"Compactor trolley for aeronautical applications"

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Field of the invention

The present invention relates to a compactor trolley for aeronautical applications, more particularly a trolley provided with a flap for direct access to the waste storage compartment, a compaction chamber and a safety locking mechanism for the flap.

Prior art

In view of the particularly strict safety standards stipulated in the aviation sector with regard to the closing systems fitted to panels, doors and shutters, the present invention aims to solve the problems associated with the use of trolleys for the efficient collection of waste inside an aircraft.

Furthermore the aeronautical sector is also characterized by very stringent technical and weight-related requirements with regard to the materials which may be used in this sector. A high mechanical strength and impact resistance, low toxicity and low inflammability are some of the characteristics which are required, although these are properties associated with materials which have a high specific weight, such as metals. The use of materials with a high specific weight in the aeronautical sector, however, reduces the load capacity of the aircraft and it is therefore one of the most important variables to be taken into consideration when choosing materials for the construction of parts and devices for aeronautical use.

The present invention is in particular applicable to the compactor trolleys comprising a door for access to a waste compaction chamber, which door comprises a flap which can be opened and closed so as to provide access to the compaction compartment.

Said compaction chamber is generally formed by a drawer comprising said door which includes the flap and is designed to house a waste storage box inside the compaction chamber so that, once the drawer and the trolley structure are engaged with each other, the box is located in a position underneath the compactor device.

A preferred example of such a compactor trolley is known from WO2018069802A1 in the name of the same present Applicant, the teachings of which relating to the general structure of the trolley, the waste storage boxes, the control systems and user interface, the safety and detection systems as well as the characteristics of the drawer and its engagement with the trolley structure are incorporated herein by way of reference.

One problem which the present inventors have encountered with these compactor trolleys is the unsatisfactory level of safety thereof, in particular with regard to the compaction operations.

In fact the known trolleys have flap closing systems arranged on the outside of the trolley and able to be operated manually by a user. With such a configuration the closure of the compaction chamber during the compaction operations is not ensured, nor does it prevent accidental opening of the flap nor an incorrect positioning of the manual closing systems.

FR 2,184,227 A5 describes a compactor trolley with a bolt-type safety locking mechanism, on which the preamble of Claim 1 is based. One problem of such a trolley of the prior art is that the locking mechanism is housed inside the compaction chamber and operated directly by the compaction plate so that it is exposed to soiling by the waste being compacted, tending to become filled with material and therefore losing its functionality. Continuous cleaning of the plate and the locking mechanism, which is unreliable and mechanically delicate, as well as the need for continuous maintenance, are therefore fundamental.

The present invention proposes a compactor trolley which solves the aforementioned problems, being safe and easy to use and suitable therefore for being used in the aeronautical sector.

One particular object of the present invention is to provide a compactor trolley which ensures safety during the compaction operations, being reliable and easy to maintain.

In connection with this problem, it is also required that this solution should have small dimensions, be easy and inexpensive to produce and assemble and be able to be easily installed, in particular

within the confined spaces present in the aeronautical sector.

## Summary of the invention

The present invention therefore relates to a compactor trolley which has a parallelepiped structure, in particular suitable for being housed in a galley, comprises a compactor device and has the characteristic features of Claim 1.

Owing to the arrangement, above the plate, of an operating part of the actuating block which acts on the safety locking mechanism, better cleaning of the locking system is ensured so that it is reliable over a long period of time without the need for particular cleaning maintenance thereof.

The present invention relates furthermore to a method for the compaction of waste according to Claim 17.

Preferred embodiments of the compactor trolley are described in the dependent clams, which are referred to here in their entirety.

The trolley may also be provided with wheels for moving it and/or an extractable drawer. Said extractable drawer may form the compaction chamber designed to contain a waste storage box which can be accessed from the front and from above for collection of the waste.

The front of the extractable drawer, opposite the front compaction compartment and the corresponding box on which the compaction plate of the compactor device may act, is provided with an opening, referred to below also as a flap, which provides access to the waste storage compartment, said waste storage compartment being accessible also from above when the drawer is extracted, even only partially.

The extractable drawer may also be divided into two compartments by means of a dividing wall and each of the two compartments may house a waste storage box.

Further objects will become clear from the detailed description of the invention below, with reference to preferred embodiments, it being understood however that variations are possible without departing from the scope of protection defined by the accompanying claims and with reference to the figures in the accompanying drawings.

## Brief description of the figures

Figure 1 is a perspective view from above of an example of a

compactor trolley with door provided with a flap and partially extracted drawer;

Figure 2 is the same view as Figure 1 with the drawer fully inserted the trolley, the door open and a waste storage box partially extracted;

Figure 3 is the same view as Figure 2 with the drawer fully inserted the trolley, the door open and the waste storage box fully inserted inside the drawer;

Figure 4 is the same view as Figure 3 with the door closed and the flap for access to the box also closed;

Figure 5 shows the same view as Figure 4 with the flap for access to the box open;

Figure 6 shows a perspective, partial, front view of an example of a compactor trolley according to the invention, with the flap open;

Figure 7 is a perspective schematic view of a detail of the inside of a trolley according to the invention, with the compaction plate lowered and flap safety locking system in the position for locking the flap;

Figure 8 shows in schematic form a partial perspective view of the flap safety locking system in the position for release of the flap;

Figure 9a shows a partial vertically sectioned view of the trolley according to the invention, in the region of the compaction plate and the safety locking system, in the unlocked position;

Figure 9b shows a partial vertically sectioned view of the trolley according to the invention, in the region of the compaction plate and the safety locking system, in the safety locking position.

With reference to the attached Figures 1 to 5, these show a preferred embodiment of an example of a compactor trolley 1 to which a safety locking mechanism according to the present invention is applicable, as will be described below.

The compactor trolley 1 for collection and compaction of the waste has a substantially parallelepiped form and comprises a rigid structure with side walls 1a, which are situated opposite each other in a transverse widthwise direction (Y-Y), a top wall 1b and a bottom wall 1c, which are situated opposite each other in a vertical heightwise

direction (Z-Z), and two other walls: a front end wall 1d and rear end wall 1e, which are situated opposite each other in a longitudinal depthwise direction (X-X).

The compactor trolley 1 is preferably provided with wheels 12 for moving it, which allow the movable collection and compaction of the waste.

The trolley 1 is provided internally with a compactor device positioned at the front, in the top zone 13 of the trolley. A control panel may be provided in the top part 1d' of the front wall 1d.

The compactor trolley 1 further comprises an extractable drawer 11 with a first chamber and optionally a second chamber, the first chamber being a compaction chamber which houses a box 16 for collection and compaction of the waste, the second chamber, when present, being able to house waste storage boxes which are empty or full of compacted and uncompacted waste.

The waste storage box 16 is open at the top 16a and, partially, on one of its sides 16b, which during use is the front side. The top opening allows loading of the waste from above and compaction thereof by means of the compactor device which is present inside the trolley 1 and arranged above the compaction chamber and therefore the box. The partial side (front) opening 16b is arranged at the front with respect to the extractable drawer 11.

The compactor trolley may be of the full-size type provided both with the first chamber and with the second chamber, while in the half-size version it will have only the first chamber, namely only the compaction chamber.

The extractable drawer 11 is provided at the front with a door 14 for insertion/extraction of the waste storage boxes 16. The door 14 has a flap 15 formed therein, said flap being located opposite the side opening 16b of the waste storage box 16 so as to provide access from the outside to the waste storage box 16 and therefore to the first chamber or compaction chamber.

The drawer 11 is also provided laterally with movable walls provided with lever locking/release systems. These movable walls, when present, can be opened and may be formed on one side or both sides of

the drawer 11; they have the function, once the waste has been compacted inside the box 16, of favouring easier removal of the box 16 which otherwise would risk remaining trapped owing to the pushing force exerted laterally by the said waste, once it is compressed/compacted in order to reduce its volume.

The drawer 11 is also provided at the front with a handle 17, or other similar device, for partial or total extraction from the rigid structure of the trolley 1. By means of the operation of partial extraction of the drawer 11 from the trolley 1 by means of the handle 17 an operator is able to access the open top portion 16a of the waste storage box 16, so that the waste may be also thrown in the said drawer from above, as well as from the front.

The open top portion 16a of the waste storage box 16 also allows the downward movement in the vertical direction of a compaction plate of the compactor device, for performing compaction of the waste inside the box 16.

The drawer 11 which houses the boxes 16 of waste of the compactor may also be completely extracted from the compactor trolley 1, favouring for example the possibility of performing cleaning without the need to remove the whole compactor from the aircraft (or in any case from the place where it is installed). Preferably, the trolley is provided with a mechanical system designed to make it completely extractable and/or to secure it to the trolley structure, a preferred example of embodiment of which is described in the publication WO2018069802A1 incorporated herein by way of reference.

The compactor trolley 1 may be advantageously provided with fixed safety contacts 19, 20, for example of the mechanical disengaging type, for checking the correct position of the drawer 11 for the purposes of correct operation of the compactor.

For the purposes of the present invention it is not necessary that the compaction chamber should be in the form of an extractable drawer, it being conceivable that it may be simply a chamber defined by the parallelepiped structure of the trolley 1, accessible via the flap 15 and optionally via the door 14 and/or the side walls.

The flap 15, housed inside a corresponding open recess of the door

14, may be made so as to be hinged at the top, bottom or laterally in said open recess and may be able to be opened towards the inside or outside of the trolley 1 with opening through an angle for example of between 20° and 180°. The flap 15 may also be provided with external safety closing systems, for example of the latch type 15a.

The flap 15 may be provided with sensors 15b of the magnetic, electromechanical, optical, inductive and similar type, as shown in Figure 2, so as to ensure that the compaction operations are performed in safety by the user.

The door 14 may also be provided with external safety closing systems 18, for example of the latch type.

The operating principle of the compactor trolley is now described.

Starting with the trolley 1 in the condition shown in Figure 4, the user opens the door 14 by operating the associated handle and inserts the box 16, optionally operating the latch 18, if necessary. Once the door 14 is closed, the compactor 1 is ready for operation. When there is rubbish which needs to be thrown away, the user has the following possibilities:

1) WASTE DISPOSAL FROM ABOVE

Pull out using the handle 17 the drawer 11, which is released by means of the associated button/actuator.

Throw the waste into the box 16 from above through the opening 16a.

Close the drawer 11 again. At this point the user presses the button on the front panel (zone 1d') and activates the compactor device for the compaction operation and, if all the operational/safety conditions are satisfied, i.e.:

the door 14 is closed;

the flap 15 is closed;

the drawer 11 is fully inserted inside the compactor trolley 1 and the fixed safety contacts 19 and 20 are in contact with each other;

the box 16 is present;

the space inside the box is not used up (signalled on the display present on 1d');

the dividing wall optionally movable between the first and second

compaction chambers of the drawer 11 is closed (only in the full-size version);

the electromechanical compaction actuator is operated so that it presses against the rubbish and compacts it.

2) WASTE DISPOSAL FROM THE FRONT

Open the flap 15 after releasing it by operating the safety latches, throw the waste into the opening which is created (zone 16b of the box), close the flap 15 again, re-engaging the latches. At this point the user presses the compaction button on the front panel (zone 1d') and, if all the operational/safety conditions are satisfied, i.e.:

the door 14 is closed;

the flap 15 is closed;

the drawer 11 is fully inserted inside the compactor trolley 1 and the fixed safety contacts 19 and 20 are in contact with each other;

the box 16 is present;

the space inside the box is not used up (signalled on the display present on 1d');

the dividing wall optionally movable between the first and second compaction chambers of the drawer 11 is closed (only in the full-size version);

the electromechanical compaction actuator is operated so that it presses against the rubbish and compacts it.

The user may repeat these operations until the box 16 is full.

Correct and efficient operation of the compactor device may be ensured by means of a control panel (the part indicated as 1d and 1d' is the front part of the control panel) which interfaces with an electronic section managed by a microprocessor with software. In this way it is possible to manage the various steps for use of the trolley in combination with those of the compactor, by suitably coordinating the compaction functions. Moreover, the control display may show information such as the number of cycles and the operating hours and/or other information useful for operation and maintenance of the compactor.

Control of operation of the compactor trolley may be furthermore improved by means of the use of suitably positioned sensors, which may be, for example, of the microswitch, optical, magnetic or other type.

These sensors allow adjustment of activation of the compaction function and ensure operation of the machine in total safety.

Advantageously, operation of the compactor trolley may be assisted by sensors which also provide information about the amount of rubbish which is present inside the waste storage box.

With reference to Figures 6-9, a compactor trolley according to the invention may have the general characteristics described hitherto and comprises in particular the first compaction chamber which is closed at the front by the door 14 in which a flap for access to the compaction chamber is formed, the flap 15 being movable between a closed position and an open position, for example by means of rotation about a respective hinging axis which may arranged on a bottom or lateral (vertical) side of the flap 15.

The compactor device comprises a compaction plate 70 arranged above the compaction chamber and designed to move in both senses of the vertical direction Z-Z, between a raised rest position disengaged from the compaction chamber and a lowered position for compaction of the waste, where the plate 70 is arranged in the compaction chamber at a suitable height for compacting the waste which may be present inside a box 16 housed inside said compaction chamber, penetrating inside the box 16 through the associated top opening 16a.

The compaction plate 70 has a top surface 70a and a bottom surface 70a directed towards the compaction chamber and designed to act on the waste for compaction thereof.

The compactor trolley according to the invention comprises a safety locking mechanism 50 for the flap 15 which is arranged inside the trolley and configured to lock mechanically the flap 15 in the closed position, namely fastened to the door 14 and therefore to the trolley structure, when said plate 70 is not in the raised disengaged/rest position.

The safety locking mechanism 50 comprises a first element 51 fixed to the flap 15 and a second, movable, locking element 52 connected to the trolley structure (or if necessary to the door 14). The locking element 52 is movable between a disengagement position (Figures 8, 9a) disengaged from the first element 51, corresponding to the raised

disengaged position of the compaction plate 70, into an engagement position (Figures 7, 9b) engaged with said first element 51, in which the locking element 52 and the first element 51 fixed to the flap are coupled together so as to lock mechanically the flap 15 in the closed position.

As shown more clearly in Figures 7 and 8, the first element comprises preferably a collar 51a which defines a seat or hole 51b; the collar 51a may for example be fixed to the flap 15 by means of suitable lateral fixing flanges 51c, for example by means of screws 51d.

An axis of the hole 51b may be for example vertical Z-Z or transverse Y-Y, in particular depending on the orientation of the opening/closing hinging axis of the flap, preferably orthogonal thereto.

The locking element comprises preferably a sliding pin 52, which has dimensions such that it can be inserted inside the hole 51b of the first element 51 so as to cause stable coupling together of pin and hole in said engaged position of pin 52 and hole 51a. The pin 52 is in particular arranged so as to slide in both senses of a direction parallel to the axis of the hole 51a.

The pin 52 is enclosed inside a housing 55 which defines a guide for the sliding movement of the pin 52.

A thrust spring 58 is preferably arranged so as to push the locking element towards the engagement position (Figures 7, 9b) where it is engaged with the first element 51. The locking element 52 is therefore normally kept by the spring 58 in the engaged locking position, a pushing action being required in order to overcome the force of the spring 58 and bring the locking element 52 into the disengaged position and thus free the flap 15.

The spring is in particular arranged coaxially around the pin 52 and is designed to act on a head 52a of the pin 52 which has a diameter greater than a shank 52b of the said pin. The spring is instead arranged so as to react against a bearing surface 55a defined by the housing 55.

The locking element preferably comprises an arm 54 integral with the pin 52 and projecting inwards in the longitudinal direction X-X. By operating the arm 54 it is therefore possible to operate the pin in both senses of the sliding direction (e.g. vertical direction Z-Z). Preferably, the arm 54 is movable inside a slot 55c (Figures 7, 8) of the

housing 55 in both senses of the sliding direction Z-Z of the pin 52 and projects towards the inside of the trolley with respect to the housing 55 itself so that a free end thereof is accessible for operation of the locking element.

Advantageously, the arm 54 may be in the form of a pin which can be coupled by means of screwing together with the pin 52 which may comprise, for this purpose, a hole with a female thread having a longitudinal axis, suitable for stable engagement with a thread of an end part 54a of the arm 54.

Preferably, and as shown in Figures 9a, 9b, the arm 54 may comprise a through-hole 54b, orthogonal to its direction of longitudinal extension and designed for the insertion of a tool for facilitating the screwing of the arm 54 onto the movable pin 52.

An actuating block 71 is integral in the vertical direction with the compaction plate and is designed to act mechanically by means of its actuating part 71a on the safety locking mechanism, in particular on the projecting arm 54, so as to cause locking and/or release of the flap 15.

In greater detail, the actuating block 71 preferably comprises an end surface 71a which is designed to act on the locking mechanism, in particular on the arm 54. As shown, the end surface 71a is arranged in an upper position in the vertical direction relative to the compaction plate 70 and is integral therewith in the vertical direction. "Upper position" is understood as meaning a position arranged at a height situated above at least the bottom surface 70b of the plate 70 and preferably the top surface 70a.

In particular, the end surface 71a may form part of a body 71b of the block 71 fixed to the top surface 70a of the compaction plate 70.

By arranging the part 71a of the actuating block 71 which acts on the locking mechanism above the compaction plate 70, the correct operation of the locking mechanism 50 is ensured independently of cleaning of the plate 70 itself; greater safety and reliability as well as a reduction in the need for maintenance are thus achieved.

Advantageously, at least the actuating arm 54 and preferably also the sliding pin 52 and the collar 51a with hole or seat may be

arranged at a height in the vertical direction such as to remain always above the height of the plate 70, both in the raised rest position (Figure 9a) and in the lowered compaction position.

With this preferred configuration the entire locking mechanism remains always free from dirt and therefore reliable, it not being required to perform in-depth cleaning of the compaction plate and of the top part of the chamber in order to avoid blockages dues to dirt in the locking mechanism.

Owing to the upper arrangement of the actuating block 71, it is also possible to configure the end surface 71a with an optimum design for operation of the locking mechanism. In particular, the end surface 71a is preferably inclined, preferably from the top downwards and from the inside towards the locking device 50.

The collar 51a formed with through-hole for receiving the pin 52 allows the synergic use of the locking pin 52 as a maintenance element which, whenever inserted, owing to its movement, tends to remove any minimum dirt which has accumulated. With this configuration, the definition of the dimensions of the thrust spring 58 is also simplified, it not being necessary for said spring to be precisely calibrated in order to position the pin in bearing contact.

For maximum reliability and simplicity of manufacture and maintenance it is preferable for the flap 15 to open towards the outside of the trolley.

Figure 7 also shows a bellows 78 for protecting the means for moving the compaction plate 70 (also called RAM).

With this configuration, the operating principle of a compactor trolley according to the invention is as follows:

- when the compaction plate 70 is in its raised rest position (Figures 8, 9a), the actuating block 71 pushes the projecting arm 54 of the locking element, keeping it in the raised end-of-travel position;
- in this position the locking pin 52 is kept in the position disengaged from the seat 51a of the first element 51 and the spring 58 is compressed;
- the flap 15 is therefore free to move in the open or closed position, allowing the on-board operators to throw the rubbish into the box by

simply opening the front flap 15 which provides access to the top part of the compaction compartment and therefore the box;

- when the compaction plate 70 is operated downwards inside the compaction chamber, the actuating block 71 moves together with the plate 70 which frees the arm 54 of the locking element 52;
- the action of the spring 58 therefore pushes the pin 52 in the direction of the seat 51 until the pin is engaged inside the seat, thus ensuring safety locking of the flap 15.

Owing to this mechanism, the compactor trolley according to the present invention allows easy access to the compaction chamber for the disposal of rubbish, while avoiding an incorrect and dangerous use (opening) of the flap 15 during a compaction cycle, which could adversely affect the functionality of the system during the compaction cycle where the compaction plate is lowered and the bellows for protecting the part for movement of the compaction plate is exposed. The risk of damage or injury to the operators, who could insert hands or other objects into the compaction chamber during the compaction cycle, is also avoided.

The safety locking mechanism is easy and inexpensive to produce and assemble and, since it is mechanical in nature, it does not require the presence of an electric power supply or sensors for ensuring the safety of the compactor trolley.

The trolley according to the invention is moreover compact, modular, light and efficient from the point of view of electric power consumption. It is also compatible with the existing aviation regulations.

The compactor trolley according to the invention may be made using any material having the necessary strength characteristics. In particular, for use in the aeronautical sector, light metallic alloys, such as aluminium alloys or composite materials with low inflammability and toxicity, known per se, are preferred.

With regard to the above, a preferred embodiment of the invention has been described, although the invention is not limited in any way to the characteristics described. Persons skilled in the art will understand that, in the light of what is disclosed here, modifications and variations may be made without thereby departing from the scope of the present

invention as defined by the accompanying claims.