

(19)



(11)

EP 2 617 543 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

24.07.2013 Bulletin 2013/30

(51) Int Cl.:

B28C 5/16 (2006.01)

B01F 7/16 (2006.01)

B08B 7/02 (2006.01)

B28C 5/48 (2006.01)

B01F 11/00 (2006.01)

B08B 9/08 (2006.01)

(21) Application number: **12151919.3**

(22) Date of filing: **20.01.2012**

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

Designated Extension States:

BA ME

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(54) **A batch mixer for mixing face mix and a method for cleaning a batch mixer**

(57) Disclosed is a batch mixer (1) for mixing face mix. The mixer (1) comprises a mixing pan (2) including one or more discharge openings (3) and a mixer unit (5) comprising a mixer unit drive (6) and one or more mixing

means (7). The mixer (1) further comprises at least one vibrator (13) for making at least parts of the mixing means (7) vibrate so that face mix sticking to the parts of the mixing means (7) is loosened.

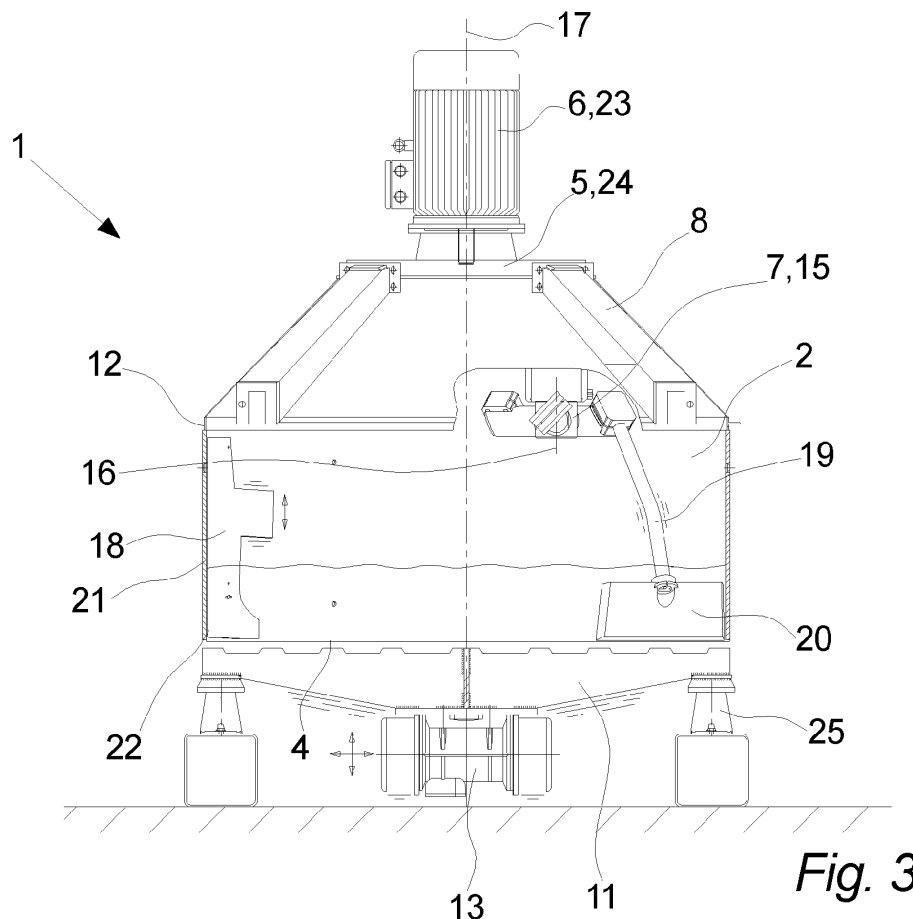


Fig. 3

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Description

Field of the invention

[0001] The invention relates to a batch mixer for mixing face mix and a method for cleaning a batch mixer.

Background of the invention

[0002] It is known to provide slabs and paving stones with a relatively thin topping (e.g. 1 to 40 mm thick) in the form of a face mix made of particularly fine-grained material. Face mix is in principle the same as ordinary concrete but all the ingredients are fine-grained and the face mix often does not contain stones or the stones are of a very small diameter such as between 0-5 mm and preferably between 0-3 mm.

[0003] The face mix can contain colouring means and it can be textured in a variety of ways to resemble other materials, similarly to stamped concrete.

[0004] However, particularly due to the fine-grained nature of the ingredients, face mix is particularly sensitive to hardened lumps of face mix being mixed into the face mix and it is therefore particularly important that the mixer used for mixing the face mix is cleaned thoroughly after the mixer has been emptied to ensure that material is not left behind which could harden and thereby potentially reduce the quality of the next batch to be mixed in the mixer.

[0005] Face mix is used e.g. at slab and paving stone manufacturing plants and here it is known to use batch mixers for mixing this particular type of concrete but even a batch mixer with the most cleaning-friendly design can be difficult to clean completely and the cleaning process can be time consuming and e.g. require large volumes of water no matter if the cleaning is done manually or by spraying water on inside of the mixing pan by mean of an integrate cleaning system.

[0006] An object of the invention is therefore to provide for an advantageous cleaning technique for a batch mixer.

The invention

[0007] The invention provides for a batch mixer for mixing face mix. The mixer comprises a mixing pan including one or more discharge openings and a mixer unit comprising a mixer unit drive and one or more mixing means. The mixer further comprises at least one vibrator for making at least parts of the mixing means vibrate so that face mix sticking to the parts of the mixing means is loosened.

[0008] Providing a batch mixer with a vibrator is advantageous in that the mixed face mix hereby can be cleaned automatically and without the use water. Furthermore, the use of a vibrator connected to the mixer for cleaning purposes enables that vibration cleaning can take place even if face mix ingredients are placed in the mixing pan hereby increasing the capacity of the mixer.

[0009] It should be pointed out that by the term "batch mixer" is to be understood any kind of mixer comprising a mixing pan with rotating mixing means extending down into the mixing pan. In a batch mixer all ingredients are loaded into the mixing pan together or in a pre-defined sequence, and mixed until a homogenous material is produced and discharged from the mixing pan in a single lot. Thus, the term "Batch mixer" does not include so called "Continuous mixers" where the ingredients are continuously charged into the mixer and where the mixing takes place as the material travels from the charging port (s) to a discharge nozzle, from where it is continuously discharged. Batch mixers exist in a number of design variations and are also known under other names such as counterflow mixer, countercurrent mixer, planetary mixer, stationary pan mixers and vertical axis mixers.

[0010] In an aspect of the invention said at least one vibrator is connected to said mixing pan.

[0011] The mixing pan of a batch mixer is directly or indirectly connected to all the parts of a mixer from which face mix should be cleaned and it is therefore advantageous to connect the vibrator to the mixing pan to ensure an efficient distribution of the vibrations.

[0012] In an aspect of the invention said at least one vibrator is connected to a bottom structure of said mixing pan.

[0013] By connecting the vibrator to the bottom structure of the mixing pan it is ensured that the vibrations are distributed efficiently to the important parts of the mixer.

[0014] In an aspect of the invention said at least one vibrator comprises means for generating vibrations at between 10 and 10,000 Hz, preferably between 80 and 5,000 and most preferred between 150 and 3,000 Hz.

[0015] If the vibrations are too high frequent the efficiency of the vibrations in relation to loosening the face mix is reduced and the risk of the vibrations affecting the integrity of the mixes is increased. However, if the vibrations are too low frequent the efficiency of the vibrations in relation to loosening the face mix is also reduced.

[0016] Thus, the present frequency ranges presents advantageous ranges in relation to the cleaning efficiency of the vibrations.

[0017] In an aspect of the invention said batch mixer further comprises vibration dampers arranged between said batch mixer and the underlying ground.

[0018] It is advantageous to place the mixer on vibration dampers so that vibrations from the vibrator are not transferred to the surroundings or at least so that the vibrations are dampened.

[0019] In an aspect of the invention said mixer unit drive comprises speed regulating means.

[0020] Providing the mixer unit drive with speed regulating means is advantageous in that it hereby is possible to increase the rotational speed of the mixing means before, after or during at least parts of the mixing means are vibrated to hereby further increase the efficiency of the vibrator.

[0021] In an aspect of the invention said speed regu-

lating means comprises a frequency converter.

[0022] Using a frequency converter is a simple and inexpensive way to control the rotational speed of the mixing means.

[0023] In an aspect of the invention said parts of said mixing means includes mixing arms and mixing shovels.

[0024] The mixing arms and the mixing shovels are formed with a relatively complex geometrical shape e.g. compared to the large even surfaces of the mixing pan and the risk of face mix sticking to the mixing arms and the mixing shovels is therefore particularly high. At the same time the complex shapes make it relatively difficult to clean the mixing arms and the mixing shovels by conventional cleaning methods and it is therefore particularly advantageous to clean the mixing arms and the mixing shovels by means of vibrations from a vibrator.

[0025] In an aspect of the invention said mixing arms are tilted in relation to a vertical plane.

[0026] Mounting the mixing arms so that they are not parallel with a vertical plane is advantageous in that particularly vertical vibrations hereby will vibrate the protruding mixing arms more and thereby increase the cleaning effect of the vibrations.

[0027] In an aspect of the invention said mixing pan is stationary and two or more suspension arms are extending between said mixing pan and said mixing unit hereby suspending said mixing unit above said mixing pan.

[0028] Making the mixing pan stationary is advantageous in that it is much easier to mount and power a vibrator if it is fixed on a stationary mixing pan. Furthermore, by suspending the mixing unit above the mixing pan by means of suspension arms extending between the mixing pan and the mixing unit it is ensured that the mixing pan and the mixing unit are firmly connected so that vibrations generated by a vibrator attached to one part is efficiently transferred to the other part, hereby increasing the efficiency of the vibrator.

[0029] The invention further provides for a method for cleaning a batch mixer. The method comprises the steps of:

- mixing face mix in a mixing pan of the batch mixer by means of a mixing unit comprising a mixer unit drive and one or more mixing means,
- emptying face mix out of a discharge opening in the mixing pan, and
- vibrating at least parts of the mixing means by means of a vibrator so that face mix sticking to said parts of the mixing means are loosened.

[0030] The mixing means are difficult and time consuming to clean by conventional cleaning methods and since the quality of face mix is particularly sensitive to lumps of hardened material in the mix it is particularly advantageous to clean the mixing means of a batch mixer by means of vibrations.

[0031] In an aspect of the invention said method further comprises the step of feeding aggregate into said mixing

pan while or before initiating said vibrating.

[0032] Feeding aggregate into the mixing pan so that at least parts of the mixing means is submerged in the aggregate while or before the vibrations are stated is advantageous in that the friction of the aggregate will further increase the efficiency of the vibrations in relation to cleaning the mixing means. Furthermore, feeding aggregate into the mixing pan is advantageous, in that once the leftover material has been loosened from the cleaning means, it can be mixed into the aggregate, which will prevent it from hardening and thereby also prevent it from contaminating the next face mix batch.

[0033] In an aspect of the invention said mixing means are rotating while said vibrator is vibrating said parts of said mixing means.

[0034] Rotating the mixing means while vibrating them is advantageous in that the centrifugal force will amplify the effect of the vibrations hereby further increasing the cleaning effect.

[0035] In an embodiment said face mix comprises colouring means.

[0036] In an aspect of the invention said vibrations are at least also being initiated while said face mix is being emptied out of said mixing pan.

[0037] Stating the vibrations while the face mix is being emptied out of the mixing pan is advantageous in that the vibrations hereby can also help to empty the mixer faster and thereby increase its capacity. Furthermore, by stating the vibrations while the face mix is being emptied out of the mixing pan it is ensured that the loosened material leaves the mixer with the rest of the face mix hereby reducing the risk of leaving material behind which could possibly contaminate the next batch of face mix.

[0038] In an aspect of the invention said method is a method for cleaning a batch mixer according to any of the previous mentioned embodiments of batch mixers.

Figures

[0039] The invention will be described in the following with reference to the figures in which

fig. 1 illustrates a cross section through the middle of a prior art batch mixer, as seen from the front,

fig. 2 illustrates the batch mixer shown in fig. 1, as seen from the top,

fig. 3 illustrates a cross section through the middle of a batch mixer comprising a vibrator, as seen from the front, and

fig. 4 illustrates an embodiment of a bottom structure for a batch mixer, as seen in perspective.

Detailed description

[0040] Fig. 1 illustrates a cross section through the mid-

dle of a prior art batch mixer 1, as seen from the front.

[0041] Prior art batch mixers 1 exists in a multitude of designs but common features are that a batch mixer 1 comprise a mixer unit 5 including mixing means 7 for mixing the ingredients placed in a mixing pan 2.

[0042] In this embodiment the mixer unit 5 is suspended above a mixing pan 2 but in another embodiment the mixer unit 5 could be placed in the mixing pan 2 e.g. placed in the centre of the pan 2 and e.g. supported on the bottom face of the pan 2.

[0043] In this embodiment the mixing pan 2 is stationary but in another embodiment of the invention the pan 2 could also be rotating.

[0044] In this embodiment the rotational axes 16, 17 of the mixer unit 5 and the centre axis of the mixing pan 2 are all vertical but in another embodiment of the invention one or more of these axis could be arranged tilted in relation to vertical. I.e. in an embodiment all these axis 16, 17 could be tilted e.g. 20° in relation to vertical e.g. to ensure that gravity will pull the mixed face mix towards a discharge opening 3 arranged at the lower end of the mixing pan 2.

[0045] The mixing means 7 usually comprises one or more mixing stars 15 extending down into the mixing pan 2 and each of the mixing stars 15 are rotated around a substantially vertical centre axis 16 of each star 15. In this embodiment all the centre axes 16 of all the mixing stars 15 are also rotate around a centre axis 17 of the mixer unit 5. This mixing means design entails that the outer periphery of the mixing stars 15 at the outer edge of the mixing pan 2 is rotating with the direction of the rotation of all the stars 15 around the mixer unit's center axis 17 and the inner periphery of the mixing stars 15 is rotating against the direction of the rotation of all the stars 15 around the mixer unit's center axis 17.

[0046] Since the mixer unit 5 is usually coaxially arranged in a cylindrical mixing pan 2 the centre axis 17 of the mixer unit 5 is usually also coaxial with the centre axis of the mixing pan 2.

[0047] In this embodiment the mixer unit 5 only comprises two mixing stars 15 and they are both rotated in the same direction at the same speed but in another embodiment one or more of the stars 15 could rotate in an opposite direction and/or one or more of the mixing stars 15 could rotate at a different speed.

[0048] The mixing stars 15 can be designed in a multitude of ways but in this embodiment each mixing star 15 comprises a number of mixing arms 19 extending down towards the bottom 4 of the mixing pan 2. The bottom end of each arm 19 is provided with a mixing shovel 20 designed to lift the material in the mixing pan 2 of the bottom 4 of the pan 2 and mix it around.

[0049] However, in another embodiment the mixing means 7 could comprise mixing sticks, mixing paddles, mixing chains, whisks or any other devices or means or any combination hereof suitable for mixing face mix or face mix ingredients in a mixing pan 2.

[0050] Furthermore, to ensure that the ingredients in

the mixing pan 2 are mixed properly the mixer unit 5 of a batch mixer 1 can also comprises one or more side scrapers 18. In this embodiment the side scrapers 18 only rotate around the centre axis 17 of the mixing unit to scrape the side 21 and the corner 22 between the side 21 and the bottom 4 of the mixing pan 2 and deliver the scraped-off material in front of a rotating mixing star 15 so that the material at the sides 21 of the pan 2 can also be thoroughly mixed into the batch.

[0051] In this embodiment all the rotating parts 7 of the mixer unit 5 are driven by a mixer unit drive 6 which in this embodiment comprises a centrally arranged motor 23 - which in this case is electrical - connected to a gear arrangement 24 - which in this case is not illustrated in any details. Different parts of the gear 24 is in turn connected to the mixing stars 15, the side scrapers 18 and possibly other mixing devices so that the direction and speed of the motion of the mixing means 7 is synchronized by the gear 24 and controlled by the gear 24 and the motor 23.

[0052] However, in another embodiment the mixer unit 5 could be formed differently i.e. it could comprise more than one motor 23, it could comprise none or more than one gear arrangement 24, each mixing star could be provided with their own individual gear 24 and motor 23 or the mixing means 7 could be driven by another power source such as a combustion engine, a hydraulic or pneumatic motor or the mixing means 7 could be driven by drive means arranged externally to the batch mixer 1.

[0053] Also, in this embodiment the mixing pan 2 is formed with vertical cylindrical sides 21 but in another embodiment of the invention it would be feasible that the mixing pan 2 was shaped differently such as square, rectangular, oval or other and the sides walls could be formed other than vertical such as sloping or none-linear.

[0054] In this embodiment the mixing pan 2 and the mixer unit 5 are formed as two separate parts. However, they are connected by means of a number of suspension arms 8 extending between the mixer unit 5 and the upper edge 12 of the mixing pan 2. The main function of the suspension arms 8 is to carry and suspend the mixer unit 5 above the stationary mixing pan 2. However, when the mixer unit 5 is operating and the mixing shovels 20 and side scrapers 18 are being dragged through the material in the mixing pan 2 the suspension arms 8 also have to transfer a substantial torque from the mixer unit 5 to the mixing pan 2.

[0055] In another embodiment the mixer unit 5 could be supported inside the mixing pan 2 or it could comprise its own separate support structure or the mixing pan 2 and the mixer unit 5 could be supported separately by a common support structure.

[0056] Fig. 2 illustrates the batch mixer 1 shown in fig. 1, as seen from the top.

[0057] In this embodiment the mixer unit 5 is suspended above the mixing pan 2 by means of three substantially evenly spaced suspension arms 8. However in another embodiment of the invention the mixer 1 could comprise

two, three, five, six or more suspension arms 8 and the suspension arms 8 could be spaced differently.

[0058] A batch mixer 1 is provided with one or more discharge openings 3 at the bottom 4 of the mixing pan 2 i.e. in the bottom face or in the sides 21 at the bottom 4 of the mixing pan 2. In this embodiment the mixing pan 2 is provided with only one discharge opening 3 but in another embodiment the pan 2 could comprise two, three or more discharge openings 3. The discharge opening 3 is provided with a sliding door so that when the mixture - such as face mix - in the mixing pan 2 has been mixed sufficiently, the door is opened and the face mix is emptied out of the mixer 1 through the discharge opening 3.

[0059] The face mix is now ready for use and could be emptied directly down into a waiting concrete lorry or it could be emptied down onto some kind of conveyor system which will transport the face mix to another location e.g. in a paving stone manufacturing site or into a face mix chute, a face mix holding hopper or a similar device.

[0060] To protect an operator of the mixer 1 from coming into contact with the face mix in the mixer 1, from getting in contact with the mixing means 7, to protect the face mix in the mixer 1 from foreign object, to hinder dust or face mix splashes from exiting the mixer 1 and for other reasons the openings between the suspension arms 8 are in this embodiment of the invention provided with doors 14 that can be closed during the face mix mixing process. In fact in an embodiment the doors 14 would be provided with safety switches (not shown) so that the mixer 1 can only operate if all the doors 14 are closed. In fig. 2 only three doors 14 are disclosed so that the mixing means 7 can be seen through the other openings but in a fully functional embodiment of a batch mixer 1 all the openings would be fully covered by some sort of covering.

[0061] In this embodiment one door 14 is provided with a cement inlet 9 and another door 14 is provided with a water inlet 10 and these and/or further inlets and/or outlets could be provided in these or other doors 14 or elsewhere in the mixer 1.

[0062] Fig. 3 illustrates a cross section through the middle of a batch mixer 1 comprising a vibrator 13, as seen from the front.

[0063] In this embodiment of the invention the mixer 1 is provided with a vibrator 13 connected to the bottom structure 11 of the mixing pan 2. However in another embodiment the vibrator 13 could be connected to the mixer 1 elsewhere such as directly to the bottom 4 of the mixing pan 2, to the side 21 of the mixing pan 2, to the mixer unit 5, to parts of the mixer unit 5 such as to the mixing means 7 or several vibrators 13 could be connected to one or more of these parts of the mixer 1.

[0064] In this embodiment of the invention mixer 1 is placed on a number of vibration dampers 25 to prevent that the vibrations generated by the vibrator 13 spreads to the underlying ground or to at least reduce the spread of the vibrations downwards. However in another embodiment the vibration dampers 25 could be placed else-

where e.g. if the vibrator 13 was located on the mixer unit 5 the vibration dampers 25 could be placed between the mixer unit 5 and the mixing pan 2, if the vibration dampers 25 was connected directly on the mixing pan 2 they could be placed between the pan 2 and the bottom structure 11 or the vibration dampers 25 could be placed anywhere else which would enable that they could prevent vibrations from spreading to the underlying ground or to parts of the mixer 1 where the vibrations was unwanted.

[0065] In this embodiment of the invention the mixing arms 19 extends backwards in relation to the rotational direction of the mixing star 15 i.e. the mixing arms 19 are tilted in relation to a vertical plane so that vertical vibrations spreading to the mixing means 7 will make the mixing arms 19 oscillate up and down more. However, in another embodiment the mixing arms 19 could be formed more or less vertical.

[0066] In the illustrated embodiment in fig. 3 the mixing star 15 is only provided with one mixing arm 19 but in a preferred embodiment the mixing star 15 would be provided with more mixing arms 19 such as two, three, four or more.

[0067] A batch of face mix can be mixed in the batch mixer 1 in a number of ways but in this embodiment only aggregate is added to the mixing pan 2 at first after which the mixing means 7 starts rotating to "grind" off face mix left on the mixing means 7 from the previous batch.

[0068] In this embodiment the electrical motor 23 of the mixer unit 5 is powered through speed regulating means in the form of a frequency converter and during the cleaning period the rotational speed of the mixing means 7 could therefore be increased to e.g. 80 Hz to hurl leftover material off the mixing means 7. To improve the cleaning process even further the vibrator 13 is vibrating at least some of the time during this cleaning process so that mixing means 7 such as side scrapers 18, mixing arms 19 and mixing shovels 20 starts oscillating whereby leftover or hardened material is shaken of the mixing means 7.

[0069] In this embodiment of the invention the vibrator 13 operates with relatively large amplitude at between 300-1,900 rotations per minute equivalent to 300-1,900 Hz but in another embodiment the vibration frequency could be higher or lower.

[0070] Once the cleaning process has ended the rotational speed of the mixing means 7 could be reduced and the vibrator 13 is stopped after which the remaining ingredients of the face mix - such as cement, colouring means, water, chemical additives or other - is added in the mixing pan 2 so that the face mix can be mixed by the mixing means 7.

[0071] However, in another embodiment the ingredients could be added in a different order, one or more of the ingredients could be omitted - except for cement - or further ingredients could be added.

[0072] Once the face mix is finished the face mix is emptied out of the mixing pan 2 through the discharge opening 3. During and/or immediately after this emptying

procedure the vibrator 13 could be started again primarily to shake fresh face mix off the mixing means 7 but e.g. also to aid the emptying process and speed it up. To further increase the effect of the vibrator 13 the rotational speed of the mixing means 7 could also be increase during the emptying phase.

[0073] Fig. 4 illustrates an embodiment of a bottom structure 11 for a batch mixer 1, as seen in perspective.

[0074] In this embodiment of the invention the bottom structure 11 is formed as a cross which will be attached to the bottom 4 of the mixing pan 2 and hereby reinforcing the pan 2. The centre of the cross is provided with a plate onto which the vibrator 13 can be attached. Once the vibrator 13 is operating the vibrations will spread through the side 21 of the mixing pan 2 to the mixing unit 5 and down to the mixing means 7.

[0075] The invention has been exemplified above with reference to specific examples of batch mixers 1, mixer units 5, vibrators 13 and other. However, it should be understood that the invention is not limited to the particular examples described above but may be designed and altered in a multitude of varieties within the scope of the invention as specified in the claims.

List

[0076]

1. Batch mixer
2. Mixing pan
3. Discharge opening
4. Bottom of mixing pan
5. Mixer unit
6. Mixer unit drive
7. Mixing means
8. Suspension arms
9. Cement inlet
10. Water inlet
11. Bottom structure
12. Upper edge of mixing pan
13. Vibrator
14. Door
15. Mixing star
16. Centre axis of mixing star
17. Centre axis of mixer unit
18. Side scraper
19. Mixing arm
20. Mixing shovel
21. Side of mixing pan
22. Corner between side and bottom of mixing pan
23. Motor
24. Gear arrangement
25. Vibration damper

Claims

1. A batch mixer (1) for mixing face mix, said mixer (1)

comprising a mixing pan (2), including one or more discharge openings (3), and

a mixer unit (5) comprising a mixer unit drive (6) and one or more mixing means (7), wherein said batch mixer (1) further comprises at least one vibrator (13) for making at least parts of said mixing means (7) vibrate so that face mix sticking to said parts of said mixing means (7) are loosened.

2. A batch mixer (1) according to claim 1, wherein said at least one vibrator (13) is connected to said mixing pan (2).
3. A batch mixer (1) according to claim 2, wherein said at least one vibrator (13) is connected to a bottom structure (11) of said mixing pan (2).
4. A batch mixer (1) according to any of the preceding claims, wherein said at least one vibrator (13) comprises means for generating vibrations at between 10 and 10,000 Hz, preferably between 80 and 5,000 and most preferred between 150 and 3,000 Hz.
5. A batch mixer (1) according to any of the preceding claims, wherein said batch mixer (1) further comprises vibration dampers (25) arranged between said batch mixer (1) and the underlying ground.
6. A batch mixer (1) according to any of the preceding claims, wherein said mixer unit drive (6) comprises speed regulating means.
7. A batch mixer (1) according to claim 6, wherein said speed regulating means comprises a frequency converter.
8. A batch mixer (1) according to any of the preceding claims, wherein said parts of said mixing means (7) includes mixing arms (19) and mixing shovels (20).
9. A batch mixer (1) according to any of the preceding claims, wherein said mixing arms (19) are tilted in relation to a vertical plane.
10. A batch mixer (1) according to any of the preceding claims, wherein said mixing pan (2) is stationary and wherein two or more suspension arms (8) are extending between said mixing pan (2) and said mixing unit (5) hereby suspending said mixing unit (5) above said mixing pan (2).
11. A method for cleaning a batch mixer (1), wherein said method comprises the steps of:
 - mixing face mix in a mixing pan (2) of said batch mixer (1) by means of a mixing unit (5) comprising a mixer unit drive (6) and one or more mixing means (7),

- emptying face mix out of a discharge opening (3) in said mixing pan (2), and
- vibrating at least parts of said mixing means (7) by means of a vibrator (13) so that face mix sticking to said parts of said mixing means (7) are loosened.

12. A method according to claim 11, wherein said method further comprises the step of feeding aggregate into said mixing pan (2) while or before initiating said vibrating.
13. A method according to claim 11 or 12, wherein said mixing means (7) are rotating while said vibrator (13) is vibrating said parts of said mixing means (7).
14. A method according to claim 11, wherein said vibrations are at least also being initiated while said face mix is being emptied out of said mixing pan (2).
15. A method according to any of claims 11-14, wherein said method is a method for cleaning a batch mixer (1) according to any of claims 1-10.

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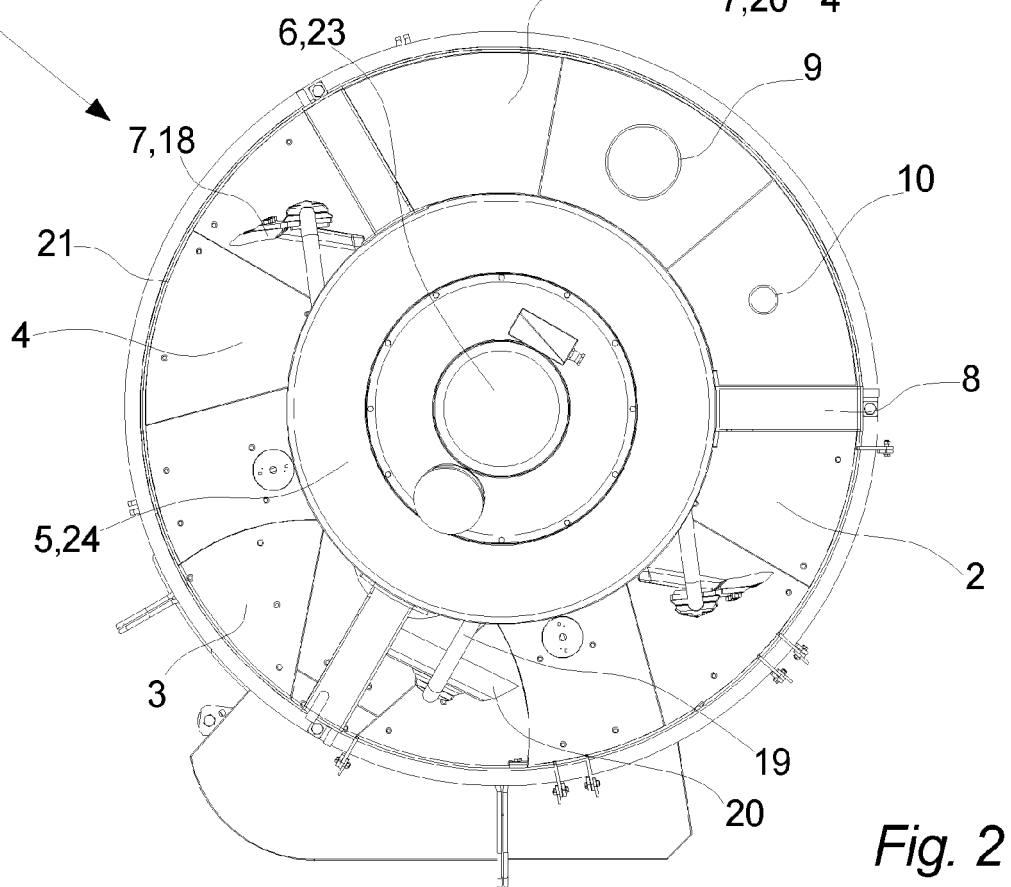
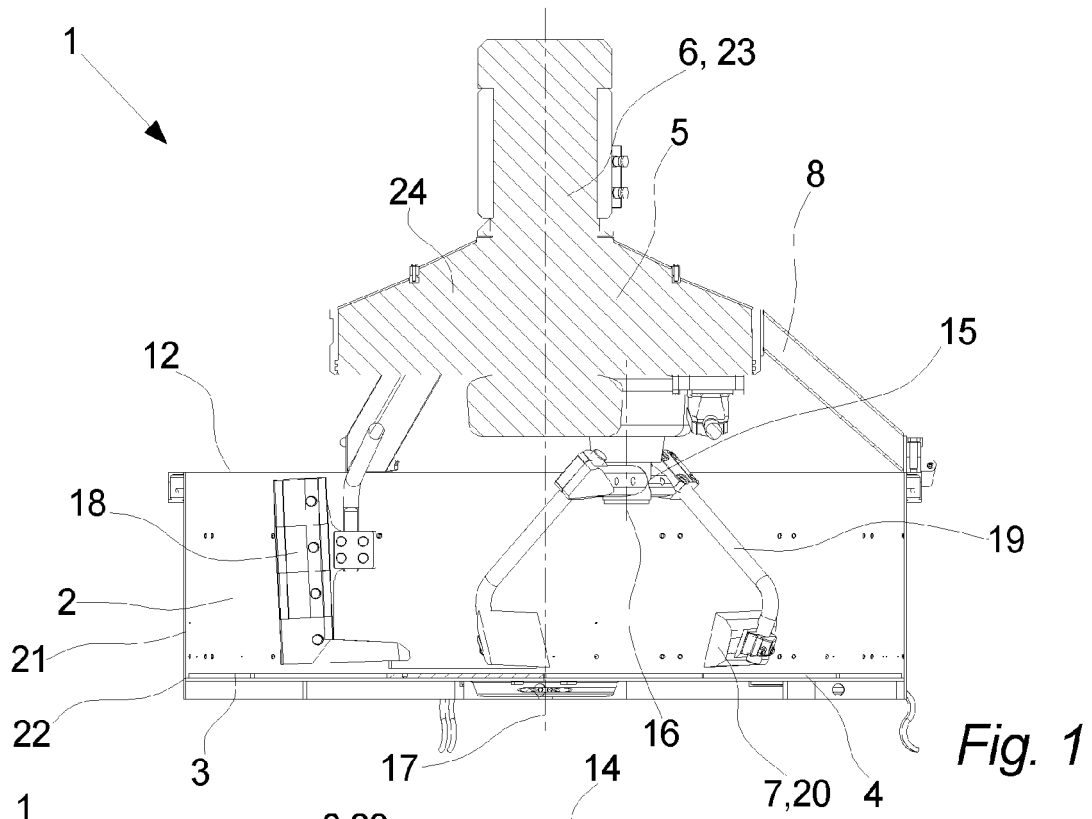
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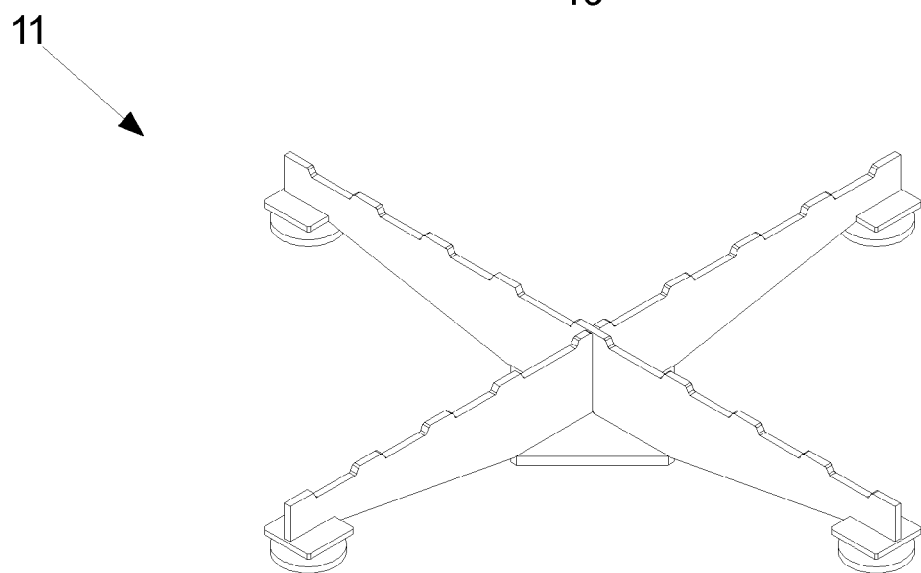
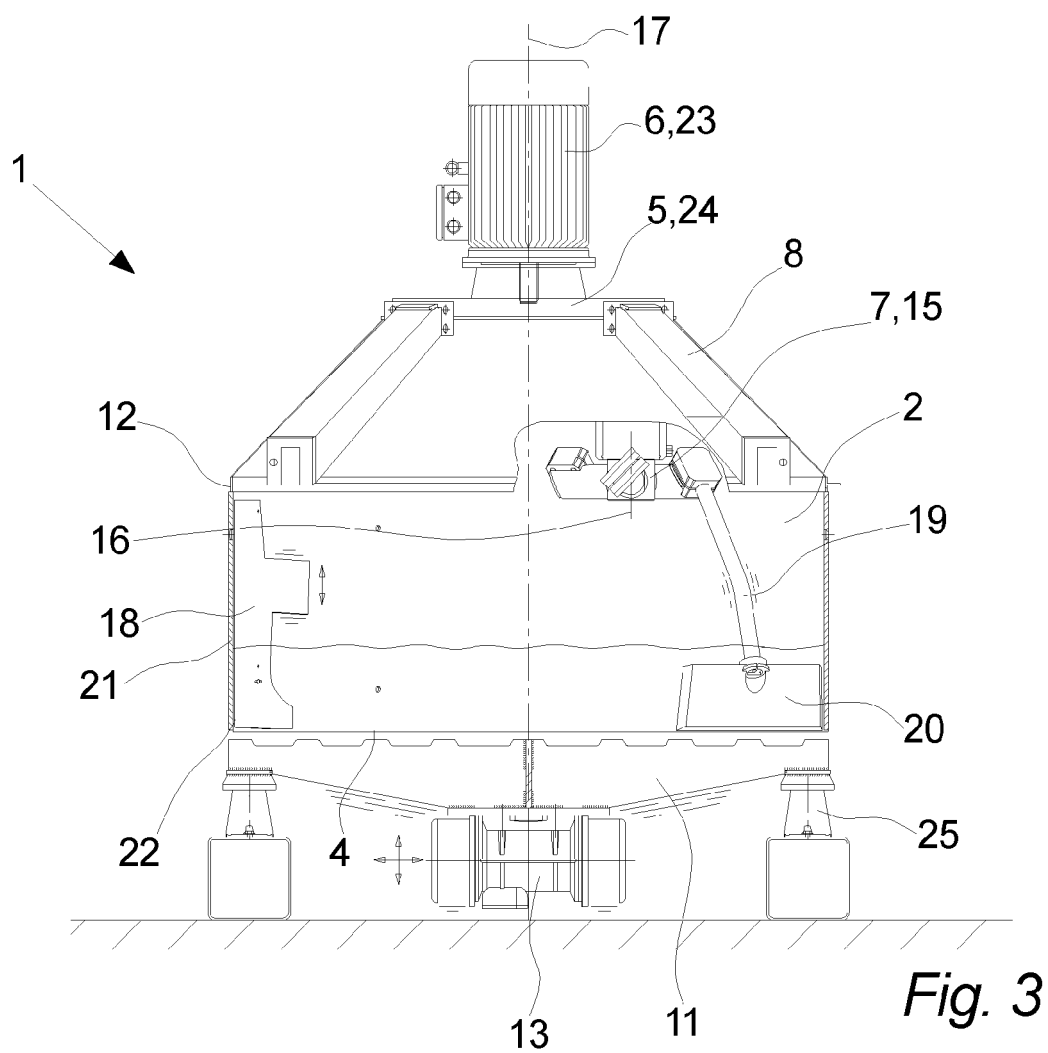


Fig. 4



EUROPEAN SEARCH REPORT

 Application Number
EP 12 15 1919

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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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