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(54) MOBILE PLANT FOR THE PRODCUTION OF CONCRETE AND CORRESPONDING ASSEMBLY METHOD

(57) A mobile concrete mixing plant (10) comprises at least a first operating portion (12), a second support portion (13) and a third command portion (14), reciprocally connected in an articulated manner. The first operating portion (12) and the third command portion (14) are both connected to the second support portion (13) in a rotatable manner respectively around a first hinging axis (X1) and a second hinging axis (X2), said second hinging axis (X2) being orthogonal to the first hinging axis (X1).

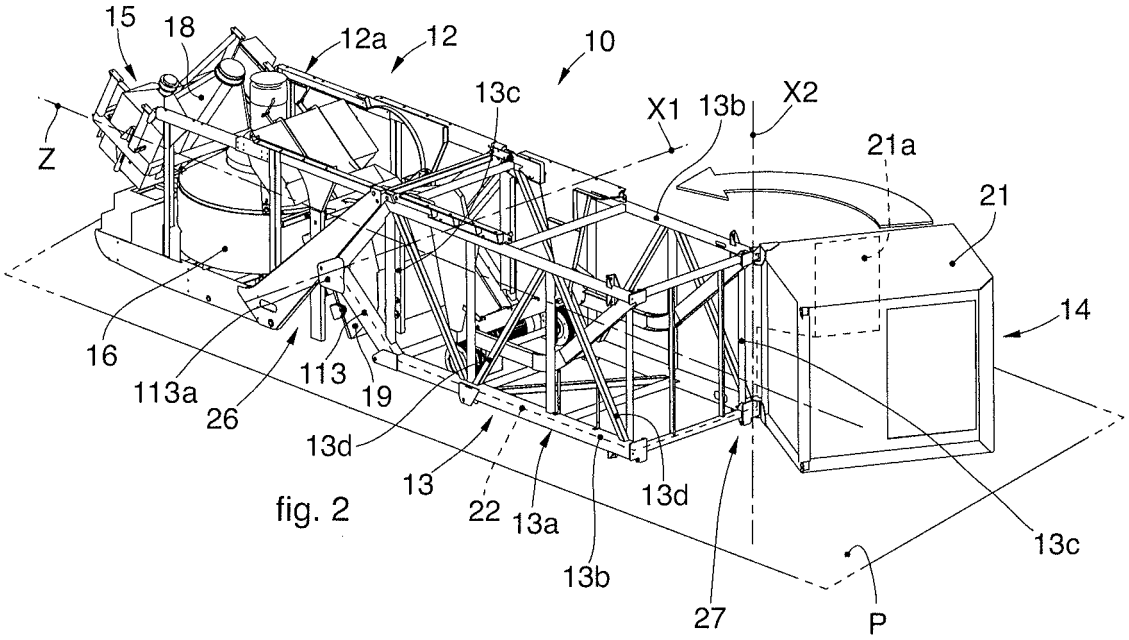

fig. 2

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a concrete mixing plant comprising a mixing unit for the production of concrete and/or bitumen.

[0002] In particular, the present invention comes within the field of mobile concrete mixing plants, that is, destined to be moved each time from one building site to another, and therefore with a bulk such as to allow it to be transported by road with standard transport vehicles.

[0003] Moreover, the present invention concerns a concrete mixing plant selectively positionable directly on a semi-trailer of a road vehicle, or inside a standard-type container for sea, air or rail transport.

BACKGROUND OF THE INVENTION

[0004] In the field of building sites and road construction sites, it is known to use mobile concrete mixing plants to make concrete and/or bitumen.

[0005] Such mobile plants are transported on each occasion to a site and mounted there and installed to be used for a period of time, dictated by the needs of the specific site, and then dis-assembled and transported to a site for subsequent use.

[0006] One requirement connected to the specific type of plant as above is to transport the plants easily to the sites where they are to be used, and also to make them operative quickly, with limited assembly and installation times.

[0007] Another requirement is to promote as much as possible a quick dis-assembly of the plants, to quickly clear the site and reduce the transfer times to the next building site, once they have finished in the previous one.

[0008] It is therefore advantageous that the operations to assemble and dis-assemble the plants should involve simple activities of unloading and moving the components of the plant, and that these activities should be as few as possible.

[0009] On this point, it is important that the supplier of mobile plants should perform interventions before the supply, able to reduce the number of the aforesaid activities, so as to simplify and accelerate the assembly and dis-assembly of the plants.

[0010] Mobile concrete mixing plants are known, for example the trestle or bridge type, provided with a mixing unit and a support structure configured to support the mixing unit at a desired height from the ground. In this way, a loading space is defined under the mixing unit in which to position an HGV (Heavy Goods Vehicle) which is loaded directly with the concrete produced in the mixer above.

[0011] Normally, concrete mixing plants also include a command unit which, during use, is electrically connected to the mixing unit for the electric power and control of the functioning thereof, and where provided, with possible accessory apparatuses, for example for metering the components of the concrete.

[0012] Mobile concrete mixing plants are known, divided into distinct modules that are transported separately to the sites where they are to be used and that are subsequently joined together on site to define the final assembly of the plant.

[0013] One disadvantage of such mobile concrete mixing plants is that they have high management costs, in particular deriving from the need to effect and manage a plurality of transports for the separate modules, and from the high number of operations needed to join and electrically connect the different modules. These operations are carried out on the site and take even two weeks or more to be completed, with the consequent disadvantageous and uneconomical stoppage of the plant. Furthermore, in particular the electric connection operations or data connection and/or hydraulic and/or pneumatic connections, require the presence on site of specialized personnel.

[0014] The operations of dis-assembling and transporting the plants to other sites are equally disadvantageous.

[0015] Mobile concrete mixing plants are also known, divided into several parts connected to each other to define a single transportable prism, in which the parts are reciprocally articulated and rotatable around parallel axes to define a transport condition and an operating condition of the plant.

[0016] However, although such plants are able to reduce the transport and assembly costs, even considerably compared to the plants indicated above, they have the disadvantage that they require connection on site of the command unit with the mixing unit.

[0017] Some known plants, also of this last type, have the disadvantage that they require a separate dispatch of the control module or the latter must be supplied in the installation place of the site.

[0018] In known solutions, to reduce the number of assembly operations, it is provided to connect the different components of the plant with specially provided connection pins, which facilitate the connection of the power and command part included in the command unit with the metering and mixing devices of the mixing unit.

[0019] It is also known, to reduce the bulk sizes of the mobile plants in the transport condition, to make the command units solid with the mixing units they are to command.

[0020] However, one disadvantage of known solutions is that they require command modules of considerably reduced sizes and/or irregular shape.

[0021] Document GR-A-20110100111 describes a mobile plant for the production of concrete provided with a containing compartment with metal panels or walls, articulated and removable, which are connected temporarily to the structure of the plant and are mounted on each occasion and dis-assembled manually by the operators, according to needs, to define the containing compart-

ment. The articulated and removable panels are accessories of the loading compartment and are passive and static, and do not need to be commanded, and hence do not need electric connections.

[0022] Documents GR-A-1.0065.037, CH-A-438.131 and SU-A-946.966 are also known, which describe plants for the production of concrete or concrete mixing plants of a known type.

[0023] There is therefore a need to perfect a mobile plant for the production of concrete and corresponding assembly method that can overcome at least one of the disadvantages of the state of the art.

[0024] In particular, one purpose of the present invention is to obtain a mobile concrete mixing plant that has limited bulk, in particular in its transport condition, so as to be transportable inside a standard-size container or also by a standard-size road vehicle.

[0025] Another purpose of the present invention is to obtain a mobile concrete mixing plant that allows to reduce management costs, reducing the assembly and disassembly operations to be carried out on each occasion at the sites.

[0026] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0027] The present invention is set forth and characterized in the independent claims, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0028] In accordance with the above purposes, a mobile concrete mixing plant according to the present invention comprises at least a first operating portion, a second support portion and a third command portion, reciprocally connected in an articulated manner.

[0029] According to one aspect of the present invention, the first operating portion and the third command portion are both connected permanently to the second support portion in a rotatable manner respectively around a first hinging axis and a second hinging axis, wherein the latter is orthogonal to the first hinging axis.

[0030] In this way, a mobile plant is advantageously obtained in a single piece, with the possibility of being transported in standard-type containers or on standard motor vehicles, also increasing the overall sizes of the mobile plant.

[0031] Furthermore, the connection of the command portion to one end of the support portion opposite the operating portion, together with the disposition of the hinging axes, allows to maximize the sizes of the command portion even though the latter remains within the transverse bulk of the second support portion. In other words, according to the present invention, there are advantageously no limits to the sizes of the command portion, except for the cross section which is constrained by transport requirements and regulated by the appropriate regulations.

[0032] According to the present invention, the first operating portion comprises at least a mixing unit for the production of concrete, and the third command portion comprises at least an electric command unit.

[0033] In some forms of embodiment, the first operating portion is hinged to a first end of the second support portion and the third command portion is hinged to a second end of the second support portion, opposite the first end. Furthermore, the first operating portion and the third command portion are configured to assume at least a transport condition, in which both have a bulk contained inside the transverse bulk of the second support portion to which they are connected.

[0034] According to the present invention, the support portion has a longitudinal axis of development, and the first hinging axis is orthogonal thereto, while the second hinging axis is orthogonal both to the first hinging axis and to the longitudinal axis of development.

[0035] In some forms of embodiment, the first hinging axis is located in an intermediate position in the transverse bulk of the second support portion, in correspondence with the first end cited above.

[0036] The hinging axis located in an intermediate position, for example median, of the transverse bulk of the second support portion, allows to reduce the longitudinal sizes of the mobile plant when it is in the transport condition, facilitating the transport thereof and also allowing to increase the sizes of the third command portion.

[0037] The present invention also concerns an assembly method to assemble a mobile concrete mixing plant provided with at least a first operating portion, a second support portion and a third command portion, wherein the first operating portion and the third command portion are connected to the second support portion in a rotatable manner respectively around a first hinging axis and a second hinging axis. The method comprises at least a preparatory step of transporting and positioning the mobile plant in proximity to a work station provided with a support plane. The positioning provides to place a longitudinal axis of development of the second support portion parallel to the support plane.

[0038] According to the present invention, the assembly method comprises, among the assembly steps, rotating the third command portion around a second hinging axis, orthogonal to the first hinging axis, to position it adjacent to the second support portion, and subsequently lifting the first operating portion, moving the latter in plane motion on a plane perpendicular to the support plane. During the lifting, it is also provided to rotate the second support portion by 90° both around the first hinging axis, and also with respect to the support plane, positioning the axis of longitudinal development perpendicular to the support plane at the end of the lifting.

[0039] It is therefore clear that the assembly of the mobile plant according to the present invention is extremely rapid and advantageously easy to perform.

[0040] According to variant solutions, the assembly method comprises a preliminary step, prior to the preparatory transport and positioning step, that provides to connect a first end of connection cables to a command unit located in the third command portion, to make the electric connection cables pass in passage channels defined by internal communicating cavities present in the second support portion, and to connect a second end of the connection cables, opposite the first end, to a mixing unit present in the first operating portion.

[0041] The various aspects and characteristics described in the present description can be applied individually where possible. These individual aspects, for example aspects and characteristics described in the attached dependent claims, can be the object of divisional applications.

[0042] It is understood that any aspect or characteristic that is discovered, during the patenting process, to be already known, shall not be claimed and shall be the object of a disclaimer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0043] These and other characteristics of the present invention will become apparent from the following description of forms of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1a is a three-dimensional view of a mobile concrete mixing plant in a transport condition,
- fig. 1b is a variant of fig. 1a;
- figs. 2 to 4 are three-dimensional views of assembly steps of the mobile plant of fig. 1a;
- figs. 5 and 6 are three-dimensional views of auxiliary assembly steps of the mobile plant of fig. 1a;
- fig. 7 is a lateral view of fig. 6.

[0044] In the following description, the same reference numbers indicate identical parts of the mobile plant according to the present invention, also in different forms of embodiment. It is understood that elements and characteristics of one form of embodiment can be conveniently incorporated into other forms of embodiment without further clarifications.

DETAILED DESCRIPTION OF SOME FORMS OF EMBODIMENT

[0045] We shall now refer in detail to the various forms of embodiment of the present invention, of which one or more examples are shown in the attached drawing. Each example is supplied by way of illustration of the invention and shall not be understood as a limitation thereof. For example, the characteristics shown or described insomuch as they are part of one form of embodiment can be adopted on, or in association with, other forms of embodiment to produce another form of embodiment. It is understood that the present invention shall include all such modifications and variants.

Fig. 1a is used to describe forms of embodiment of a mobile concrete mixing plant 10 in a transport condition, in this case inserted in a container 111, for example the open top type. The mobile plant 10 is also configured to be housed inside a closed container 111.

Fig. 1b is used to describe variant forms of the mobile plant 10, in a transport condition in which it is positioned on a semi-trailer of a road transport vehicle, such as an articulated vehicle 11.

[0046] The mobile plant 10 can be divided into three portions, in which a first portion or operating portion 12, a second portion or support portion 13, and a third portion or command portion 14 are connected to each other in articulated fashion.

[0047] In particular, in the transport condition, the mobile plant 10 has a substantially prismatic shape, in which the three portions 12, 13, 14 are aligned along a longitudinal axis coinciding with an axis of longitudinal development Z of the support portion 13.

[0048] In forms of embodiment described here, the first operating portion 12 comprises at least a mixing unit 15 for the production of concrete and the third command portion 14 comprises at least an electric command unit 21a.

[0049] In the present description we shall refer only to the three portions 12, 13, 14 as above, with this intending only to indicate one of the possible solutions, in particular a minimum basic configuration.

[0050] Indeed, there is nothing to exclude that the mobile plant 10 can comprise not only the three portions 12, 13, 14, but also one or more other portions, connected to the former in an articulated fashion and configured to come within a common transverse bulk, in the transport condition of the mobile plant 10, in order to define the prismatic shape of the mobile plant 10, compatible with transport by container 111 or articulated vehicle 11.

[0051] In fact it can be provided that one or more other articulated sections, for example carrying accessory devices, apparatuses or members, can be added in modular fashion to the portions 12, 13, 14 along the axis of longitudinal development Z, or co-penetrating in the portions 12, 13, 14, thus conferring great compactness on the mobile plant 10, even when the plant equipment is complete.

[0052] Figs. 1a and 1b are used to describe forms of embodiment in which the operating portion 12 and the command portion 14 are connected to opposite ends of the support portion 13.

[0053] The operating portion 12 is pivoted to a first end 26 of the support portion 13 and is connected to it rotatably around a first hinging axis X1, orthogonal with respect to the axis of longitudinal development Z.

[0054] In particular, in some forms of embodiment,

both the operating portion 12 and the command portion 14 are permanently hinged, or rotatably connected, to the support portion 13. In other words, once hinged or connected rotatably with respect to each other, it is not provided, in order to use the mobile plant 10 in question, to separate the operating portion 12 and the command portion 14 from the support portion 13.

[0055] In this way, advantageously, it is possible to keep the connections - electric, software, pneumatic, hydraulic or others as provided - permanently connected and associated with the command portion 14 provided by the electric command unit 21a.

[0056] Indeed, the operating portion 12 remains permanently connected rotatably to the command portion 14 by means of the support portion 13, which means that the connections, for example electric and software, are permanently connected and do not need pins or cables to be made when the mobile plant 10 is put into service.

[0057] The presence of the electric command unit 21a in the command portion 14 and the fact that the command portion 14 and the operating portion 12 are permanently connected to the support portion 13 means that the portions 12 and 14 are kept connected both physically and also in terms of electric connection, data (software) connection and/or other connections possibly required or necessary, such as hydraulic and/or pneumatic connections.

[0058] In possible implementations, other portions of the plant can be provided, which are articulated and permanently connected rotatably.

[0059] In possible implementations, the command portion 14 is pivoted to a second end 27 of the support portion 13, opposite the first end 26, and is connected to the latter rotatably around a second hinging axis X2, orthogonal both to the axis of longitudinal development Z and to the first hinging axis X1.

[0060] The axis of longitudinal development Z, the first X1 and second X2 hinging axes can be considered as part of a Cartesian triad of axes.

[0061] The reciprocal hinging of the portions 12, 13, 14 of the mobile plant 10 can be obtained by hinging elements chosen from hinges with a simple hinging, with a single or multiple axis, or by connecting rods and/or block link system guides or parallelogram systems, or by other mechanical members suitable to determine an articulation of the portions 12, 13, 14. Said articulation can be defined by a pure rotary movement or roto-translatory. In the case of an articulation between operating portion 12 and support portion 13, the hinging members can be configured to hinge permanently, as we said above, the operating portion 12 to the support portion 13.

[0062] In some forms of embodiment, the support portion 13 comprises a frame 13a formed by cross-pieces 13b, uprights 13c, and possibly diagonal elements 13d, reciprocally connected to define a trellis-like reticular structure. The hinging members are therefore associated with the frame 13a. The second end 27 of the support portion 13 can be defined by an end upright element 13c of the frame 13a.

[0063] In some forms of embodiment, the first hinging axis X1 can be positioned in an intermediate position, for example median, in the transverse bulk of the support portion 13 in correspondence to the first end 26 of the latter. This solution allows to reduce the length of the mobile plant 10 compared with solutions where for example the hinging occurs in a position of upper or lower end of the support portion 13.

[0064] By intermediate position we mean that the first hinging axis X1 intersects the third support portion 13 transversely at two points of the frame 13a, opposite and inside two corresponding opposite faces of the prismatic shape of the support portion 13.

[0065] To this purpose, it can be provided that, in correspondence with the first end 26, the frame 13a includes a pair of inclined structural elements 113 positioned on two opposite sides of the frame 13a and reciprocally converging from a respective upright 13c toward the center of the respective side. In substance, the pair of structural elements 113 can define the first end 26 of the support portion 13.

[0066] The structural elements 113 are attached to each other at a respective terminal end 113a and this attachment defines, for each of the two sides of the frame 13a, the hinging point of the operating portion 12 to the support portion 13. It is clear that the hinging points thus determined define the first hinging axis X1.

[0067] The operating portion 12 includes the mixing unit 15 for the production of concrete and/or bitumen.

[0068] The operating capacity of the mixing unit 15 can be as much as 1.5 m^3 of concrete returned.

[0069] By the term mixing unit 15, in the present description, we mean a unit to produce concrete which can for example comprise a mixer 16, which can have one or more vertical or horizontal axes, a loading device 17 and a metering device 18 to feed the components of the concrete to the mixer 16, such as inert materials, water, cement or bitumen, and additives.

[0070] The operating portion 12 includes a support frame 12a, for example the reticular type, configured to support the mixing unit 15 and defining the transverse bulk of the operating portion 12 when the mobile plant 10 is in its transport condition.

[0071] In some forms of embodiment, described by way of example with reference to fig. 1a, the transverse sizes of the mobile plant 10 can be maintained within 2.15 m in width and 2.35 m in height, required to be able to put the mobile plant 10 inside the container 111, for example the open top type, with a length comprised between about 20 feet to about 40 feet to be transported with standard transport means. In this case, inside the container 111 the length of the mobile plant 10 transported can be maintained within 11.80 m.

[0072] It is therefore possible to transport, in a container 111, plants with a relatively high yield (1.5 m^3), with undisputed advantages in operating and economic terms.

[0073] In some forms of embodiment, described by way of example with reference to fig. 1b, in the transport condition, the mobile plant 10 can assume transverse sizes contained within a width of 2.55 m and a height of 2.6 - 2.7 m, required for loading on a standard articulated vehicle 11.

[0074] However, in the case of necessity, the size of the command portion 14 can also reach a width of 3 m for a height of about 3.3 m, the maximum values allowed for exceptional loads without an escort.

[0075] Furthermore, the fact that the three portions 12, 13, 14 of the mobile plant 10 are connected to each other to define a prism in a single piece, allows to transport, in Italy, objects having a longitudinal dimension of up to 17.68 m, provided that the overall length of the articulated vehicle 11 does not exceed 18.75 m. Making the mobile plant 10 in a single piece defined by three sections connected to each other therefore allows to increase the length of the mobile plant 10 itself, without departing from the field of transport on articulated trucks 11 of the standard type. This increase can be exploited, obviously, for exceptional loads which allow to have sizes with bigger maximum bulk.

[0076] Fig. 1 is used to describe forms of embodiment in which the operating portion 12 also includes a lifting device 19, for example a winch, configured to move the loading device 17.

[0077] The lifting device 19 is pivoted to the support frame 12a to be contained, in the transport condition of the mobile plant 10, within the bulk of the support portion 13.

[0078] The lifting device 19 and the metering device 18, in some forms of embodiment, can be connected in articulated fashion to the support frame 12a and can be mobile to retract, partly or completely co-penetrating the operating portion 12 or the support portion 13, inside the transverse bulk thereof in the transport condition. For example, the lifting device 19 can be one of the other portions of the plant that are articulated and permanently connected rotatably as described above.

[0079] The support portion 13 includes a frame 13a with a transverse bulk, when the mobile plant 10 is in the transport condition, substantially equal to that of the operating portion 12.

[0080] The frame 13a of the support portion 13 performs the function of a bearing structure of the mixing unit 15 and the operating portion 12 when the mobile plant 10 is in the operating condition.

[0081] Both the support frame 12a and the frame 13a can be defined by metal structural elements, for example made of steel, connected to each other, for example by welding, nailing or screwing.

[0082] The structural elements can be the closed tubular type, or can be section shapes, for example H-bars, L-bars, T-bars or C-bars, or other types.

[0083] The structural elements of the frame 13a can define the cross-pieces 13b, uprights 13c and possible diagonal elements 13d as described above. In the same way, the structural elements of the support frame 12a can also be formed by cross-pieces, uprights and possibly diagonal elements.

[0084] The support portion 13 can also include guide elements of the loading device 17, for example a first part 20a of two longitudinal guides 20 reciprocally parallel and positioned on two sides of the frame 13a and configured to constrain the motion of the loading device 17 in a direction parallel to the axis of longitudinal development Z.

[0085] A second part 20b of each of the longitudinal guides 20 can be provided in the operating portion 12.

[0086] First and second parts 20a, 20b are configured to be positioned in reciprocal continuity in the operating condition of the mobile plant 10, to define said longitudinal guides 20.

[0087] The command portion 14 can include a command cabin 21, in which an electric command unit can be housed, for example the command board or electric command unit 21 a cited above, configured to electrically power and manage the drive and operations of the apparatuses of the mobile plant 10 that function electrically.

[0088] Such apparatuses can be the mixer 16, the loading device 17, the metering device 18 and the lifting device 19.

[0089] The command board 21 a can be connected directly to these apparatuses already before the mobile plant 10 is transported, or a preparation for connection can be provided, and completed at the site where the plant is then used.

[0090] For example, fig. 4 is used to describe forms of embodiment, which can be combined with all the forms of embodiment described here, in which connection cables 22 can be provided, for example electric connection cables, and/or other connections, such as data connection cables (software), pneumatic connections, hydraulic connections or a combination thereof, which can be housed inside the components of the support frame 12a and the frame 13a.

[0091] According to some forms of embodiment of the present invention, the connection cables 22 can be connected to the command board 21 a in a preliminary step that provides to connect a first end of the connection cables 22 to the command board 21 a present in the command cabin 21 of the command portion 14, to pass the connection cables 22 in passage channels defined by communicating internal cavities of the structural elements of the support portion 13, and to connect a second end of the connection cables 22, opposite said first end, to the electric devices of the mixing unit 15. As we said, the structural elements can be the cited cross-pieces 13b, uprights 13c and possibly diagonal elements 13d of the frame 13a.

[0092] This solution allows to reduce the number of assembly operations to be carried out on site, operations that would require time and specialized personnel.

[0093] Furthermore, the positioning of the first hinging axis X1 in the median zone of the transverse bulk of the support portion 13 allows to reduce the length of the con-

nection cables 22.

[0094] Figs. 2 to 4 are used to describe forms of embodiment of assembly steps of a method to assemble the mobile plant 10, once it has been transported to its work station in a building site.

[0095] The work station includes a support plane P on which the mobile plant 10 rests during use.

[0096] After it has been transported to its work station, for example by the articulated vehicle 11, the mobile plant 10 is unloaded and positioned lying on the support plane P with its axis of longitudinal development Z substantially parallel to the support plane P.

[0097] Fig. 2 shows by way of example one position of the mobile plant 10 in which the axis of longitudinal development Z and the first hinging axis X1 are parallel to the support plane P, while the second hinging axis X2 is perpendicular thereto.

[0098] This allows to rotate the command portion 14 around the second hinging axis X2, for example by 90°, 180° or 270°, until the command cabin 21 is positioned laterally adjacent to the support portion 13.

[0099] Fig. 3 shows by way of example an operation after the positioning of the mobile plant 10, during which the operating portion 12 is lifted, moving it in plane motion on a plane perpendicular to the support plane P and, during the lifting, the support portion 13 is simultaneously rotated by 90° both around the first hinging axis X1 and also with respect to the support plane P.

[0100] Fig. 4 shows the situation at end of lifting, where the axis of longitudinal development Z is perpendicular to the support plane P.

[0101] During the lifting and rotations described above, the connection cables 22 remain always correctly inserted in the frame 13a and therefore do not require cabling or attachment operations that would entail a considerable use of time and resources during the assembly of the mobile plant 10, delaying the latter's availability for use.

[0102] With reference to fig. 4, at the end of lifting, the mobile plant 10 is in the operating condition, where the support portion 13 rests on the support plane P with its base face in correspondence with the hinging end of the command portion 14, which in turn rests on the support plane P with a base face of the cabin 21.

[0103] In the operating condition, described by way of example with reference to figs. 4 to 7, the operating portion 12 of the mobile plant 10 protrudes cantilevered with respect to the support portion 13 and is raised with respect to the support plane P by a quantity sufficient to allow to position an HGV, such as for example a truck-mounted concrete mixer, under the mixing unit 15, to carry out a direct loading thereof.

[0104] Once positioned in the operating condition, the mobile plant 10 can be made solid by adding tie rods 23 that connect the operating portion 12 to the support portion 13 on the opposite side of the latter with respect to the side from which the operating portion 12 protrudes cantilevered.

[0105] In the same way, reinforcement plates or braces 25 can be associated with the mobile plant 10 in the operating condition, configured to connect and supply support to the operating portion 12 in the zone where the latter protrudes with respect to the support portion 13.

[0106] Figs. 4 to 7 are used to describe forms of embodiment in which one or more auxiliary or accessory structures 24 are associated to the mobile plant 10, and are configured to allow access to the operating portion 12 for possible operators.

[0107] The auxiliary structures 24 can include, for example, practicable platforms 24a, connected to the operating portion 12 and surrounding the mixing unit 15.

[0108] Other auxiliary structures 24, shown for example in figs. 6 and 7, can include steps 24b to access the operating portion 12 and connecting, for example, the platforms 24a to the support plane P.

[0109] It is clear that modifications and/or additions of parts may be made to the mobile plant 10 as described heretofore, without departing from the field and scope of the present invention.

[0110] It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of mobile plant concrete mixing, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

1. Mobile concrete mixing plant, comprising at least a first operating portion (12), a second support portion (13) that has an axis of longitudinal development (Z) and a third command portion (14), reciprocally connected in an articulated manner, **characterized in that** said first operating portion (12) comprises at least a mixing unit (15) for the production of concrete, and said third command portion (14) comprises at least an electric command unit (21 a), wherein said first operating portion (12) and said third command portion (14) are both connected to said second support portion (13) in a rotatable and permanent manner respectively around a first hinging axis (X1) orthogonal to said axis of longitudinal development (Z) and a second hinging axis (X2), orthogonal both to said first hinging axis (X1) and to said axis of longitudinal development (Z).

2. Plant as in claim 1, **characterized in that** said first operating portion (12) is hinged to a first end (26) of said second support portion (13) and said third command portion (14) is hinged to a second end (27) of said second support portion (13), opposite said first end (26), said first operating portion (12) and said third command portion (14) being configured to assume at least a transport condition, in which both have a bulk contained inside the transverse bulk of

said second support portion (13).

3. Plant as in claim 2, **characterized in that** said support portion (13) has a prismatic shape.

4. Plant as in claim 2 or 3, **characterized in that** said support portion (13) comprises a frame (13a) formed by cross-pieces (13b), uprights (13c), and possibly diagonal elements (13d), reciprocally connected to define a trellis-like reticular structure.

5. Plant as in claim 4, **characterized in that** said second end (27) of the support portion (13) is defined by an end upright element (13c) of the frame (13a).

6. Plant as in claim 2, 3, 4 or 5, **characterized in that** said first hinging axis (X1) is positioned in an intermediate position in the transverse bulk of said second support portion (13) in correspondence to said first end (26).

7. Plant as in claims 4 and 6 or 5 and 6, **characterized in that** in said intermediate position the first hinging axis (X1) intersects transversely the third support portion (13) in two points of the frame (13a) opposite and inside two corresponding opposite faces with a prismatic shape of the support portion (13).

8. Plant as in claims 6 or 7 combined with one of claims 4 or 5, **characterized in that** the frame (13a) comprises, in correspondence with said first end (26), a pair of structural elements (113) inclined positioned on two opposite sides of the frame (13a) and reciprocally converging from a respective upright (13c), toward the center of the respective side.

9. Plant as in claim 8, **characterized in that** said pair of structural elements (113) define the first end (26) of the support portion (13).

10. Plant as in claim 8 or 9, **characterized in that** the structural elements (113) are attached to each other at a respective terminal end (113a) and said attachment defines, for each of the two sides of the frame (13a), the hinging point of the operating portion (12) to the support portion (13), and the two hinging points thus determined define the first hinging axis (X1).

11. Plant as in any claim hereinbefore, **characterized in that** both the operating portion (12) and the command portion (14), and any other possible portions of the plant, are rotatably connected to the support portion (13) in a permanent manner.

12. Plant as in any claim hereinbefore, **characterized in that** it provides connection cables (22) connected in a permanent manner both to said command unit (21a) and to said mixing unit (15).

13. Plant as in claim 12, **characterized in that** at least said second portion (13) is made with structural elements provided with internal cavities communicating with each other to define passage channels inside which there are said connection cables (22), connected at a first end to said mixing unit (15) and at a second end, opposite said first end, to said electric command unit (21a).

14. Plant as in claim 12 or 13, **characterized in that** said connection cables (22) comprise one or more electric connection cables.

15. Plant as in claim 12, 13 or 14, **characterized in that** said connection cables (22) comprise one or more data connection and/or hydraulic connection and/or pneumatic connection cables.

16. Assembly method to assemble a mobile concrete mixing plant (10) provided with at least a first operating portion (12), a second support portion (13) and a third command portion (14), wherein said first operating portion (12) and said third command portion (14) are connected to said second support portion (13) in a rotatable manner respectively around a first hinging axis (X1) and a second hinging axis (X2), comprising at least a preparatory step of transporting and positioning said mobile plant (10) in proximity to a work station provided with a support plane (P), placing a longitudinal axis of development (Z) of said second support portion (13) parallel to said support plane (P);
characterized in that it comprises the following assembly steps:

- rotating said third command portion (14) around said second hinging axis (X2), orthogonal to said first hinging axis (X1), to position it adjacent to said second support portion (13);
- lifting said first operating portion (12) moving the latter in plane motion on a plane perpendicular to said support plane (P) and, during the lifting, rotating said second support portion (13) by 90° both around said first hinging axis (Xl), and also with respect to said support plane (P), positioning said axis of longitudinal development (Z) perpendicular to said support plane (P) at the end of said lifting.

17. Method as in claim 16, **characterized in that** it comprises a preliminary step, prior to said preparatory transport and positioning step, that provides to connect a first end of electric connection cables (22) to a command unit (21 a) of said third command portion (14), to make said electric connection cables (22) pass in passage channels defined by internal communicating cavities of said second support portion (13), and to connect a second end of said electric

connection cables (22), opposite said first end, to a mixing unit (15) of said first operating portion (12).

18. Method as in claim 17, **characterized in that** it also provides to keep said electric connection cables (22) permanently connected to said command unit (21 a) and to said mixing unit (15) both during said preparatory step and also during said assembly steps.

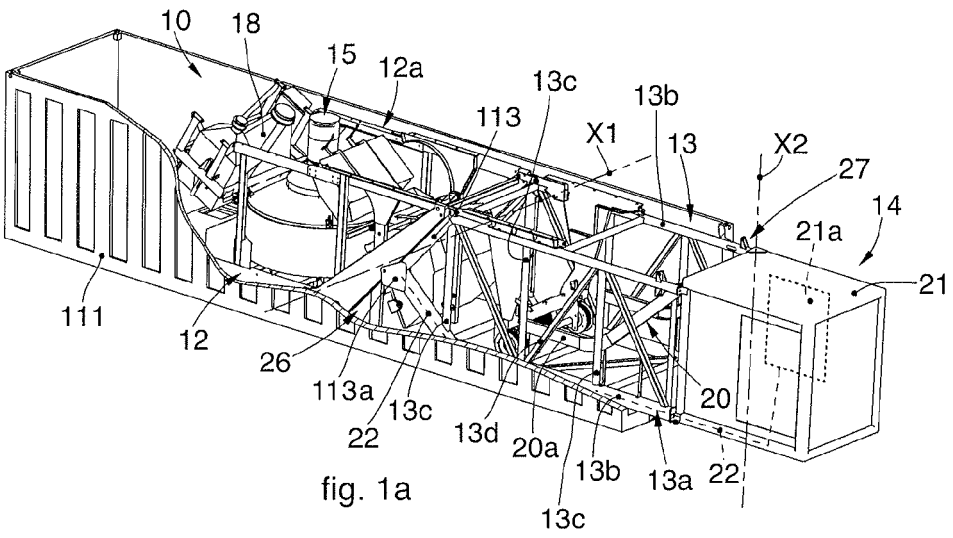

10
18
15
12a
13c
13b
113
X1
13
X2
27
14
21a
21
111
12
26
113a
13c
22
13d
20a
13b
13a
22
20
13c

fig. 1a

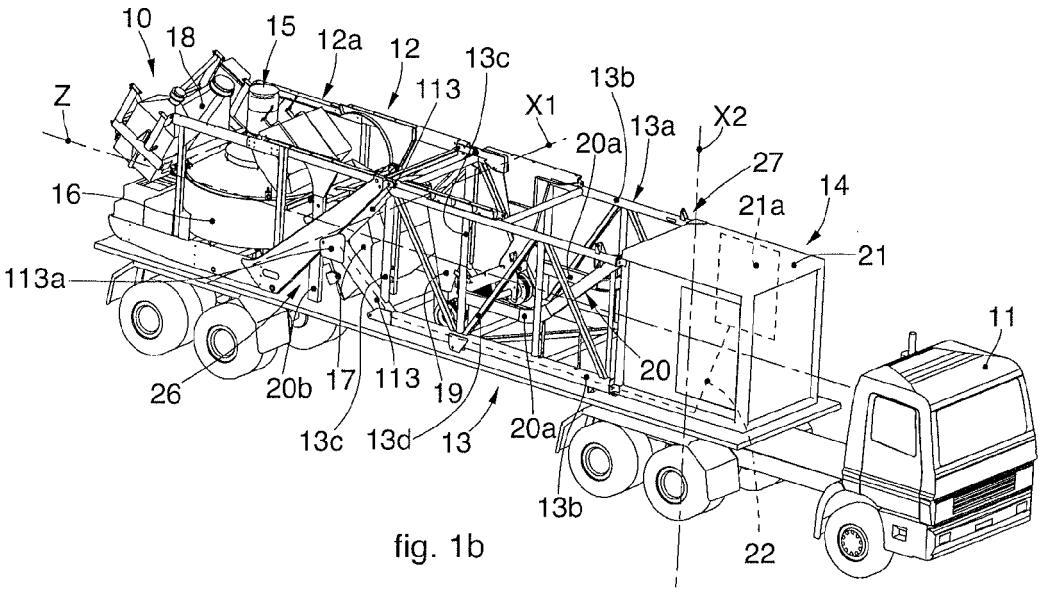
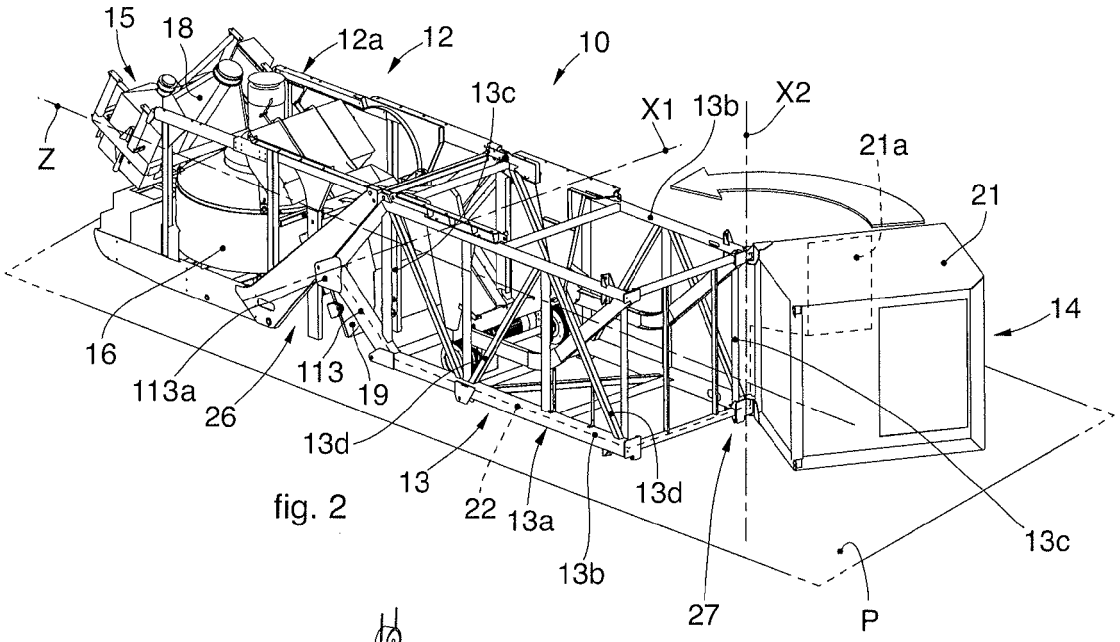

10
18
15
12a
12
13c
113
X1
13b
13a
X2
20a
27
14
21a
21
Z
16
113a
11
26
20b
17
113
19
20
13c
13d
13
20a
13b
22

fig. 1b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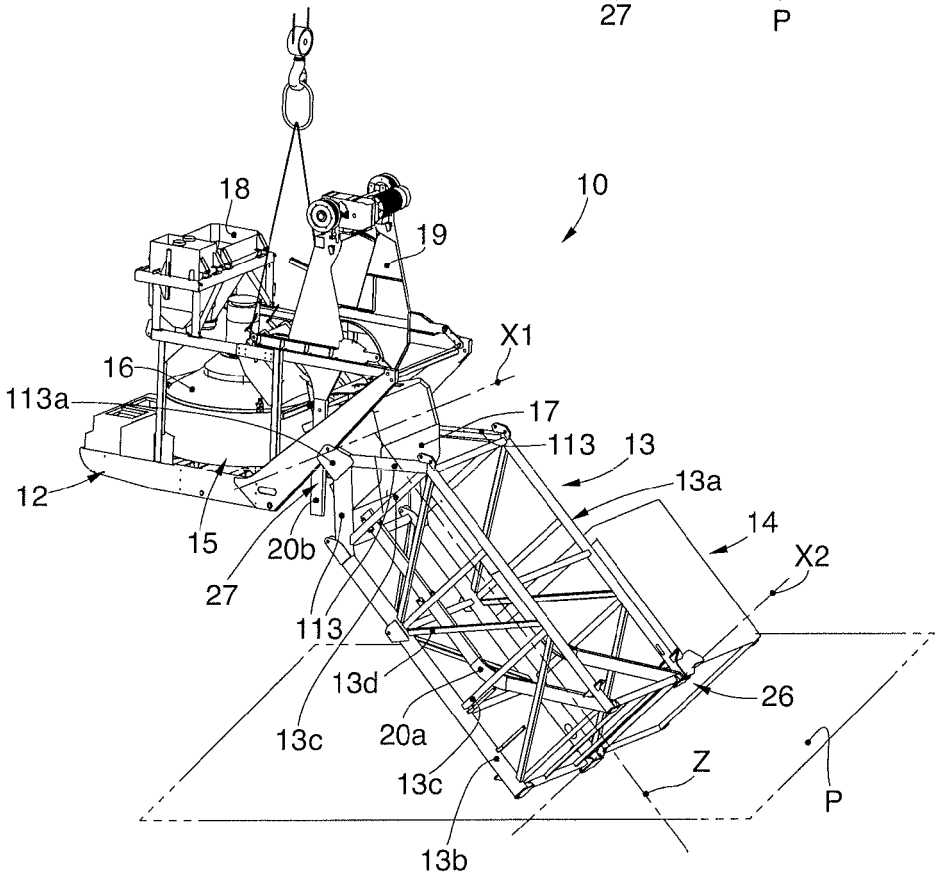
12a
12
10
13c
X1
13b
X2
21a
21
Z
14
16
113a
26
113
19
13d
13
22
13a
13d
13c
13b
27
P

fig. 2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X1
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113a
17
113
13
13a
12
14
15
20b
X2
27
113
13d
26
13c
20a
Z
13c
P
13b

fig. 3

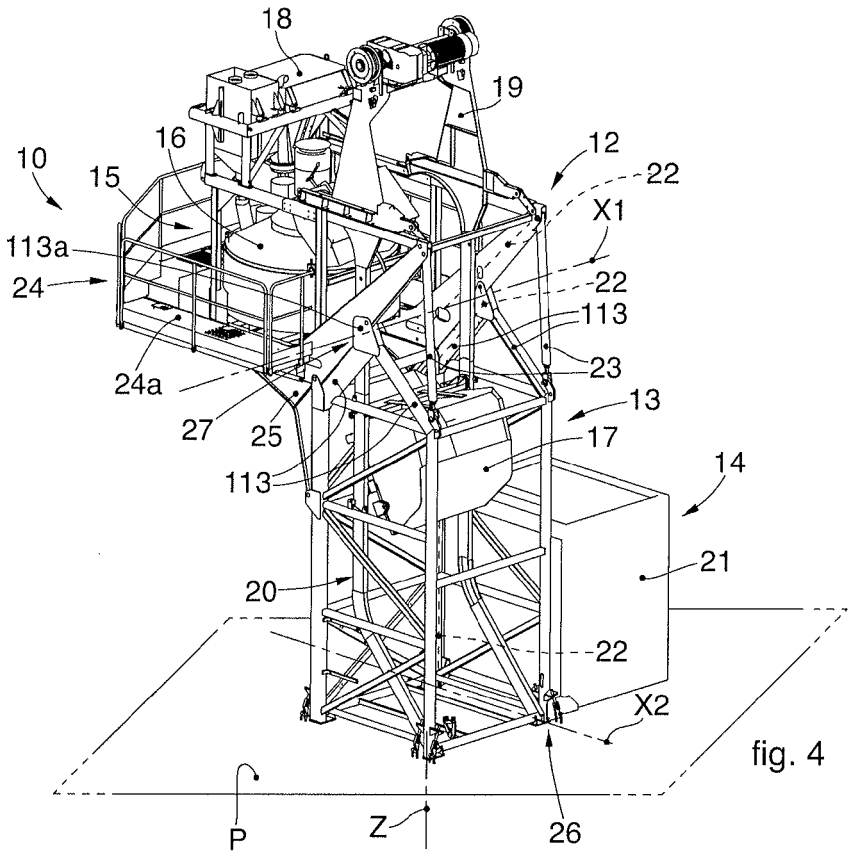

18
19
16
10
15
12
22
X1
113a
24
22
113
23
24a
27
25
13
17
113
14
21
20
22
X2
P
Z
26

fig. 4

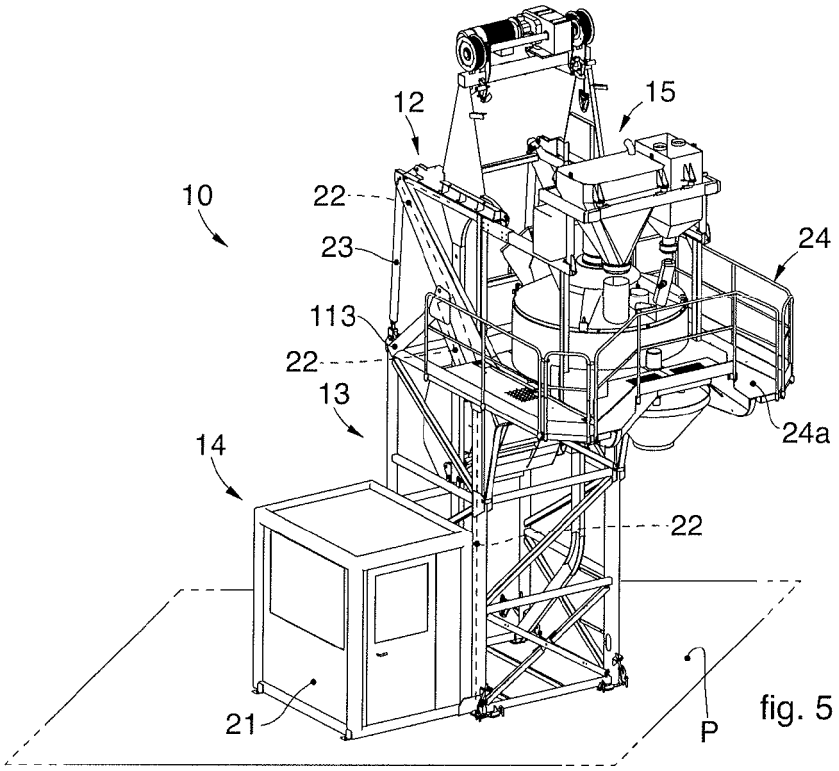
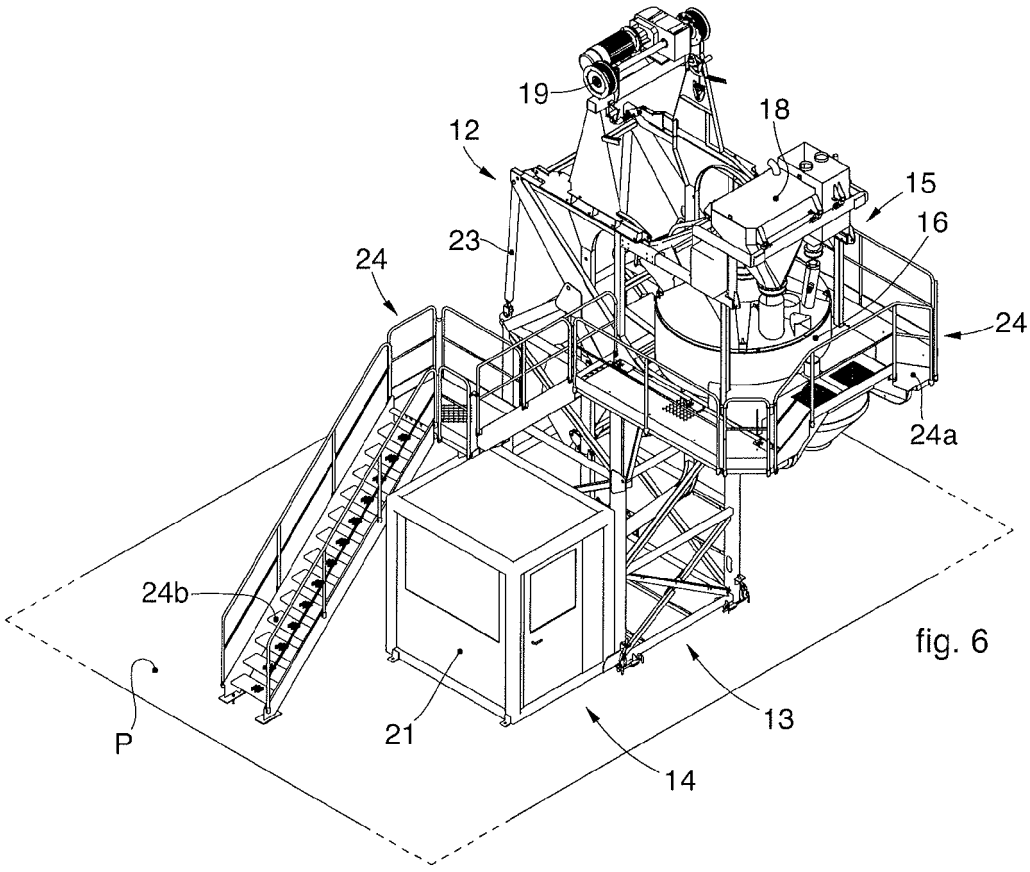

12
15
10
22
24
23
113
22
13
24a
14
22
21
P

fig. 5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12
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16
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24a
24b
P
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13
14

fig. 6

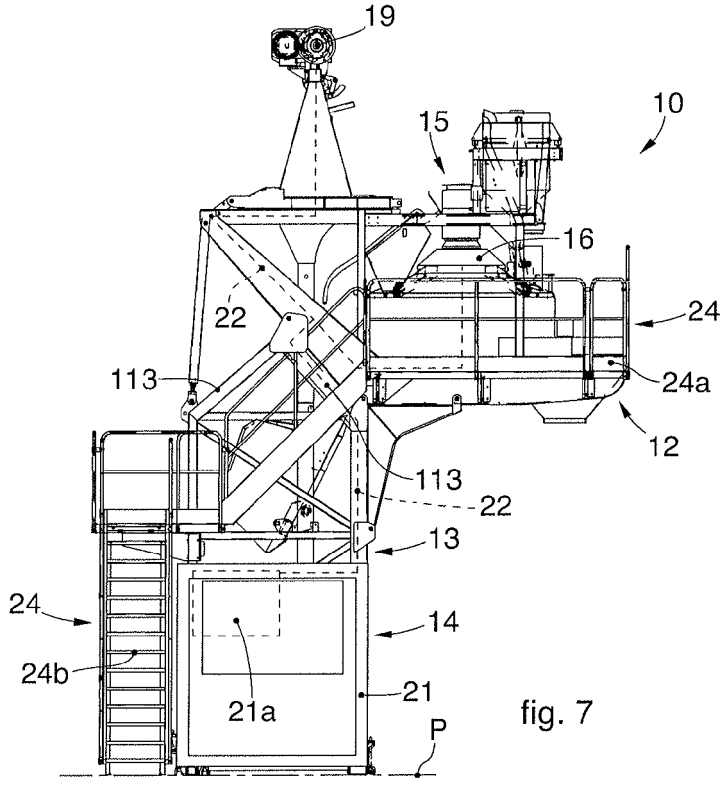
19
10
15
16
22
24
113
24a
12
113
22
13
24
14
24b
21
21a
P

fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 7446

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GR 2011 0100 111 A (TZANAVARIS NIKOS ATHANASIOU [GR]; SPANOS CHRISTOS IRAKLI [GR] SPANOS C) 20 September 2012 (2012-09-20) * figures *	1-4,6	INV. B28C7/04 B01F13/00 B28C9/04 E01C19/10
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TECHNICAL FIELDS SEARCHED (IPC)

B28C
B01F
E01C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 October 2015	Orij, Jack

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14-10-2015

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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