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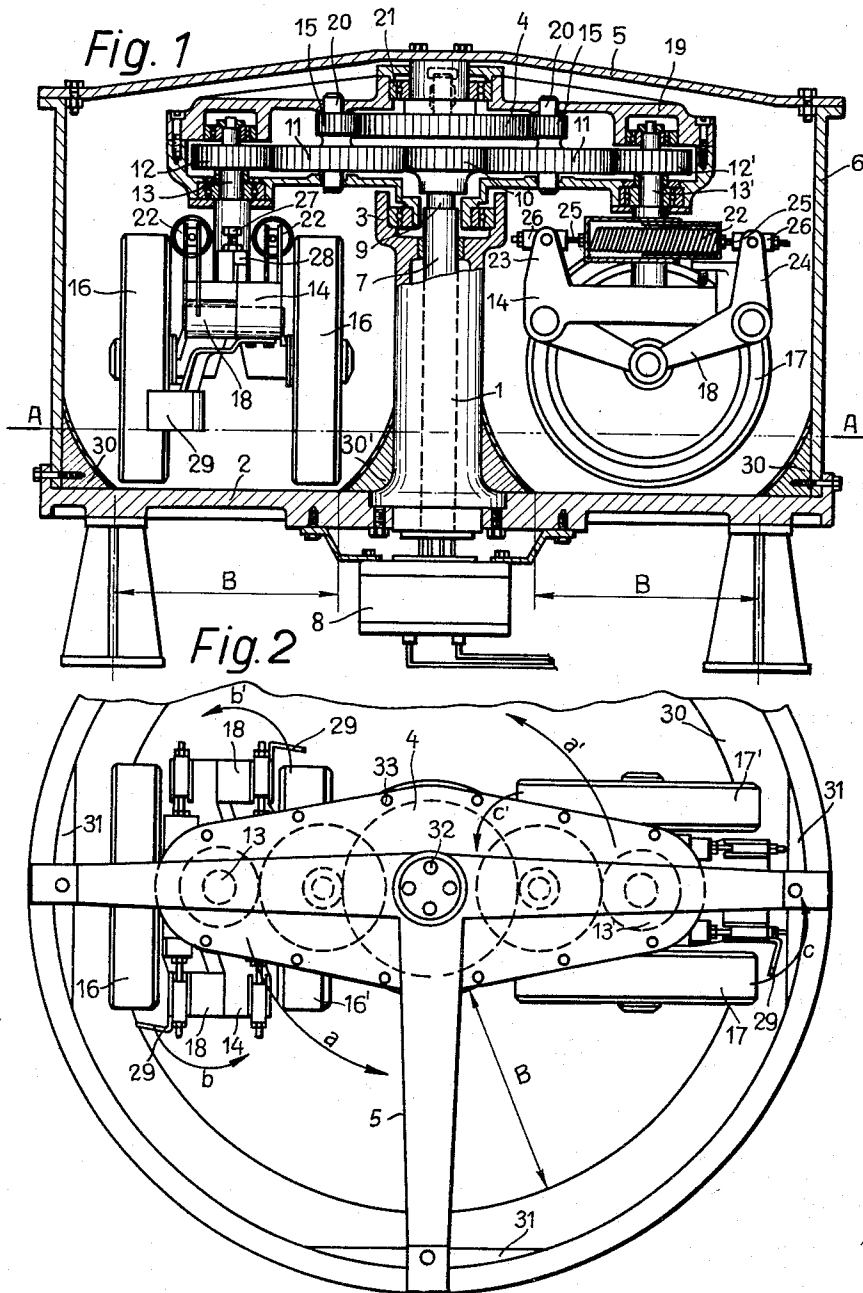
I. PELLIZZETTI

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GRINDING-MIXING MILL FOR FOUNDRY SAND

Filed July 14, 1959

3 Sheets-Sheet 1



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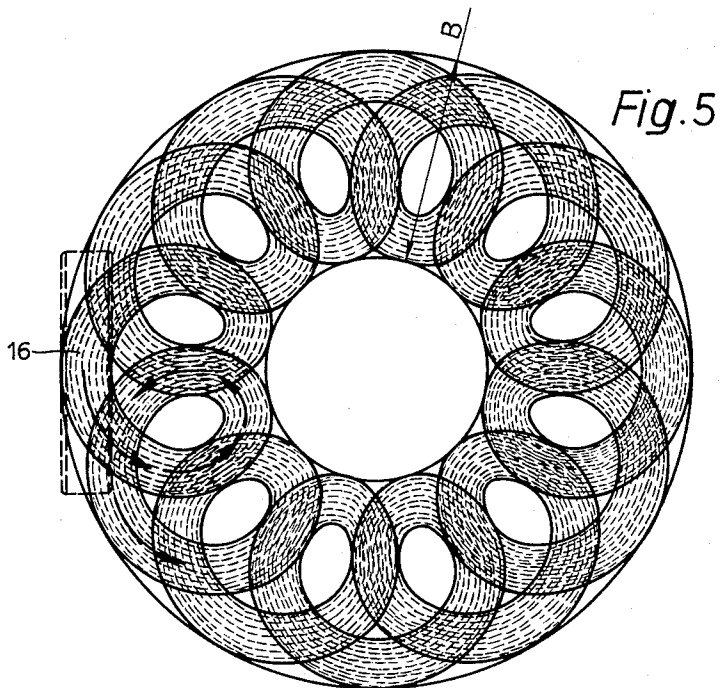
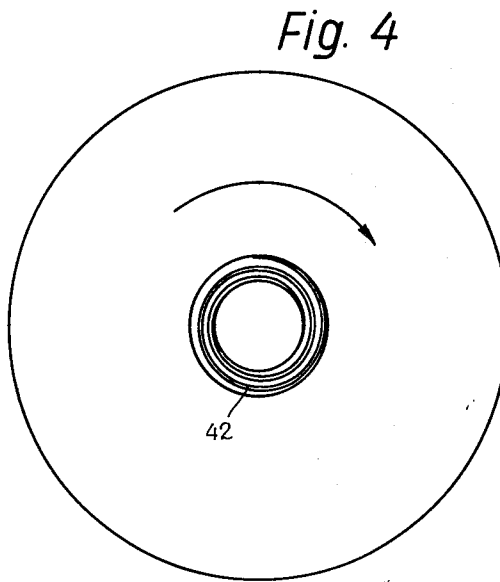
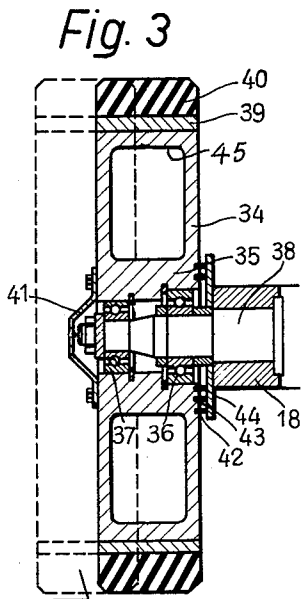
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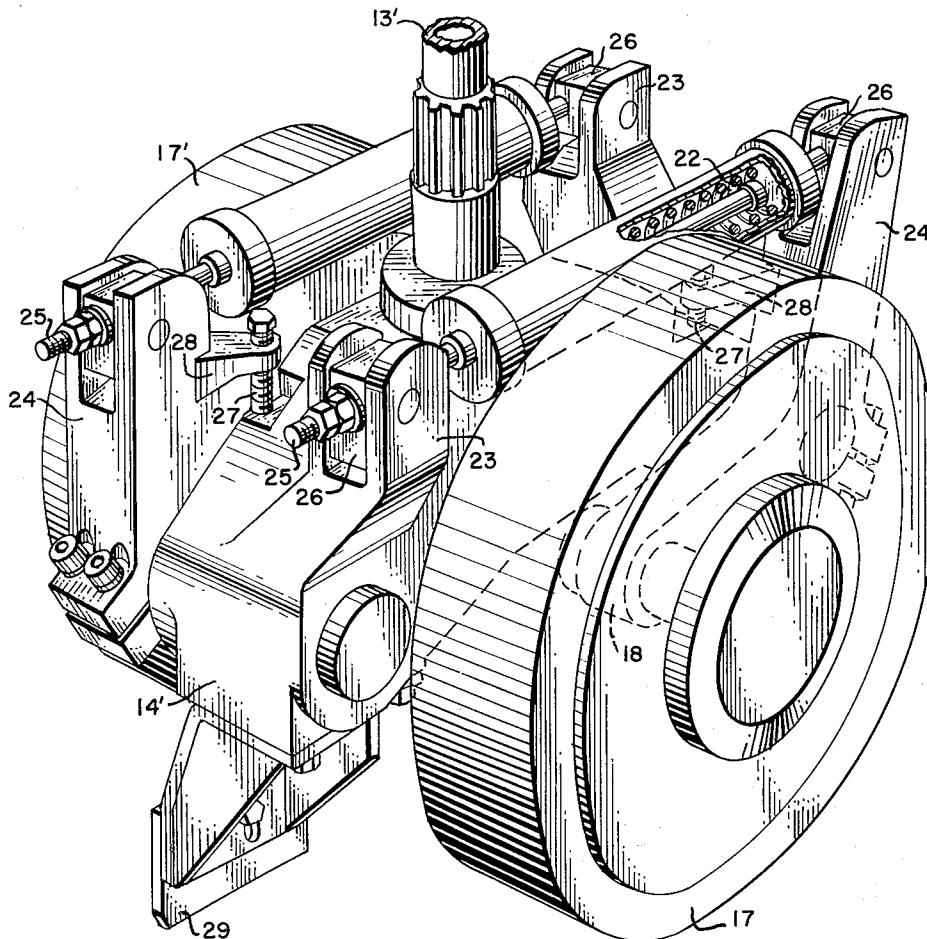


FIG. 6

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2,998,935

GRINDING-MIXING MILL FOR FOUNDRY SAND

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1 Claim. (Cl. 241-126)

Processing of foundry sand is of greatest importance for successful casting. Foundrymen have therefore devoted, for many years, their efforts towards the development of grinding-mixing mills or mullers for the satisfactory processing foundry sand in order to obtain a material of satisfactory physical properties which are usually predetermined depending upon the nature of the casting.

Though grinding-mixing mills of a certain interest have been developed, the problem has not yet been fully solved because the machines are more or less objectionable due to many aspects thereof which may be summarized as follows:

Insufficient output due to a restricted processing path which is limited by the width of the grinding wheels employed which always or nearly always travel through the same paths;

Wear and tear of the conveying and mixing members ("ploughshares" or scrapers), which therefore must be frequently adjusted or replaced. On the other hand, such members were thought heretofore strictly necessary in order to convey the material beneath the grinding wheels which, as mentioned above, constantly travel over the same path;

The grinding wheels are of excessive weight and require an excessive power, and moreover tend to break the silica granules giving rise to increased dust formation resulting in lower permeability of the sand;

The sand is not ground and mixed with constant uniformity, the action of the ploughshares nearly always forms heaps or valleys, thereby deforming the ideal level of the material to be processed.

The principal object of this invention is to provide a grinding-mixing mill constructed to eliminate the above mentioned disadvantages.

According to this invention a grinding-mixing mill of the type comprising a circular vat, at least one circular grinding wheel rolling on the vat bottom and means for carrying along the grinding wheel over an annular path on the bottom, the latter means including a central vertical driving shaft, is characterized in that the grinding mill is supported by a shaft eccentric with respect to the driving shaft and is positively rotated, whereby the grinding wheel, while performing its annular travel on the bottom, rotates at the same time about the eccentric shaft.

Another feature of the invention is that the grinding wheel is mounted and freely rotatable on a radial spindle on the eccentric shaft in order to revolve about the eccentric shaft.

Other characteristic features and advantages of this invention will be understood from the appended description referring to the accompanying drawings which are given merely by way of example, wherein:

FIG. 1 is an axial vertical sectional view of a grinding-mixer showing the most advantageous embodiment of this invention;

FIG. 2 is a fragmentary plan view of FIG. 1;

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FIG. 3 is a diametrical sectional view of a grinding wheel employed on the grinding mixer shown in FIG. 1; FIG. 4 is a side view of FIG. 3, and

FIG. 5 is a diagram illustrating the operative path of a grinding wheel on the bottom of the grinding mixer shown in FIGS. 1 and 2.

FIG. 6 is a view showing the stop structure claimed herein.

Referring to the drawings the mullers according to the invention comprises a central tubular column secured to a circular bottom 2. The column supports, through the interposition of a bearing 3 enclosed by its top end, and a bearing 21 on the hub of a sun-wheel 4 secured to a centering bridge 5, a rotatable hollow spider 19. The centering bridge is diametrically arranged and bolted at both ends to a top of the cylindrical circumferential wall 6 which forms, together with the bottom 2, the vat of a grinding mixer.

A driving shaft 7 extends axially through the central column 1 and is driven by an electric motor 8 secured beneath the bottom 2. The top end of the shaft 7 is formed with spline grooves 9 for splining thereto a pinion 10 transmitting motion through two planet wheels 11, 11' at a desired ratio to two driving toothed wheels 12, 12' splined to shafts 13, 13', respectively. The latter are rotatably supported by the diametrically opposed arms of the spider 19 and extend downwardly parallel with the shaft 7. The lower end of each of the shafts 13, 13' has rigidly attached thereto a cross-member 14, 14', respectively. The planet wheels 11, 11' are fast with two other planet wheels 15, 15' which mesh with the sun-wheel 4. Trunnions 20, 20' for the planet wheels 11, 15 and 11', 15' are rotatably supported by the arms of the spider 19. The whole epicyclic gearing described above is housed in the cavity in the spider.

On rotation of the pinion 10 fast with the shaft 7 the planet wheels 11, 11' rotate and carry along simultaneously the two driving wheels 12, 12', hence the shafts 13, 13' and cross-members 14, 14'. At the same time the planet wheels 15, 15' roll on the stationary sun-wheel 4, thereby slowly rotating the spider 19. It will be seen from FIGURE 1 that the diameters of the gears 10, 11, 15, 4 are selected to considerably reduce speed from the pinion 10 towards the sun-wheel 4, whereas, on the other hand, the diameters of the gears 12, 12' substantially equal the diameter of the pinion 10.

It will be clear from the above that, since two kinds of transmission ratios are provided, namely a higher ratio for the shafts 13, 13', and a lower ratio for the spider 19, two rates of speed result which, having a common source of motion constituted by the pinion 10, will stay fully synchronized. Consequently, on each rotation of the spider, the shafts 13, 13' can accomplish e.g. twelve turns each in full synchronism. The motion of the shafts 13, 13' is therefore a synchronized revolving movement about the driving shaft 7.

As will be explained in greater detail hereafter, the shafts 13, 13' each drive a respective pair of coaxial grinding wheels 16, 16' and 17, 17' situated at diametrically opposed positions with respect to their shafts 13, 13', respectively. Moreover, one pair of grinding wheels 16, 16' is angularly displaced through 90° to the other pair 17, 17', as shown by FIG. 2. Consequently, it ensues from the above example that these four grinding wheels each perform the above-mentioned twelve revolutions a

total of forty-eight revolutions are performed by the four grinding wheels about their respective shafts 13, 13' on each revolution of the spider 19. Considering that the grinding wheels 16, 16' are off-set through 90° with respect to the grinding wheels 17, 17', and the above-mentioned revolving movement does not allow each of the two-grinding wheels of one and the same pair to travel on the track of the other. It may be concluded that during one revolution of the spider 19 the four wheels will by their forty-eight revolutions, performed over four distinct paths, thoroughly grind and mix the sand situated on the vat bottom 2.

The individual grinding wheels are each supported by their respective cross-members 14, 14' by means of a respective bell-crank lever each having two arms 18, 24 fulcrumed to one end of the respective cross-member. The arm 18 of each of the bell-crank levers has fast therewith a respective spindle 38, FIG. 3, for the grinding wheel it supports. The individual spindles extend radially with respect to their respective shaft 13, 13'. In order to effect the desired pressure by the grinding wheels on the sand four tension springs 22, one for each grinding wheel, protected by a telescopic sheath, are fastened at one end to a bracket 23 fast with the respective cross-member 14, 14', and at their other end to the respective bell-crank arms 24 of the above mentioned bell-crank levers. The traction force of the springs 22 is adjusted by means of nuts and lock-nuts and threaded spindles 25 extending through studs 26 pivoted to the bracket 23 and arm 24, respectively. Consequently, the springs 22 constantly urge the respective grinding wheels 16, 16', 17, 17' towards the bottom 2, while resiliently opposing any upward movement due to sand heaps exceeding a normal level A—A or any foreign body, stones or the like. In order to keep the springs 22 from forcefully urging the grinding wheels 16, 16', 17, 17' directly against the metallic bottom of the vat, the bell-crank levers 18, 24 are each formed with a support 28 having an adjustable stop screw 27 abutting its respective cross-member 14, 14'. The grinding wheels 16, 16', 17, 17' can thereby be kept in a slight rolling contact with the bottom 2, or even slightly spaced from the bottom as shown in FIG. 1. On the other hand in order to avoid upward thrusts due to any heaping of the sand, levelling blades 29 are arranged ahead of their respective grinding wheels at the height of the maximum sand level denoted on the drawing by the line A—A. The leveling blades 29 are attached to their respective cross-members 14, 14'. It will be clear that with this arrangement the grinding wheels will travel on the sand while it is constantly at the same level, whereby grinding and mixing are improved in uniformity in that they are carried out by the grinding wheels at a constant pressure.

It will be seen from FIG. 1 that the wall 6 and column 1 are at right angles to the bottom 2, so that the grinding wheels 16, 16', 17, 17' because of their circular shape would normally leave, during their revolutional movement, unprocessed sand adjacent the wall and column. Two annular members 30, 30' of concave arcuated cross-sectional shape extend throughout the inner circumference of the bottom 2 and throughout the outer circumference of the bottom, respectively, to eliminate this possibility. These annular members together with the bottom 2 form an annular channel having arcuate sides and simultaneously determine the width B (FIGURES 2 and 5) of a track on the bottom 2 which is proportioned to the axial spacing of the grinding wheels in each pair, whereby all the sand is acted upon by the grinding wheels.

In FIG. 2 the arrows *a*, *a'* indicate the movement of the spider 19 and, the arrows *b*, *b'* and *c*, *c'* indicate the movements of the grinding wheels 16, 16' and 17, 17', respectively, about the shafts 13, 13' denoted by dotted lines. The centering bridge 5, which is fully shown, is bolted to supports 31 fast with the vat wall

6 by screws 32 visible at the middle of the centering bridge 5. The screws attaching the sun-wheel 4, to the bridge 5 are shown by dotted lines.

The hollow spider 19 enclosing the whole gearing is made up of two sections, namely a lower box and a lid shown in sectional view in FIG. 1, sealed together by screws 35, FIG. 2.

In FIG. 3 is shown the body 34 of one of the grinding wheels 16, 16', 17, 17' which is formed with a central hub 35 housing bearings 36, 37 for the spindle 38 to allow free rotation of the grinding wheel when the latter frictionally rolls on the sand disposed on the bottom 2 of the grinding mixer.

As will be seen from the drawing, the body 34 of the grinding wheel comprises two spaced flange portions both integral with the hub 35 and a felloe 45 to form a hollow construction of lightest possible weight consistent with the work to be performed by the grinding wheels. The felloe 45 has fitted thereon a rim 39 made of steel or other suitable material coated by a thick hard rubber cover 40 contacting the sand for grinding and mixing purposes. It will be understood that the grinding wheel need not be replaced in case of wear. When the cover 40 is worn it is sufficient to replace the rim unit 39, 40 similarly to solid tires of lorry wheels. In order to protect the bearings 36, 37 against dust, sand, water or other foreign materials, the bearings are protected at the front by a tight sealing lid or cap 41 fast with the grinding wheel body and at the rear by a special seal. To this end a logarithmic spiral groove 42 is formed in the front face of the hub 35. A rubber seal 43 is inserted into the groove. The rubber seal is disposed in sliding contact with a polished face of a flange 44 fixed to the spindle 38. It will be seen from FIG. 4, showing a front view of the spiral, that since the spiral is directed opposite to the sense of rotation of the grinding wheel, any foreign body coming into contact with the spiral seal 43 is regularly rejected outwardly without any possibility of access to the bearing 36.

FIGURE 5 illustrates diagrammatically, by way of explanation the path followed by one grinding wheel, such as wheel 16, during one revolution of the spider 19, where provision is made for the grinding wheel to perform twelve revolutions in accordance with the above described example, in order to supply a demonstration of the above object of fully scanning the whole width "B" of the bottom 2. Since four grinding wheels are provided which travel over four distinct paths similar to the path shown in FIG. 5, it may be said that the bottom is exposed to the action of the grinding wheels throughout, so that the sand is methodically and efficiently processed.

What I claim is:

In a grinding-mixing mill a stationary vat having means defining a horizontal circular bottom, a stationary tubular column vertically extending from a central zone on said bottom, a vertical driving shaft arranged for concentric rotation in the column, a hollow spider rotatably supported at the top end of the column, said spider including two hollow radial arms extending in opposite directions, two vertical shafts rotatably depending from a respective one of said hollow arms and each disposed at a position eccentric to the driving shaft, an epicyclic gearing enclosed by the spider adapted to rotate the spider with respect to the column and the two eccentric shafts with respect to their respective arms on rotation of the driving shaft, for each eccentric shaft a cross member fixed on the lower end of a respective eccentric shaft, for each cross member a pair of bell crank levers fulcrumed at opposite ends of the cross member each having a first arm upwardly extending from the fulcrum and for each eccentric shaft a second arm extending towards the second arm of the other bell crank lever in the pair, a pin directed radially to the eccentric shaft on the free end of each said second arm, a circular grinding wheel rotat-

able on each pin, adjustable spring means operative between the first arms of the bell crank levers in the pair to deflect the pin-carrying arms towards the bottom of the vat, and adjustable stop means operative between each bell crank lever and cross member within a range including a condition in which the respective grinding wheels are adjacent to but out of contact with said bottom.

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