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(54) **BUCKET, EARTHMOVING MACHINE, HANDLING METHODS**

(57) The present invention relates to a bucket (1) which comprises a bucket body (2) which delimits a material-containing compartment (4) and an access opening (6) to the material-containing compartment (4); wherein the bucket body (2) comprises at least one seat (22) at least partially circumscribed by a thickness (S) of a wall (20) of the bucket body (2); and a bucket-side coupler (10) of a coupling connectable to a machine-side coupler

(58) of said coupling of an earth-moving machine. The bucket-side coupler (10) is at least partially housed in said seat (22) and is removably fastened to the bucket body (2) by means of mechanical fastening means (8).

The invention also relates to an earth-moving machine comprising said bucket and methods for managing earth-moving machines.

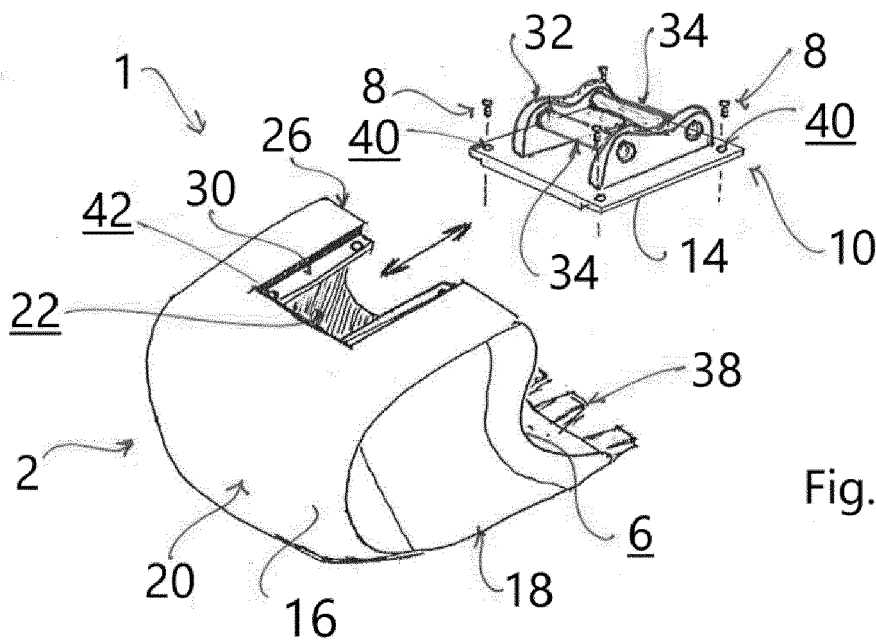


Fig. 1

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DescriptionField of the invention

[0001] The invention falls within the sector of equipment for earth-moving machines.

Prior art

[0002] In the sector of earth-moving machines it is known to use couplings for connecting a tool to an excavator.

[0003] According to a known configuration of a coupling, one part of a coupling is fixed to the excavator where it is always left mounted, except when maintenance or extraordinary replacement operations are required. Another part of the coupling is fixed to the tool. Connecting together of the coupling part fixed to the excavator and the other coupling part fixed to the tool involves the use of a pair of locking members, one intended to support and the other one to allow movement of the tool.

[0004] Said connection operation is not a simple operation and cannot be easily or rapidly performed by a single operator.

[0005] Different types of couplings exist on the market and may be of a universal or proprietary nature.

[0006] The tools are manufactured so that they are designed or suitable for fixing together with only one type of coupling since, during a manufacturing process, the coupling part is welded onto the tool depending on the features of the coupling part fixed to the excavator.

[0007] This therefore means that, if an excavator requires a new tool, the choice of the new tool is limited to the tools which have a coupling part compatible with that of the excavator.

[0008] Alternatively, it is possible to order a new tool, although the manufacturing process lasts several (on average 3 to 6) weeks before the desired tool may be delivered.

[0009] The Applicant, after long and intensive R&D activity, has developed a bucket, an earth-moving machine and handling methods which are able to provide a suitable response to the existing limitations, drawbacks and problems.

[0010] The present invention therefore relates to a bucket having the features of the attached claims.

[0011] The present invention relates furthermore to an earth-moving machine comprising said bucket having the features of the attached claims.

[0012] The present invention relates furthermore to methods for handling an earth-moving machine having the features of the attached claims.

Summary of the invention

[0013] The object of the invention is to solve the aforementioned drawbacks of the prior art.

[0014] The present invention relates to a bucket 1 which comprises a bucket body 2 which delimits a material-containing compartment 4 and an opening 6 for access to the material-containing compartment 4, wherein the bucket body 2 comprises at least one seat 22 at least partially circumscribed by a thickness S of a wall 20 of the bucket body 2, and a bucket-side coupler 10 connectable to a machine-side coupler 58 of an earth-moving machine. The bucket-side coupler 10 is at least partially (for example: only partially) housed in said seat 22 and is removably fastened to the bucket body 2 by means of mechanical fastening means 8.

[0015] In this way, the bucket-side coupler 10 may be removed from the bucket body 2, for example replaced with a different bucket-side coupler 10, by means of the mechanical fastening means 8.

[0016] The present invention relates furthermore to an earth-moving machine which comprises a machine-side coupler 58 of a coupling, and at least one bucket 1 according to the present invention, the bucket-side coupler 10 of which is connected to said machine-side coupler 58 in a releasable manner.

[0017] The present invention relates furthermore to a method for handling an earth-moving machine comprising the following steps (I) - (VI):

(I) provision of an earth-moving machine comprising a machine-side coupler 58 of a coupling;

(II) selection of a bucket body 2 which delimits a material-containing compartment 4 and an access opening 6 to the material-containing compartment 4, wherein the bucket body 2 comprises at least one seat 22 which is at least partially circumscribed by a thickness S of a wall 20 of the bucket body 2;

(III) selection of a bucket-side coupler 10 of said coupling, which is configured to be connected to the machine-side coupler 58 of the earth-moving machine of step (I);

(IV) at least partially housing of the bucket-side coupler 10 of step (III) in the seat 22 of the bucket body 2 of step (II);

(V) following step (IV), removably fastening of the bucket-side coupler 10 to the bucket body 2 by means of mechanical fastening means 8, so as to obtain a bucket 1;

(VI) connection of the bucket 1 of step (V) to the earth-moving machine of step (I) by means of said bucket-side coupler 10 and said machine-side coupler 58 of the coupling.

[0018] The present invention relates furthermore to a method for handling an earth-moving machine comprising the following steps (I') - (VI'):

(I') provision of an earth-moving machine comprising a machine-side coupler 58 of a coupling;

(II') selection of a bucket body 2 which delimits a material-containing compartment 4 and an access opening 6 to the material-containing compartment 4; wherein the bucket body 2 comprises at least one seat 22 which is at least partially circumscribed by a thickness S of a wall 20 of the bucket body 2;

(III') selection of a bucket-side coupler 10 of said coupling, which is configured to be connected to the machine-side coupler 58 of the earth-moving machine of step (I');

(IV') connection of the machine-side coupler 58 of step (I') and the bucket-side coupler 10 of step (III');

(V') at least partially housing of the bucket-side coupler 10 of step (IV') inside the seat 22 of the bucket body 2 of step (II');

(VI') following step (V'), removably fastening of the bucket-side coupler 10 to the bucket body 2 by means of mechanical fastening means 8.

[0019] It is pointed out that in this description the expressions "configured to be connected to the machine-side coupler" or "connectable to a machine-side coupler" mean that the bucket-side coupler 10 is designed and constructed to interact with the machine-side coupler of said coupling, so as to complete the coupling and fix the bucket to the earth-moving machine in order to make the latter operative for carrying out working operations such as levelling, movement of material, raising of material, excavation work or the like.

Advantages of the invention

[0020] The invention has the following advantages.

[0021] Advantageously, the bucket according to the present invention comprises a second-level connection which connects together the bucket-side coupler and the bucket body and which provides the bucket itself with a degree of versatility greater than that of the known buckets. In fact, it is not necessary for the bucket according to the present invention to retain the same bucket-side coupler defined at the time of its manufacture, but the bucket-side coupler of the coupling may be changed depending on the machine-side coupler of said coupling of the earth-moving machine.

[0022] Advantageously, the releasable connection of the bucket-side coupler does not modify the operability and functioning of the bucket since the inset space of the seat inside which the bucket-side coupler is inserted may be used in such a way as not to modify the lever arms predefined by the manufacturer and therefore in such a way as not to negatively influence the operating efficiency

of the bucket.

[0023] Advantageously, owing to the presence of a lowered seat, it is possible to gain space within the thickness of the bucket body wall and, for some embodiments, further space inside the material-containing compartment, without however weakening the structure of the bucket.

[0024] Advantageously, a through-opening in the form of a recess results in a high degree of versatility also compared to the bucket-side couplers which project partially from an edge of the bucket (for example Klak™ couplers).

[0025] Advantageously, the bucket according to the present invention does not have welded portions acting between the bucket-side coupler and the bucket body, such that the joint between bucket body and bucket-side coupler may be realized using tools such as spanners or screwdrivers and without having to mechanically remove pre-existing welds.

[0026] Advantageously, the mechanical fastening means which can be used in the bucket according to the present invention are ordinary and available at a low cost.

[0027] Advantageously, the contact area between the bucket-side coupler and the bucket body is relatively small compared to the total surface area of the bucket body. The fact that this contact surface is superimposed only on a part of the total surface, and preferably on a part of the top surface of the bucket body, means that the bucket-side coupler may be selected independently of the geometrical features of the bucket which, purely by way of example, may have any width along the first direction.

[0028] Advantageously, owing to the presence of the seat, it is possible to obtain also a geometric (form-fit) coupling between the bucket body and bucket-side coupler.

[0029] Advantageously, the connecting wall is guided into its correct position with respect to the bucket body, or outside of this position during disassembly, in a precise and reliable manner.

[0030] Advantageously, the bucket-side couplers which can be used with the bucket according to the present invention are not particularly limited since substantially any type of coupling may be placed on the bucket-side coupler and may be connected to the bucket body according to the present invention. By way of example, the bucket-side coupler according to different embodiments could mount equally well a standard-type coupler RA™, Lehnhoff™ (for example of the "SW" or "Symlock" type), RC™, Klak™, Morin™, Came™, Volvo™, or Verachert™.

[0031] Advantageously, with the handling method according to the present invention it is possible to reduce the fixed warehouse management costs since the bucket bodies and the bucket-side parts may be stored separately, disconnected from each other, so as to allow the composition of a suitable or desired combination for a given earth-moving machine, said combination being

able to be varied each time depending on the particular circumstances.

[0032] Advantageously, with the handling method according to the present invention it is possible to adapt rapidly the bucket of an earth-moving machine depending on the working operation to be carried out and independently of the availability of buckets provided with a connection suitable for that earth-moving machine. This advantage is particularly significant in the case where fleets of earth-moving machines are hired.

[0033] Advantageously, the present invention results in production cost-savings since the bucket bodies may be made by means of repetitive welds which are very similar (if not even identical) and are therefore suitable for automated mass-production.

[0034] Advantageously, the present invention results in organizational cost-savings since the production of bucket bodies may be programmed independently of the bucket-side couplers required for those bucket bodies.

[0035] In fact, the bucket bodies are made without bucket-side couplers, and the bucket-side couplers are produced in accordance with a production and organizational program which is independent of the production and organizational planning of the bucket bodies. Therefore, these production processes do not risk creating a bottle-neck for each other.

[0036] Advantageously, as a result of the present invention, it is possible to shorten the bucket delivery times since the time required for production of the bucket-side couplers is drastically reduced (to about a few days) compared to the several weeks usually required for the manufacture of a bucket complete with its own welded coupling.

Preferred embodiments

[0037] In accordance with various embodiments, the bucket 1 is an excavation bucket or a levelling bucket.

[0038] In accordance with various embodiments, the bucket 1 is a bucket for general uses, a reinforced bucket, a rock bucket, a bucket comprising a grille for selecting and separating materials, a trapezoidal bucket, a directable bucket or a channel-cleaning bucket.

[0039] Preferably, the material-containing compartment 4 is designed to contain an excavation material.

[0040] In accordance with a possible embodiment, the bucket-side coupler 10 forms part of a quick coupling, the machine-side coupler 58 being the other part of said quick coupling. Quick couplings are devices which are known in this sector. Examples of quick couplings are disclosed in the prior art documents EP 1,522,635 A2 and US 2009/311086 A1.

[0041] Preferably, the bucket-side coupler 10 (for example a connecting wall 12 thereof) and the bucket body 2 are devoid of welds connecting them with each other.

[0042] In accordance with one embodiment, the mechanical fastening means 8 pass through the bucket body 2, or a connecting wall 12 of the bucket-side coupler 10,

or the connecting wall 12 and the bucket body 2.

[0043] Preferably, the mechanical fastening means 8 are of the threaded type and comprise for example screws or bolts.

5 **[0044]** By way of example, the seat 22 has a polygonal - for example square, rectangular or trapezoidal - form in a plan view.

[0045] In accordance with one embodiment, the seat 22 terminates at an edge 26, preferably a top edge, of the bucket body 2.

10 **[0046]** In accordance with another embodiment, the seat 22 extends as a recess from an edge 26, preferably a top edge, of the bucket body 2.

15 **[0047]** In accordance with a preferred embodiment, the seat 22 comprises at least one through-opening 44 which communicates with the material-containing compartment 4. The adjective "through" means that the opening crosses completely the thickness S of the wall 20, forming a passage in the material-containing compartment 4.

20 **[0048]** In accordance with another preferred embodiment, the through-opening 44 extends as a recess from an edge 26 of the bucket body 2.

[0049] In accordance with a further preferred embodiment, the seat 22 is separated from the material-containing compartment 4 by a bottom wall 46.

25 **[0050]** In accordance with one embodiment, the through-opening 44 or the bottom wall 46 are contained within the thickness S.

30 **[0051]** Preferably, the through-opening 44 or the bottom wall 46 are arranged at least partly inside the material-containing compartment 4. According to this embodiment, the wall 20 is formed, shaped or bent in such a way as to project into the material-containing compartment 4 with respect to an inner surface of the bucket body - facing the material-containing compartment 4 - which delimits a perimeter thereof.

35 **[0052]** The seat 22 is preferably arranged approximately centrally between side walls 18 of the bucket body 2 and is positioned in a top surface 48 of the bucket body 2.

40 **[0053]** Preferably, the wall 20 is a containment wall which extends around a first direction X.

[0054] In accordance with one embodiment, the bucket-side coupler 10 comprises at least one connecting wall 12 for connection with the bucket body 2.

45 **[0055]** Preferably, the connecting wall 12 delimits at least one abutment surface 14 with the bucket body 2, more preferably at least two (for example: only two) abutment surfaces 14.

50 **[0056]** In accordance with another embodiment, the connecting wall 12 delimits at least one abutment surface 14 with the bucket body 2 which has a surface area of between 3% to 40%, preferably between 4% and 30%, more preferably between 10% and 25%, in relation to a surface area of an external surface 16 - opposite to the material-containing compartment 4 - of the bucket body 2.

55 **[0057]** In accordance with one embodiment, the bucket

body 2 comprises at least one pair of side walls 18 which are spaced apart in the first direction X.

[0058] In the embodiment shown, the first direction X is oriented along a width of the bucket body 2.

[0059] Preferably, the side walls 18 may be oriented transversely or orthogonally with respect to the first direction X.

[0060] In accordance with one embodiment, the access opening 6 is circumscribed by a bottom edge 24 and by a top edge 26 of the containment wall and by front edges 28 of the side walls 18. Preferably, the bottom edge 24 forms an excavation edge of the bucket 1, being for example provided with one or more wear teeth or components 38 projecting from the front of the bucket body 2.

[0061] In accordance with another embodiment, the containment wall may be formed by one or more wall elements joined together, for example one or more wall plates. By way of example, at least one wall element may be substantially flat. By way of a further example, at least one wall element may be inwardly curved, so as to delimit a concave surface 36 facing the material-containing compartment 4.

[0062] Preferably, the side walls 18 are connected to opposite end portions of the containment wall, so as to circumscribe with said containment wall said material-containing compartment 4 and said opening 6 for access to the material-containing compartment 4.

[0063] Preferably, the connecting wall 12 is removably fastened to the containment wall.

[0064] Preferably, the connecting wall 12 is arranged at least partially superimposed on, more preferably so as to close, the through-opening 44. Even more preferably, the connecting wall 12 or at least one part of the bucket-side coupler 10 is housed in the through-opening 44.

[0065] Preferably, said recess is partly delimited by at least one pair of guides 30 (for example guides parallel to each other) with which the connecting wall 12 partially makes contact. Said pair of guides 30 is configured to slidably guide the connecting wall 12 during disengagement from, or engagement with, the bucket body 2.

[0066] The guides 30 are for example lowered with respect to the external surface 16 of the bucket body 2.

[0067] In accordance with another embodiment, the bucket-side coupler 10 comprises a pair of coupling side walls 32 connected to, and extending substantially parallel away from, the connecting wall 12. Preferably, the coupling walls 32 are connectable to the machine-side coupler by means of locking elements 34, for example pins, engaging elements or a pin and a transverse wall. More preferably, said locking elements 34 extend or are aligned parallel to the first direction X.

[0068] In accordance with a further embodiment, the bucket-side coupler 10 comprises a coupling body 50 from the opposite sides of which locking elements 34, preferably a pair of tubular portions 52 and a pair of flanges 54, project. Each tubular portion 52 or flange 54 is preferably aligned - parallel to the first direction X - with

the other tubular portion 52 or flange 54 of the pair and is facing on an opposite side of the coupling body 50. According to one embodiment, the coupling body 50 is fastened (for example welded) to the connecting wall 12.

[0069] In accordance with a yet further embodiment, the bucket-side coupler 10 comprises a connecting wall 12, wherein the locking elements 34 (for example engaging elements) project frontally from the connecting wall 12 and from an edge 26 of the bucket body 2, and wherein said bucket-side coupler 10 comprises a further locking element 56 which is connected and extends from an upper surface of the connecting wall 12.

[0070] In any one of the preceding embodiments, said engaging elements are preferably in the form of a hook or comprise curved portions.

[0071] According to different embodiments, the bucket-side coupler could comprise a coupler known in the sector. Only by way of example, the bucket-side coupler could be selected from a standard-type coupler RA™, Lehnhoff™ (for example of the "SW" or "Symlock" type), RC™, Klak™, Morin™, Came™, Volvo™, or Verachtert™.

[0072] Preferably, the earth-moving machine is characterized in that it is a mini-excavator with a service weight comprised from 0.8 tonnes to 5.9 tonnes or a mid-excavator with a service weight comprised from 6 tonnes to 10 tonnes.

[0073] In other embodiments, the earth-moving machine is characterized in that it is an excavator with a service weight of more than 10 tonnes.

[0074] In accordance with one embodiment, the machine-side coupler is located on an operating arm 60 of the earth-moving machine, more preferably on an end portion of an articulated operating arm 60. Even more preferably, the articulated operating arm 60 comprises a raising arm connected to a frame of the earth-moving machine and an excavation arm connected rotatably to the raising arm. According to said embodiment, the machine-side coupler is located at one end of the excavation arm opposite to an end connected to the raising arm.

[0075] Preferably, a first locking element 34 is pivotably hinged together with the articulated operating arm 60 and with the bucket, and a second locking element 34 is pivotably hinged together with a linear actuator for moving the bucket relative to the articulated operating arm 60 along a circle-arc trajectory. Preferably, said linear actuator can be operated in a mechanical or hydraulic manner, preferably hydraulically.

[0076] Preferably, during said handling method, the bucket body 2 of step (II) or (II') and the bucket-side couplers of step (III) or (III') are independently selected from among a plurality of bucket bodies and bucket-side couplers with different features.

[0077] By way of example, the bucket bodies 2 of said plurality have different features as regards at least one of the following: size, maximum load, volume or depth of the material-containing compartment 4, dimensions (for example: width) of the bucket body 2.

[0078] By way of a further example, the bucket-side

couplers 10 of said plurality have different features as regards at least one of the following: geometry of the bucket-side coupler 10, type and/or arrangement of one or more locking elements of said bucket-side coupler 10, distance between locking elements of said bucket-side coupler 10, distance between at least one locking element of said bucket-side coupler 10 with respect to an external surface 16 of the bucket body 2.

[0079] Preferably, the handling methods are performed by means of a bucket 1 or an earth-moving machine according to any one of the embodiments discussed in this description. Therefore, even where not expressly mentioned, these handling methods may comprise any step which is deducible from or implicit in the description of the bucket and the earth-moving machine.

[0080] The advantages of the invention will emerge even more clearly from the detailed description given below based on the attached figures provided by way of example and therefore of a non-limiting nature.

Description of the figures

[0081]

Fig. 1: exploded perspective view of a bucket according to the present invention, in accordance with a possible embodiment thereof;

Fig. 2: side view of the bucket according to Fig. 1, in which the bucket-side coupler is being engaged with, or disengaged from, the bucket body;

Fig. 3: perspective view of the bucket body from a perspective opposite to that of Fig. 1;

Fig. 4: schematic front view of a seat in the bucket body, according to a first embodiment;

Fig. 5: schematic front view of a seat in the bucket body, according to second embodiment;

Fig. 6: schematic front view of a seat in the bucket body, according to a third embodiment;

Fig. 7: schematic front view of a seat of the bucket body, according to a fourth embodiment;

Fig. 8: schematic front view of a seat in the bucket body, according to a fifth embodiment; the broken-line zone indicates that the through-opening may be present or absent in this embodiment;

Fig. 9: perspective view of a bucket-side coupler which can be used in an embodiment of the present invention;

Fig. 10: side view of a bucket-side coupler according to another embodiment of the present invention;

Fig. 11: cross-sectioned side view of a bucket-side coupler according to a further embodiment of the present invention, this figure corresponding to Fig. 3 of the prior art document WO 02/103121 A1 in which the reference numbers of the present invention have been inserted;

Fig. 12: perspective view of an operating arm of an earth-moving machine and a bucket according to the present invention having, mounted thereon, a bucket-side coupler according to Fig. 11, during assembly or disassembly of the bucket on or from said earth-moving machine.

15 Detailed description of the bucket according to the invention in a preferred embodiment

[0082] Fig. 1 shows an exploded view of a bucket 1 which comprises a bucket body 2 and a bucket-side coupler 10 of a coupling.

[0083] The bucket body 2 delimits a material-containing compartment 4 and an access opening 6 to the material-containing compartment 4.

[0084] The bucket body 2 comprises a pair of side walls 18 which are spaced from each other in a first direction X and at least one containment wall 20 which extends around the first direction X.

[0085] The side walls 18 are connected to opposite end portions of the containment wall, so as to circumscribe with said containment wall the material-containing compartment 4 and the access opening 6 to the material-containing compartment 4. The side walls 18 are oriented orthogonally with respect to the first direction X.

[0086] The containment wall extends partially around the first direction X. A concave surface 36 of the containment wall is directed towards the material-containing compartment 4 and delimits a bottom thereof, said material-containing compartment 4 being circumscribed laterally by inner surfaces of the side walls 18. The access opening 6 is circumscribed by a bottom edge 24 and by a top edge 26 of the containment wall and by front edges 28 of the side walls 18.

[0087] A part of the external surface 16 of the bucket body 2, opposite to the material-containing compartment, acts as a support surface for the bucket body 2. The support surface is situated approximately opposite the position occupied by a seat 22 which at least partially receives a bucket-side coupler 10 of a coupling (described below).

[0088] The bucket body 2 comprises at least one seat 22 which is at least partially circumscribed by a thickness S of the containment wall 20 of the bucket body 2. Said seat 22, in the embodiments shown in Fig. 1 and Fig. 3, comprises a through-opening 44 which extends in the manner of a recess from a top edge 26 of the bucket body 2.

[0089] The bucket 1 comprises a bucket-side coupler 10 of a coupling. The bucket-side coupler 10 is connect-

able in a releasable and articulated manner to a machine-side coupler of the coupling of an earth-moving machine (not shown).

[0090] The bucket-side coupler 10 comprises at least one connecting wall 12 removably fastened to the bucket body 2, more precisely to the containment wall, by means of mechanical fastening means 8, for example screws or bolts.

[0091] More precisely, the mechanical fastening means 8 pass through first holes 40 in the connecting wall 12 and second holes 42 in the bucket body 2, the first holes 40 and the second holes 42 being aligned with each other in order to allow the introduction of the mechanical fastening means 8. The mechanical fastening means 8 are retained inside the first holes 40 and inside the second holes 42 by means of screw nuts (not shown) or by means of internal threading formed in the thicknesses of the connecting wall 12 and/or the bucket body 2 delimiting the first holes 40 and/or the second holes 42.

[0092] The connecting wall 12 is arranged at least partially superimposed on the through-opening 44, so as to close it. In this way, a part of the inner surface facing the material-containing compartment 4 is delimited by the connecting wall 12.

[0093] The recess is delimited laterally by a pair of guides 30 with which the connecting wall 12 partially makes contact. The pair of guides 30 is configured to guide sliding of the connecting wall 12 when being disengaged from, or engaging with, the bucket body 2.

[0094] The guides 30 are shown lowered with respect to the external surface 16. Each guide 30 is crossed by at least one second hole 42.

[0095] The bucket-side coupler 10 comprises a pair of coupling walls 32 which are connected and extend substantially parallel away from the connecting wall 12, orthogonally with respect to the connecting wall 12.

[0096] The coupling walls 32 are connectable to the machine-side coupler by means of locking elements in the form of pins spaced apart along the coupling walls 32, these pins being configured to be housed in first seats of the coupling walls 32 and in second seats of the machine-side coupler.

Detailed description of the handling method of the invention according to a first preferred embodiment

[0097] The method for handling an earth-moving machine according to the invention comprises a step (I) of providing an earth-moving machine comprising a machine-side coupler of a coupling.

[0098] During a second step (II) a bucket body 2 which delimits a material-containing compartment 4 and an access opening 6 to the material-containing compartment 4 is selected. The bucket body 2 comprises at least one seat 22 which is at least partially circumscribed by a thickness S of a wall 20 of the bucket body 2.

[0099] During a step (III) a bucket-side coupler 10 of said coupling is selected, whereby the bucket-side cou-

pler 10 is configured to be connected to the machine-side coupler of the earth-moving machine of step (I).

[0100] The bucket body 2 of step (II) and the bucket-side couplers 10 of step (III) are selected independently from among a plurality of bucket bodies and bucket-side couplers with different features, as discussed above.

[0101] During a step (IV) the bucket-side coupler 10 of step (III) is at least partially housed in the seat (22) of the bucket body 2 of step (II).

[0102] During a step (V), following step (IV), the bucket-side coupler 10 is removably fastened to the bucket body 2 by means of mechanical fastening means 8 so as to obtain a bucket 1.

[0103] Finally, during a step (VI), the bucket 1 of step (V) is connected to the earth-moving machine of step (I) by connecting together said bucket-side coupler 10 and said machine-side coupler of the coupling.

Detailed description of the handling method of the invention according to a second preferred embodiment

[0104] The method for handling an earth-moving machine according to another embodiment of the invention comprises the same steps (I), (II) and (III) illustrated in the previous example, indicated here as steps (I'), (II') and (III'), respectively.

[0105] During a step (IV') the machine-side coupler 10 of step (I') and the bucket-side coupler 10 of step (III') are connected together.

[0106] Consequently, differently from the preceding embodiment, only the bucket-side coupler 10 of step (III'), and not the finished bucket 1, is connected to the machine-side coupler before the bucket-side coupler 10 is connected to the bucket body 2.

[0107] During a following step (V') the bucket-side coupler 10 of step (III') is at least partially housed in the seat (22) of the bucket body 2 of step (II').

[0108] During a step (VI'), following step (V'), the bucket-side coupler 10 is removably fastened to the bucket body 2 by means of mechanical fastening means 8.

[0109] Even though not previously specified, a person skilled in the art, drawing on the typical expertise in the sector, may vary or replace some of the aspects indicated above with other technically equivalent elements.

[0110] These variations or replacements also fall within the scope of the following claims.

[0111] Moreover, any alternative illustrated in relation to a particular embodiment may be implemented independently of the other described embodiments.

LIST OF REFERENCE NUMBERS

[0112]

1	bucket
2	bucket body
4	material-containing compartment
6	access opening

8 mechanical fastening means, preferably of the threaded type
 10 bucket-side coupler
 12 connecting wall
 14 abutment surface
 16 external surface
 18 side wall
 20 wall, preferably containment wall
 22 seat
 24 bottom edge
 26 edge, preferably top edge
 28 front edge
 30 guide
 32 coupling wall
 34 locking element
 36 concave surface
 38 wear tooth or component
 40 first hole
 42 second hole
 44 through-opening
 46 bottom wall
 48 top surface
 50 coupling body
 52 tubular portion
 54 flange
 56 further locking element
 58 machine-side coupler
 60 operating arm
 S thickness
 X first direction

Claims

1. A bucket (1) comprising:

a bucket body (2) which delimits a material-containing compartment (4) and an access opening (6) to the material-containing compartment (4); wherein the bucket body (2) comprises at least one seat (22) at least partially circumscribed by a thickness (S) of a wall (20) of the bucket body (2);
 a bucket-side coupler (10) connectable to a machine-side coupler (58) of an earth-moving machine;
 wherein the bucket-side coupler (10) is at least partially housed in said seat (22) and is removably fastened to the bucket body (2) by means of mechanical fastening means (8).

2. The bucket according to claim 1, wherein said bucket-side coupler (10) and said bucket body (2) are devoid of welds connecting them with each other, and wherein the mechanical fastening means (8) pass through the bucket body (2) or a connecting wall (12) of the bucket-side coupler (10) or the connecting wall (12) and the bucket body (2);

preferably wherein the mechanical fastening means (8) are of the threaded type.

3. The bucket according to claim 1 or 2, wherein said seat (22) comprises at least one through-opening (44) which communicates with the material-containing compartment (4).

4. The bucket according to claim 3, wherein said through-opening (44) extends in the manner of a recess from one edge (26) of the bucket body (2).

5. The bucket according to claim 1 or 2, wherein said seat (22) is separated from the material-containing compartment (4) by a bottom wall (46), said bottom wall (46) being arranged at least partly inside the material-containing compartment (4).

6. The bucket according to any one of the preceding claims, wherein said seat (22) is arranged approximately centrally between side walls (18) of the bucket body (2) and is positioned in a top surface (48) of said bucket body (2).

7. The bucket according to any one of the preceding claims, wherein said wall (20) is a containment wall which extends around a first direction (X) and wherein the bucket body (2) comprises at least one pair of side walls (18) spaced apart along the first direction (X);
 wherein the side walls (18) are connected to opposite end portions of the containment wall, so as to circumscribe with said containment wall the material-containing compartment (4) and said access opening (6), and wherein said connecting wall (12) is removably fastened to the containment wall.

8. The bucket according to any one of the preceding claims, when dependent on claim 3 or 4, wherein the connecting wall (12) is arranged so as to at least partially close said through-opening (44).

9. The bucket according to claim 4, wherein said recess is delimited partly by at least one pair of guides (30) with which the connecting wall (12) at least partially makes contact, said pair of guides (30) being configured to guide sliding of the connecting wall (12) during disengagement from, or engagement with, the bucket body (2).

10. The bucket according to any one of the preceding claims, wherein the bucket-side coupler (10) comprises a pair of coupling walls (32) which extend substantially parallel away from the connecting wall (12), said coupling walls (32) being connectable to the machine-side coupler (58) by means of locking elements (34), for example pins or engaging elements.

11. An earth-moving machine comprising:

- a machine-side coupler (58), said machine-side coupler being for example mounted on an operating arm (60) of the earth-moving machine;
- at least one bucket (1) according to any one of the preceding claims, wherein the bucket-side coupler (10) is connected to said machine side coupler (58) in a rotatable manner.

12. The earth-moving machine according to the preceding claim, **characterized in that** it is:

- a mini-excavator with a service weight comprised from 0.8 tonnes to 5.9 tonnes; or
- a midi-excavator with a service weight comprised from 6 tonnes to 10 tonnes.

13. A method for handling an earth-moving machine comprising the following steps:

- (I) provision of an earth-moving machine comprising a machine-side coupler (58) of a coupling;
- (II) selection of a bucket body (2) which delimits a material-containing compartment (4) and an access opening (6) to the material-containing compartment (4); wherein the bucket body (2) comprises at least one seat (22) partially circumscribed by a thickness (S) of a wall (20) of the bucket body (2);
- (III) selection of a bucket-side coupler (10) of said coupling, which is configured to be connected to the machine-side coupler (58) of the earth-moving machine of step (I);
- (IV) at least partially housing of the bucket-side coupler (10) of step (III) in the seat (22) of the bucket body (2) of step (II);
- (V) following step (IV), removably fastening of the bucket-side coupler (10) to the bucket body (2) by means of mechanical fastening means (8), so as to obtain a bucket (1);
- (VI) connection of the bucket (1) of step (V) to the earth-moving machine of step (I) by means of said bucket-side coupler (10) and said machine-side coupler (58).

14. A method for managing an earth-moving machine comprising the following steps:

- (I') provision of an earth-moving machine comprising a machine-side coupler (58) of a coupling;
- (II') selection of a bucket body (2) which delimits a material-containing compartment (4) and an access opening (6) to the material-containing compartment (4); wherein the bucket body (2) comprises at least one seat (22) partially circumscribed by a thickness (S) of a wall (20) of the bucket body (2);

scribed by a thickness (S) of a wall (20) of the bucket body (2);

(III') selection of a bucket-side coupler (10) of said coupling, which is configured to be connected to the machine-side coupler (58) of the earth-moving machine of step (I');

(IV') connection of the machine-side coupler (58) of step (I') and the bucket-side coupler (10) of step (III');

(V') at least partial housing of the bucket-side coupler (10) of step (IV') in the seat (22) of the bucket body (2) of step (II');

(VI') following step (V'), removably fastening of the bucket-side coupler (10) to the bucket body (2) by means of mechanical fastening means (8).

15. The managing method according to claim 13 or 14, wherein the bucket body (2) of step (II) or (II') and the bucket-side couplers of step (III) or (III') are independently selected from among a plurality of bucket bodies and bucket-side couplers with different features;

wherein the bucket bodies (2) of said plurality have different features as regards at least one of the following: size, maximum load, volume or depth of the material-containing compartment (4), dimensions (for example: width) of the bucket body (2); and

wherein said bucket-side couplers (10) of said plurality have different features as regards at least one of the following: geometry of the bucket-side coupler (10), type and/or arrangement of one or more locking elements of said bucket-side coupler (10), distance between locking elements of said bucket-side coupler (10), distance between at least one locking element of said bucket-side coupler (10) with respect to an external surface (16) of the bucket body (2).

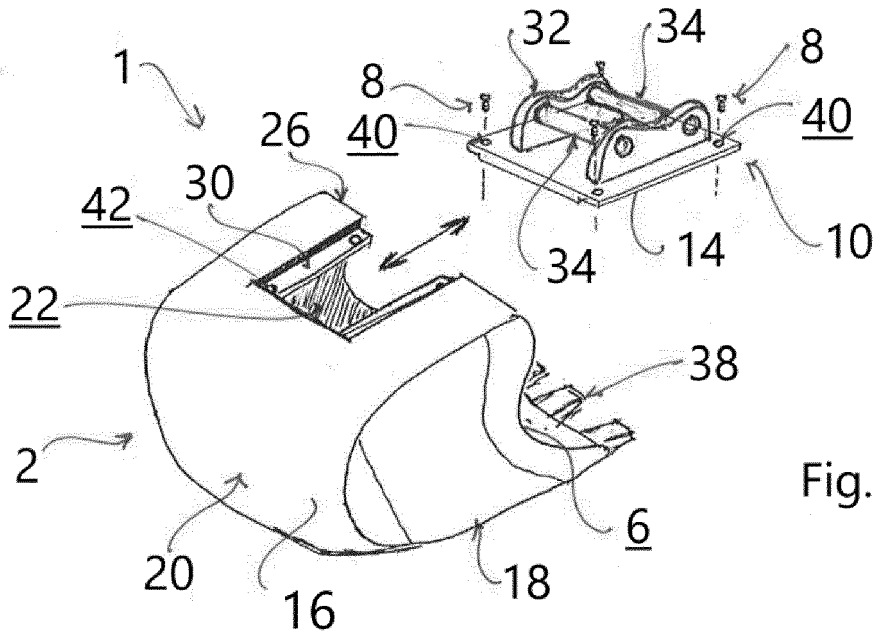


Fig. 1

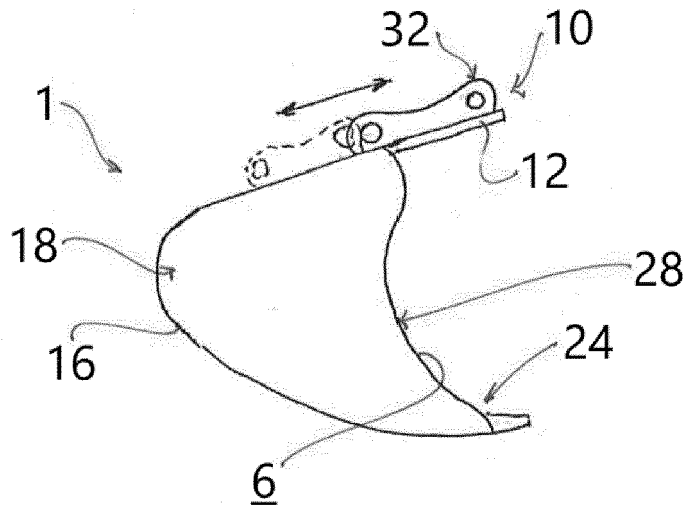
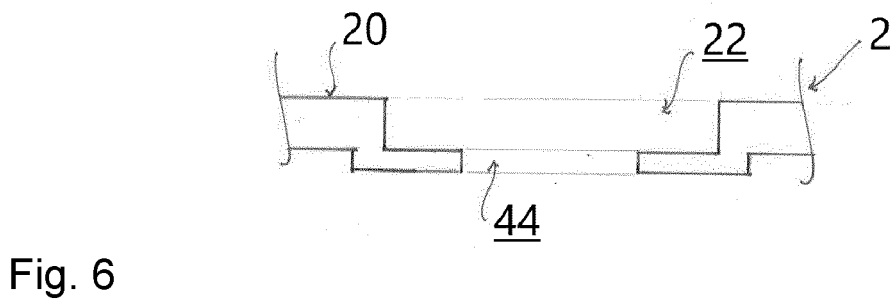
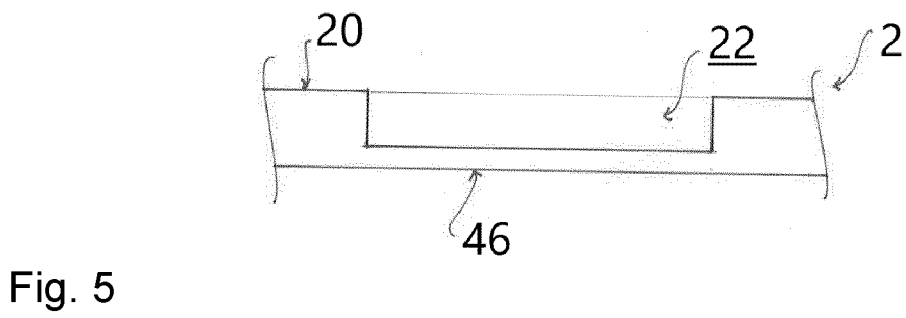
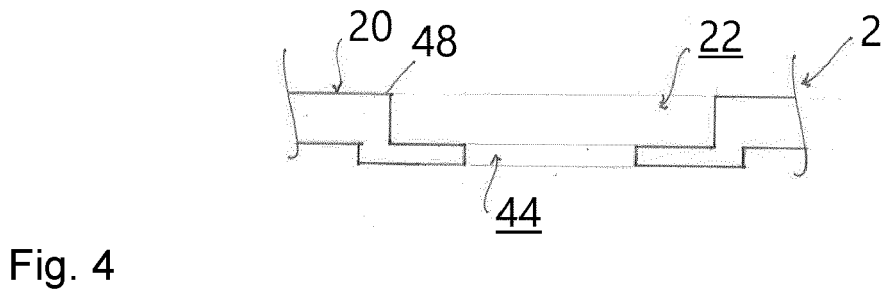
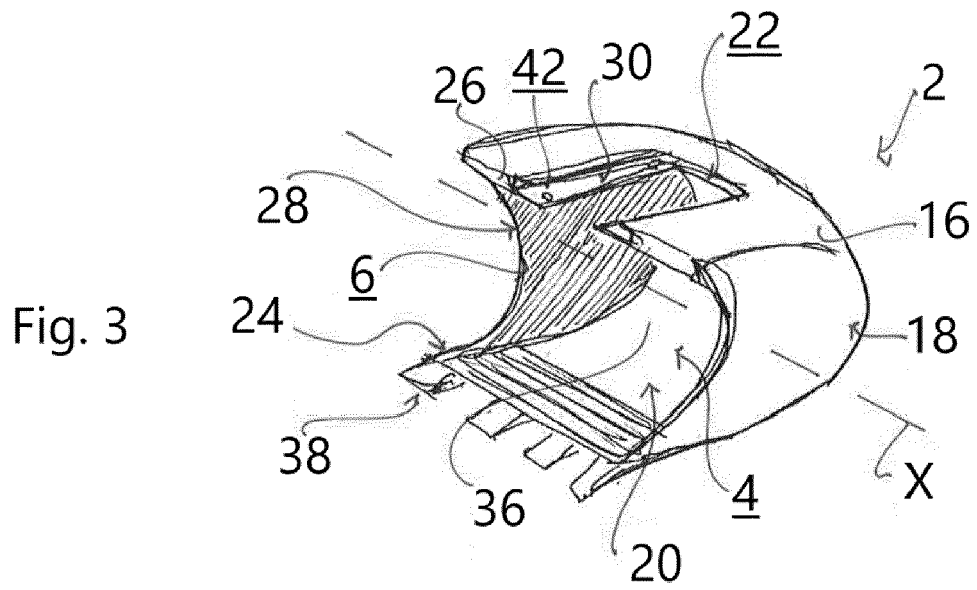


Fig. 2



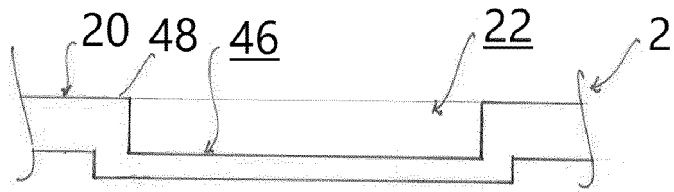


Fig. 7

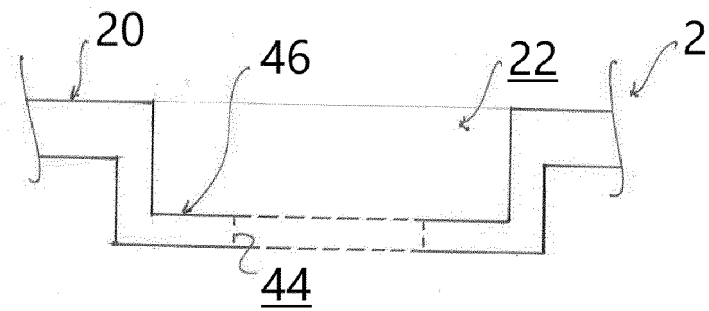


Fig. 8

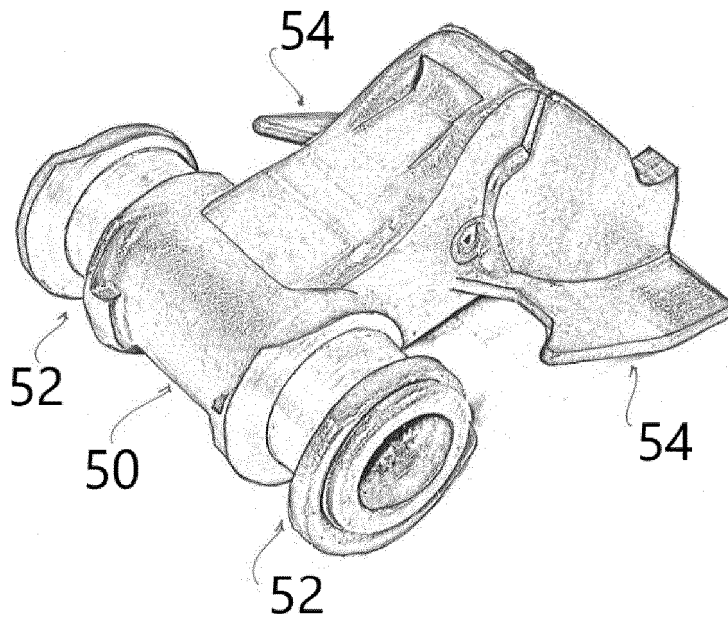


Fig. 9

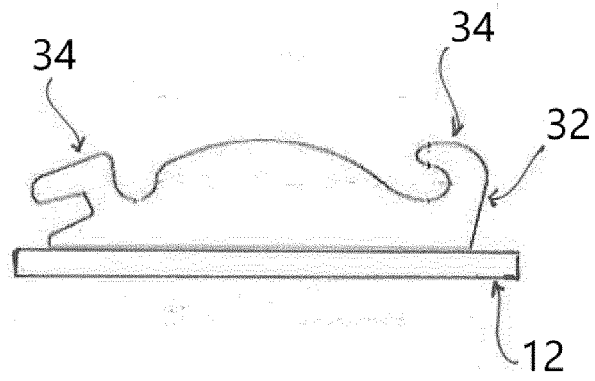


Fig. 10

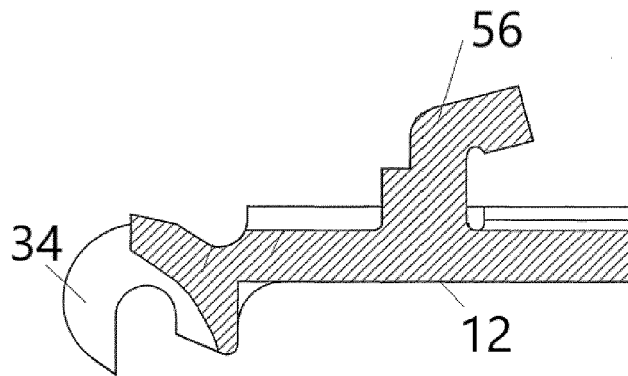


Fig. 11

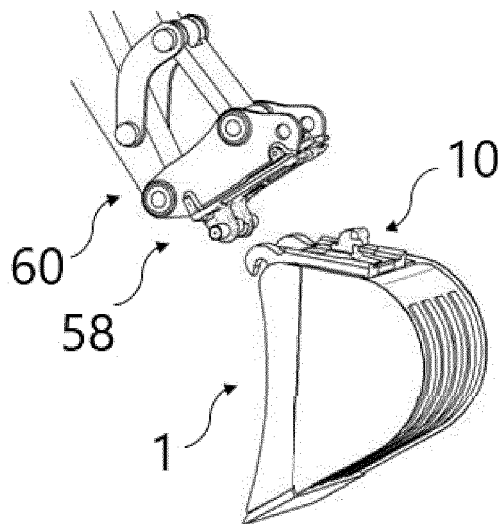


Fig. 12



EUROPEAN SEARCH REPORT

Application Number
EP 23 15 9898

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DOCUMENTS CONSIDERED TO BE RELEVANT

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	<p>JP 2005 090052 A (HITACHI CONSTRUCTION MACHINERY) 7 April 2005 (2005-04-07) * paragraph [0076] - paragraph [0084] * * figures 1, 11 *</p> <p>-----</p>	1, 6, 7, 11	<p>INV. E02F3/32 E02F3/36 E02F3/40</p>
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X	<p>AU 740 734 B2 (CLARK EQUIPMENT CO) 15 November 2001 (2001-11-15) * figures 1, 2, 5-7, 13, 14 * * page 1a, line 4 - line 12 *</p> <p>-----</p>	1, 5-7, 10, 11, 13-15	
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			<p>TECHNICAL FIELDS SEARCHED (IPC)</p> <p>E02F</p>

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The present search report has been drawn up for all claims

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Place of search Munich	Date of completion of the search 25 July 2023	Examiner Bultot, Coralie
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