July 19, 1932. N. W. STRATFORD 1,867,898

MULLING APPARATUS

Filed Feb. 15, 1930 3 Sheets-Sheet 1

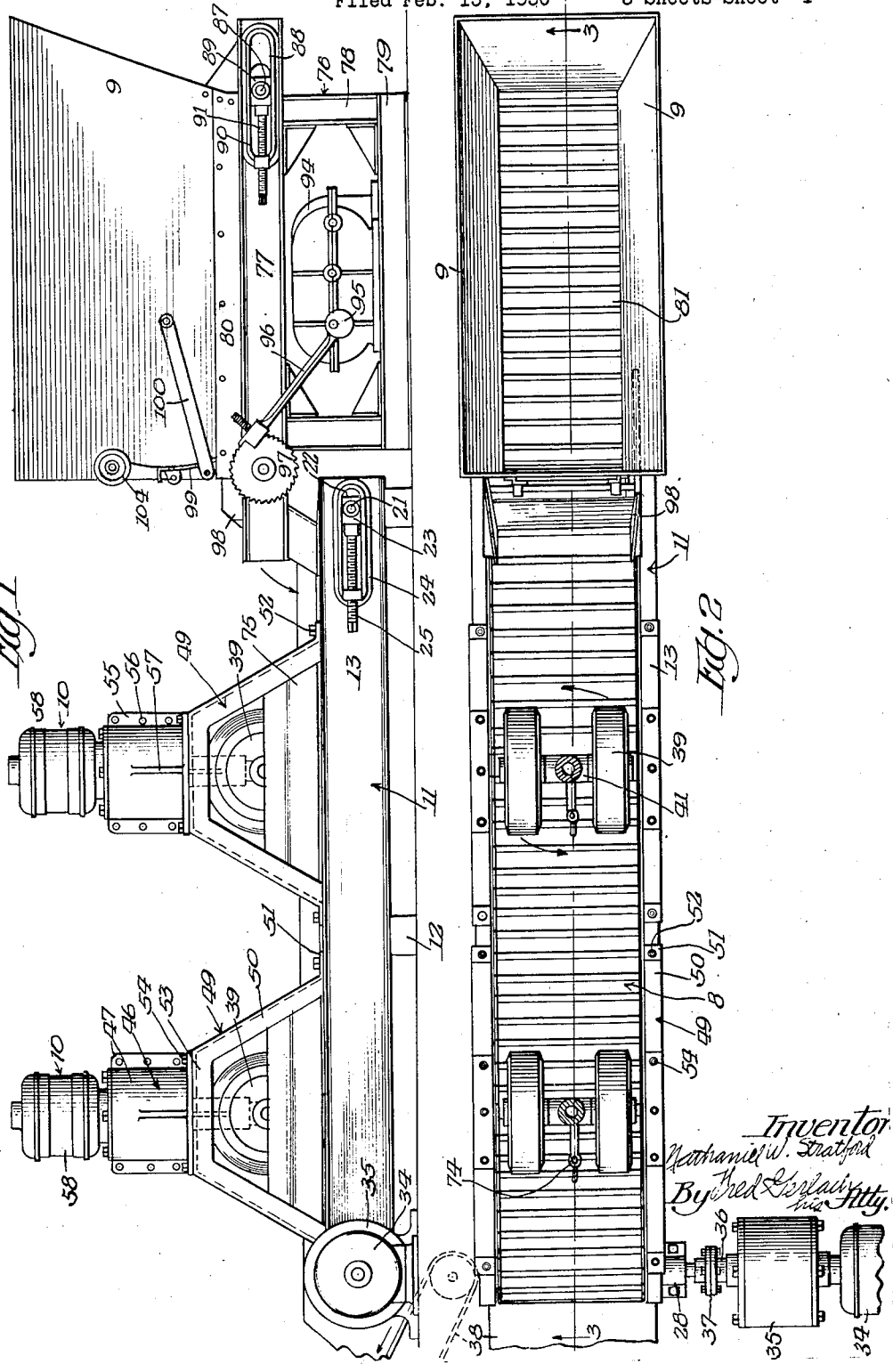


Fig. 1

Fig. 2

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MULLING APPARATUS

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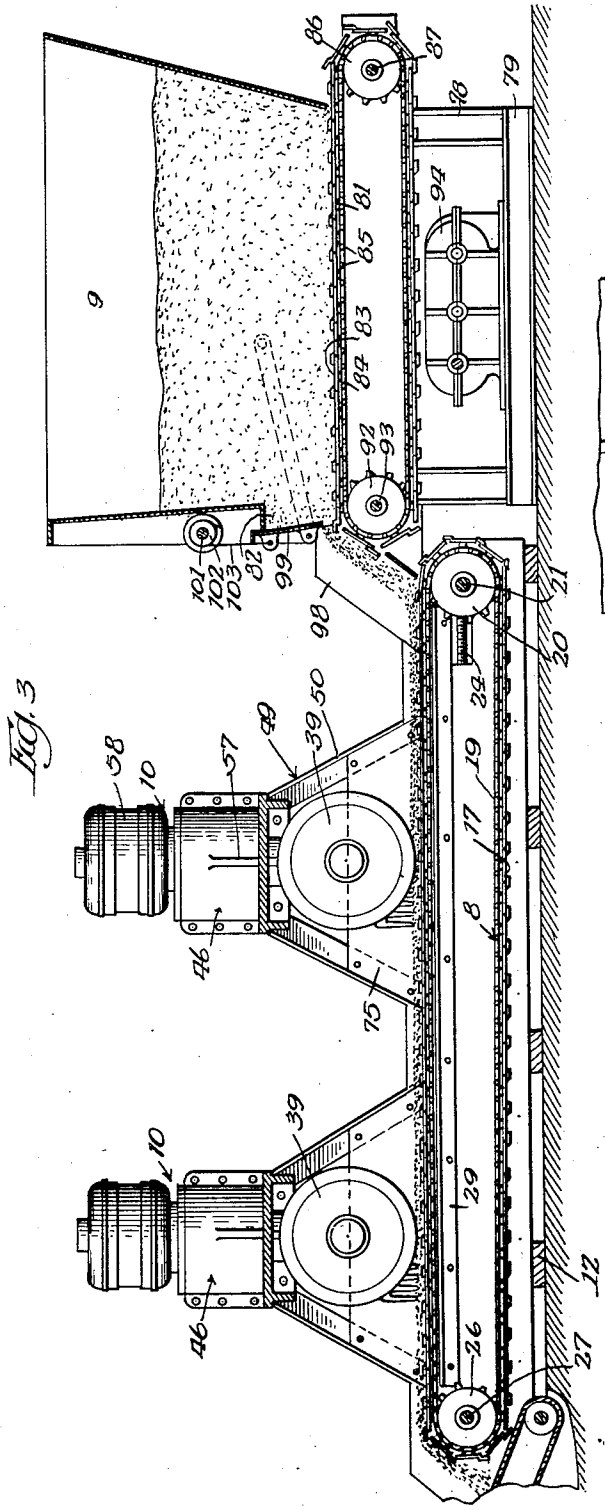


FIG. 3

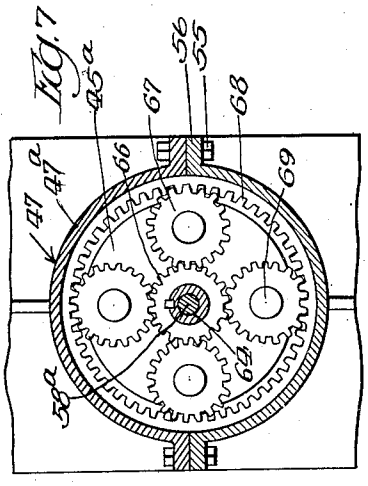


FIG. 7

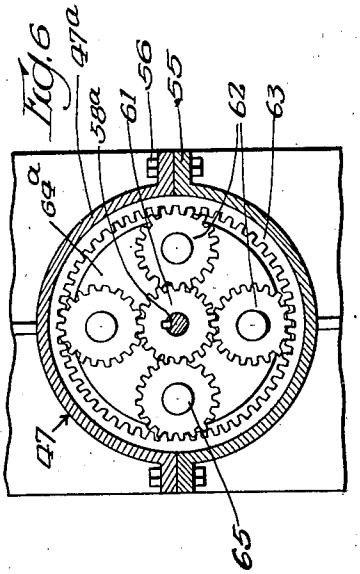


FIG. 6

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MULLING APPARATUS

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Fig. 5

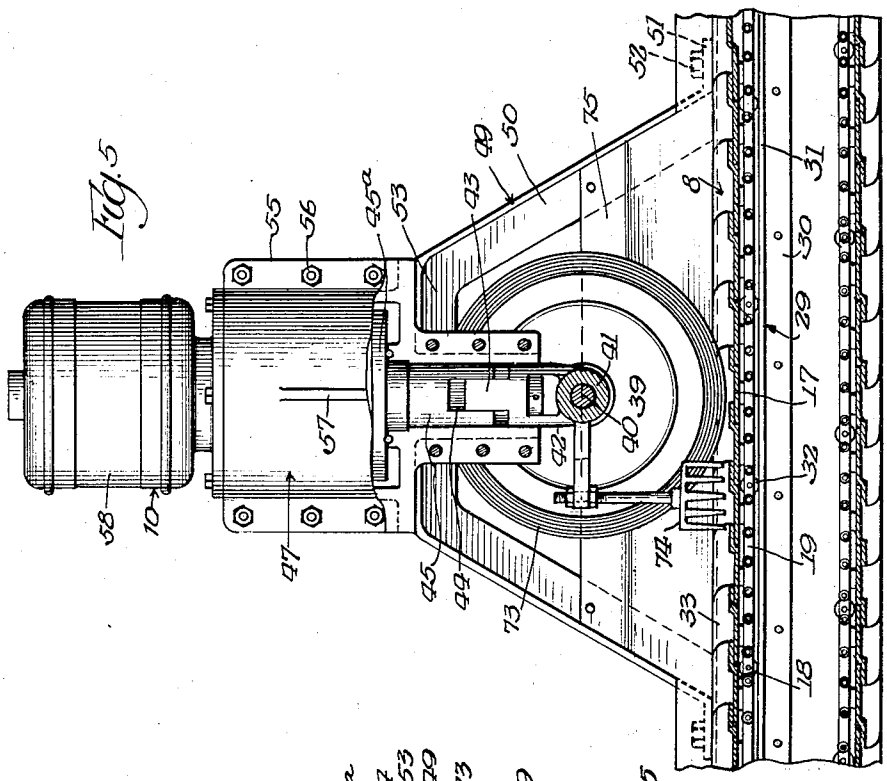
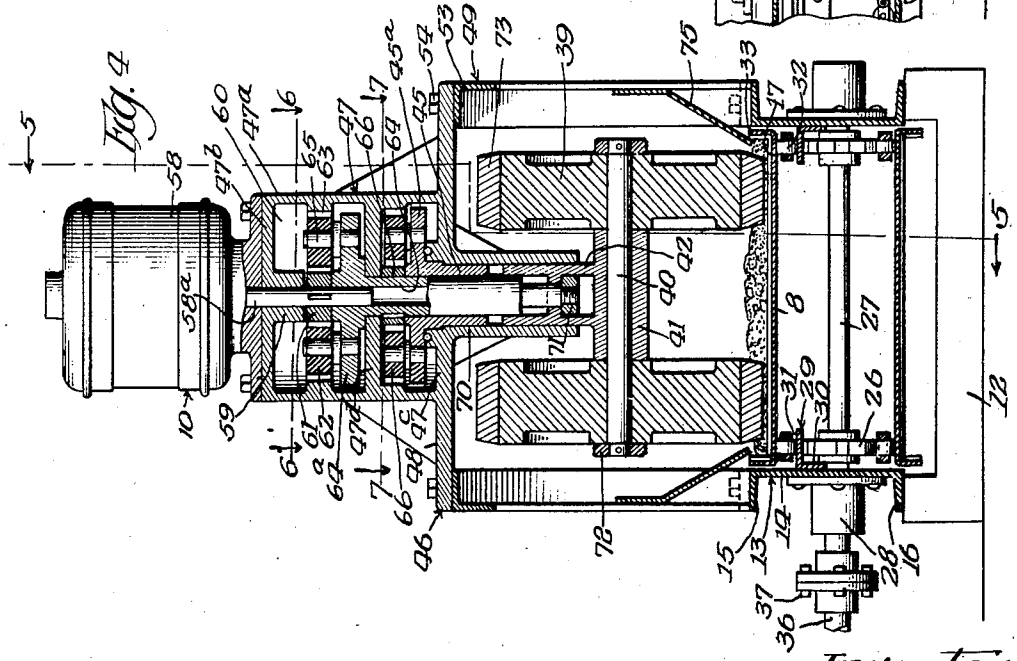


Fig. 4



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UNITED STATES PATENT OFFICE

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MULLING APPARATUS

Application filed February 15, 1930. Serial No. 428,565.

The present invention relates generally to apparatus for mulling or mixing granular material. More particularly the invention relates to that type of mulling apparatus which is used in a foundry or similar establishment to mull, mix or recondition molding sand and comprises a frame, a sand supporting member on the frame and a pair of wheels or mullers which are positioned above the sand supporting member and are driven so that they are rotated bodily in a circular path over the aforesaid member for sand mulling purposes.

One object of the invention is to provide a mulling apparatus of the aforementioned type in which the member for supporting the sand is mounted movably on the frame and is adapted to be moved during rotation or drive of the mullers so as to cause the sand to be progressively fed into the path of said mullers.

Another object of the invention is to provide a sand mulling apparatus of the type under consideration in which the sand supporting member is in the form of an endless conveyor which is adapted to receive the sand at one end thereof and operates during drive to convey the sand into the path of the mullers and then to discharge the mulled sand into a hopper or a second conveyor.

A further object of the invention is to provide an apparatus for mulling molding sand which comprises an endless conveyor for delivering the sand to the mullers and includes a device for storing the sand that is to be mulled and delivering the sand to the receiving end of the conveyor in such a manner that the sand is evenly distributed and is in the nature of a layer of substantially uniform thickness on the conveyor.

A still further object of the invention is to provide a sand mulling apparatus which is generally of a novel construction, may be manufactured at a comparatively low cost and is an improvement upon previously designed apparatus for the same purpose by virtue of the fact that the feeding and discharge of the sand may be carried out without interruption.

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

The invention consists in the several novel features hereinafter set forth and more particularly defined by the 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 side elevational view of a sand mulling apparatus embodying the invention;

Figure 2 is a plan sectional view;

Figure 3 is a vertical longitudinal section taken on the line 3—3 of Figure 2 and disclosing in detail the construction and arrangement of the endless conveyor and the device for supplying sand in regulated quantity to the conveyor;

Figure 4 is a vertical transverse section, showing one of the mulling units which operate in connection with the conveyor to effect the desired mulling of the sand;

Figure 5 is a section taken on the line 5—5 of Figure 4;

Figure 6 is a horizontal section taken on the line 6—6 of Figure 4; and

Figure 7 is a section taken on the line 7—7 of Figure 4.

The apparatus which forms the subject matter of the invention is adapted primarily for use in a foundry and serves to mull, mix or recondition molding sand. It comprises an endless conveyor 8 which receives the sand that is to be mulled or mixed from a reservoir 9 and operates, during drive

thereof, to carry the sand horizontally and in a rectilinear path past a pair of mulling units 10.

The endless conveyor 8 is mounted in an elongated metallic supporting frame 11 which is supported by means of blocks 12 on the floor of the foundry. The frame comprises a pair of channel iron beams 13 which form the sides of the conveyor-frame and consist of vertically extending webs 14, outwardly extending upper flanges 15 and outwardly extending lower flanges 16. The lower flanges rest upon and are suitably secured to the blocks 12 which, as indicated in Figure 4, extend transversely and serve to cross connect the channel iron beams 13.

The conveyor 8 is disposed between the beams 13 and comprises an endless series of slats 17. The latter are shaped so that they overlap one another and are pivotally connected by means of lugs 18 to a pair of endless chains 19. The rear ends of the chains extend around a pair of sprocket wheels 20 which are mounted on a transversely extending shaft 21. The ends of this shaft extend through elongated slots 22 in the rear ends of the beams 13 and are journalled in bearing blocks 23 which are slidably mounted in guideways 24. These guideways are secured to the vertically extending webs 14 of the beams and are connected to the bearing blocks 22 by means of screws 25. Tightening or loosening of the conveyor is effected by adjusting the screws 25. The front ends of the chains 19 extend around a pair of driving sprockets 26 which are mounted on a transversely extending shaft 27. The ends of this shaft extend through the front ends of the beams 13 and are journalled in bearings 28 which are fixed to the outer faces of the webs 14. The upper reach of the conveyor is supported by means of a pair of longitudinally extending angle iron bars 29. These bars comprise vertical legs 30 and horizontal legs 31. The vertical legs are welded or otherwise secured to the inner faces of the webs 14. The horizontal legs 31 project inwardly and form supports for rollers 32 which are carried by the chains 19.

The side margins of the slats 17 are bent substantially at right angles so as to form flanges 33 which prevent the sand from being displaced laterally when it is on the conveyor.

The conveyor 8 is adapted to be continuously driven by means of an electric motor 34 so as to cause the sand to be conveyed from the reservoir 9 to the discharge end of the supporting frame. The motor 34 is located at the discharge end of the conveyor and is connected to drive reducing gearing which is mounted in a housing 35. The reducing gearing comprises a drive shaft 36 which is journalled in one end of the housing 35 and is connected by a coupling 37 to one end of the shaft 27. When current is supplied to the motor 34, the rotor of the motor operates to drive the speed reducing gearing in the housing 35. The gearing in turn effects a low speed drive of the shaft 27 and causes a continuous motion to be imparted to the conveyor 8 through the medium of the chains 19. During drive of the conveyor the sand which as hereinafter described is supplied in regulated quantity from the resorvoir 9, is fed progressively to the mulling units 10 and then is discharged onto the floor of the foundry or a second conveyor 38. In the event that a second conveyor is used such conveyor is arranged so that the receiving end thereof is located beneath the discharge end of the conveyor 8. A characteristic and an advantage of utilizing an endless conveyor in connection with the mulling apparatus and as the support for the sand is that the sand is subjected but once to the action of the mulling units 10 and as a result, the permeability of the sand is not affected. Another advantage is that the mulling operation may be carried out continuously in that it is not necessary to stop the apparatus for sand loading and unloading purposes. Another feature of utilizing an endless conveyor as the supporting medium for the sand resides in the fact that the sand is caused to be moved during drive or rotation of the mullers and as a result is subjected to a thorough and efficient mulling action.

The mulling units are positioned above the endless conveyor 8 and operate, during drive of the conveyor, to mull or mix the sand so that it is adapted for use for molding purposes. One of the units is located slightly inwardly of the receiving end of the conveyor and serves, during operation of the apparatus, to effect a preliminary mulling or mixing of the sand. The other unit is located between the discharge end of the conveyor and the first mentioned mulling unit and serves to complete the mulling of the sand.

Each of the mulling units 10 comprises a pair of wheels or mullers 39 which are loosely mounted on the ends of a horizontally extending axle 40. This axle is journalled in a spider 41 which is driven as hereinafter described so as to swing the axle bodily and cause the mullers to travel in a circular path in order to effect the desired mulling or mixing of the sand on the endless conveyor 8. The central portion of the spider 41 is provided with an upwardly extending spindle 42. The latter is provided with a pair of lugs 43 which fit and are vertically slidable in slots 44 in the lower end of a vertically extending driving sleeve 45. The lugs and slots form a driving connection between the spindle of the spider and the driving sleeve 45 and permit the axle to move vertically so that the mullers are adapted to travel readily over the sand and adjust themselves to any height within a

limited range. The driving sleeve 45 is supported from above in a cast metal housing structure 46. This housing structure consists of a hollow cylindrically shaped member 47 and a pair of horizontally extending arms 48. The latter extend transversely with respect to the supporting frame for the endless conveyor 8 and are supported by means of a pair of brackets 49. These brackets are preferably formed of angle iron and embody legs 50, the lower ends of which are provided with horizontally extending lugs 51. The latter fit against the upper flanges 15 of the beams 14 and are held rigidly in place by bolts 52. The brackets 49, in addition to the legs 50, embody horizontally extending portions 53 which underlie the outer ends of the arms 48 and are secured to the latter by bolts 54. The housing structure 46 is formed in two sections. These sections are provided with flanges 55 which extend outwardly from the cylindrical member 47 and are secured together by bolts 56 so that the housing structure is of a unitary character. The cylindrical member 47 is joined to the arms 48 by vertically extending reinforcing webs 57 and comprises an annular side wall 47^a, a top wall 47^b, a bottom wall 47^c and an intermediate wall 47^d. The intermediate wall is formed integrally with the central portion of the side wall 47^a and is located midway between the top wall 47^b and the bottom wall 47^c. The top wall 47^b forms a support for an electric motor 58 and is provided with a bearing 59 in which is journalled the rotor shaft 58^a of the motor. The interior of the cylindrical member 47 forms a compartment 60 in which is disposed planetary or epicyclic gearing for driving the spider 41. The gearing is driven by the motor 58 and comprises a pinion 61 which is keyed to the rotor shaft 58 of the motor; a plurality of gears 62 which are driven by the pinion 61, mesh with an internal gear 63 on the inner periphery of the side wall 47^a of the member 47 and are connected to a vertically extending tubular element 64 by means of studs 65; a pinion 66 which is keyed or otherwise secured to the central portion of the element 64; and a plurality of gears 67 which are driven by the pinion 66, mesh with an internal gear 68 on the inner periphery of the side wall 47^a and are connected to a flanged portion 45^a on the upper end of the driving sleeve 45 by means of studs 69. The tubular element 64 is loosely mounted in the sleeve 45 and is provided at its upper end with a radially extending flange 64^a which rests upon the intermediate wall 47^d and has sockets for receiving the studs 65. The driving sleeve 45 extends through a bearing member 70 which is formed integrally with and depends from the bottom wall 47^c of the member 47 and supports the flanged portion 45^a so that the sleeve is supported against downward displacement. The lower end of the bearing member 70 is extended so as to encircle the upper end of the spindle 42. The lower end of the tubular element 44 is provided with a nut 71 which supports the spider 41 in such a manner that the axle 40 is sustained in a position wherein the mullers 39 are out of contact with the conveyor. By adjusting the nut 71 the mullers 39 may be raised or lowered into the desired position with respect to the conveyor. When the motor 58 is actuated the planetary or epicyclic gearing in the chamber 60 rotates the driving sleeve 45. The latter in turn swings the spider 41 and the axle 40 so as to cause the mullers 39 to move in a circular path and effect the desired mulling or mixing of the sand on the subjacent portion of the conveyor 8. The axle 40 is provided at the ends thereof with a pair of members 72 which serve to retain the mullers against the ends of the spider and prevent lateral displacement thereof. The mullers 39 are provided with rims 73 which are removably mounted so that they may be replaced when they become worn. A rake 74 is connected to the spider 41 and operates, during swinging of the axle 40, to rake the sand into the path of the mullers. To prevent the sand on the conveyor 8 from being displaced laterally or thrown over the flanges at the side margins of the slats 17, side plates 75 are provided. These plates are arranged in parallel relation and are secured to the legs 50 of the brackets 49. The mullers 39 are preferably arranged so that during rotation or drive thereof they pass in close proximity to the plates 75 and the side margins of the conveyor slats. As a result of this arrangement the entire layer of sand on the conveyor is subjected to the action of the mullers.

The reservoir 9 operates to store the sand that is to be mulled or mixed and operates, as hereinafter described, to supply the sand in regulated quantity to the receiving end of the endless conveyor 8. It is preferably elongated as indicated in Figures 1, 2 and 3 and is supported upon a framework 76 which is located in front of the receiving end of the conveyor-frame. The framework 76 comprises a pair of channel iron sills 77 which are arranged in parallel relation and are supported upon standards 78. The latter are mounted on and project upwardly from a base 79 which rests upon the floor of the foundry. The sides of the reservoir are fixed to the sills 77 by means of angle iron bars 80 which are bolted or otherwise secured to the top flanges of the sills. The top of the reservoir is open so that it can be filled from an overhead sand delivery system or in any other suitable manner. The bottom of the reservoir is formed by an endless conveyor 81. This conveyor is adapted to feed the sand forwardly through a discharge opening 82 which is formed in the front wall of

the reservoir and is substantially equal in width to the width of the conveyor 8. The conveyor 81 consists of an endless series of slats 83. The latter are shaped so that they overlap one another and are connected to a pair of endless chains 84 by means of pivot lugs 85. The rear ends of the chains extend around a pair of sprocket wheels 86 which are mounted on a transversely extending shaft 87. The ends of this shaft extend through elongated slots 88 in the rear ends of the sills 77 and are journalled in bearing blocks 89 which are slidably mounted in guideways 90. The latter are secured to the sills 77 and are connected to the bearing blocks 89 by means of screws 91. When it is desired to tighten the conveyor 81, the screws 91 are adjusted so as to shift the bearing blocks 89 and the shaft 87. The front ends of the chains 84 extend around a pair of driving sprockets 92 which are mounted on a transversely extending shaft 93. The latter is located beneath the discharge opening 82 and is arranged so that the ends thereof project through the front ends of the channel iron sills 77. The conveyor 81 is operated to feed the sand step by step through the discharge opening 82 by means of driving mechanism which consists of a motor (not shown) in a housing 94. The driving mechanism, in addition to the motor, comprises an eccentric 95 which projects from one side of the housing 94; a pawl 96 which is mounted on and operated by the eccentric; and a ratchet wheel 97 which is fixed to one end of the shaft 93 and is driven by the pawl. The housing 94 is supported on the base 79 and is disposed beneath the central portion of the conveyor 81. When the conveyor is driven by the mechanism heretofore described, the sand is fed through the discharge opening 82. From said discharge opening 82, the sand passes onto a chute 98. The latter is connected to the front ends of the sills 77 and is adapted to direct the sand onto the receiving end of the endless conveyor 8.

The discharge of sand through the opening 82 is controlled by means of a gate 99 which is vertically movable and is in the nature of a valve whereby the height of the discharge opening may be varied to regulate the quantity of sand that is discharged from the reservoir. The gate is supported by a pair of arms 100 which project rearwardly and are pivoted to the sides of the reservoir so that the gate can swing upwardly or downwardly. The arms are preferably arranged so that the gate will be shifted upwardly when engaged by scrap in the sand in order to permit such scrap to pass thereunder and move out of a position wherein it would tend to obstruct the discharge opening and interfere with the regulated delivery of the sand. The raising and lowering of the gate is effected by means of mechanism which comprises a transversely extending shaft 101, a drum 102 on the shaft and a cable 103. The latter is wound around the drum and is connected at its distal end to the gate 99. The shaft 101 is adapted to be turned for drum rotating purposes by means of a hand wheel 104. When the hand wheel is turned in one direction, the drum 102 is rotated so as to cause the cable to wind thereon and raise the gate 99. When the hand wheel 104 is turned in the opposite direction, a lowering of the gate is effected. The gate 99 and the conveyor 81 exemplify means for supplying sand in regulated quantity to the receiving end of the endless conveyor 8. By providing sand supply means of the character herein described, the sand is caused to be distributed evenly over the conveyor 8 and is in the nature of a layer which is substantially of uniform thickness throughout.

Assuming that the various motors are running, the operation of the mulling apparatus is as follows:

The endless conveyor 81 is moved step by step by means of the pawl and ratchet and causes the sand in the reservoir 9 to be fed into the chute 98. The gate 99 controls the discharge of the sand through the opening 82 so that the feeding of the sand is unform and the sand is caused to be delivered onto the endless conveyor 8 in the form of a layer of uniform thickness. The endless conveyor 8 operates to convey the sand from the chute 98 towards the discharge end of the elongated conveyor supporting frame. As the sand is moved on the conveyor 8 into the path of travel of the mullers 39 the desired mulling takes place. The mulling unit that is located at the receiving end of the conveyor 8 operates to effect a preliminary mulling. The second unit operates on the partially mulled sand and serves to complete the mulling operation. By having the surface or medium that supports the sand movable relatively to the path of travel of the mullers, the mulling operation is expedited and the sand is mulled in an efficient manner. After the sand has been subjected to the action of the mulling units, it is discharged from the conveyor 8 and is in readiness for use in connection with molding. The mullers 39 are preferably supported so that they are positioned a slight distance above the endless conveyor 8. By supporting the mullers in this manner, wear of the rims 73 and the conveyor 8 is avoided. In the event that it should be desired to change the position of the mullers with respect to the conveyor, it is only necessary to adjust the nut 71. During operation of the apparatus, the discharge of the sand from the reservoir 9 is controlled by the gate 99. If it is desired to feed the sand to the endless conveyor 8 so that it is in the form of a rela-

tively thick layer, the gate 99 is raised so as to increase the size of the discharge opening. If it is desired to deliver the sand to the conveyor 8 in comparatively small quantities, the gate 99 is lowered so as to decrease the size of the discharge opening 82. In the event that the gate encounters scrap in the sand it is automatically forced upwardly so as to permit such scrap to pass thereunder.

The mulling apparatus disclosed herein is exceedingly efficient in operation in view of the fact that the endless conveyor permits of a continuous operation and serves to move the sand progressively into and out of the path of travel of the mullers. Since the conveyor travels in a rectilinear path the sand is caused to be subjected to the action of the mullers but once and therefore it is practically impossible to destroy or alter materially the permeability of the sand. The apparatus consists of but a small number of parts and therefore may be manufactured at a comparatively low cost.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claims, without departing from the spirit and scope of the invention.

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

1. In a mulling apparatus of the character described, the combination of an elongated supporting frame, an endless conveyor supported on the frame so that it extends lengthwise thereof and comprising an upper reach for the material to be mulled movable in a substantially rectilinear path and a lower or return reach, a muller for the material positioned above, and adapted to operate on the material on, the upper reach of the conveyor, and means for driving the conveyor to feed the material progressively under the muller and then to discharge it from the conveyor after it has been subjected to the operation of the muller.

2. In a mulling apparatus of the character described, the combination of an elongated supporting frame, an endless conveyor supported on the frame so that it consists of an upper reach for the material to be mulled and a lower or return reach and is movable lengthwise of the frame and in a substantially rectilinear path, a power-driven mulling unit comprising a muller positioned above and movable bodily in a circular path over the upper reach of the conveyor for mulling purposes, and means for driving the conveyor so as to cause the material to be fed progressively under the muller and then to be discharged from the conveyor after it has been subjected to the action of the muller.

3. In a mulling apparatus of the character described, the combination of an elongated supporting frame, an endless conveyor supported on the frame so that it comprises an upper and a lower reach and is movable longitudinally of the frame and in a substantially rectilinear path, a muller positioned above, and adapted to operate on the material on, the upper reach of the conveyor, means for delivering the material to be mulled in regulated quantity onto one end of the said upper reach of the conveyor, and means for driving the conveyor so as to feed the material from the delivery means into engagement with the muller and then to discharge the material from the other end of the upper reach after it has been fed past and subjected to the action of the muller.

4. In a muller, the combination of an elongated supporting frame embodying a pair of laterally spaced sides and sprocket wheels at the ends of and between the sides, an apron conveyor for the material to be mulled mounted on and supported by the sprocket wheels so that it embodies an upper reach for the material to be mulled and a lower or return reach, a power-driven mulling unit supported on the frame-sides and comprising a muller wheel positioned above and movable bodily in a circular path over the upper reach of the conveyor for mulling purposes, means for rotating one of the sprocket wheels so as to drive the conveyor and cause the material to be fed progressively into the path of travel of the muller wheel and then to be discharged from the conveyor after it has been subjected to the action of said muller wheel.

5. In a mulling apparatus of the character described, the combination of a supporting frame, an endless conveyor carried by the frame, a muller positioned above the conveyor, a reservoir adapted to contain the material to be mulled and provided with a discharge opening above the receiving end of the conveyor, and a movable bottom for feeding the material through the discharge opening onto one end of the conveyor, means for driving the conveyor at a substantially uniform speed and so as to cause the material to be moved progressively into engagement with the muller and then to be discharged from the other end of the conveyor after it has been subjected to the action of the muller, and a gate associated with the discharge opening of the reservoir and adapted to regulate the discharge of material by the movable bottom.

6. In a mulling apparatus of the character described, the combination of an elongated supporting frame embodying a pair of sides, an endless conveyor for supporting the material to be mulled carried by the frame and positioned between the sides, a pair of mulling units positioned above the conveyor and arranged one in front of the other, and means for driving the conveyor so as to cause

the material to be subjected successively to the action of the muller units.

7. In a mulling apparatus of the character described, the combination of an elongated supporting frame embodying a pair of sides, an endless conveyor for supporting the material to be mulled carried by the frame and positioned between the sides, a pair of power-driven mulling units supported by the frame over the conveyor and arranged one in front of the other, each of said units comprising a muller movable bodily in a circular path, and means for driving the conveyor so as to cause the material to be moved successively into engagement with the mullers.

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