Nov. 15, 1949 S. B. DAVIES 2,488,381

APPARATUS FOR TREATING MOLDER'S SAND

Filed Feb. 4, 1946 3 Sheets-Sheet 1

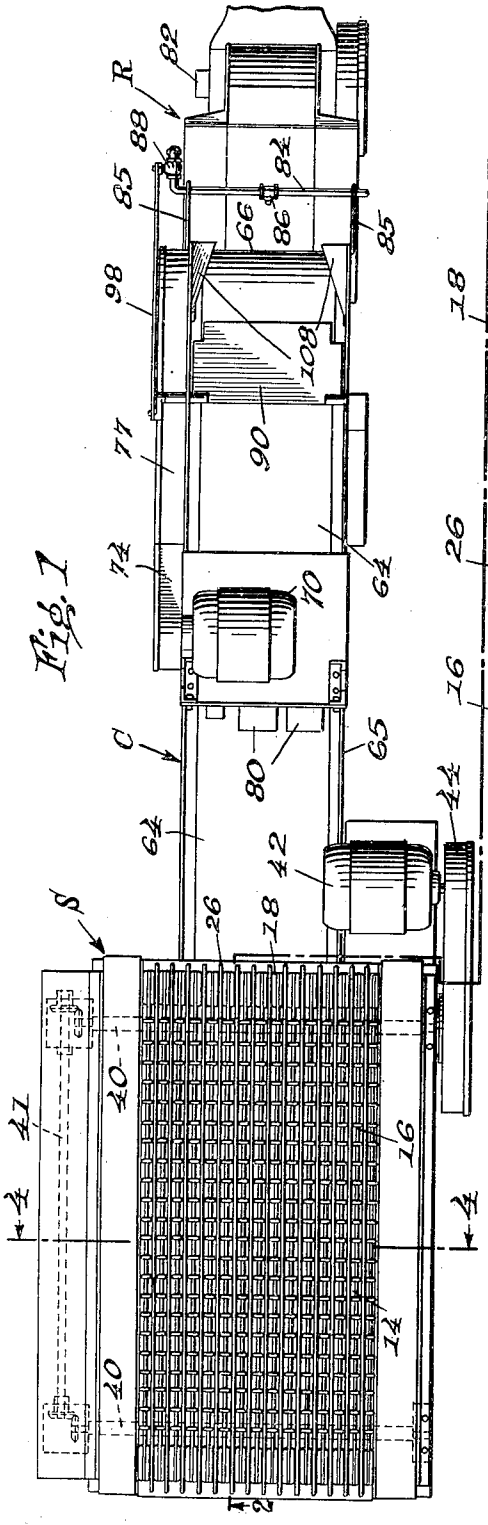


Fig. 1

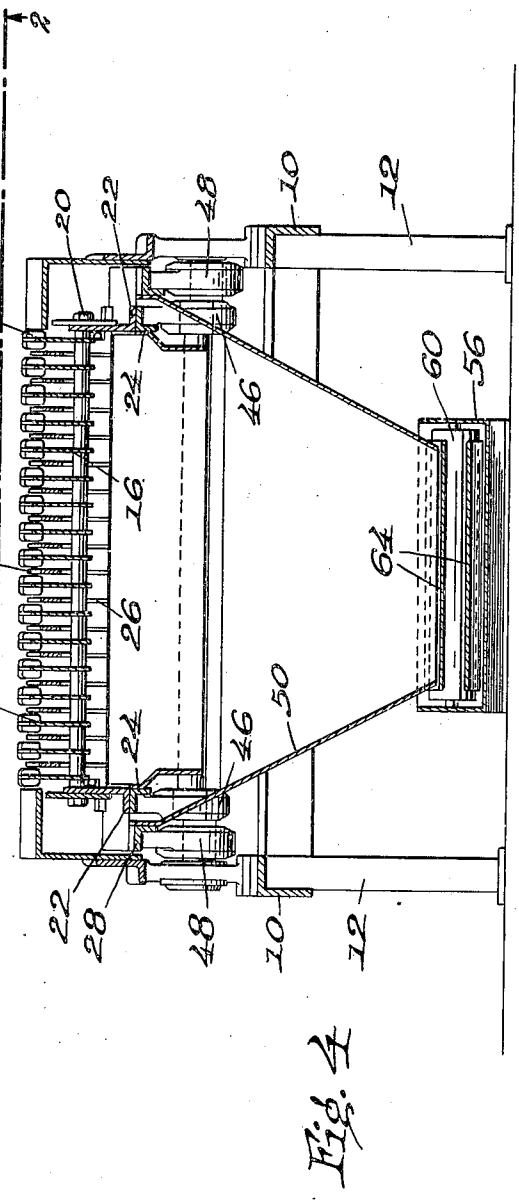


Fig. 4

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APPARATUS FOR TREATING MOLDER'S SAND

Filed Feb. 4, 1946 3 Sheets-Sheet 2

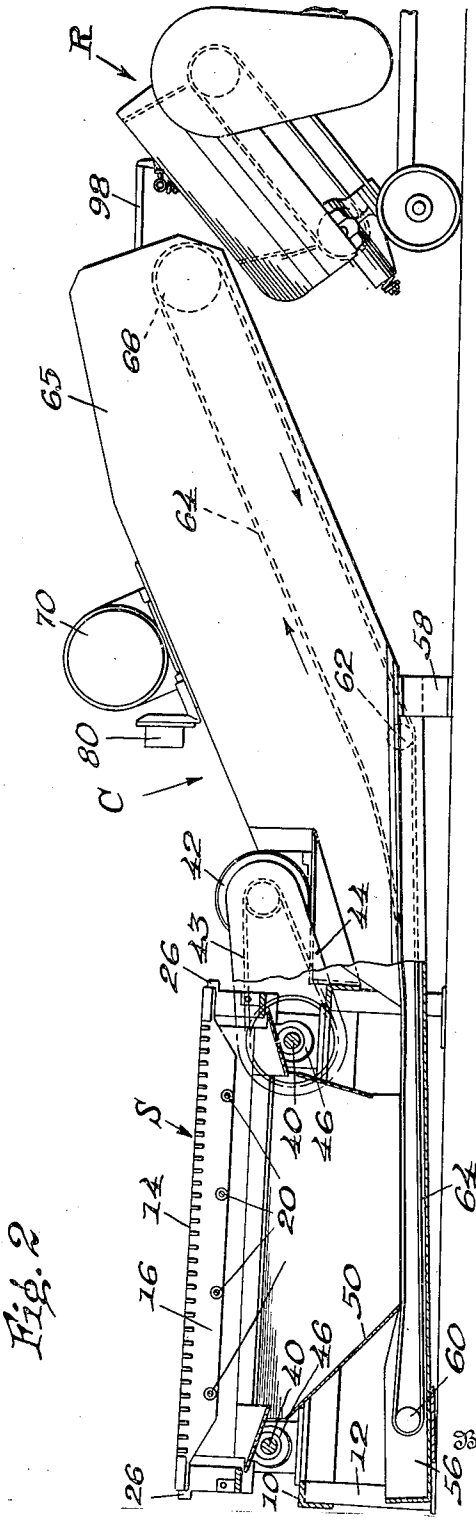


Fig. 2

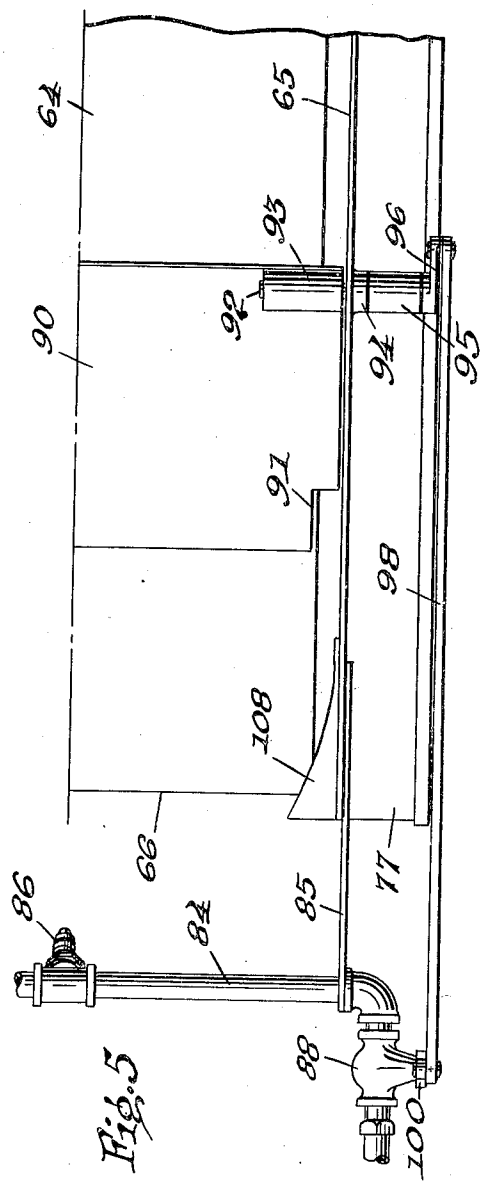


Fig. 5

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Nov. 15, 1949 S. B. DAVIES 2,488,381

APPARATUS FOR TREATING MOLDER'S SAND

Filed Feb. 4, 1946 3 Sheets-Sheet 3

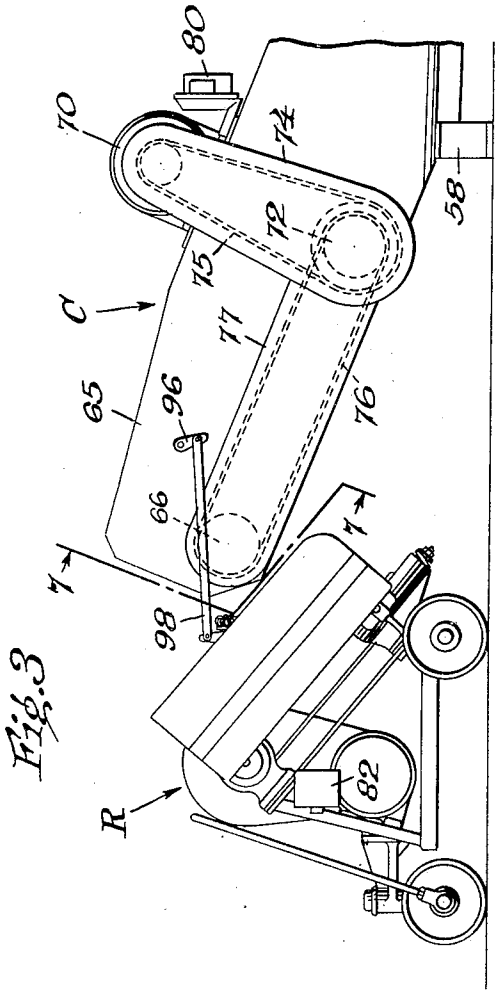


Fig. 3

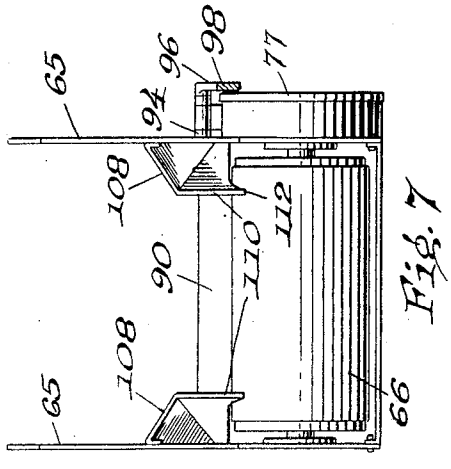


Fig. 7

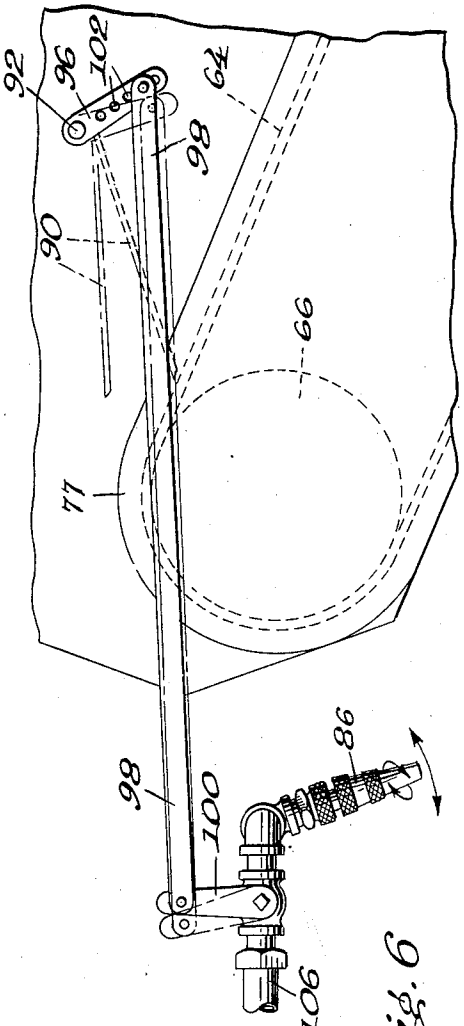


Fig. 6

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Patented Nov. 15, 1949 2,488,381

UNITED STATES PATENT OFFICE

2,488,381

APPARATUS FOR TREATING MOLDER'S SAND

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Application February 4, 1946, Serial No. 645,453

2 Claims. (Cl. 22—89)

1

The present invention relates to apparatus and methods for processing molder's sand and particularly for recovering sand which has once been used, mixing it with an appropriate amount of new sand and eliminating foreign matter therefrom, wetting down the sand to properly temper it, and then blending and discharging the sand in fine particles into piles along the foundry floor preparatory to reuse in forming molds.

A principal object of the invention is to provide apparatus which will eliminate the collecting of sand by a separate shift or group of workers after the mold flasks have been broken down to remove the castings therefrom.

It is also an object of the invention to provide for automatically granulating, conveying and elevating the sand taken from the old molds to a point where it may be discharged into a sand separator and blender or other device, and during the preceding operations, to supply new sand to the mass to revivify it and to then supply a regulated amount of water to the sand in accordance with the volume of sand being processed or conveyed, in order that the mass of sand will be in the best possible condition to be finally treated by the separator and blender or other device, or collected for reuse.

Another object of the invention is to provide a novel means for controlling the application of water to the sand in a uniform and automatic manner. Various other objects and advantages of the invention will become apparent as the description progresses.

In the drawings, which are illustrative of one form and arrangement which the invention may take, and which are not intended to restrict the invention defined in the claims:

Figure 1 is a top plan view of the shake-out, conveyor and combined separator and blender.

Figure 2 is a side elevational view partly in section of the above assembly, taken along the line 2—2 of Figure 1.

Figure 3 is a side elevational view of the end portion of the conveyor and the separator, showing the opposite side thereof from that illustrated in Figure 2.

Figure 4 is a transverse vertical sectional view of the shake-out taken along the line 4—4 of Figure 1.

Figure 5 is an enlarged partial top plan view of the terminal end of the conveyor showing the mechanism for applying water to temper the sand as it drops into the separator.

Figure 6 is a side elevational view of the tempering mechanism of Figure 5.

2

Figure 7 is an end view of the conveyor looking inwardly from a position indicated by the lines 7—7 of Figure 3.

The invention is particularly useful in foundries where stationary molding machines are used. In such foundries, processed sand is piled along the length of the foundry, usually against the wall between adjacent molding machines, there usually being a row of such machines along the wall with a pile of sand between adjacent machines. When the molds have been made they are set on the floor adjacent the machines and one shift of workers pours the metal into the molds. When the metal has solidified, a second shift will break the molds and remove the castings therefrom, leaving the used mold sand together with a considerable amount of foreign matter in a confused condition on the fundry floor. This material is initially hot and somewhat burned from the heat of the metal, and to prepare it for further use it is customary to add some new sand and then to moisten the mixture with water in order to temper it. In order to provide a proper mixture for further use, and depending on the composition of the sand, it is desirable that the quantity of water added should be carefully and evenly controlled. The sand thus mixed and tempered is then shoveled into a sand separator or blender of well known type, such as is generally disclosed in Patent No. 1,559,915, to G. F. Royer, November 3, 1925, and in machines which constitute an improvement over that disclosed in said patent.

It will be obvious from the above that several shifts of workers are required to perform the above operations, including one shift to shake out the molds and remove the castings, and another shift, usually working at night, to condition the sand and shovel it into the sand separator and blender so that it may be blended and properly disposed in piles ready for use in the molding machines beginning with the next day's work shift.

In the present invention, a combination of equipment is provided to automatically carry out the above operations, including a shake-out to break down the mold flasks and remove the scrap while processing the used sand into more or less granular form, a conveyor to receive this sand and carry it to the separator and blender while providing for the addition of a regulated amount of water, and the separating and blending machine itself, which blends and discharges the sand by centrifugal force into piles while simultaneously releasing the confined gases from

the sand and aerating and introducing oxygen into the clean sand. The invention also provides for adding the proper amount of new sand to the mass during the steps mentioned above. The apparatus which I have provided to accomplish the above purposes is described in detail below.

Referring to Figures 1 and 2, the assembly comprises generally the conventional shake-out S on which the mold flasks are placed to be agitated and broken down, the conveyor C which carries the resulting sand from beneath the shake-out, and the separator R which finally receives the sand with water added thereto, and blends and distributes it with considerable velocity in rows or piles onto the foundry floor in preparation for the subsequent molding operations. It will be understood that under certain conditions the separator may not be used at the discharge end of the conveyor, or some other processing machine may be there interposed to perform additional or different treatment. However, an important feature of the invention is the controlled tempering of the mixture of old and new sand for immediate blending by the separator.

The shake-out may be constructed in any appropriate well-known manner, generally following the construction as disclosed in the Royer Patent No. 2,020,800 issued November 12, 1935.

As described in said patent, the shake-out comprises a frame member 10 properly spaced from the floor on legs 12, the shake-out having a top surface or grid 14 (Figure 1) consisting of two units or sets of screening elements. One is made up of a plurality of vertically and longitudinally disposed parallel plates or bars 16 (Figure 4), each of which is provided with transversely disposed parallel fins or fingers 18, as described in said patent. The individual elements 16 are rigidly secured together in predetermined relation by means of transverse bolts 20 having suitable spacer collars along the length thereof. The bolts 20 are suitably supported in side frame members 22, which are in turn mounted on lower frame members 24.

The other units or grids of the screening body comprise a plurality of parallel longitudinally disposed screening plates or bars 26 (Figure 4) secured in predetermined relation to each other and between the bars 16 by corresponding transversely extending bolts and spacer collars. The bars on which the elements 26 are carried are suitably connected with longitudinally disposed substantially parallel angle iron supporting frame members 28 as described in said patent.

Secured in suitable journals mounted upon the main frame of the apparatus are a pair of rotatable shafts 40 (Figure 2). These shafts are connected to be rotated in unison by a counter shaft 41 and by bevel gears as shown in Figure 1 and described in said patent. Driving movement is imparted to one of the shafts 40 by any suitable prime mover such as an electric motor 42, through any appropriate driving conection such as a belt 43 inclosed within the housing 44.

Upon each of the transverse shafts 40, there are mounted two pairs of eccentrics 46 and 48, these eccentrics being surrounded by suitable straps as described in said patent. The inner straps are operatively connected to the supporting frame members 22 for the screening elements 16, while the outer straps are operatively connected to the frame members 28 of the rectangular supporting frame for the other set of screening elements 26. The adjacent cams on each of the transverse shafts are oppositely pitched, so that when one strap is in its upper position, the adjacent strap is in its lower positions. As described in the Royer Patent 2,020,800, the units of the screening body are given movements by the cams so that one set is always moving in a direction opposite to that of the other, yet the rotational or translational movement of the two units with respect to the axis of a common orbit is always in the same direction, and the upper edges of the bars 26 and the fingers 18 exert a combined action on a mass of material disposed on the grid, separating relatively small granules from the mass of material and allowing same to fall through the spaces defined by the members 16 and 26. The movements described impart a longitudinal movement to any article or material which is not passed through the screen, and this movement is toward the left as the assembly is viewed in Figures 1 and 2, the left-hand end being the discharge end of the shake-out, and being slightly elevated above the opposite end. It will be understood that the metal castings being broken from the mold flasks, as well as foreign objects such as wires and the like, will be discharged off of the left-hand end of the grid 14 as viewed in Figure 2, while granulated sand will fall through the openings of the grid.

If necessary, appropriate walls may be provided along and above the side edges of the grid in order to retain the flasks against displacement over the inlet and side edges of the shake-out, but for purposes of simplicity, these have been omitted in the drawings.

When the mold flasks have been agitated and operated on by the grid in a manner which will be understood from the disclosure of the Royer Patent 2,020,800 and my Patent 2,206,164, dated July 2, 1940, the sand thus shaken out will drop through the grids into a hopper 50 which depends from the shake-out as shown in Figures 2 and 4. It will be understood that this hopper has suitable front, rear and side walls, thus completely enclosing and confining the falling material, so that it is guided onto the horizontal flight of the conveyor C.

As best shown in Figure 2, the inlet end of the conveyor comprises a box-like enclosure 56 which rests on the floor or is supported in any suitable manner, this structure gradually slanting upwardly and being supported intermediate the length of the conveyor by leg members 58. Extending laterally between the side walls of the supporting structure of the conveyor are rollers 60 and 62, which are mounted for free rotation across the frame of the conveyor, and a belt 64 passes beneath the roller 62 and around the roller 60. As shown in Figure 2, this conveyor belt extends beneath the hopper 50 of the shake-out and is moved in the direction of the arrows to convey the material from the shake-out to the separator or other device, or simply to a point of discharge, in the manner hereinafter described, there being upwardly extending side walls 65 on each side of the conveyor belt to retain the material thereon.

Beyond the inner end of the shake-out, the frame of the conveyor is inclined upwardly as shown in Figure 2, and there is a conveyor roller 66 mounted for rotation across the frame at the terminal or upper end thereof. Referring to Figure 3, the roller 66 of the conveyor is shown as the driving element therefor, and it is driven by a motor 70 mounted on one side of the upwardly extending wall of the conveyor. The motor 70

has a driving connection with the roller 66 through belts or chains, there being an intermediate driven pulley or wheel 72 mounted for rotation on the frame adjacent the lower end of the inclined portion of the conveyor, this wheel being connected with the motor by a belt or chain 75, and with the drive roller 66 for the conveyor by a belt or chain 76 (Figure 3). The belts 75 and 76 may be suitably protected by housings 74 and 77 respectively. The belt 64 is normally driven by the motor continuously and at uniform speed.

From the above, it will be apparent that the conveyor belt 64 when driven in the direction indicated in Figure 2, will carry granulated material received from the hopper 50 of the shake-out in an upwardly inclined direction and will discharge the material over the portion of the conveyor which passes around the roller 66 and into the inlet compartment of the separator R. The conveyor belt thus has a substantially horizontal flight extending beneath the shake-out and an upwardly inclined flight beyond the shake-out which elevates the material so that it may be discharged while being tempered into the inlet hopper of the separator.

At any appropriate position on the frame of the assembly, controls may be provided to selectively operate the shake-out, conveyor and separator motors. In Figure 1, such controls are shown as at 80, whereas in Figure 3 a separate control for the separator is shown at 82. Preferably, the electric control mechanism will all be positioned at one point such as at 80 in Figure 1, so that one man may control the operation of the assembly, there being necessary electrical leads, not shown, to accomplish these purposes. However, if convenient, independent electrical controls may be provided adjacent each of the agencies involved.

In order to temper the sand being delivered by the conveyor to the separator, a water pipe 84 is positioned transversely across the assembly just above the point where the conveyor delivers to the separator, said pipe being supported by members 85 rigid with the side walls of the conveyor. As previously discussed, it is highly desirable to temper the sand with regulated quantities of water in accordance with the exact volume of sand which is being delivered to the separator. Proper regulation of moisture content of the sand greatly improves the operation of the separator.

The water pipe 84 may be provided with one or more downwardly directed outlet nozzles 86, and on the inlet side of the pipe 84 there is a control valve 88 whose degree of opening is governed by the volume of material being carried by the conveyor or delivered to the separator, to control the amount of tempering water being applied thereto. The nozzle 86 may have adjustable sections to basically regulate the amount of liquid to be delivered therefrom, in accordance with the composition of the sand being used, and after this adjustment has been made, the delivery of tempering water is under the control of the volume of material being delivered, as now described. The nozzle 86 may also be capable of regulation to cause the manner of discharge of water therefrom to vary as adjusted between a simple stream to a wide spray, and the nozzle is also swiveled to control the direction of discharge of the water into the sand as it leaves the conveyor.

As shown in Figures 5 and 6, there is a relatively heavy material responsive metal plate 90 which extends entirely across the top surface of the

conveyor having movements controlled by the mean amount of sand conveyed. The plate 90 is rigidly secured to opposite stub shafts 92 which are carried in bearings 94 integral with the side walls 65 of the conveyor, and on one side in bearings 95 on housing 77. The outer end of one of the shafts 92 rigidly carries a rocking lever 96, which is pivoted in adjusted positions to the end of a connecting rod 98. The opposite end of the rod 98 is pivoted to an operating handle link 100, whose positions determines the degree of opening of the valve 88. When a relatively great quantity of sand is present on the conveyor belt, the plate 90, whose free end is presented in the direction of movement of the conveyor, is lifted upwardly as indicated in Figure 6, and this movement turns its stub shaft 92 in the bearings 94 and 95 and rocks the arm 96. The arm 96 in turn moves the connecting rod 98, and through the link 100, the valve 88 is opened to a controlled degree to permit passage of a greater amount of water to the nozzle 86. Conversely, when a lesser amount of sand is moving on the conveyor belt beneath the plate 90, the latter will drop and operate the valve to reduce the volume of water being supplied. Proper adjustment of the operation of the valve may be effected by selectively pivoting the end of the rod 98 at any one of a number of holes 102 in the arm 96, and when no sand is passing along the conveyor, the arrangement is such that the valve 88 will close.

The plate 90 is of sufficient weight to constantly bear down on the material on the conveyor, and it therefore smoothes out furrows and uneven masses of sand, making the distribution of sand uniform throughout the width of the conveyor. As is clear from Figure 1, the plate 90 is substantially rectangular in form and it is of width substantially equal to that of the conveyor, so that the plate is responsive to the total amount of sand passing its trailing edge at a given time, and it distributes the sand so as to be responsive to a true measure of its volume. The weight of the plate is not, however, great enough to cause the sand to build up behind the plate. By reason of the even continuous movement of the conveyor belt, the movements of the plate are likewise even and continuous, and not erratic, so that the flow of water is evenly increased and decreased rather than being turned on and off. Hence, all of the sand discharged from the conveyor is supplied with a proper degree of moisture, as distinguished from having successive quantities which are either dry or saturated.

It will be understood that the uniform controlled water tempering is applied to said previously processed sand which has had new sand added to the old. The new sand may be distributed onto the mass of old sand at the lower end of the inclined portion of the conveyor, but I find that best results are achieved if it is thrown on to the grid of the shake-out, where it is mixed with the old sand by the oscillating grids and in the hopper 50, prior to reaching the conveyor belt. The proportion of new sand needed for best results will be known, and predetermined quantities may be thrown on the grid in accordance with the number of mold flasks being broken down per unit of time.

It will be evident that the plate 90 may be adjusted with respect to the valve so that the quantity of tempernig water is regulated in accordance with the particular work being performed in the foundry, and furthermore, the

amount of new sand added may be similarly regulated.

Referring to Figures 1 and 7, it will be noted that opposite baffles 108 having vertically disposed inwardly converging walls 110 are provided at the terminal end of the conveyor on the side walls 65 thereof. The vertical walls 110 terminate at 112 beyond the conveyor roller 66. These baffles or wings of the side walls center the sand for discharge into the separator R, and prevent the sand from spilling over the sides of the conveyor belt and into the adjacent moving parts of the roller 66.

It will be obvious that various changes may be made in the apparatus, as well as variations in the methods disclosed herein, without departing from the invention as defined in the appended claims.

I claim:

1. In apparatus of the character described, a shake-out comprising a grid spaced from the foundry floor to break down mold flasks and permit the sand to sift therethrough while preventing passage of the castings and foreign matter, a conveyor having a section beneath said grid and a delivery section extending beyond the same, said latter section being upwardly inclined to elevate the sand a substantial distance above the foundry floor, said conveyor comprising a belt and means to drive said belt continuously at uniform speed, a sand separator and blender positioned directly beneath the upper terminal end of said conveyor to receive the sand therefrom and to blend and discharge it, in fine particles for further molding operations, a movable member pivotally mounted over the delivery section of said conveyor belt and having a substantially straight, free edge directed toward and positioned adjacent to the upper terminal end of said conveyor belt and extending entirely across the same, said member being continuously responsive in its movements to the mean quantity of sand passing upwardly along the delivery section of said conveyor at any given time, a pipe for supplying tempering water having a nozzle positioned to direct the tempering water into the sand beyond the terminal end of said conveyor as it drops into said separator and a control valve for said nozzle, and means operatively connecting said valve with said member to continuously govern the degree of opening of said valve in order to continuously regulate the moisture content of the delivered sand in accordance with the volume of sand being delivered.

2. In apparatus of the character described, a sand separator and blender having a feed inlet and means to support same on the foundry floor, a shake-out comprising a grid spaced from the foundry floor to break down mold flasks and permit the sand to sift therethrough, a conveyor having a section beneath said grid and an upwardly inclined delivery section arranged with its discharge end positioned above said separator to deliver sand directly into said inlet, said conveyor comprising a belt and means to drive said belt continuously upwardly at uniform speed, a relatively heavy plate pivoted over said belt and having a substantially straight, free, movable edge extending entirely across said belt and presented toward the upward direction of travel of said belt, said edge of said plate being located immediately adjacent to the upper terminal end of said conveyor, said plate serving to retard the upward movement of the sand on said belt and to evenly and continuously distribute the sand over said belt whereby even regulated quantities of sand are delivered from said shake-out to said separator by said conveyor, said conveyor having side baffles at its discharge end to direct the sand inwardly toward the center of said belt for proper delivery to the inlet of said separator, a pipe having a nozzle positioned to direct tempering water into the sand beyond the terminal delivery end of said conveyor as it drops into said separator, said pipe having a control valve therein, and connecting means between said plate and said valve to continuously govern the degree of opening of said valve in response to the movements of said plate.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
762,596	Packer	June 14, 1904
1,587,621	Walther	June 8, 1926
2,206,164	Davies	July 2, 1940
2,273,126	McGillin	Feb. 17 1942
2,331,102	Bird	Oct. 5, 1943
2,347,226	Whittaker	Apr. 25, 1944
2,367,278	Hewlett	Jan. 16, 1945