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(54) AUTONOMOUS CONTAINER WITH SOLID WASTE COMPACTING SYSTEM AND METHOD FOR OPERATING THE SAME

AUTONOMER BEHÄLTER MIT KOMPAKTIERUNGSSYSTEM FÜR FESTSTOFFMÜLL UND VERFAHREN ZUM BENUTZEN DEMSELBEN

CONTENEUR AUTONOME AVEC SYSTÈME DE COMPACTAGE DE DÉCHETS SOLIDES ET SA MÉTHODE D'UTILISATION

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Description

1. Introduction

[0001] The present equipment is designed with the purpose of solving several problems arising from daily need towards urban solid waste collection, either of undifferentiated or recycled nature.

[0002] A great deposition capacity, safety, polyvalence, and mobility, together with low acquisition and exploitation costs, turn this equipment into the ideal solution for several applications such as: urbanizations, villages and small interior towns, beaches, camping sites, holiday resorts, street markets, concerts or summer festivals, football stadiums, central discharge sites for large city sweeping, ecopoints for locations with large waste volumes.

[0003] The present equipment is intended to be conveyed in vehicles equipped with loading arms according to DIN 14505 and 30722, commonly known as "polibennes", DIN 30720 commonly known as "multibennes" or similar thereto.

2. Presentation

[0004] Recently, a propensity towards increasing the storage capacity within collection points has been registered within the scope of urban solid waste collection, due to the fact that population density has increased within urban zone, but also due to a necessity towards collection circuit rationalization.

[0005] The protection of stored waste material is also fundamental, avoiding the action of "garbage removing individuals" and animals, which disperse the waste material thus hindering its collection.

[0006] The equipment herein disclosed, besides comprising these two characteristics, allows compacting deposited waste, in as much as it incorporates an electro-hydraulic compression mechanism (5). Up to such point, there is nothing new, the waste compactor already exists for a long time, but it has the inconvenience of requiring an electrical connection to the mains network, which limits its use in public road, not only due to the requirement for an electrical connection point, but also due to the danger inherent to its presence.

[0007] This equipment is above all innovative in its power autonomy, which has so far always been the greatest obstacle to the use of compactors in public road.

[0008] The main action herein undertaken was to reassess and resize power requirements, thus adapting the hydraulic group and compression mechanism (5) to work at low voltage, and allowing it to be supplied by solar panels. The document US 2007/101875 A1 discloses a trash compactor with solar panels energy supply. The present mechanism is autonomous, waiving from an electrical connection to the mains network and operating at low voltage. This way, autonomy, mobility, high collection and safety rates are achieved.

[0009] In order to increase its polyvalence and adaptability, the present equipment can have a connection to the mains network, a diesel or gasoline generator, and adjustable solar panels.

Brief description of the Drawings

[0010] For an easier understanding of the invention, drawings are herein attached, which represent preferred embodiments of the disclosure which, however, do not intend to limit the scope of the present disclosure, the invention being defined by the subject-matter of claims 1 and 4.

Figure 1 represents a perspective view of an autonomous container with solid waste compaction system according to the present invention. The following elements are disclosed in figure 1, see also accompanying reference number for the element "compression mechanism":

- solar panels;
- dashboard protection door;
- hoisting means;
- hydraulic group;
- 5 - compression mechanism;
- openings for waste material disposal;
- volume of compressed matter;
- double-effect cylinders for door opening and closing;
- rear door;
- drum.

Figure 2 represents a partially cross-sectional perspective view, wherein the inner compaction mechanism is to be observed within the drum with the respective pneumatic cylinder, as well as the storage volume of compressed waste.

Figure 3 represents the diagram of the control electro-hydraulic circuit of compaction cylinder, as well as of the opening and closing of the container door, wherein one may observe that the compaction cylinder control and the door opening and closing cylinder control are carried out by two electrovalves which are controlled by the programmable automate. The reference numbers refer to the following elements:

11 - flow control valve for rear door seed control;
12 - pressure switch controllers;
13 - electrovalve for compacting directional control;
14 - electrovalve for rear door control;
15 - electrical motor;
16 - pump;
- pressure regulators within the compaction cylinder circuit;

- valve for unidirectional control.

Figure 4 represents a perspective view of an autonomous container comprising solid waste compaction system. The following elements are disclosed in figure 4, see also accompanying reference number for the element "compression mechanism":

- solar panels;
- dashboard protection door;
- hoisting means rear door;
- Hydraulic group;
- 5 - compression mechanism;
- volume of compressed matter;

3. Characteristic

[0011] The base equipment consists of a container comprising the following main elements:

- Drum (s)
- Compression mechanism (5)
- Solar panels
- Accumulators
- Accumulator charge regulator
- Electro-hydraulic group
- Power and control electrical switchboard panel (protected by an anti-vandalism door)
- Protection door for the switchboard panel.

[0012] The equipment was designed for public road assembly, being exempt from access restrictions towards its use. The arrangement of control elements shall be as high as to allow their operation exclusively by adults, although their use by children is not problematic.

[0013] Its operation is extremely simple, its control being carried out automatically, preferably by a programmable automate. A set of instructions transmitted by light signs (LEDs) has been designed in order to simplify first-time use, namely:

Information

- Green sign - Operational equipment;
- Yellow sign - Equipment in operation;
- Red sign - Equipment out of service (for example, upon accumulator discharge or waste material overload).

Operation

- Upon green light, press the black button to open the drum.
- Raise the drum and deposit the waste material bag;
- Close of the drum.

[0014] In its preferred embodiment, the container has a 5.5 m length, a 2.5 m width and a 2.2 m height, and each drum has a 0.470 m diameter, a 0.730 m length and consequently a capacity of about 130 liters.

[0015] The volume of compressed matter storage has a variable capacity of 12-30 m^3.

4. **Operation**

[0016] The equipment is arranged on public road, for instance, a garden, or parking site, wherein it may receive sun light for the longest time possible, and since it is of constant charge, it is then previously charged.

[0017] Users shall then proceed with waste material depositing, thus following the above-mentioned procedure, until the waste material accumulated within the container causes an increase on compaction pressure up to 3/4 of its utmost limit, the same being detected by a pressure detector. At this point a SMS is automatically sent to the central control system (via modem-based communication system), reporting that the equipment has reached 3/4 of its utmost capacity thus being necessary to proceed with its removal. Upon continuous use, the equipment will eventually reach its utmost operational pressure, which will cause both the deposition drum to stop, upon actuation of the red sign indicating the state of the equipment, and a further SMS to be sent to the central control system informing that the equipment is full.

[0018] In the case of the compacting cycle taking longer than expected, the equipment actuates the red sign and a SMS is sent to the central control system reporting that the equipment is faulty.

[0019] Should the battery charge be lower to a preset level, a SMS is sent reporting low charge.

[0020] Once full, the equipment is collected and taken to unload at an appropriate site for such purpose. The hydraulic opening of the rear door allows an easy discharge in landfill or recess tank sites.

[0021] Despite the system being particularly simple such that a failure probability is extremely reduced, an option for internal connection of a parallel supplying system is provided for operation with the equipment.

[0022] The panels used shall be of higher quality and resistance, including stone projection resistance. Either way, the panels are arranged such that they are hardly visible and are protected against vandalism or theft.

[0023] This equipment can be designed for simple or bi-flux housing, for such being provided with two independent compression mechanisms and two independent containers for use, for example, in paper/cardboard compaction, on the one side, and packaging on the other side.

Claims

1. Container with a solid waste compaction system comprising hoisting means for hoisting the container by means of a loading arm of a waste collector vehicle or equivalent hoisting device, said container

comprising the following elements:

- One or several drums provided with a lid which is opened for residue deposition;
- a compression mechanism (5) with a hydraulic compression cylinder in each drum;
- a door opening and closing cylinders for container evacuation;
- one or several solar panels serving the purpose of supplying the compression mechanism (5), which supplies electrical power accumulators, the energy supplied by the solar panels being sufficient to act upon the compression mechanism (5), drum, and door opening and closing cylinders for container evacuation, thus assuring the container's energetic autonomy;
- a pressure detector and a communication system, wherein the communication system is configured to send a message to a central control system, when the pressure detector registers ¾ of the utmost pressure in the compression system; and wherein the pressure detector is configured to stop automatically the equipment and/or send a message to a central control system, when said pressure detector reaches said utmost pressure;

said container being provided with a set of light signs configured to supply information on the state of the equipment:

- green sign: operational equipment;
- yellow sign: equipment in operation;
- red sign: equipment out of service,

said container being configured for implementing the following operation steps:

- upon green light, pressing a black button to open the drum;
- depositing the waste material bag;
- closing of the drum;
- compacting,

the container also comprising

- a temporizer configured to stop the equipment, thus actuating the red light and sending a SMS to the central control system reporting that the equipment is faulty when the compacting cycle takes longer than anticipated;
- a battery charge controller configured to actuate the red light and send a SMS to the central control system reporting low charge when the charge within the batteries is lower than a preset limit thus hindering the compactor operation;
- a charge regulator for the accumulators and a power and control electrical switchboard panel, wherein door opening and closing cylinder control and compaction cylinder control are carried out, respectively, by means of two electro-valves (13, 14) which act upon double-effect cylinders, which operate respectively for the actuation of the door and the compaction cylinders, the valves being controlled by an automatic control system, preferably a programmable automate.

2. Container according to claim 1, **wherein** said container is provided with an electrical connection to the mains network allowing either the container to be supplied with electrical power or the accumulators to be charged.

3. Container according to claim 1, **wherein** said container is provided with a diesel or gasoline generator, which allows either the said container to be supplied with electrical power or the accumulators to be charged.

4. Method for the operation of automatic control system of the container described in the claims 1 to 3.

5. Method according to claim 4, **wherein** the battery charge controller actuates the red light and sends a SMS to the central control system reporting low charge when the charge within the batteries is lower than a preset limit thus hindering the compactor operation.

Patentansprüche

1. Behälter mit einem stabilen Abfall-Verdichtungssystem, bestehend aus Hebemitteln zum Anheben des Behälters über einen Ladearm eines Abfallsammelfahrzeugs oder ein gleichwertiges Hebezeug, wobei der besagte Behälter aus folgenden Elementen besteht:

- Einer oder mehreren Trommeln, die mit einem Deckel versehen sind, der zur Deponierung der Rückstände geöffnet wird;
- einem Kompressionsmechanismus (5) mit einem hydraulischen Kompressionszylinder in jeder Trommel;
- Zylindern zum Öffnen und Schließen der Türen für die Entleerung des Behälters;
- einem oder mehreren Solarmodulen mit dem Zweck, den Kompressionsmechanismus (5), welcher elektrische Energiespeicher versorgt, mit Strom zu versorgen, wobei die von den Solarmodulen gelieferte Energie ausreichend ist, um den Kompressionsmechanismus (5), die Trommel und die Zylinder zum Öffnen und Schließen der Türen zur Behälterentleerung zu speisen und somit die energetische Autonomie

des Behälters zu gewährleisten;
- einem Druckmelder und einem Kommunikationssystem, worin das Kommunikationssystem konfiguriert ist, um eine Meldung an das zentrale Steuersystem zu senden, wenn der Druckmelder ¾ des maximalen Drucks des Kompressionssystem registriert; und worin der Druckmelder ausgelegt ist, die Ausrüstung automatisch zu stoppen und/oder eine Meldung an ein zentrales Steuersystem zu senden, wenn der besagte Druckmelder den besagten Maximaldruck erreicht;

der besagte Behälter ist mit einem Satz von Leuchtanzeigen ausgerüstet, die dazu bestimmt sind, Informationen über den Status der Ausrüstung zu liefern:

- grünes Licht: Ausrüstung betriebsbereit;
- gelbes Licht: Ausrüstung in Betrieb;
- rotes Licht: Ausrüstung außer Betrieb,

der besagte Behälter ist konfiguriert, um die folgenden Arbeitsschritte zu implementieren:

- Drücken der schwarzen Taste bei grünem Licht, um die Trommel zu öffnen;
- Deponieren des Abfallsacks;
- Schließen der Trommel;
- Verdichten,

Der Behälter besteht auch aus

- Einer Zeitschaltuhr, die ausgelegt ist, die Ausrüstung zu stoppen und somit das rote Licht zu betätigen, und eine SMS-Nachricht an das zentrale Steuersystem mit der Mitteilung zu senden, dass die Ausrüstung defekt ist, wenn der Verdichtungszyklus länger als erwartet dauert;
- Einer Akku-Ladesteuerung, die ausgelegt ist, das rote Licht zu betätigen und eine SMS-Nachricht an das zentrale Steuersystem mit der Mitteilung zu senden, dass ein niedriger Ladezustand vorliegt, wenn die Ladung der Akkus niedriger als ein voreingestellter Grenzwert ist und somit den Verdichterbetrieb behindert;
- Einem Laderegler für die Akkus und einer elektrischen Schalttafel für die Stromversorgung und Steuerung,

worin die Steuerung der Zylinder zum Öffnen und Schließen der Türen und des Kompressionszylinders über zwei Elektroventile (13, 14) durchgeführt wird, welche die doppelwirkenden Zylinder zur Betätigung der Türen und des Kompressionszylinders betätigen, wobei die Ventile über ein automatisches Steuersystem, vorzugsweise eine programmierbare Steuerung gesteuert werden.

2. Behälter gemäß Anspruch 1, **worin** der besagte Behälter mit einem Elektroanschluss an das Wechselstromnetz ausgerüstet ist, der entweder die Stromversorgung des Behälters oder die Ladung der Akkus ermöglicht.

3. Behälter gemäß Anspruch 1, **worin** der besagte Behälter mit einem Diesel- oder Benzingenerator ausgerüstet ist, welcher entweder die Stromversorgung des besagten Behälters oder die Ladung der Akkus ermöglicht.

4. Methode für den Betrieb des automatischen Steuersystems des Behälters, der in den Ansprüchen 1 bis 3 beschrieben ist.

5. Methode gemäß Anspruch 4, **worin** die Akku-Ladesteuerung das rote Licht betätigt und eine SMS-Nachricht an das zentrale Steuersystem mit der Mitteilung sendet, dass ein niedriger Ladezustand vorliegt, wenn die Ladung der Akkus niedriger als ein voreingestellter Grenzwert ist und somit den Verdichterbetrieb behindert.

Revendications

1. Conteneur avec un système de compactage de déchets solides comprenant des moyens de levage pour le levage du conteneur au moyen d'un bras de chargement d'un véhicule collecteur de déchets ou d'un dispositif de levage équivalent, ledit conteneur comprenant les éléments suivants:

- un ou plusieurs tambours munis d'un couvercle qui est ouvert pour le dépôt de résidus;
- un mécanisme de compression (5) avec un cylindre de compression hydraulique dans chaque tambour;
- un cylindre pour l'ouverture et la fermeture de la porte pour l'évacuation des conteneurs;
- un ou plusieurs panneaux solaires servant à alimenter le mécanisme de compression (5), qui alimente des accumulateurs électriques, l'énergie fournie par les panneaux solaires étant suffisante pour agir sur le mécanisme de compression (5), le tambour, et les cylindres d'ouverture et de fermeture de la porte pour l'évacuation du conteneur, en assurant ainsi l'autonomie énergétique du conteneur;
- un détecteur de pression et un système de communication, dans lequel le système de communication est configuré pour envoyer un message à un système de commande central, lorsque le détecteur de pression enregistre ¾ de la pression maximale dans le système de compression; et dans lequel le détecteur de pression est configuré pour arrêter automatiquement

l'équipement et/ou envoyer un message à un système de commande central, lorsque ledit détecteur de pression atteint ladite pression maximale;

ledit conteneur étant pourvu d'un ensemble de panneaux lumineux configurés pour fournir des informations sur l'état de l'équipement:

- panneau vert : équipement opérationnel;
- panneau jaune : équipement en fonctionnement;
- panneau rouge : équipement hors service,

ledit conteneur étant configuré pour mettre en œuvre les étapes de fonctionnement suivantes:

- au feu vert, presser le bouton noir pour ouvrir le tambour;
- déposer le sac à déchets;
- fermer le tambour;
- compacter,

le conteneur comprenant également

- un temporisateur configuré pour arrêter l'équipement, en actionnant ainsi le feu rouge et l'envoi d'un SMS au système de commande central signalant que l'équipement est défectueux lorsque le cycle de compactage prend plus de temps que prévu;
- un contrôleur de charge de batterie configuré pour actionner le feu rouge et envoyer un SMS au système de commande central signalant une faible charge lorsque la charge dans les batteries est inférieure à une limite prédéfinie, en entravant ainsi le fonctionnement du compacteur;
- un régulateur de charge pour les accumulateurs et un tableau de distribution et de commande électrique,

dans lequel la commande du cylindre d'ouverture et de fermeture des portes et la commande des cylindres de compactage sont effectuées, respectivement, au moyen de deux électrovannes (13, 14) qui agissent sur des cylindres à double effet, qui fonctionnent respectivement pour l'actionnement de la porte et des cylindres de compactage, les vannes étant commandées par un système de commande automatique, de préférence un automate programmable.

2. Conteneur selon la revendication 1, **dans lequel** ledit conteneur est pourvu d'une connexion électrique au réseau principal qui permet que le conteneur soit alimenté en énergie électrique, ou bien que les accumulateurs soient rechargés.

3. Conteneur selon la revendication 1, **dans lequel** ledit conteneur est pourvu d'un générateur diesel ou essence, qui permet que le conteneur soit alimenté en énergie électrique, ou bien que les accumulateurs soient rechargés.

4. Procédé de fonctionnement du système de commande automatique du conteneur décrit dans les revendications 1 à 3.

5. Procédé selon la revendication 4, **dans lequel** le contrôleur de charge de batterie actionne le feu rouge et envoie un SMS au système de commande central signalant une faible charge lorsque la charge dans les batteries est inférieure à une limite prédéfinie, en entravant ainsi le fonctionnement du compacteur.

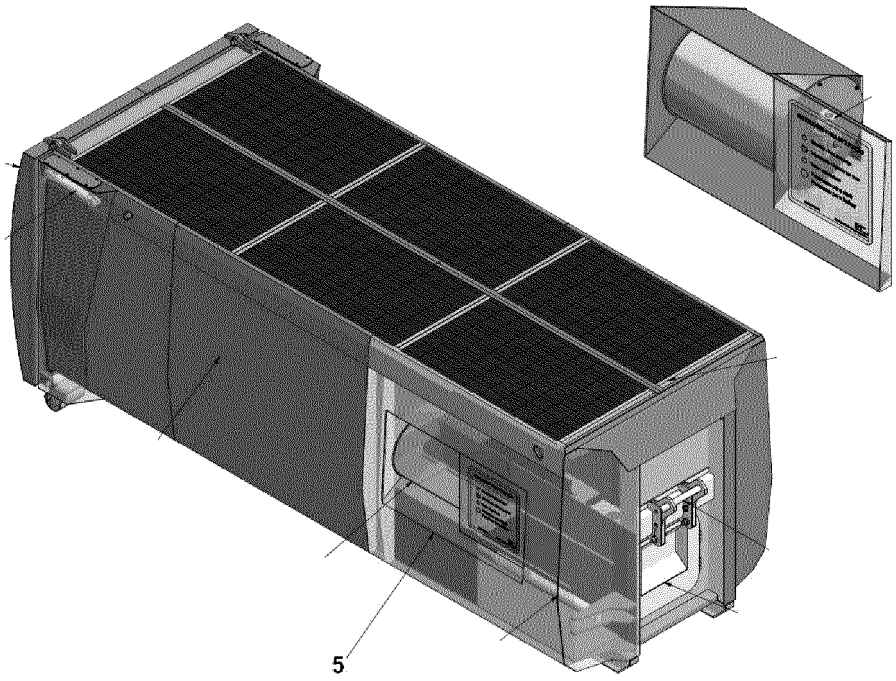

Figure 1

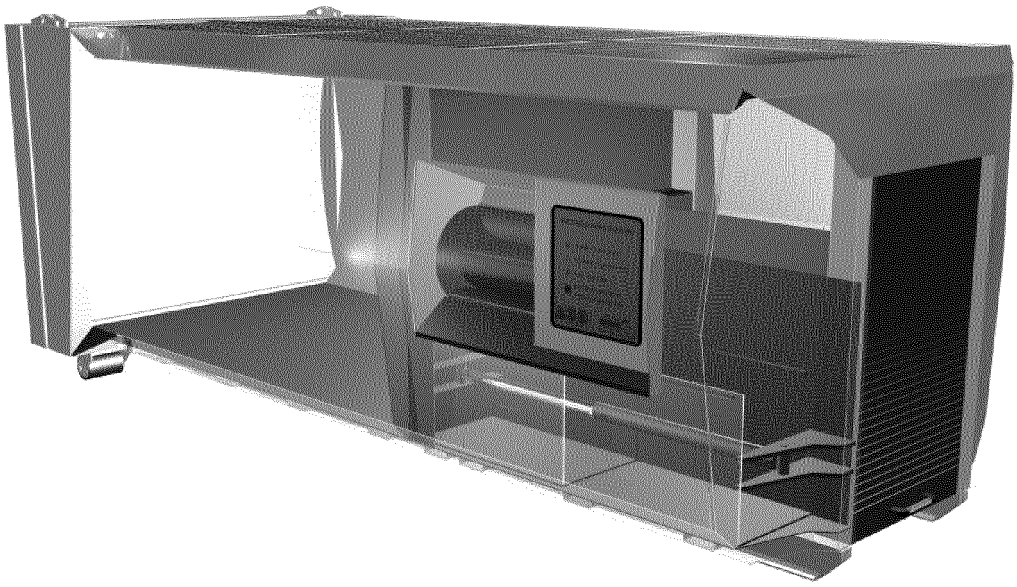

Figure 2

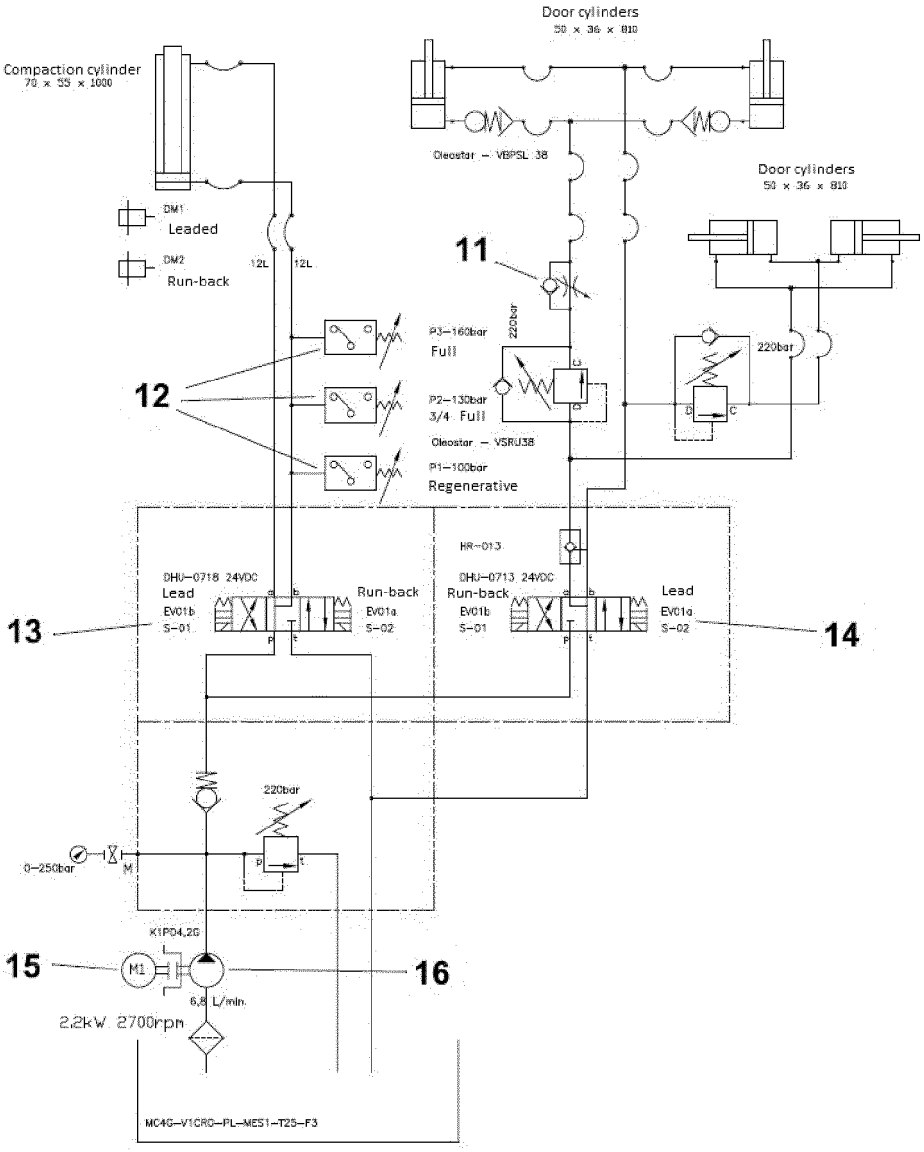
Door cylinders
50 x 36 x 810
Compaction cylinder
70 x 55 x 1000
Cleostar – VBPSL 38
Door cylinders
50 x 36 x 810
DM1
Leaded
DM2
Run-back
12L
12L
11
P3–160bar
Full
220bar
220bar
12
P2–130bar
3/4 Full
Cleostar – VSRU38
P1–100bar
Regenerative
HR–013
DHU–0718 24VDC
Lead
EV01b
S–01
Run-back
EV01a
S–02
DHU–0713 24VDC
Run-back
EV01b
S–01
Lead
EV01a
S–02
13
14
220bar
0–250bar
K1P04,2G
15
16
6,8 L/min.
2,2kW 2700rpm
MC4G–V1CRO–PL–ME51–T25–F3

Figure 3

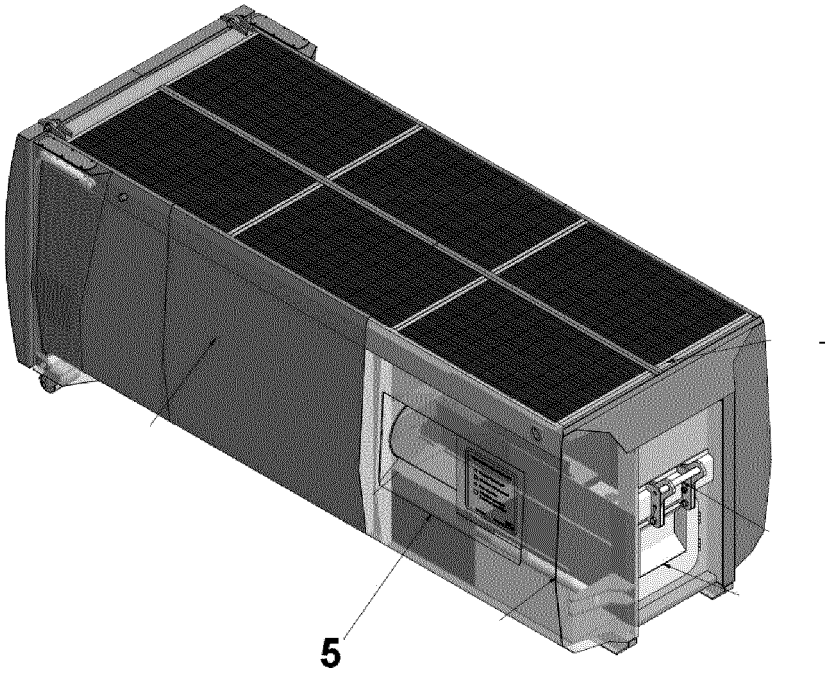

Figure 4

REFERENCES CITED IN THE DESCRIPTION

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