

(19)



(11)

EP 2 617 544 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) **B28C 5/32** (2006.01)
B01F 7/00 (2006.01)

(21) Application number: **12151920.1**

(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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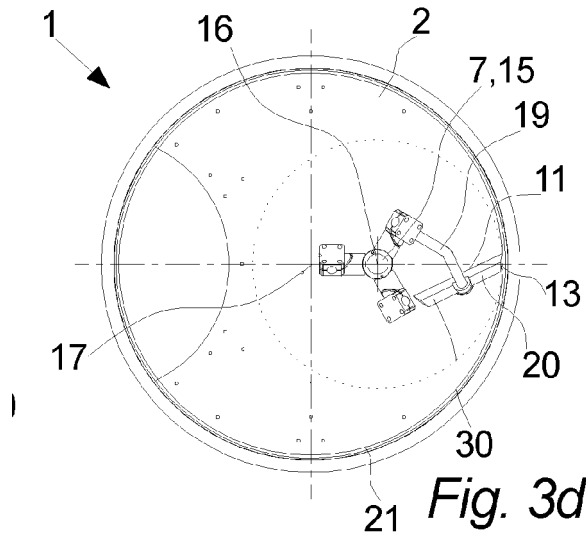
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(54) **A batch mixer for mixing concrete and a method for mixing concrete in a batch mixer**

(57) Disclosed is a batch mixer (1) for mixing concrete. The mixer (1) comprises a mixing pan (2) having a bottom surface (4) from which a cylindrical sidewall (21) protrudes and one or more discharge openings (3). The mixer (1) further comprises a mixer unit (5) including a mixer unit drive (6) and one or more mixing means (7), wherein the mixing means (7) comprises at least one

rotatable mixing star (15) having a rotational axis (16) arranged eccentrically with the centre axis (17) of the cylindrical sidewall (21). A mixing shovel (20) of the mixing star (15) is arranged to pass the cylindrical sidewall (21) at a distance of maximum 20 mm from the sidewall (21) when the mixing star (15) is rotating in the mixing pan (2) around the rotational axis (16).



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Description

Field of the invention

[0001] The invention relates to a batch mixer for mixing concrete and a method for mixing concrete in a batch mixer.

Background of the invention

[0002] Horizontal axis mixers, where the mixing drum rotates, are well known for mixing small batches of concrete onsite but for mixing large concrete batches e.g. at a precast production plant, a masonry production plant or for filling up ready mix trucks it is known to use large batch mixers.

[0003] Batch mixers can be designed in many ways but all of them comprise a mixing pan with mixing means extending down into the mixing pan.

[0004] To ensure the quality of concrete it is important that all the ingredients of the concrete are evenly distributed in the finished concrete mix and that the finished concrete is of a substantially uniform grain size. However, e.g. if all the ingredients in the concrete are particularly fine-grained or if certain other conditions are present, lumps of material can form during the mixing process and if the mixer is not properly cleaned between batches, lumps of concrete can harden in the mixer and get mixed into the following concrete batch.

[0005] An object of the invention is therefore to provide for an advantageous technique for mixing concrete in a batch mixer.

The invention

[0006] The invention provides for a batch mixer for mixing concrete. The mixer comprises a mixing pan having a bottom surface from which a cylindrical sidewall protrudes and one or more discharge openings. The mixer further comprises a mixer unit including a mixer unit drive and one or more mixing means, wherein the mixing means comprises at least one rotatable mixing star having a rotational axis arranged eccentrically with the centre axis of the cylindrical sidewall. A mixing shovel of the mixing star is arranged to pass the cylindrical sidewall at a distance of maximum 20 mm from the sidewall when the mixing star is rotating in the mixing pan around the rotational axis.

[0007] Arranging the rotational axis of the rotatable mixing star eccentrically in relation to the centre axis of the cylindrical sidewall of the mixing pan so that the rotational axis and the centre axis does not coincide is advantageous in that it hereby is ensured that a mixing shovel of the mixing star will rotate against and away from the sidewall when the mixing star is rotating around the rotational axis which enables that lumps of material can be crushed between the mixing shovel and the sidewall.

[0008] Furthermore, by arranging the mixing shovel so that it passes the cylindrical sidewall at a distance of maximum 20 mm from the sidewall it is ensured that substantially all lumps that can be formed during a concrete mixing process or any lumps originating from hardened concrete can be crushed.

[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 mixer unit also comprises means for rotating said at least one mixing star around said centre axis of said cylindrical sidewall.

[0011] By also rotating the individually rotating mixing stars around the centre axis of the cylindrical sidewall it is ensured that the mixing shovel will be able to crush lumps of material along the entire periphery of the mixing pan hereby increasing the efficiency of the mixing shovels material crushing effect.

[0012] In an aspect of the invention said rotational axis of said at least one mixing star is arranged eccentrically at a distance between 5% and 95%, preferably between 10% and 80% and most preferred between 15% and 60% of the radius of said cylindrical sidewall from said centre axis of said cylindrical sidewall.

[0013] If the rotational axis of the mixing star is arranged too close to sidewall of the mixing pan the mixing shovels will only be able to crush relatively small lumps and the risk of lumps at the middle of the mixing pan not being crushed is increased. However, if the rotational axis of the mixing star is arranged too far from the sidewall of the trajectory of the mixing shovels will be very similar to the periphery of the mixing pan i.e. the shovels will almost run parallel with the sidewall thereby reducing the lump crushing effect of the shovels.

[0014] Thus, the present placement ranges provides for an advantageous position of the rotational axis of the mixing star in relation to the lump crushing effect of the shovels.

[0015] In an aspect of the invention said mixing shovel is mounted at the end of a mixing arm and said mixing arm is tilted in relation to a vertical plane.

[0016] Tilting the mixing arm in relation to a vertical plane is advantageous in that it enable that the mixing arm can extend further hereby making it more flexible and thereby more yielding and flexible in relation to lumps

that cannot be crushed and thereby protecting bearing and drive means of the mixing unit from damaging overloads.

[0017] In an aspect of the invention said mixing shovel is mounted at the end of a mixing arm and said mixing arm is primarily made of spring steel.

[0018] Forming the mixing arm primarily of spring steel is advantageous in that thereby more yielding and flexible in relation to lumps that cannot be crushed and thereby protecting bearing and drive means of the mixing unit from damaging overloads.

[0019] In an aspect of the invention said mixing shovel is mounted at the end of a mixing arm by means of a fixation part at said end of said mixing arm protruding into a fixation hole in said mixing shovel and wherein said fixation part and said fixation hole comprises mutually corresponding locking surfaces preventing said mixing shovel from rotating around said fixation part.

[0020] It is easier to make a cleaning friendly joint in one part extends into the other and by forming the parts with mutually corresponding locking surfaces it is in a simple and efficient manner ensured that the mixing shovel cannot rotate around the mixing arm hereby increasing the lump crushing effect of the mixing shovel.

[0021] In an aspect of the invention said fixation part protrudes into said fixation hole from a first side and a fixation bolt engages said fixation part from an opposite side of said fixation hole so that said fixation bolt pulls said fixation part into said fixation hole when said fixation bolt is tightened.

[0022] By pulling the fixation part of the mixing arm into the hole in the mixing shovel by means of a bolt located at the opposite side of the hole is advantageous, in that it provides for a simple and strong way of fixating the shovels position on the arm by means of only one or a few bolts and at the same time protects the joint so that the joint all in all is more cleaning friendly, whereby the risk of lumps of concrete being left behind to harden - and thereby contaminate the next batch - is reduced.

[0023] In an aspect of the invention said locking surface of said fixation part is tapering towards the free end of said fixation part.

[0024] Making the locking surface of the fixation part taper so that the fixation part becomes thinner towards the free end is advantageous in that the fixation part hereby will wedge in the fixation hole and thereby secure the joint efficiently.

[0025] In an aspect of the invention said mixing shovel comprises an outer side substantially facing outwards in relation to said rotational axis of said mixing star and wherein said outer side is arranged to be substantially parallel with a tangent of said cylindrical sidewall at the point where said outer side is closest to said sidewall.

[0026] If the outer side of the shovel is angled in relation to the sidewall, the shovel might miss the lumps or push the in front of the shovel instead of crushing them against the sidewall. Furthermore if the outer side is angled in relation to the tangent of the sidewall at the point of attack

it is possible that material could be wedged by shovel whereby the lumps crushing effect of the shovel is reduced.

[0027] In an aspect of the invention said mixer unit drive comprises speed regulating means.

[0028] Providing the mixer unit drive with speed regulating means such as a frequency converter is advantageous in that it hereby is possible to increase the rotational speed of the mixing star during a lumps crushing phase to increase the efficiency of the lump crushing effect of the shovel and reduce the rotational speed of the mixing star during a mixing phase to increase the mixing effect of the shovel.

[0029] In an aspect of the invention said mixing pan is stationary and wherein two or more suspension arms are extending between said mixing pan and said mixing unit hereby suspending said mixing unit above said mixing pan.

[0030] Hereby is achieved an advantageous embodiment of the invention.

[0031] In an aspect of the invention said concrete is face mix wherein none of the ingredients in said face mix has a size over 5 mm and preferably not a size over 3 mm.

[0032] 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. 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. 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.

[0033] However, particularly due to the fine-grained nature of the ingredients, lumps of the ingredients in face mix is particularly difficult to dissolve during the mixing process and due to the fine-grained nature of face mix this type of concrete is particularly sensitive to hardened lumps of face mix being mixed into the face mix. It is therefore particularly advantageous to use the present invention to mix face mix.

[0034] The invention further provides for a method for mixing concrete in a batch mixer. The method comprises the steps of:

- mixing concrete 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,
- rotating a mixing shovel of the mixing means by means of the mixer unit drive so that at least an outer side of the shovel is rotated towards the sidewall of the mixing pan and passes the sidewall at a distance of maximum 20 mm, and
- crushing lumps of material between the outer side of the shovel and the sidewall.

[0035] Crushing lumps of ingredients or hardened concrete by means of a mixing shovel is advantageous in that a inexpensive and efficient way of crushing lumps is hereby provided which will increase the quality of the mixed concrete and/or reduced the mixing time hereby increasing the capacity of the mixer.

[0036] In an aspect of the invention the method is a method for mixing concrete in a batch mixer according to any of the previously mentioned embodiments of batch mixers.

Figures

[0037] 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. 3a-3f illustrates different positions of a mixing star with a mixing shovel, as seen from the top,
- fig. 4 illustrates an embodiment of a mixing shovel, as seen from the front,
- fig. 5 illustrates a cross-section through the middle of the mixing shovel disclosed in fig. 4, as seen from the side, and
- fig. 6 illustrates an exploded view of the mixing shovel disclosed in fig. 5, as seen from the top.

Detailed description

[0038] Fig. 1 illustrates a cross section through the middle of a prior art batch mixer 1, as seen from the front.

[0039] 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.

[0040] 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.

[0041] In this embodiment the mixing pan 2 is stationary but in another embodiment of the invention the pan 2 could also be rotating.

[0042] 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.

[0043] 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.

[0044] 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.

[0045] 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.

[0046] 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.

[0047] 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.

[0048] 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.

[0049] 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 synchro-

nized by the gear 24 and controlled by the gear 24 and the motor 23.

[0050] 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.

[0051] 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.

[0052] 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.

[0053] 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.

[0054] Fig. 2 illustrates the batch mixer 1 shown in fig. 1, as seen from the top.

[0055] 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.

[0056] 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.

[0057] 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 conveyer 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.

[0058] 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.

[0059] 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.

[0060] Fig. 3a-3f illustrates different positions of a mixing star 15 with a mixing shovel 20, as seen from the top.

[0061] In all the figures 3a-3f the mixing star 15 is only provided with one mixing arm 19 and one mixing shovel 20 but in a preferred embodiment of the invention all the arms of the mixing star 15 would each be provided with a mixing arm 19 which in turn would be provided with a mixing shovel 20.

[0062] In this embodiment the mixing star 15 is designed to be fitted with three mixing arms 19 but in another embodiment the mixing star 15 could be designed to accommodate another number of mixing arms 19 such as one, two, four, five, six or more.

[0063] In this embodiment the mixer 1 is only provided with one mixing star 15 but in another embodiment the mixer 1 could comprise two, three or more mixing stars 15 and one or more of these mixing stars 15 could rotate in an opposite direction, they could operate at a different rotational speed, they could have a different diameter or they could be arranged differently in relation to the centre axis of the mixing pan 2.

[0064] In this embodiment the mixing pan 2 is stationary and the mixing arm 19 with the mixing shovel 20 rotates around the rotational axis 16 of the mixing star 15 and the entire mixing star 15 is furthermore rotated around the centre axis 17 of the mixing pan 2. However, in another embodiment the rotational axis 16 of the mixing star(s) 15 could be fixed and the mixing pan 2 could be rotating during the mixing process.

[0065] The rotational axis 16 of the mixing star 15 is arranged approximately 35% of the radius of the cylindrical sidewall 21 from the centre axis 17 of the sidewall 21. However, in another embodiment the diameter of the mixing star 15 could be reduced and/or the radius of the sidewall 21 could be bigger entailing that the mixing star 15 could have to be arranged closer to the sidewall 21

to ensure the lump crushing effect of the mixing shovel 20. Similarly, the diameter of the mixing star 15 could be bigger and/or the radius of the sidewall 21 could be smaller entailing that the mixing star 15 would have to be moved closer to the centre 17 of the pan 2.

[0066] The six illustrations 3a-3f show the mixing shovel 20 in six different positions as it approaches and moves away from the sidewall 21. In fig. 3a-3c the shovel 20 is approaching the wall 21, in fig. 3d the shovel 20 is in the position in which it is closest to the sidewall 21 and in fig. 3e and 3f the shovel 20 is rotating away from the sidewall 21.

[0067] In this embodiment of the invention the mixing shovel 20 passes the cylindrical sidewall 21 in a distance of approximately 3 mm from the sidewall 21 i.e. in fig. 3d the distance between the outer side 13 of the mixing shovel 20 and the sidewall 21 is approximately 3 mm. Thus, in this embodiment the outer side 13 of the shovel 20 would most likely crush any lumps of material that is over 3 mm in size. However, in another embodiment the outer side 13 of the mixing shovel 20 could be arranged to pass closer by the sidewall 21 or further away from the sidewall 21 such as between 2 mm and 15 mm from the sidewall 21 e.g. dependent on the particular type of concrete being mixed in the mixer 1, dependent on the maximum size of the ingredients of a particular concrete type being mixed or other.

[0068] In this embodiment of the invention the outer side 13 of the shovel 20 is substantially parallel with a tangent of the cylindrical sidewall 21, when the shovel is closest to the sidewall 21 - at this point - but in another embodiment of the invention the gap between the outer side 13 of the shovel 20 and the sidewall could be widest at the front side 11 of the shovel 20 i.e. in the direction of the rotation of the shovel 20 e.g. to lead lumps into the gap or the gap could be widest at the back side 30 of the shovel 11 i.e. opposite the direction of the rotation of the shovel 20 e.g. to avoid that the shovel would wedge material against the sidewall 21.

[0069] It is obviously important that the mixing arm 19 and the rest of the mixing means 7 are formed so rigid that the lumps caught between the shovel 20 and the sidewall 21 are thoroughly crushed as the mixing arm 19 rotates closer and closer towards the sidewall 21. However, if the lumps cannot be crushed it is also important to protect the mixing means 7 and the mixer unit drive 6 from damaging overloads. Thus, in this embodiment the mixing arm 19 is made of spring steel to make it so flexible that it can bend slightly if a stone or a similar object is caught between the shovel 20 and the sidewall 21 and then return to its original position once it rotates away from the sidewall 21. To further increase the resilience of the mixing arm 19 the mixing arm 19 is also tilted in relation to a vertical plane so that the arm 19 can be made longer.

[0070] In this embodiment of the invention the mixer unit drive 6 driving the mixing star 15 is provided with speed regulating means in the form of a frequency con-

verter connected to the electrical motor 23 driving the mixing star 15. Hereby is enabled that the mixing star 15 can rotate at a particular speed (typically relatively low) during the mixing process and the speed can then be increased during a lump crushing process.

[0071] Fig. 4 illustrates an embodiment of a mixing shovel 20, as seen from the front.

[0072] To ensure the lump crushing effect of the mixing shovel 20 it is important that the shovel 20 cannot rotate on the mixing arm 19. But the life of the shovel 20 can be relatively short in that the shovel 20 is exposed to intense wear and tear from constantly moving around in the concrete and furthermore crushing lumps and it is therefore important that the shovel 20 is easy to replace.

Thus, to form a solid and durable joint, which also makes it easy to replace the shovel 20, the mixing shovel 20 is in this embodiment mounted at the end of the mixing arm 19 by means of a fixation part 26 at the end of the mixing arm 19. The fixation part 26 protrudes into a fixation hole 25 in the mixing shovel 20 and the fixation part 26 and the fixation hole 25 comprises mutually corresponding locking surfaces 28, 29 in the form of matching flat surfaces. The fixation part 26, the fixation hole 25 etc. is shown and discussed in more details in relation to figs. 5 and 6.

[0073] Fig. 5 illustrates a cross-section through the middle of the mixing shovel 20 disclosed in fig. 4, as seen from the side.

[0074] In this embodiment of the invention the mixing arm 19 has a circular cross-section to reduce its resistance when it is being rotated through the concrete in the mixing pan 2. However, the end of the arm 19 has been machined to form a flat side on the arm 19 hereby forming a fixation part 26 at the end of the mixing arm 19. Thus, in this embodiment the fixation part 26 is formed integrally with the mixing arm 19 but in another embodiment of the invention the fixation part 26 could be formed as a separate part being attached to the arm 19.

[0075] The flat side of the fixation part 26 forms a locking surface 28 in that this locking surface 28 corresponds to a similarly flat locking surface 29 of the fixation hole 25 in the shovel 20. Thus, when the locking surfaces 28, 29 of the fixation part 26 and the fixation hole 25 are pressed firmly together the shovel 20 cannot be rotated in relation to the mixing arm 19.

[0076] In this embodiment of the invention both locking surfaces 28, 29 are formed as flat surfaces but in another embodiment of the invention one or both surfaces 28, 29 could comprise protrusions which e.g. would be interlocking or one or both surfaces 28, 29 could be formed more or less complex e.g. to increase the interlocking aspect of the joint, to make it easier to disassemble the joint or for other reasons.

[0077] To ensure that the locking surfaces 28, 29 of the fixation part 26 and the fixation hole 25 are pressed firmly together, the fixation part 26 is in this embodiment provided with an internally threaded blind hole 32. Thus, the fixation part 26 extends into the fixation hole 25 from

one side of the fixation hole 25 and a fixation bolt 27 then engages the threaded blind hole 32 from the other side of the fixation hole 25 so that when the bolt 27 is tightened it will pull the fixation part 26 into the fixation hole 25.

[0078] In this embodiment the bolt 27 is also provided with a washer 31 to ensure the bolts 27 ability to pull the fixation part 26 but in another embodiment the same could be achieved through a different design of the fixation bolt 27, the fixation hole 25 or other.

[0079] In this embodiment only one bolt 27 is provided to pull the fixation part 26 and fixate it in the fixation hole 25 but in another embodiment of the invention two, three or more bolts 27 could be provided at each mixing arm 19.

[0080] Fig. 6 illustrates an exploded view of the mixing shovel 20 disclosed in fig. 5, as seen from the top.

[0081] In this embodiment of the invention the locking surface 28 on the fixation part 26 is also tapering towards the free end of the fixation part 26 so that the locking surfaces 28, 29 primarily interlocks at the upper edge of the fixation hole 25. This design entails that the locking surfaces 28, 29 only touches over a relatively small area making it easy to separate the shovel 20 from the arm 19 e.g. if the shovel 20 needs to be exchanged.

[0082] In this embodiment the shovel 20 comprises a metal framework 33 at least partly covered by a wearing surface 34. In this embodiment the wearing surface 34 is made by polyurethane (PUR) but in another embodiment the wearing surface 34 could be made from another type of synthetic material, such as plastic, synthetic rubber or it could be made of natural rubber or any other kind of material suitable for forming mixing shovels 20 or it could be made from any combination of these materials.

[0083] In this embodiment of the invention the size of the fixation hole 25 is not constant all the way through the hole 25 in that the locking surface 29 in the hole 25 in the main body of the framework 33 is moved slightly closer to the centre of the hole 25. This hole design enables that the tapering locking surface 28 of the fixation part 26 can rest against the locking surface 29 of the fixation hole 25 in at least to different places as is can be seen in fig. 5, hereby ensuring a stronger joint and better control of the shovel 20 on the arm 19.

[0084] The invention has been exemplified above with reference to specific examples of batch mixers 1, mixer units 5, mixing shovels 20 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

[0085]

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. Front side of shovel
12. Upper edge of mixing pan
13. Outer side of mixing shovel
14. Door
15. Mixing star
16. Rotational 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. Fixation hole
26. Fixation part
27. Fixation bolt
28. Locking surface of fixation part
29. Locking surface of fixation hole
30. Back side of shovel
31. Washer

32. Threaded hole in fixation part
33. Framework
34. Wearing surface

Claims

1. A batch mixer (1) for mixing concrete, said mixer (1) comprising a mixing pan (2) having a bottom surface (4) from which a cylindrical sidewall (21) protrudes, wherein said mixing pan (2) further comprises 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 mixing means (7) comprises at least one rotatable mixing star (15) having a rotational axis (16) arranged eccentrically with the centre axis (17) of said cylindrical sidewall (21) and wherein a mixing shovel (20) of said mixing star (15) is arranged to pass said cylindrical sidewall (21) at a distance of maximum 20 mm from said sidewall (21) when said mixing star (15) is rotating in said mixing pan (2) around said rotational axis (16).
2. A batch mixer (1) according to claim 1, wherein said mixer unit (5) also comprises means for rotating said at least one mixing star (15) around said centre axis (17) of said cylindrical sidewall (21).
3. A batch mixer (1) according to claim 1 or 2, wherein said rotational axis (16) of said at least one mixing star (15) is arranged eccentrically at a distance between 5% and 95%, preferably between 10% and 80% and most preferred between 15% and 60% of the radius of said cylindrical sidewall (21) from said centre axis (17) of said cylindrical sidewall (21).
4. A batch mixer (1) according to any of the preceding claims, wherein said mixing shovel (20) is mounted at the end of a mixing arm (19) and wherein said mixing arm (19) is tilted in relation to a vertical plane.
5. A batch mixer (1) according to any of claims 1-3, wherein said mixing shovel (20) is mounted at the end of a mixing arm (19) and wherein said mixing arm (19) is primarily made of spring steel.
6. A batch mixer (1) according to any of claims 1-3, wherein said mixing shovel (20) is mounted at the end of a mixing arm (19) by means of a fixation part (26) at said end of said mixing arm (19) protruding into a fixation hole (25) in said mixing shovel (20) and wherein said fixation part (26) and said fixation hole (25) comprises mutually corresponding locking surfaces (28, 29) preventing said mixing shovel (20) from rotating around said fixation part (26).
7. A batch mixer (1) according to claim 6, wherein said fixation part (26) protrudes into said fixation hole (25) from a first side and wherein a fixation bolt (27) engages said fixation part (26) from an opposite side of said fixation hole (25) so that said fixation bolt (27) pulls said fixation part (26) into said fixation hole (25) when said fixation bolt (27) is tightened.
8. A batch mixer (1) according to any of claims 6 or 7, wherein said locking surface (28) of said fixation part (26) is tapering towards the free end of said fixation part (26).
9. A batch mixer (1) according to any of the preceding claims, wherein said mixing shovel (20) comprises an outer side (13) substantially facing outwards in relation to said rotational axis (16) of said mixing star (15) and wherein said outer side (13) is arranged to be substantially parallel with a tangent of said cylindrical sidewall (21) at the point where said outer side (13) is closest to said sidewall (21).
10. A batch mixer (1) according to any of the preceding claims, wherein said mixer unit drive (6) comprises speed regulating means.
11. 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).
12. A batch mixer (1) according to any of the preceding claims, wherein said concrete is face mix wherein none of the ingredients in said face mix has a size over 5 mm and preferably not a size over 3 mm.
13. A method for mixing concrete in a batch mixer (1), wherein said method comprises the steps of:
- mixing concrete 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),
 - rotating a mixing shovel (20) of said mixing means (7) by means of said mixer unit drive (6) so that at least an outer side (13) of said shovel (20) is rotated towards said sidewall (21) of said mixing pan (2) and passes said sidewall (21) at a distance of maximum 20 mm, and
 - crushing lumps of material between said outer side (13) of said shovel (20) and said sidewall (21).
14. A method according to claim 13, wherein said method is a method for mixing concrete in a batch mixer (1) according to any of claims 1-12.

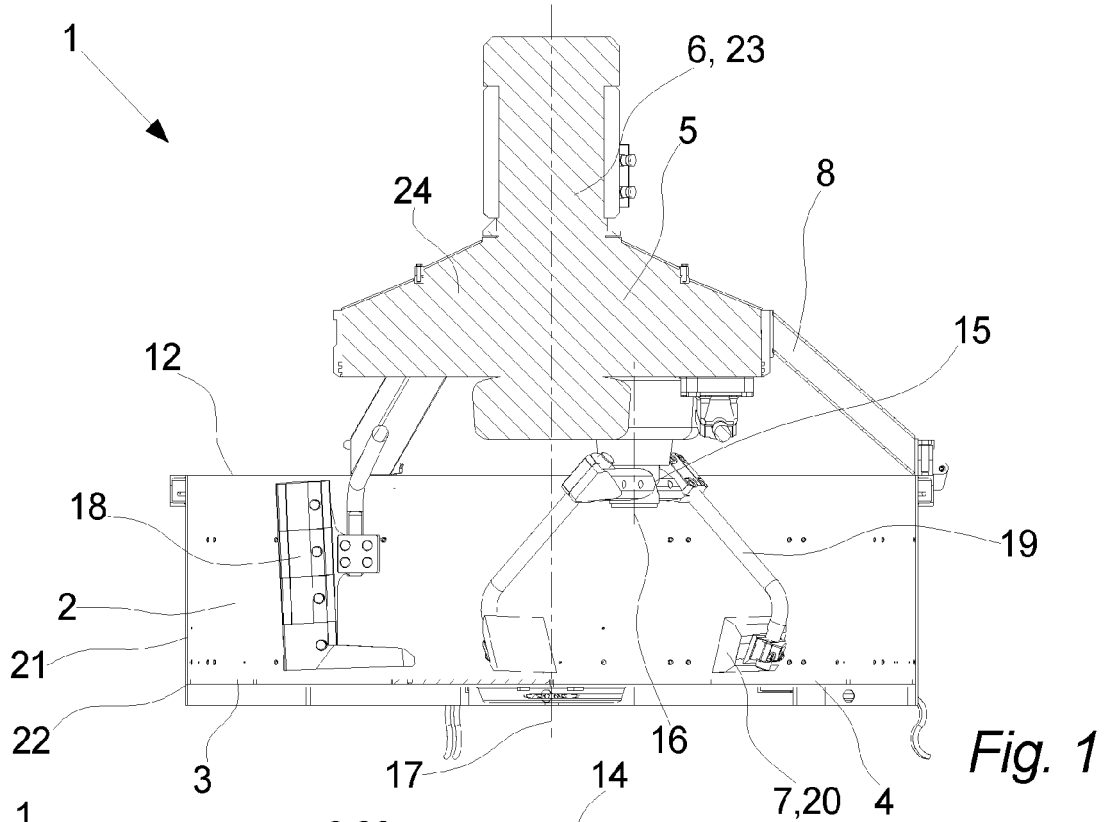


Fig. 1

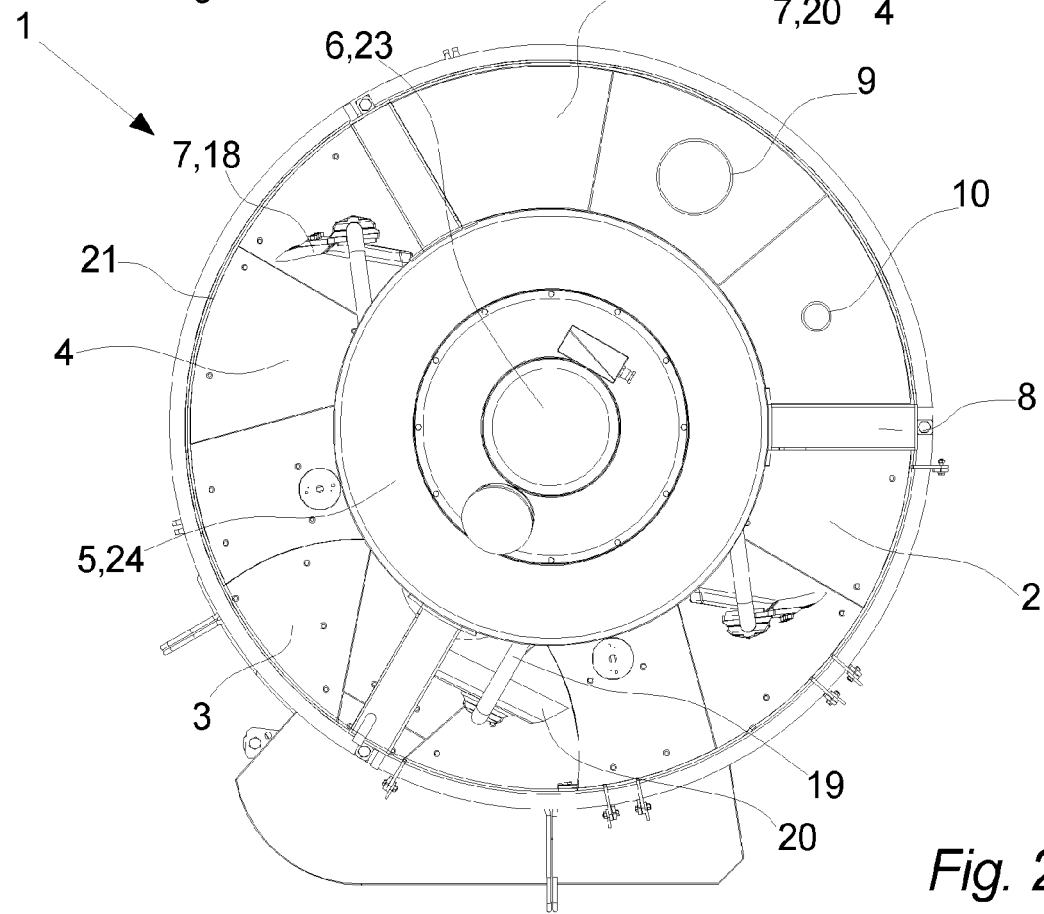


Fig. 2

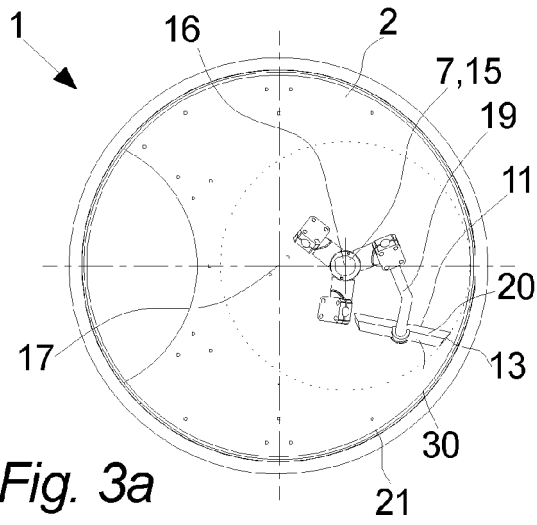


Fig. 3a

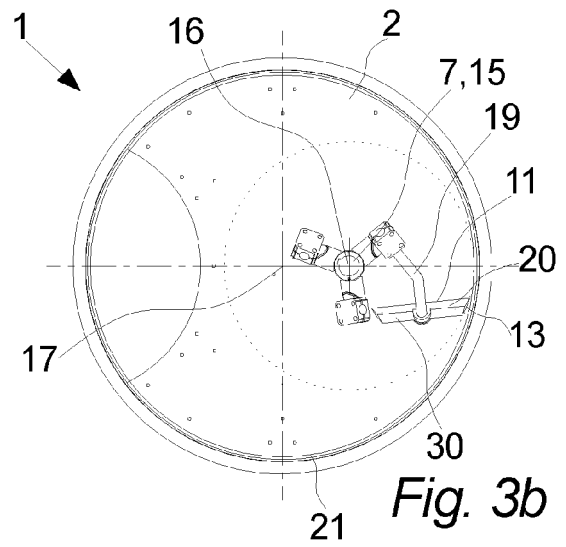


Fig. 3b

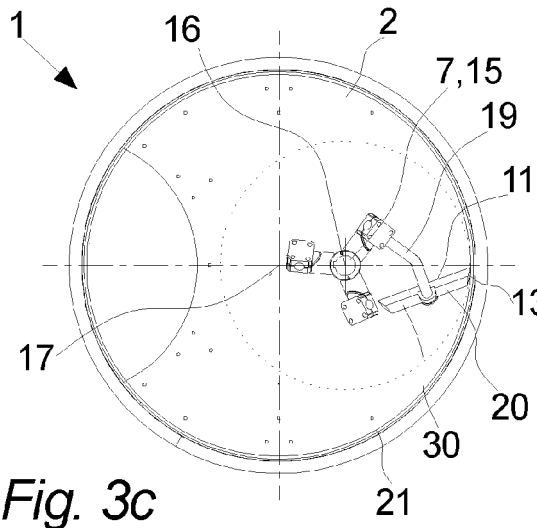


Fig. 3c

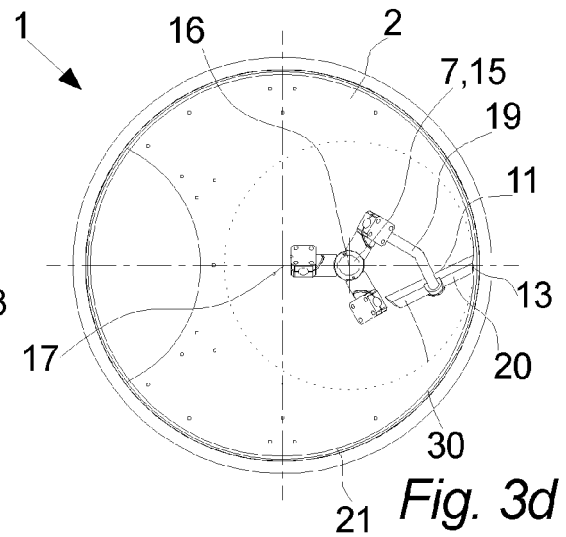


Fig. 3d

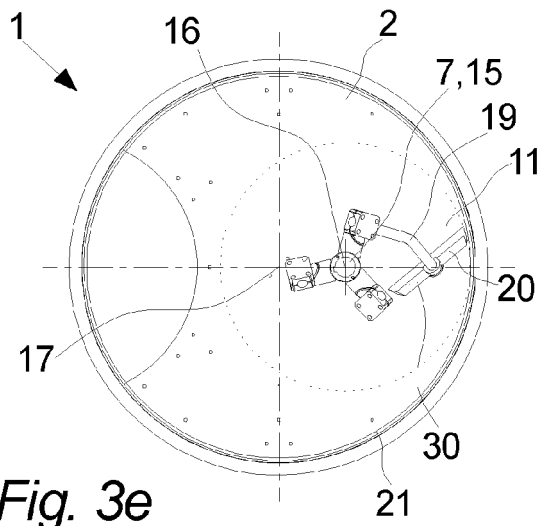


Fig. 3e

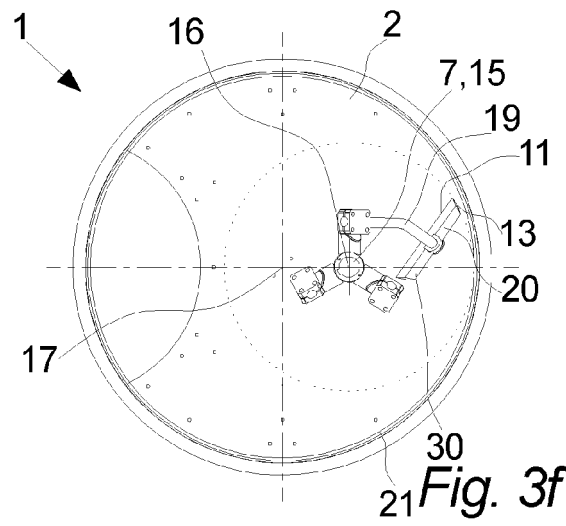
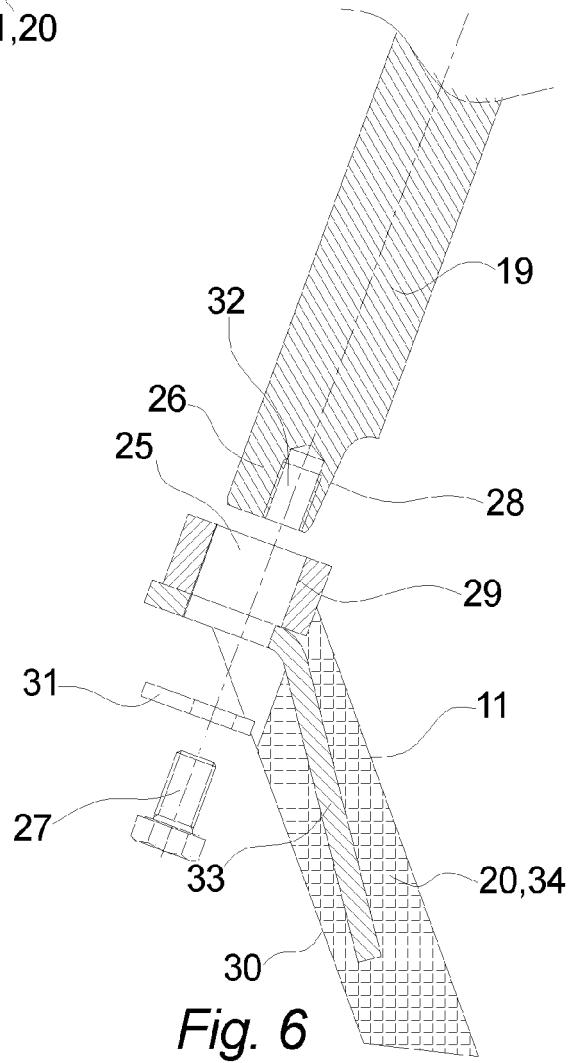
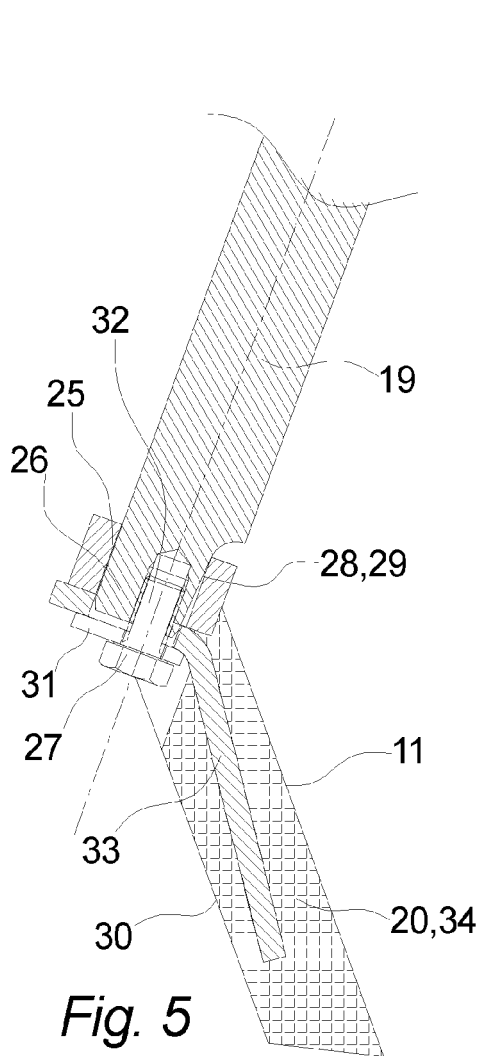
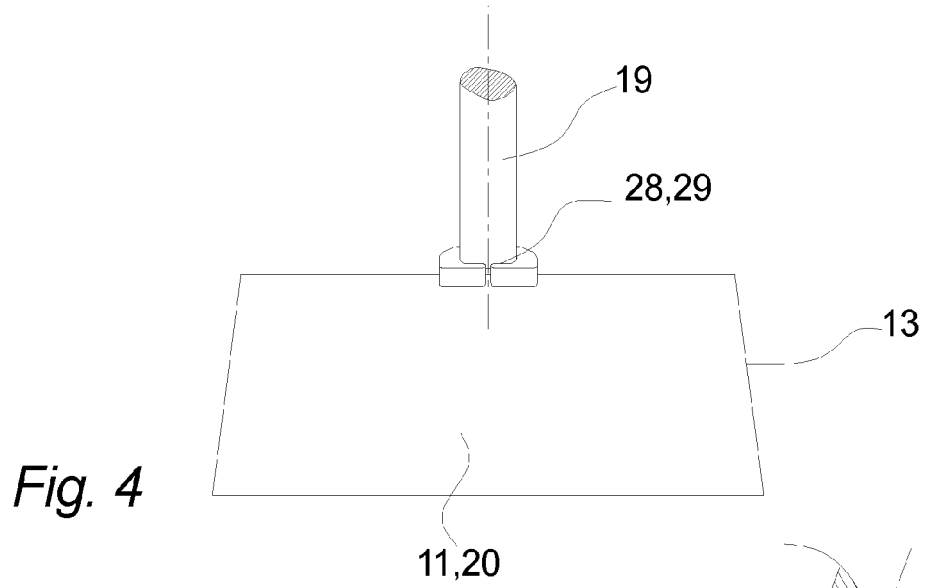


Fig. 3f





EUROPEAN SEARCH REPORT

Application Number
EP 12 15 1920

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Place of search The Hague		Date of completion of the search 12 July 2012	Examiner Orij, Jack	
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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				

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