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MIXERS

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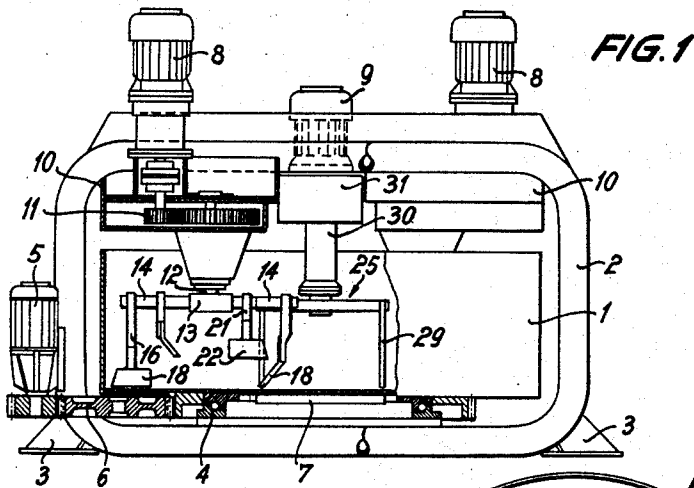


FIG. 1

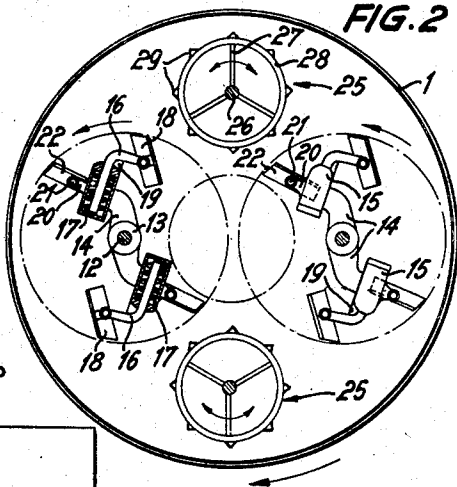


FIG. 2

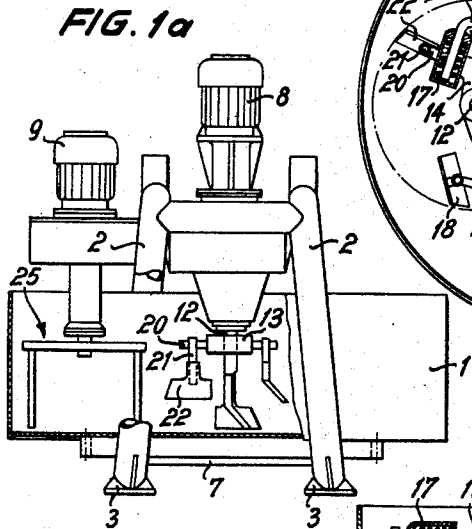


FIG. 1a

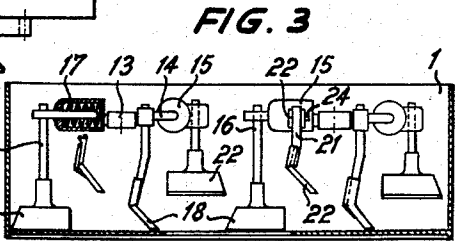


FIG. 3

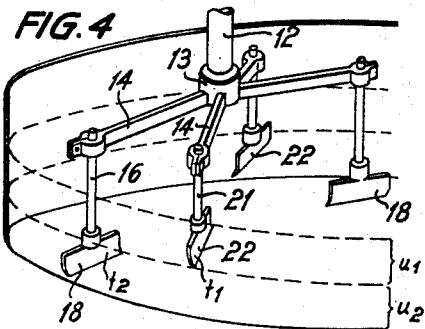


FIG. 4

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3,109,632
MIXERS

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The invention relates to mixers having a mixing bowl rotating around a vertical axis in which bowl bladelike mixing tools are arranged in one or several, and particularly in two systems of tools which tool systems rotate around one or several respectively eccentric axes parallel to the axis of the mixing bowl in counter-current or concurrently. Particularly the invention relates to such mixers of this type, in which a central discharge opening is provided in the bowl of the mixer, which opening can be closed by a liftable and depressable closure plate. Such mixers are principally suitable and extensively employed for mixtures of all kind and particularly for clay, chamotte, stoneware compositions, concrete, molding sand for casting, sand-lime brick compositions, ores, artificial fertilizers and the like, further also for mixtures containing tar and asphalt as well as for lacquer and oil paints, artificial resins, pharmaceutical products, food stuffs and the like.

In many cases it is desired to increase considerably the throughput per hour of such mixers at the same diameter. Concerning the prior embodiments, especially when provided with edge-runners, the height of the layer cannot be increased without an extreme diminution of the efficiency and the rotating speed is strongly limited. The height of the layer of mixing material cannot be increased as desired without diminishing the effect of mixing and dressing. Especially, when plastic materials, such as ceramic materials, have to be treated in the mixer, it is necessary to provide the tool systems at least partly with edge runners in order to obtain satisfactory mixing effects. The efficiency of an edge runner, however, is restricted to a relatively small height of the layer of material to be treated and further the rotational velocity of edge runners cannot be increased to the desired degree.

Therefore an object of the present invention is to increase the capacity of bowl mixers having a mixer bowl rotating around a vertical axis and tool system rotating therein around an eccentric axis in counter-current without increasing the diameter of the mixer bowl.

Another object of the invention is to permit the treatment of the material in a higher layer by increase of the mixing effect and of the intensity of mixture. Finally an object of the invention is to provide a mixer of the type mentioned above which allows agitation and kneading of plastic materials, such as ceramic raw materials, concrete and so on with omission of the hitherto usual edge runners.

These objects and additional advantages according to the invention are obtained by providing, in a mixer having a rotating mixer bowl and tool systems arranged eccentrically to the axis of the bowl and rotating in the same or the opposite direction thereto, at least two mixing tools in each tool system, of which tools one has a smaller depth of immersion into the bowl or into the material to be mixed than the tool following the said mixing tool. Preferably the mixing tools immersed at different depths consist of mixing blades. The shape of such mixing blades is well known per se, but hitherto the mixing blades have been arranged at the star-shaped arms of the tool system in such a manner that they rotate with their lower edges at the same level on or closely above the bottom of the mixer bowl. While it is well known to mount these mixing blades adjustably with respect to the height of the

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arms of the tool system, this adjustability had exclusively the purpose of making it possible to compensate the wear of the blades at the lower edges thereof during long periods of operation.

According to the invention, it is preferred to arrange in each tool system an even number of mixing tools, one-half of which are arranged in the hitherto common manner on or closely above the bottom, while the other half is spaced at a considerable distance from the bottom of the mixer bowl at a common level. The difference of the depth of immersion between the following mixing tools is preferably about half of the layer height provided for the use of the mixer.

The mixing tools staggered with respect to the height have the effect that the circulation of the mixing material at the surface of the layer of material, which circulation is normally relatively small, becomes strongly increased and a furrow in the material is formed behind each upper tool by the rotation, in which the subsequent tools arranged at the lower level follow and thereby are required to pass through a fraction only, for example one-half of the entire height of the material layer and thus are strongly relieved. Thereby the effect results, that in spite of an essentially higher layer of mixing material, the necessary power input in relation to the entire amount of the material to be treated is decreased.

The efficiency and operation of this arrangement according to the invention can further be increased by making the upper mixing blade broader in the horizontal dimension than the lower blade in order that the different relative motions resulting from the eccentricity of the tool system in the circular path of the various tools is compensated.

The mixing tools arranged alternatively at higher and lower levels are arranged at the same radius in order, that each lower mixing blade may run in the furrow formed by the upper mixing blade.

The mixing tools can be arranged at the periphery of the tool system at equal angular distances, for example the three lower mixing blades can be positioned at angular distances each of 120° while the mixing blades at the upper level are displaced with respect thereto each by 60°. However, preferably the upper mixing tools are displaced forwardly with respect to the rotation direction by a relatively small distance ahead of the corresponding lower blades, i.e., for example by a distance of about 20 to 40°. When by this arrangement each lower blade follows relatively shortly behind the upper blade, the advantage results, that the furrow formed by the upper blade has still a broad and deep profile in the range of the periphery, where the following lower blade is operating. Further the unsymmetric distribution of the upper blades with respect to the lower blades has the advantage that according to a preferred embodiment of the invention the upper blades can be fixed on the same arms of the tool system as the lower blades, so that the whole weight of the tool system is not essentially increased by the arrangement of the upper blades.

In the former counter-current mixers the mixing tools operating along the bottom of the bowl usually are elastically mounted to be able to deviate when impinging on coarse ingredients of the mixing material, for example stones in ceramic clay compositions or concrete. The upper blades provided according to the invention, however, do not need to be elastically mounted, because they run above the lower layer of the mixing material and therefore such hard ingredients as stones or the like can escape downwards into this layer of mixing material. On the other hand, however, the upper mixing blades can be attached to the tool system adjustably with respect to the height in a manner well known per se.

The arrangement of vertically staggered mixing tools according to the invention results in the additional advantage that by reason of the increase of mixing intensity and of kneading effect obtained thereby, the simultaneous employment of conventional edge runner tools can be eliminated. Further effects and features of the invention are indicated in the following description of a preferred embodiment of the invention illustrating the structure and operation of the counter-current mixer. The shown embodiment is given in an illustrative manner and it is not intended to restrict the invention to this special embodiment.

FIG. 1 is a front view of the counter-current mixer having two eccentric tool systems and two whirling instruments, the bowl being partly in section.

FIG. 1a is a side view, partly in section, of the device of FIG. 1, seen from the right-hand side.

FIG. 2 shows in a top view that machine of FIG. 1.

FIG. 3 shows one of both the tool systems in a side view.

FIG. 4 indicates the operation of the blades staggered in height in a diagrammatical and perspective view.

With reference to FIG. 1 the mixer bowl 1 is supported in a support stand 2 consisting of steel tubes which stand has several essentially rectangular frames connected with each other and resting on feet 3. The mixing bowl turns on a large ball bearing 4 and is driven by the motor 5 through a toothed wheel gearing 6. The discharging device 7 is merely indicated, since it is well-known per se (cf. for example U.S. Patent 2,031,149, particularly FIG. 6) and is not critical to the subject matter of the invention.

Above the mixing bowl, motors 8 and 9 are mounted in the supporting stand for individual drive of the tool systems and the whirling instruments. In a bridge 10 likewise mounted on the supporting stand 2 is the reducing gear 11 for the main shaft of each tool system. A socket 13 is keyed or otherwise mounted on the said shaft, which socket has two essentially radial arms 14. At the end of each arm 14 is a sleeve 15. The angle bar 16 is mounted with one of its arms in the sleeve and enclosed by a spiral spring 17, one end of which bar is fixed at the bottom of the sleeve, while the other end of the said bar engages in a cover arranged at the open end of the sleeve in such a manner, that the spring tends to press the bar downwards and thereby to press the blade 18 attached at its other end towards the bottom of the bowl 1. An abutment 19 limits the lowest position of the blade to a position a short distance above the bottom of the bowl. This resilient mounting of the mixing blades is likewise known per se, for example, in German Patent No. 256,065. According to the invention, however, a holding device 20, for example, a forklike clamping fish plate is arranged rigidly clamping a bar 21 which carries a blade 22 in rigid relation to the tool system. As particularly is to be seen from FIG. 3, the bar 22 has such a length that the blade 23 is at a considerable distance above the bottom of the mixing bowl and in the embodiment shown this distance is more than and particularly about one and a half times the height of blade 18. By loosening of the clamping screws 24 the clamping fork 22 can be released

in order to adjust the bar 21 in accordance with the wearing of the lower edge of blade 22 or to exchange it for a new blade, if desired.

While in the present embodiment each tool system has merely two arms 14 and two pairs of blades 18, 22, it is to be understood, that merely an example is concerned and depending on the size of the mixer and on its equipment with one or two tool systems, also three or four arms each having two blades staggered with respect to the height can be provided.

As shown in FIG. 2 in the sectors of the bowl area between the tool systems two whirling instruments 25 consisting of the driving plug 26 having the cross bars 27, a holding ring 28 and eight triangular rods are inserted. Each of these whirling instruments is mounted by its shaft in a sleeve 30 which is arranged in a bridge 31 on the frame stand 2 and directly driven by the motor 9. By reason of this direct drive in contrast to the insertion of the reducing gear 11 between the motor 8 and the tool system, this whirling instrument turns at a considerably higher speed of rotation than the tool system of the mixer blades.

What I claim is:

1. A mixer comprising a bowl part, having a bottom, a support part mounted above the bowl part, means mounting at least one of said parts to turn with respect to the other about the central vertical axis of the bowl part, a member mounted on said support part to rotate with respect thereto about a second vertical axis eccentric to said bowl axis, means to rotate said member, and at least two mixing tools fixedly carried by said member a first of said tools being located near the bottom of the bowl and the second tool having its lower edge spaced at least as far from the bowl bottom as the upper edge of the first tool, said tools having substantially the same radial extent with respect to the second axis and being at substantially the same axial distance therefrom, the first tool being angularly displaced from the second tool about said second axis in a direction opposite the direction of rotation of said member by an angle substantially less than a right angle.

2. A mixer as claimed in claim 1 in which said angle is 20° to 40°.

3. A mixer as claimed in claim 1 in which the lower edges of the second blades are spaced above the upper edges of the first blades.

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