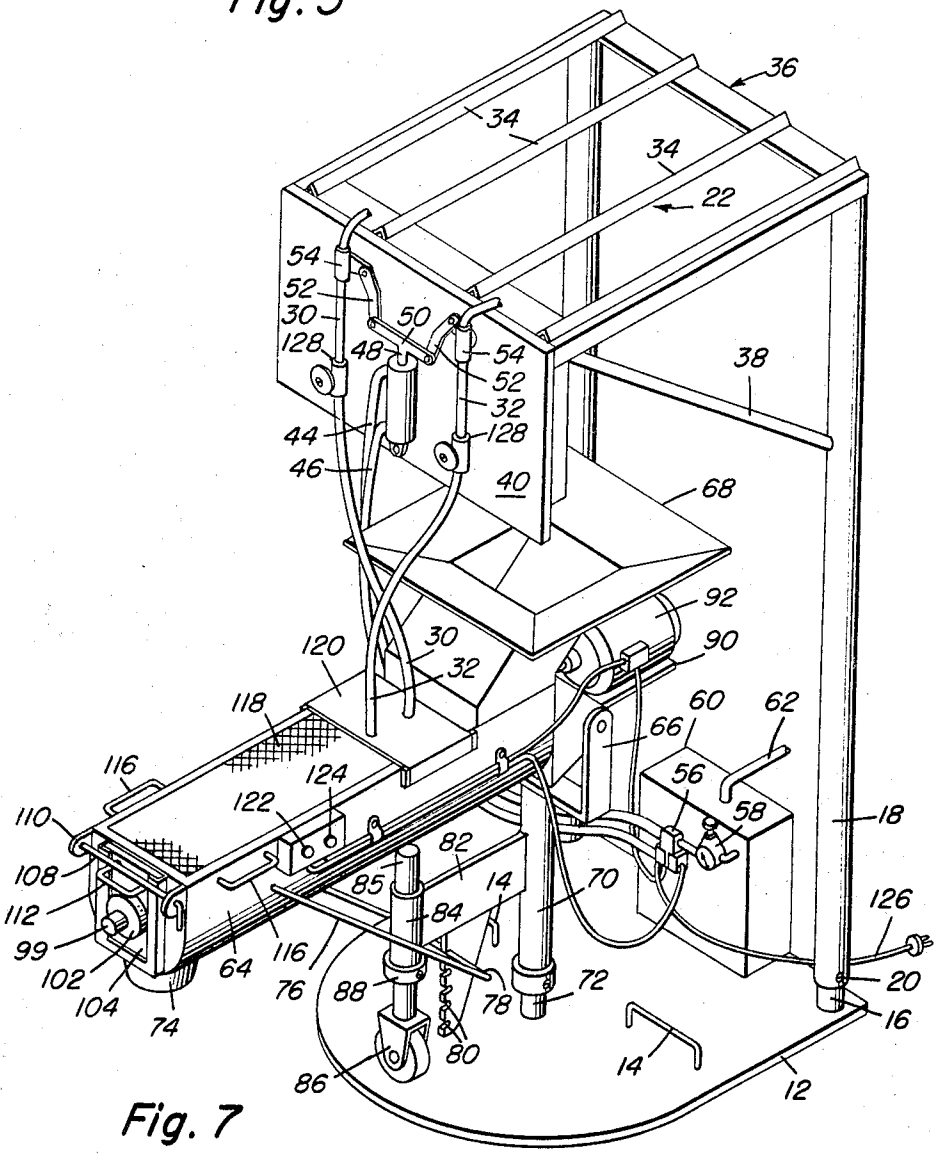
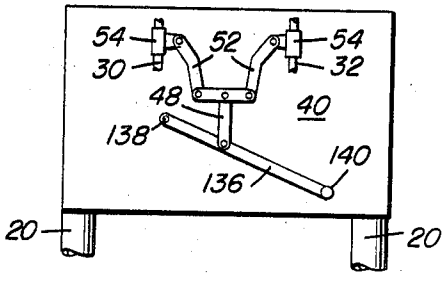


Fig. 7



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CONTINUOUS OPERATION MULLING APPARATUS AND METHOD FOR ACCURATELY PROPORTIONING FOUNDRY SAND INGREDIENTS

Filed Nov. 16, 1967 Sheet 3 of 3

Fig. 4

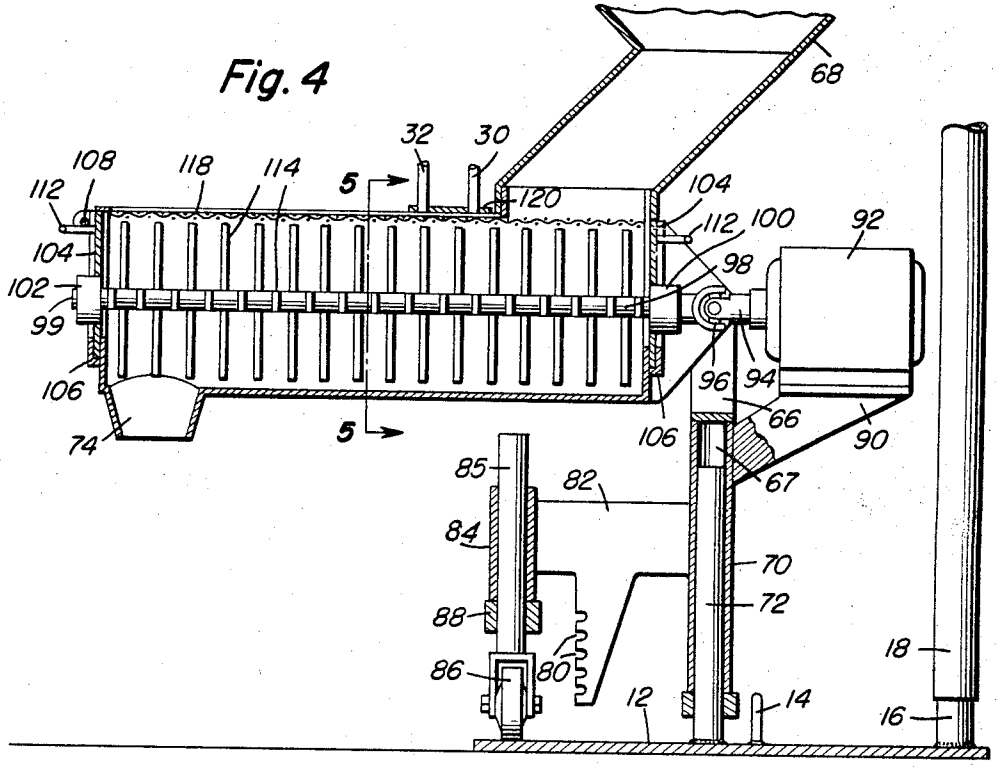


Fig. 5

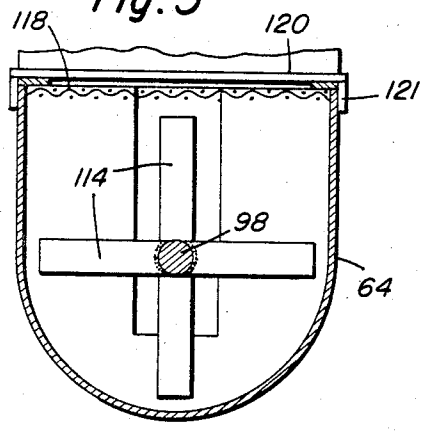
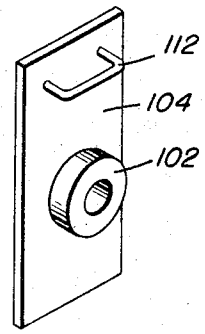


Fig. 6



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United States Patent Office 3,430,929
Patented Mar. 4, 1969

3,430,929

CONTINUOUS OPERATION MULLING APPARATUS AND METHOD FOR ACCURATELY PROPORTIONING FOUNDRY SAND INGREDIENTS

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Filed Nov. 16, 1967, Ser. No. 683,542
U.S. Cl. 259—146 25 Claims
Int. Cl. B28c 7/12

ABSTRACT OF THE DISCLOSURE

This invention is a continuous operation mulling apparatus and method for accurately proportioning foundry sand ingredients. In this invention, the foundry sand ingredients are continuously gravity fed into a mulling trough at spaced apart points at an ingredients receiving end, and are discharged continuously at the other end. Each ingredient is metered, and the formula may be changed by changing the metering. The timing of the mulling operation is changeable by changing the inclination of the mulling trough. Further, the mulling trough is pivotal 90° to either side at a center point, swinging about a center under the sand feed hopper, so that a number of separate receptacles may be placed in a semi-circle and when one receptacle is filled, the trough discharge spout may be moved to the next receptacle without stopping the continuous operation.

Objects of invention

It is an object of this invention to provide a gravity fed continuous operation foundry sand ingredients mulling apparatus and method.

A still further object of this invention is to provide a continuous operation foundry sand ingredients mulling apparatus and method that is an improvement over patentee's prior Patent No. 3,355,154 of November 28, 1967.

A further object of this invention is to provide that the gravity feed means for the foundry sand ingredients are accurately metered to make the formula controllable, and adjustable as desired and to provide a mulling trough whose inclination is adjustable to vary the mulling time as desired.

A still further object of this invention is to provide a mulling trough whose discharge end may be swung about, on a radius about a center at its sand feed so that the mulling process may operate continuously and it may discharge mulled foundry sand into various receptacles such as boxes, forms, wheelbarrows or the like, without stopping the mulling procedure.

A further object of this invention is to provide a mulling trough and apparatus which may be easily accessible for rapid and easy maintenance as needed or desired.

A further object of this invention is to provide a mulling apparatus in the form of an elongate mulling trough which will continuously receive the ingredients in spaced apart relation at one end and continuously discharge the mulled ingredients at the other.

A further object of this invention is to provide a platform base having an elevated platform, the base supporting the muller, and the elevated platform supporting tanks for liquid ingredients above the muller for gravity feeding the liquid ingredients to the muller.

A further object of this invention is to make the platform readily portable by a fork lift so that it, with its supported apparatus, may be stored when not in use, and to provide fork lifting hangers on the platform base located in the path of a caster swingably supporting the discharge end of an elongate muller trough, pivoted on the platform base at its feed end, the hangers limiting the swinging movement of the elongate muller trough.

A further object of this invention is to provide a hopper or funnel for the mulling trough that is so positioned with relation to the gravity feed sand chute that it will automatically stop the flow of sand from the chute into the funnel or hopper should the sand fail to flow continuously into the mulling trough for any reason, including the reason that the rotation of the mulling blade may have been stopped, thus preventing any overflow of sand from the funnel or hopper.

A further object of this invention is to provide a trough mulling apparatus and liquid tank ingredient supply apparatus mounted on a platform and framework that is readily transportable, when desired, by means of a conventional lift fork.

Brief summary of invention

In brief, this invention includes a fork lift transportable platform and framework with an elongate mulling trough pivotally mounted at its sand feeding end and adjustably inclined at its other end. The framework on the platform provides support for gravity feeding liquid ingredients tanks and valves and valve controls, either pneumatically or manually operated, the valves being both cut off valves and metering valves on pipes from the tanks to the mulling trough. This platform and framework is spaced for use in combination with a gravity feed sand chute having a metering valve leading from any suitable sand supply means, and discharging below the top level of trough hopper so that sand cannot overflow the hopper.

Description of figures

With the above and other objects in view becoming further apparent from the following detailed description, when read in conjunction with the accompanying drawings, in which:

FIG. 1 is a side elevational view of the complete invention.

FIG. 2 is a front discharge end view of FIG. 1.

FIG. 3 is a perspective view of the mulling trough swingingly mounted on a fork liftable base and framework along with its controls.

FIG. 4 is a sectional view through the mulling trough on line 4—4 of FIG. 2.

FIG. 5 is a sectional view across the mulling trough on an enlarged scale, on line 5—5 of FIG. 4.

FIG. 6 is a perspective view of a removable bearing plate at each end of the trough.

FIG. 7 is a fragmentary view of a manual control means for the cut off valves in the liquid ingredients feed pipes.

Description of invention

There is shown at **10** the continuous operation apparatus for accurately proportioning foundry sand ingredients and for carrying out the method of this invention. This apparatus **10** includes a base platform **12** having fork lift cooperating hangers **14** thereon. Upright stanchion rods **16** at the rear thereof telescopically support support sleeves **18** thereon, in adjusted position by one or more set screws **20**. At the tops of the sleeves **18**, a grid platform **22** provides support for acid and binder liquid tanks **24** and **26**, these tanks being preferably of corrosion resistant material such as suitable stainless steel or plastic material. Each tank **24** and **26** is provided with a vent pipette **28** so that the liquids may readily gravity flow down through their discharge pipes **30** and **32** made of suitable corrosion resistant plastic material.

The grid **22** includes two spaced apart pairs of spaced angle irons **34** supported on a rectangular frame **36** sup-

posed on the tops of stanchion sleeve 18 and on brace rods 38. A plate 40 depending from the front of frame 36 provides a support wall for a pneumatic cylinder 42 having air pressure pipes 44 and 46 leading to opposite ends thereof for operating the pneumatic piston of a connecting rod 48 connected to a control bar 50 pivoted to the ends of levers 52 to control opening and closing valves 54, one in each pipe 30 and 32. The lower ends of air pressure pipes 44 and 46 are connected through a solenoid valve 56 and pressure gauge 58 to a pressure tank 60 whose pressure is maintained by a pressure pipe 62 from any suitable pressure source (not shown) such as a pneumatic pump or the like.

An elongate mulling trough 64 is pivotally supported on a Y yoke 66 at its feeding end, the yoke 66 being directly under the center of a funnel or hopper 68 discharging into the feed end of the mulling trough 64. The yoke 66 has a depending pivot or Y stem 67 extending into the open top of a sleeve 70 telescopically supported on a stanchion rod 72 secured on base platform 12. Suitable bearings (not shown) may be provided between the top of sleeve 70 and the yoke 66, so that the yoke 66, and thus the trough 64 may freely pivot or swing about the sleeve 70 and the center of the hopper.

The discharge end of trough 64 is provided with a discharge spout 74. The trough 64 is pivotally supported on a U-member 76, whose bight 78 is selectively inserted in a toothed rack bar 80 depending from an arm 82 extending from the sleeve 70 and supporting a sleeve 84 through which a caster stem 85 of caster 86 is adjustably secured by a collar 88. As will be apparent, the elevation of the trough 64 is controlled by the sleeve 84 and 70. The inclination of the trough 64 is controlled by the cooperation of the U-support 76 and the toothed rack 80. The trough 64 may pivot or swing through a range of approximately 180° while continuing indefinitely in operation. The fork lift hangers 14 also serve as limit stops for the swinging movement of trough 64. Extending from the rear of sleeve 70 is a motor support platform 90 for an electric motor 92 whose shaft 94 is connected to a universal joint 96 to a muller shaft 98 journaled through a bearing 100 at the rear of the trough 64. At the front or discharge end of trough 64 is a similar bearing 102 on vertical plate 104 removably supported in a vertical U trackway 106 and removably locked in position by a transverse pin 108 through eyes 110 on the end of the trough 64, the pin 108 contacting the top of a handle 112 in the bearing plate 104. The muller shaft 98 is detachably secured to the universal joint 96 by any suitable means, and may have a slightly smaller neck 99 extending through both bearings 100 and 102. The rear bearing 100 is mounted on a plate and U trackway similar to the plate 104 for the front bearing, so that, by raising the bearing plates 104 and after detaching the muller shaft 98 from universal joint 96, the muller shaft 98 may be readily removed for servicing and replacement. Fastened on the muller shaft 98 are a plurality of suitable muller blade paddles 114 which may, but need not be, propeller blades, inasmuch as the travel of the mixing ingredients through the trough 64 from the hopper end to the spout end is controlled mainly by its adjusted angle of inclination.

The muller trough 64 is provided with a pair of handles 116 to assist in adjusting the inclination thereof. The trough 64 is a U shaped, open channel member, as seen in FIG. 5, and has a grid mesh 118 removably placed over its open top so that the mulling action is fairly visible. Adjacent the hopper or funnel 68, a flanged plate 120 is removably provided thereon between vertical trackways 121 with suitable apertures through which the acid and binder pipes extend in spaced apart relation to discharge into the trough 64, the acid pipe 30 being closer to the hopper 32 so that the liquid acid discharges into the sand already in the trough, and then the liquid binder discharges into the mulling sand and acid. Mounted on the side of trough 64, switch buttons 122 and 124 start and stop the motor 92 and actuate the solenoid valve 56, electricity for both being supplied by conduit 126 plugged into a suitable source of electricity. In addition to the opening and closing valves 54, each pipe 30 and 32 is also provided with a metering valve 128 so that the rate of flow therethrough may be accurately adjusted to the desired amount, according to the particular formula being used.

The apparatus is placed so that the hopper may be gravity fed with sand from a sand chute 130, bringing sand from any suitable source, such as a supply hopper through a building wall. An adjustable gate valve 132 is provided in the sand chute 130 to accurately meter the rate of flow of the sand into the hopper 68. To insure that there is no possibility of the sand overflowing the hopper 68, the discharge end 134 of sand chute 130 is extended into the hopper 68 to below the level of the top edge of the hopper, thus blocking discharge of sand from the chute end 134 until sand in the hopper drops below the discharge end 134. If desired, the pneumatic cylinder 42 and associated pneumatic operating parts may be omitted, and the valves 54 for the acid pipe 30 and binder pipe 32 may be manually controlled. To do so, a handle grip may be located at the bottom end of connecting rod 48, or if leverage is desired, the bottom end of connecting rod 48 is pivoted to a lever 136 which is pivoted at one end 138 to the plate 40 on frame 36, and a handle 140 is provided at the other end of the lever 136.

Operation and summary of invention

In operation, the foundry sand is made by mulling a prescribed amount of sand with a prescribed amount of acid, usually phosphoric acid, and the mulling the acid and sand with a prescribed amount of binder, usually a resin furfural binder. In this invention, all ingredients are gravity fed continuously and accurately into the elongate muller trough 64 in metered amounts, then mulled for a predetermined period of time, then discharged continuously. The acid is placed in tank 24, from which it is gravity fed through pipe 30 past the opened valve 54 and through its metering valve 128 and through the flanged plate 120, where it is gravity fed into sand which has entered the trough 64 by means of the sand chute 130, past the sand metering gate valve 132 and the discharge end 134 below the level of the top of the hopper 68. Should the sand fail to feed down through hopper 68, as when the motor 92 is stopped, the sand filling the hopper 68 will block the sand chute discharge end 134 and thus will not overflow onto the base platform 12 or floor on which it may be placed. The binder from tank 26 will likewise gravity feed past its opened valve 54 and its metering valve 128 into the mulling sand and acid in the trough 64, for the binder pipe 32 enters the trough at a point intermediate the discharge end of acid pipe 30 in the trough 64 and the trough discharge spout 74. To change the formula for the foundry sand, the metering valves for the sand, the acid and the binder will be changed as desired. To change the timing of the mulling action, the bight 78 of U support 76 will be adjusted into a different part of the toothed rack 80 to change the inclination of the muller trough 64, and thus speed up the action if the inclination is increased, and slow it down, if the inclination is lessened. Buttons 122 and 124 are used to start or stop the action, as desired.

The mulling action may be observed through the open grid mesh 118. The apertured plate 120 and grid mesh 118 are readily removable permitting the bearing locking pins 108 to be removed and the bearing plates 104 to be removed, along with the muller shaft 98 and blades 114 for service or replacement. The prepared foundry sand will discharge from the spout 74 into any suitable receptacle placed thereunder. A semicircle of receptacles such as wheelbarrows, forms, boxes, etc. may be placed on the

floor about the semicircular end of base platform **12**, and as soon as one receptacle is filled, the trough is swung about the axis of shaft **72** and sleeve **70** to the next receptacle with no interruption of mulling operation, and then to the next, replacing the receptacles until all the foundry sand has been prepared as desired. If the space occupied by the apparatus is needed for other purposes when the apparatus is not functioning, it may be readily picked up by a fork lift through handle **14** and moved as desired, then replaced when its use is again desired.

Abstract of invention drawings

In the drawing like reference numerals refer to like parts and, for the purposes of explication, marshalled below are the following reference numerals of this Continuous Operation Mulling Apparatus and Method for Accurately Proportioning Foundry Sand Ingredients:

12—base platform
14—fork lift cooperating hangers
16—upright stanchions on **12**
18—telescoping sleeve on **16**
20—set screw **18** to **16**
22—tank supporting grid platform
24—acid containing tank
26—binder tank
28—vent pipettes on tanks **24** and **26**
30—acid discharge pipe
32—binder discharge pipe
34—angle irons of **22**
36—rectangular form of **22**
38—brace from **18** to **32**
40—plate depending from front of **22**
42—pneumatic cylinder
44—air pressure pipe
46—air pressure pipe
48—connecting rod
50—valve control rod on **48**
52—levers pivoted to **48** and to valves **54**
54—opening and closing valves for pipes **30** and **32**
56—air pressure solenoid valve
58—pressure gauge
60—pressure tank
62—pressure supply pipe to **60**
64—elongate muller trough
66—Y yoke at feed end of **64**
67—Y stem of yoke **66**
68—hopper or funnel to trough **64**
70—sleeve on **72** for Y stem **67** of yoke **66**
72—stanchion rod for **70**
74—discharge spout of trough **64**
76—adjustable U support for trough **64**
78—bight of **76**
80—toothed rack
82—caster pivoting arm on **70**
84—sleeves on **82** for caster stem
85—stem of caster **86**
86—caster
88—collar on caster
90—motor platform
92—electric motor
94—motor shaft
96—universal joint
98—muller shaft
100—rear bearing for **98**
102—front bearing for **98**
104—bearing plate
106—vertical U trackway for **104**
108—locking pin
110—locking pin eyes on trough **64**
112—handle on **104**
114—muller blades on shaft **98**
116—trough handles
118—grid mesh
120—flanged plate, apertured for discharge ends of **30** and **32**
122—switch button for solenoid valve **56**
124—switch button for motor **92**
126—electricity supply conduit
128—metering valves on pipes **30** and **32**
130—sand chute
132—metering gate valve on sand chute **130**
134—discharge end of sand chute **130**
136—manually operating lever
138—pivot—one end of **136** to **140**
140—handle—other end of lever **136**

What is claimed is:

1. A continuous operation foundry sand ingredients milling apparatus comprising in combination, an ingredients mixing elongate muller trough (**64**), a feed sand supply chute (**130**) discharging into one end of said trough (**64**), a sand metering valve (**132**) in said chute (**130**), a plurality of foundry sand liquid ingredient supply tank means (**24**, **26**) supported adjacent said muller trough (**64**), a liquid feed pipe means (**30**, **32**) from each liquid tank means (**24**, **26**) discharging separately into said elongate trough (**64**) beyond said sand chute, liquid metering valve means (**128**) in each said liquid pipe means (**30**, **32**), and a discharge spout (**74**) in the bottom of the opposite end of said elongate trough (**64**).

2. The combination of claim **1**, the discharge ends of said liquid supply pipe means (**30**, **32**) being spaced apart (**120**) at said trough (**64**).

3. The combination of claim **2**, and means for simultaneously cutting off the flow in said liquid supply pipe means (**30**, **32**).

4. The combination of claim **1**, said muller trough (**64**) comprising an elongate channel (**64**), an elongate paddle blade muller means (**98**, **114**) therein, means (**92**) rotating said elongate paddle blade muller means (**98**, **114**) about an elongate axis.

5. The combination of claim **4**, and pivoted U-support and toothed rack means (**76**, **80**, **96**) for adjustably supporting the discharge spout (**74**) end of said trough (**64**) at a downward angle from its feed end.

6. The combination of claim **5**, and castor means (**86**) supporting said trough (**64**) for horizontally swinging its discharge spout end (**74**) about its feed end as a center (**66**, **67**).

7. The combination of claim **5**, and a hopper (**68**) on said trough (**64**) at its feed end, the end (**134**) of said sand supply chute (**130**) extending into said trough hopper (**68**) below its top edge.

8. The combination of claim **7**, and a grid mesh (**118**) over said elongate trough (**64**), said liquid feed pipe means (**30**, **32**) extending through and positioned (**120**) on said grid mesh (**118**).

9. The combination of claim **4**, and castor means (**86**) supporting said trough (**64**) for horizontally swinging its discharge spout end (**74**) about its feed end as a center (**66**, **67**).

10. The combination of claim **1**, said muller trough (**64**) comprising an elongate channel (**64**), an elongate muller shaft (**98**), a plurality of spaced apart muller blades (**114**) on said muller shaft (**98**), and readily removable and replaceable bearing means (**100**, **102**) for rotatably journaling said muller shaft (**98**) in said elongate muller trough (**64**).

11. The combination of claim **1**, said feed sand supply chute (**130**) gravity feeding sand into said elongate trough (**64**), said adjacent liquid supply tank means (**24**, **26**) being supported above said muller trough (**64**), and said liquid feed pipe means (**30**, **32**) being gravity fed from each said liquid tank means (**24**, **26**) into said elongate trough (**64**).

12. A continuous operation foundry sand ingredients mulling apparatus comprising in combination, an ingredients mixing elongate muller trough (**64**), a feed sand

supply chute (130) discharging into one end of said trough (64), a sand metering valve (132) in said chute (130), a plurality of foundry sand liquid ingredient supply tank means (24, 26) supported adjacent said muller trough (64), a liquid feed pipe means (30, 32) from each liquid tank means (24, 26) discharging into said elongate trough (64), liquid metering valve means (128) in each said liquid pipe means (30, 32), a discharge spout (74) in the bottom of the opposite end of said elongate trough (64), said muller trough (64) comprising an elongate channel (64), an elongate muller shaft (98), a plurality of spaced apart muller blades (114) on said muller shaft (98), readily removable bearing means (100, 102) for rotatably journaling said muller shaft (98) in said elongate muller trough (64), said removable bearing means (100, 102, 104) comprising a bearing plate (104), a bearing (100, 102) extending through said plate (104), a U trackway (106) on the end of said elongate trough (64), a handle (112) on said bearing plate, pin eyes (110) on the opposite sides of said trackway (106) at the top thereof, and a locking pin (108) removably inserted through said pin eyes (110) and abutting the top of said plate handle (112) to lock said bearing (100 or 102) in position.

13. A continuous operation foundry sand ingredients mulling apparatus comprising in combination, an ingredients mixing elongate muller trough (64), a feed sand supply chute (130) discharging into one end of said trough (64), a sand metering valve (132) in said chute (130), a plurality of foundry sand liquid ingredient supply tank means (24, 26) supported adjacent said muller trough (64), a liquid feed pipe means (30, 32) from each liquid tank means (24, 26) discharging into said elongate trough (64), liquid metering valve means (128) in each said liquid pipe means (30, 32), a discharge spout (74) in the bottom of the opposite end of said elongate trough (64), said muller trough (64) comprising an elongate channel (64), an elongate muller means (98, 114) therein, means (92) rotating said elongate muller means (98, 114) about an elongate axis, means (86) supporting said trough (64) for horizontally swinging its discharge spout end (134) about its feed end as a center (66, 67), said support means comprising a platform base (12), a pivot means (72) mounted on said base (12) beneath said feed end center, and a castor (84) supporting the discharge (74) end of said trough (64) on said platform base (12).

14. The combination of claim 13, and fork lift cooperating hangers (14) secured in said platform base (12), said hangers (14) being spaced on opposite sides of said pivot means (72) in the path of said caster (84) limiting the swing of said trough (64) to approximately half a circle.

15. A continuous operation foundry sand ingredients mulling apparatus comprising in combination, an ingredients mixing elongate muller trough (64), a feed sand supply chute (130) discharging into one end of said trough (64), a sand metering valve (132) in said chute (130), a plurality of foundry sand liquid ingredient supply tank means (24, 26) supported adjacent said muller trough (64), a liquid feed pipe means (30, 32) from each liquid tank means (24, 26) discharging into said elongate trough (64), liquid metering valve means (128) in each said liquid pipe means (30, 32), a discharge spout (74) in the bottom of the opposite end of said elongate trough (64), and a platform base (12), said muller trough being supported on said platform base (12), and an elevated platform (22) on said base (12) extending above said muller trough (64), said liquid supply tanks (24, 26) being supported on said elevated platform (22).

16. The combination of claim 15, and opening and closing valve means (54) for each said pipe means (30, 32), and common means (50) for actuating each said opening and closing valve means (54) simultaneously.

17. The combination of claim 16, said common means including a control rod (50) operatively connected to each said opening and closing valve means (54).

18. The combination of claim 17, and a manually operative handle (136) operatively connected to said control rod (50).

19. The combination of claim 17, and power means for actuating said control rod (50) comprising a pneumatic cylinder (42), a pneumatic piston rod (48) connected to said control rod (50) extending from said pneumatic cylinder (42), and solenoid controlled valve means (56) for actuating said pneumatic cylinder (42) to operate said opening and closing valves (54).

20. In a method of mulling foundry sand and liquid ingredients in a continuous operation, the steps of metering (132) a supply of sand into one end (68) of an elongate mulling trough (64), metering (128) acid (30) into the sand in the mulling trough (64) adjacent the sand receiving end (68) and metering binder into the mulling sand and acid at a point intermediate the acid feed therein and the opposite discharge end of the mulling trough.

21. The method of claim 20, and changing the foundry sand formula by changing the metering (128, 132) of the ingredients.

22. The method of claim 21, and inclining (76, 80) the muller trough (64) to a selected degree of inclination (78, 80) to determine the timing of the mulling action.

23. The method of claim 20, and inclining (76, 80) the muller trough (64) to a selected degree of inclination (78, 80) to determine the timing of the mulling action.

24. The method of claim 20, and automatically stopping the sand feed into the trough by locating the discharge end (134) of a gravity sand feed chute (130) in and below the top end of a trough (64) hopper (68) receiving the sand.

25. The method of claim 20, and feeding all said metering by gravity.

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ROBERT W. JENKINS, *Primary Examiner.*

U.S. Cl. X.R.

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