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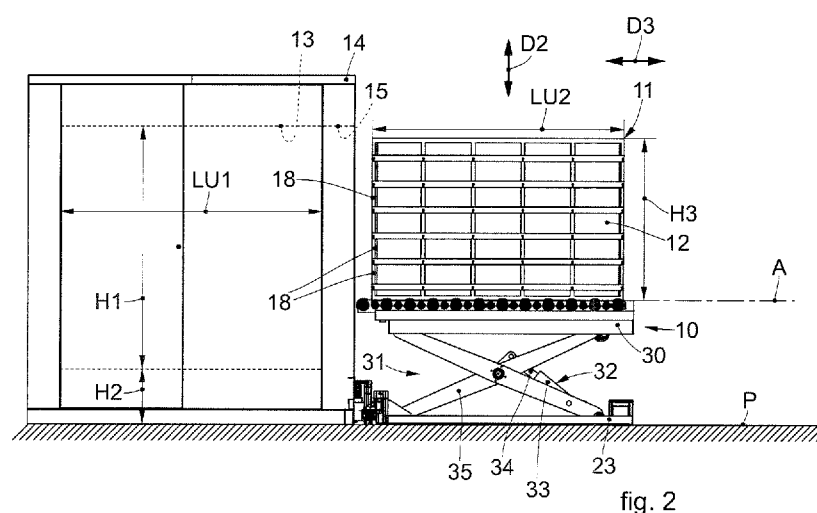
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(54) Title: APPARATUS AND METHOD TO AUTOMATICALLY INTRODUCE AND REMOVE A SUPPORT FOR CARRYING MEDICAL OBJECTS INTO AND FROM A LARGE-CAPACITY WASHING CHAMBER



(57) Abstract: Apparatus (10) and method to automatically introduce and remove a support (11) for carrying medical objects (12) into and from a large-capacity washing chamber (13). The apparatus (10) comprises a slider (23), horizontally mobile on a support plane (P), and a platform (30) mounted on the slider (23) and mobile vertically, between a lowered position, resting on the slider (23), and a loading position, which is raised with respect to the slider (23), in order to facilitate the loading of the medical objects (12) into the support (11).



- 1 -

“APPARATUS AND METHOD TO AUTOMATICALLY INTRODUCE AND REMOVE A SUPPORT FOR CARRYING MEDICAL OBJECTS INTO AND FROM A LARGE-CAPACITY WASHING CHAMBER”

* * * * *

5 FIELD OF THE INVENTION

The field of application of the present invention is the washing sector, understood as actual washing proper, disinfection, sterilization, sanitization and any other known operation, or which will be developed hereafter, suitable to return any medical object whatsoever, such as for example instruments, devices, products, containers of drugs or medicines, also liquids, or other, to optimal
10 hygienic conditions for its re-use. More particularly, the present invention is one of the apparatuses and methods to automatically introduce and remove a support for carrying medical objects into and from a large-capacity washing chamber, that is, of at least one or more cubic meters.

15 BACKGROUND OF THE INVENTION

In the medical sector, and in particular in that of the washing treatment, understood as above, of the many medical objects which must be treated to be returned to optimal hygienic conditions for their reuse, various apparatuses are known, among which there are those which Applicant has developed, produced
20 and marketed for over a decade and which have also been disclosed through patent publications, such as for example the international patent application published under the number WO-A-2013/068822 and the European patent application EP-A- 3072531.

Among known apparatuses, a particular sector is occupied by those having at least one large-capacity washing chamber, that is, able to accommodate inside
25 itself large-size supports or sliders, for example with a parallelepiped shape with sizes ranging from one to three meters, and even more. One of these known washing chambers marketed by the Applicant is, for example, that marketed under the trade name “Steelco LC80”.

30 The technical problem that the present invention has faced and solved is that of the automatic and safe movement of a support for carrying objects, having a considerable weight, even more than 10,000 N, with respect to a large-capacity washing chamber, in particular from a loading position, outside the washing

chamber, to inside the latter, and vice versa.

An apparatus for loading and moving objects, which however has bulky sizes and limited capacity for movement, is described for example in document WO-A-90/15754.

5 One purpose of the present invention is therefore to provide an apparatus and to perfect the corresponding method to automatically introduce and remove a support for carrying medical objects into and from a large-capacity washing chamber, which are simple and reliable and which on the one hand allow the operator to load the support with the medical objects to be treated, safely and
10 without making excessive efforts, and to remove them from the same support when the treatment has been completed, remaining outside the washing chamber, and on the other hand automatically carry out all the operations of introducing the support into the washing chamber, when loading is complete, and the subsequent removal of the support from the same washing chamber, without the operator
15 ever having to enter the washing chamber.

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

SUMMARY OF THE INVENTION

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

In accordance with the above purposes, an apparatus according to the present invention to automatically introduce and remove a support for carrying medical
25 objects into and from a large-capacity washing chamber, comprises transport means configured at least to take the support from a loading position, in which the support is distant from the washing chamber, to an introduction position, in which the support is in correspondence with the washing chamber.

In accordance with a characteristic aspect of the present invention, the
30 transport means comprise a slider, positioned on a first support plane where the washing chamber lies and translatable in a first sliding direction with respect to the washing chamber by means of first command means; and a platform mounted on the slider and mobile in a second raising and lowering direction perpendicular

to the first direction; the platform is mobile between a lowered position, resting on the slider, and a loading position which is raised with respect to the slider, and vice versa, and commanded by second command means; feed means are mounted on the platform, configured to selectively translate the support in a third
5 introduction and removal direction, from a first position in which the support is completely outside the washing chamber, to a second position in which the support is completely inside the washing chamber; the third direction to introduce and remove the support is perpendicular both to the first sliding direction of the slider and also to the second raising and lowering direction of the platform.

10 The second command means can comprise a fluid-dynamic jack, connected to a mechanism with crossed levers, pivoted with respect to each other, and connected in the lower part to the slider and in the upper part to the platform.

In accordance with another characteristic aspect of the invention, the feed means comprise a plurality of drive wheels mounted rotatable on the platform
15 and which together define a second temporary support plane for the support, parallel to the first support plane.

The drive wheels can be selectively made to rotate, in both directions, by third command means, which can comprise at least a first electric motor connected to the drive wheels.

20 In accordance with another characteristic aspect of the invention, the feed means also comprise other command means configured both to thrust the support in the last part of its travel inside the washing chamber, and also to begin to remove the support from the washing chamber.

The fourth command means can comprise a screw, mounted rotatable in both
25 directions of rotation, around a transverse axis parallel to the third direction, and connected coaxially to a second electric motor, with this screw a corresponding nut can be engaged, integral with the lower and proximal part of an arm, on a distal end of which a fork is present, configured to cooperate with the support.

The fork can be mounted on a shaft rotatably supported by the arm, and the
30 fork can be mobile between an inactive position, in which it is lowered and does not interfere with the support, and a working position, in which it is raised and in cooperation with the support, commanded by fifth command means.

In accordance with another characteristic aspect of the invention, a method to

automatically introduce and remove a support that carries medical objects into and from a large-capacity washing chamber comprises at least a loading step, in which the support is loaded on transport means, in a loading position distant from the washing chamber, and a translation step in which the transport means,
5 comprising a slider commanded by first command means and a platform, take the support from the loading position to an introduction position, in which the support is in correspondence with the washing chamber, in a first sliding direction of the slider parallel to a first support plane where the washing chamber lies. Moreover, the loading step provides to raise the support, commanded by
10 second command means, in a second raising and lowering direction of the platform perpendicular to the first direction, from a lowered position in which the support is on the level of the washing chamber, to a raised position, to facilitate the loading of the medical objects into the support. The method also comprises an introduction step, in which the support is moved by other command means from
15 the outside to the inside of the washing chamber in a third introduction and removal direction of the support which is perpendicular both to the first direction and also to the second direction.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other characteristics of the present invention will become apparent
20 from the following description of some embodiments, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a view from above of an apparatus to automatically introduce and remove a support for carrying medical objects into and from a large capacity washing chamber according to the present invention, shown in a loading position
25 of the support;
- fig. 2 is a lateral view of the apparatus in fig. 1;
- fig. 3 is a front view of the apparatus in fig. 1 shown in a translation position of the slider;
- fig. 4 is an enlarged detail of fig. 3;
- 30 - fig. 5 is a view from above of the apparatus in fig. 1, shown in a position of introduction of the support into the washing chamber;
- fig. 6 is a lateral view of the apparatus in fig. 3;
- fig. 7 is a view from above of the apparatus in fig. 1, shown in a position in

which the support is completely introduced into the washing chamber;

- fig. 8 is a lateral view of the apparatus in fig. 7;
- fig. 9 is an enlarged and partly sectioned detail of fig. 6;
- fig. 10 is an enlarged and partly sectioned detail of fig. 8.

5 We must clarify that in the present description and in the claims the terms vertical, horizontal, top, left and below, with their declinations, have the sole function of better illustrating the present invention with reference to the drawings and must not be used in any way to limit the scope of the invention itself, or the field of protection defined by the claims. For example, by the term horizontal we
10 wish to indicate a plane that can be either parallel to the line of the horizon or inclined, even by several degrees, for example up to 10°.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

With reference to figs. 1 and 2, an apparatus 10 according to the present invention is configured to automatically introduce and remove a support 11 (figs.
15 2 and 3) suitable to support a large quantity of medical objects, such as for example surgical instruments, flasks of physiological substances, or other, generally indicated by the reference numeral 12, into and from a large-capacity washing chamber 13, for example about 4 m³, of a washing machine 14 of a known type.

20 The washing chamber 13 (figs. 1, 2 and 3) has, for example, a substantially parallelepiped shape, with a width LA1 of about 1100 mm, a length LU1 of about 2000 mm and a height H1 of about 1900 mm. The base of the washing chamber 13 is positioned at a height H2, for example about 500 mm from a first support plane P, which can consist of a floor.

25 In the example provided here, the washing chamber 13 has a single front aperture 15, which can be selectively and hermetically closed by a horizontally sliding door 16.

The support 11 consists, for example, of a structure 17 having a substantially parallelepiped shape and made of metal bars disposed in a grid, which define a
30 plurality of horizontal shelves 18. In particular, the structure 17 comprises in its lower part two lateral bars 19 and 20 (fig. 3) and a front bar 21.

The structure 17, as a whole, has sizes slightly smaller than those of the washing chamber 13, so that the same structure 17 can easily enter and exit the

latter. For example, the structure 17 has a width LA2 of about 820 mm, a length LU2 (fig. 2) of about 1650 mm and a height H3 of about 1100 mm, and has quite a big overall weight, for example comprised between about 5,000 N and about 6,000 N, so it would be extremely difficult and unsafe for operators and for the medical objects disposed in it, to move it manually, even by several people at the same time.

Moreover, the structure 17 is provided, in its lower part, with a plurality of idle wheels 22 (figs. 4 and 8), by means of which it can slide inside the washing chamber 13.

The apparatus 10 comprises a slider 23 configured to translate horizontally in a first direction D1 (figs. 1 and 3) on the support plane P (figs. 2 and 3), between a loading position of the support 11 (figs. 1, 2 and 3), and a position to introduce the support 11 into the washing chamber 13 (figs. 5 to 8), and vice versa, for example by means of first command means 24 (figs. 3 and 4), consisting essentially of an electric motor 25, mounted on the lower front part of the machine 14 and with which a transmission belt 26 is associated, stretched between a drive pulley 27, connected to the electric motor 25, and a driven pulley 28. The slider 23, in its front part, is provided with idle wheels 29 (figs. 3, 4, 9 and 10).

This first direction D1 is therefore a sliding direction of the slider 23 with respect to the washing chamber 13.

The slider 23 therefore slides outside and substantially along a wall of the machine 14 in direction D1 to move toward or away from the front aperture 15 of the washing chamber 13, see for example fig. 1.

A horizontal platform 30 is mounted on the slider 23, and is configured to be selectively raised and lowered in a second vertical direction D2 (fig. 2), keeping itself horizontal, by means of second command means 31, for example consisting of a fluid-dynamic jack 32, for example using oil or compressed air.

The second direction D2 is therefore a raising and lowering direction of the platform 30.

The fluid-dynamic jack 32 has a cylinder 33 integral with the slider 23 and a piston 34 connected to a mechanism with crossed levers 35, pivoted to each other, which is connected in the lower part to the slider 23 and in the upper part

to the platform 30 (fig. 2).

The platform 30 comprises two lateral bars 36 and 37 (figs. 1, 3, 4, 9 and 10) and feed means configured to selectively feed the support 11 in a third direction D3 (figs. 1, 2, 9 and 10), perpendicular both to the first direction D1 and also to the second direction D2, to take it inside the washing chamber 13 and remove it therefrom, as will be described in detail hereafter. The feed means comprise a plurality of drive wheels 38 mounted rotatable on the two lateral bars 36 and 37, and selectively made to rotate in both directions by third command means 39 (figs. 9 and 10), which comprise one or more first electric motors 40 connected to the same drive wheels 38. The drive wheels 38 together define a second temporary support plane A (figs. 2 and 4) for the support 11, parallel to the first support plane P.

The third direction D3 is therefore a direction for introducing and removing the support 11, in particular into and from the washing chamber 13.

The third direction D3 for introducing and removing the support 11 is perpendicular both to the first sliding direction D1 of the slider 23, and also to the second direction D2 for raising and lowering the platform 30.

The feed means also comprise fourth command means 41 (figs. 1, 5, 7, 9 and 10), mounted on the platform 30, in a median position between the two lateral bars 36 and 37, and configured to thrust the support 11 in the last part of its travel inside the washing chamber 13 and to start to remove it therefrom.

The fourth command means 41 comprise a screw 42 (figs. 9 and 10), mounted rotatable, in both directions of rotation, around a transverse axis Y parallel to the third direction D3, and connected coaxially to a second electric motor 43. With the screw 42 a corresponding nut 44 is engaged, integral with the lower and proximal part of an arm 45, on a distal end 46 of which there is a fork 47, configured to cooperate with the front bar 21 of the structure 17. When the arm 45 is in the inactive position (figs. 1 and 5) the fork 47 is positioned around the middle of the platform 30.

In particular, the fork 47 is mounted on a horizontal shaft 48 (fig. 1), supported rotatably by the arm 45, and is mobile between an inactive position, in which it is lowered and does not interfere with the structure 17 (figs. 1 and 5), and a working position, in which it is raised and in cooperation with the front bar 21 of the

structure 17 (figs. 7, 9 and 10), commanded by fifth command means 49, consisting, for example, of an electromagnetic actuator, or by a small compressed-air jack.

We must clarify that the five command means 24, 31, 39, 41 and 49 are
5 advantageously controlled by a computerized central unit, of a known type, and not shown in the drawings, and are served by members to detect the position of the various components of the apparatus 10 subject to movement, so that each movement thereof is controlled and is performed automatically and in maximum safety, and can be programmed.

10 The functioning of the apparatus 10 as described heretofore, which also constitutes the method to automatically introduce and remove the support 11 for medical objects 12 into and from the washing chamber 13, according to the present invention, is as follows.

Initially, the apparatus 10 is in, or is taken to, a loading position (figs. 1, 2 and
15 3), that is, it is moved to the left with respect to the aperture 15 of the washing chamber 13, with the platform lowered, resting on the slider 23 below. In this initial position, the support 11 is located on the platform 30, so that its lateral bars 19 and 20 (fig. 3), go to rest on the drive wheels 38, which are stationary (fig. 4).

Then follows a step of loading the medical objects 12 in the support 11, which
20 begins with the raising, in the second direction D2, of the platform 30 with respect to the slider 23, which remains stationary in its initial position, to facilitate the operators, who therefore do not need to bend down to dispose the medical objects 12 in the different shelves 18 of the structure 17. The raising of the platform 30 is performed by driving the second command means 31 and the
25 height to which the platform 30 is taken is chosen according to the needs of the operators performing the loading.

When the loading of the support 11 is completed, the second command means 31 are again driven and the platform 30 is returned to its initial position, that is, resting on the slider 23 below.

30 Then follows a translation step, in which, by activating the first command means 24, the slider 23 is translated, with the already loaded support 11 on board, in the first direction D1 until it is taken into the introduction position, that is, in front of the front aperture 15 of the washing chamber 13, which is open. In fact,

in the meantime, the door 16 has been made to slide toward the left part of the machine 14 (fig. 3).

Then follows a step of introducing the support 11, with the medical objects 12 loaded on it, into the washing chamber 13, in the third direction D3. To do this, the third command means 39 are driven, which make all the drive wheels 38 rotate (anti-clockwise in fig. 9), so that the support 11 itself is at least partly taken into the washing chamber 13. In fact, when the front bar 21 of the structure 17 (fig. 9) has reached the position where the fork 47 is, when at rest, some of the drive wheels 38 have lost contact with the lateral bars 19 and 20 of the structure 17 and the thrust of the other drive wheels 38 could be insufficient to complete the travel of the support 11. To overcome this risk, the fifth command means 49 are driven, which take the fork 47 into its working position to engage with the front bar 21 of the structure 17.

The fourth command means 41 are then driven, so that the second electric motor 43 commands the rotation of the screw 42 and consequently the arm 45 takes its distal end 46 and therefore the fork 47, with the front bar 21 of the structure 17 associated with it, as far as the inside of the washing chamber 13 (figs. 7, 8 and 10).

At this point, the whole support 11 with all the medical objects 12 to be treated is completely inside the washing chamber 13.

The fifth command means 49 can then be driven so that the fork 47 returns to its inactive position, and then the fourth command means 41 can be commanded to return the arm 45 back, reversing the direction of rotation of the second electric motor 43 and of the screw 42.

When the arm 45 has reached its initial position (fig. 9), the door 16 can be closed and the machine 14 can begin its treatment cycle on the medical objects 12.

When the treatment is finished, the removal of the support 11 with the medical objects 12 is performed, proceeding in the inverse direction.

After having opened the door 16, the fourth command means 41 are driven, which take the arm 45 with its fork 47 inside the washing chamber 13 and below the support 11.

The fifth command means 49 are then driven to take the fork 47 to engage

with the front bar 21 of the structure 17 (figs. 7, 8 and 10).

The fourth command means 41 are then driven, but in the inverse direction, to take the arm 45 toward its initial inactive position, and by means of the fork 47, the arm 45 draws the support 11 with it until the lateral bars 19 and 20 are taken
5 onto the drive wheels 38, which in the meantime have been made to rotate by the third command means 39.

Then the slider 23 is returned by first command means 24 to its initial position (figs. 1, 2 and 3) and there the second command means 31 cause the platform 30 to be raised (fig. 2), to facilitate the removal of the medical objects 12 from the
10 support 11.

Once this last operation has been completed, the support 11 can be reloaded with other medical objects 12 to be treated, or, if necessary, the platform 30 can be lowered by the second command means 31, so that the apparatus 10 returns to its initial starting position.

15 It is clear that modifications and/or additions of parts may be made to the apparatus 10 and corresponding method to automatically introduce and remove a support for carrying medical objects into and from a large-capacity washing chamber as described heretofore, without departing from the field and scope of the present invention.

20 It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of apparatuses and or methods to automatically introduce and remove a support for carrying medical objects into and from a large-capacity washing chamber, having the characteristics as set
25 forth in the claims and hence all coming within the field of protection defined thereby.

In the following claims, the sole purpose of the references in brackets is to facilitate reading: they must not be considered as restrictive factors with regard to the field of protection claimed in the specific claims.

CLAIMS

1. Apparatus (10) to automatically introduce and remove a support (11) for carrying medical objects (12) into and from a washing chamber (13), in particular a large-capacity washing chamber (13), comprising:

5 transport means (23, 30) configured at least to take said support (11) from a loading position, in which said support (11) is configured to be positioned distant from said washing chamber (13), to an introduction position, in which said support (11) is configured to be positioned in correspondence with said washing chamber (13),

10 **characterized in that** said transport means comprise:

a slider (23), positioned on a support plane (P) where said washing chamber (13) lies and translatable in a first sliding direction (D1) with respect to said washing chamber (13) by means of first command means (24); and

15 a platform (30) mounted on said slider (23) and mobile in a second raising and lowering direction (D2) perpendicular to said first direction (D1), said platform (30) being mobile between a lowered position, resting on said slider (23), and a loading position which is raised with respect to said slider (23) and vice versa, and commanded by second command means (31);

20 feed means (38, 39, 41, 47) being mounted on said platform (30), configured to selectively feed said support (11) in a third introduction and removal direction (D3), from a first position in which said support (11) is completely outside said washing chamber (13), to a second position in which said support (11) is completely inside said washing chamber (13);

25 said third direction (D3) to introduce and remove the support (11) being perpendicular both to said first sliding direction (D1) of the slider (23) and also to said second raising and lowering direction (D2) of the platform (30).

2. Apparatus (10) as in claim 1, **characterized in that** said second command means (31) comprise a fluid-dynamic jack (32), connected to a mechanism with crossed levers (35), pivoted with respect to each other, and connected in the lower part to said slider (23) and in the upper part to said platform (30).

30 3. Apparatus (10) as in claim 1 or 2, **characterized in that** said feed means comprise a plurality of drive wheels (38) mounted rotatable on said platform (30) and which together define a second temporary support plane (A) for said support

(11), parallel to said first support plane (P).

4. Apparatus (10) as in claim 3, **characterized in that** said drive wheels (38) are selectively made to rotate, in both directions, by third command means (39) which comprise at least a first electric motor (40) connected to said drive wheels
5 (38).

5. Apparatus (10) as in any claim hereinbefore, **characterized in that** said feed means also comprise fourth command means (41) configured both to thrust said support (11) in the last part of its travel inside said washing chamber (13), and also to begin to remove said support (11) from said washing chamber (13).

10 6. Apparatus (10) as in claim 5, **characterized in that** said fourth command means (41) comprise a screw (42), mounted rotatable in both directions of rotation, around a transverse axis (Y) parallel to said third direction (D3), and connected coaxially to a second electric motor (43), **and in that** with said screw (42) a corresponding nut (44) is engaged, integral with the lower and proximal
15 part of an arm (45), on a distal end (46) of which a fork (47) is present, configured to cooperate with said support (11).

7. Apparatus (10) as in claim 6, **characterized in that** said fork (47) is mounted on a shaft (48) rotatably supported by said arm (45), **and in that** said fork (47) is mobile between an inactive position, in which it is lowered and does not interfere
20 with said support (11), and a working position, in which it is raised and in cooperation with said support (11), commanded by fifth command means (49).

8. Method to automatically introduce and remove a support (11) that carries medical objects (12) into and from a washing chamber (13), in particular a large-capacity washing chamber (13), comprising a loading step, in which said support
25 (11) is loaded on transport means (23, 30), in a loading position distant from said washing chamber (13), **characterized in that** it also comprises a translation step in which said transport means (23, 30), comprising a slider (30) commanded by first command means (24) and a platform (30), take said support (11) from said loading position to an introduction position, in which said support (11) is in
30 correspondence with said washing chamber (13), in a first sliding direction (D1) of the slider (23) parallel to a first support plane (P) where said washing chamber lies, wherein said loading step provides to raise said support (11), commanded by second command means (31), in a second raising and lowering direction (D2) of

the platform (30) perpendicular to said first direction (D1), from a lowered position in which said support (11) is on the level of said washing chamber (13), to a raised position, to facilitate the loading of said medical objects (12) into said support (11), and wherein said method also comprises an introduction step, in
5 which said support (11) is moved by other command means (39, 41) from the outside to the inside of said washing chamber (13) in a third introduction and removal direction (D3) of the support (11) that is perpendicular both to said first direction (D1) and also to said second direction (D2).

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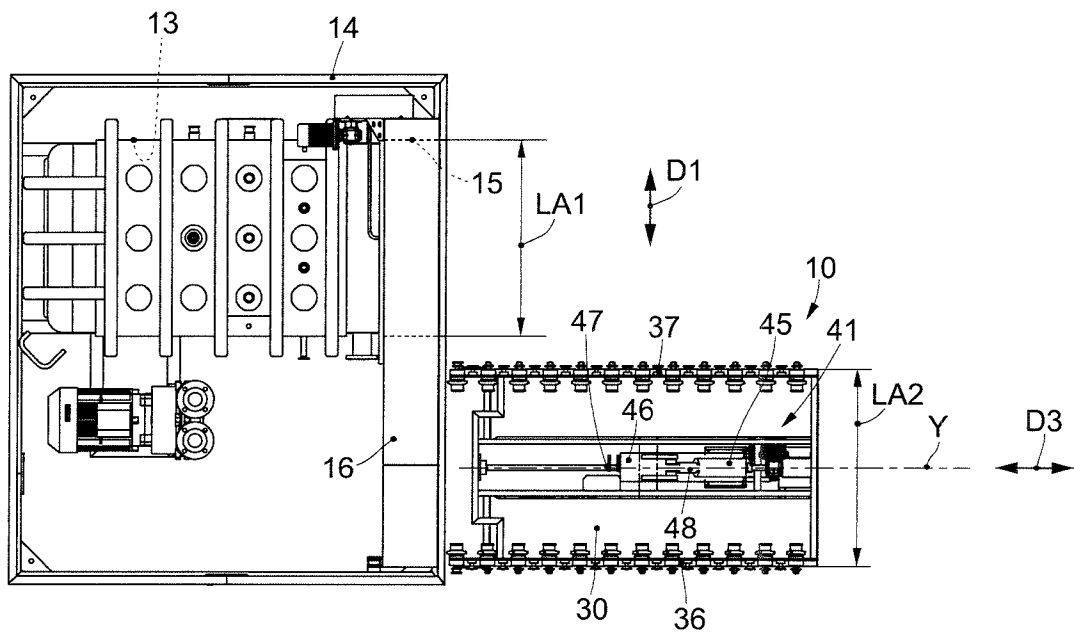


fig. 1

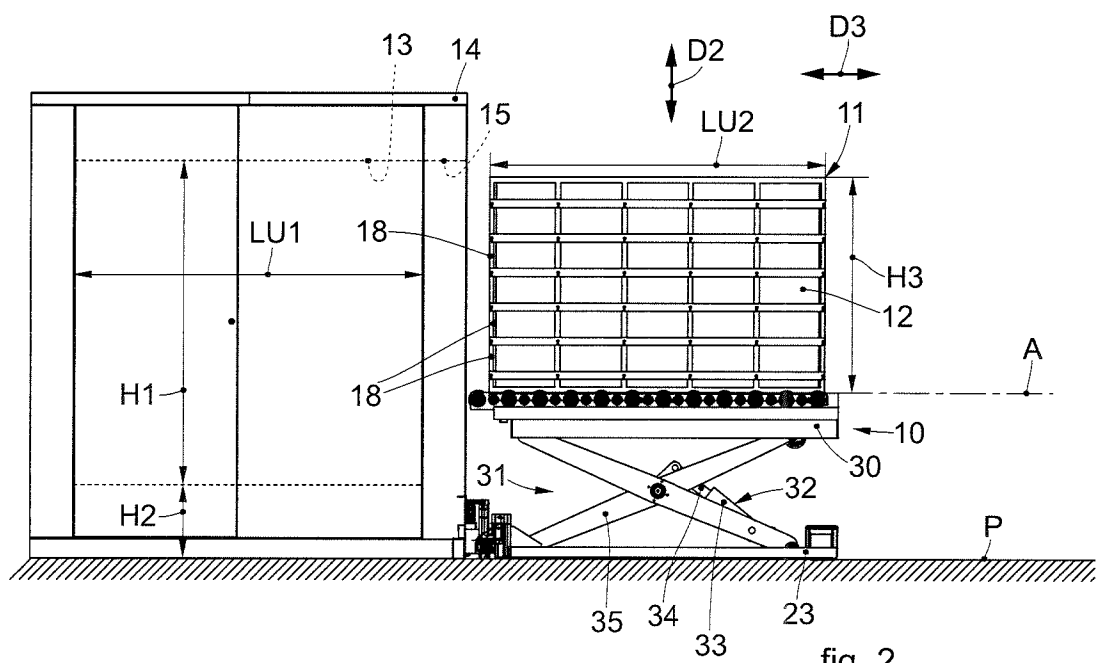


fig. 2

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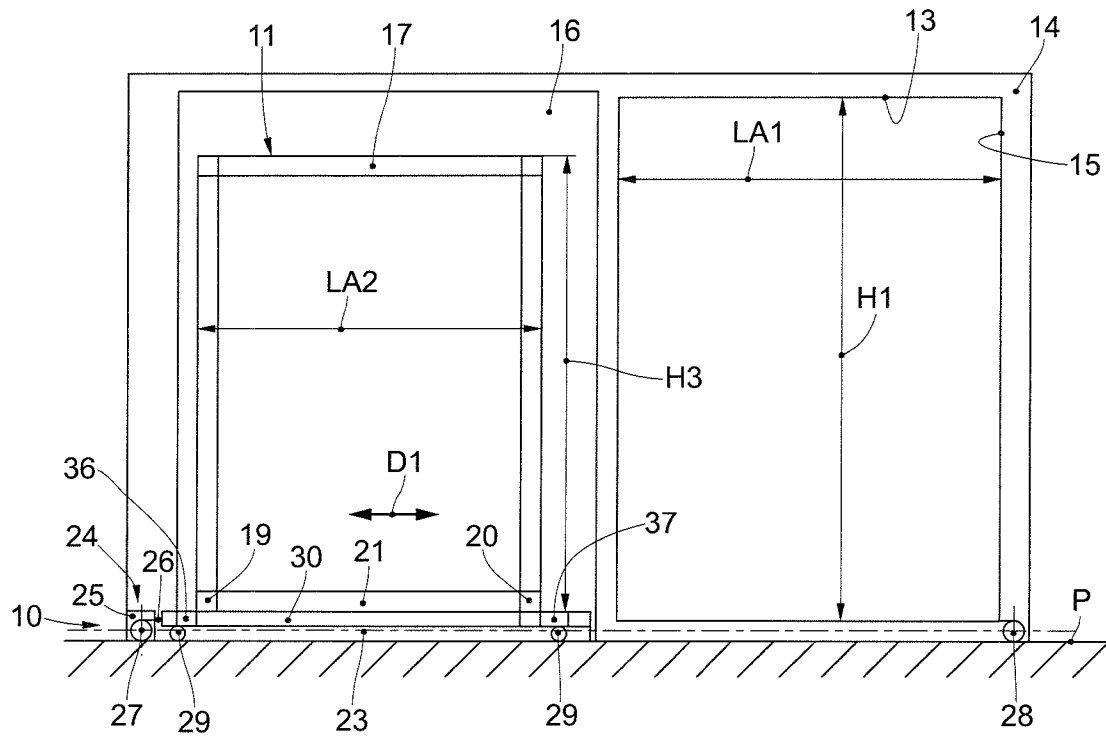


fig. 3

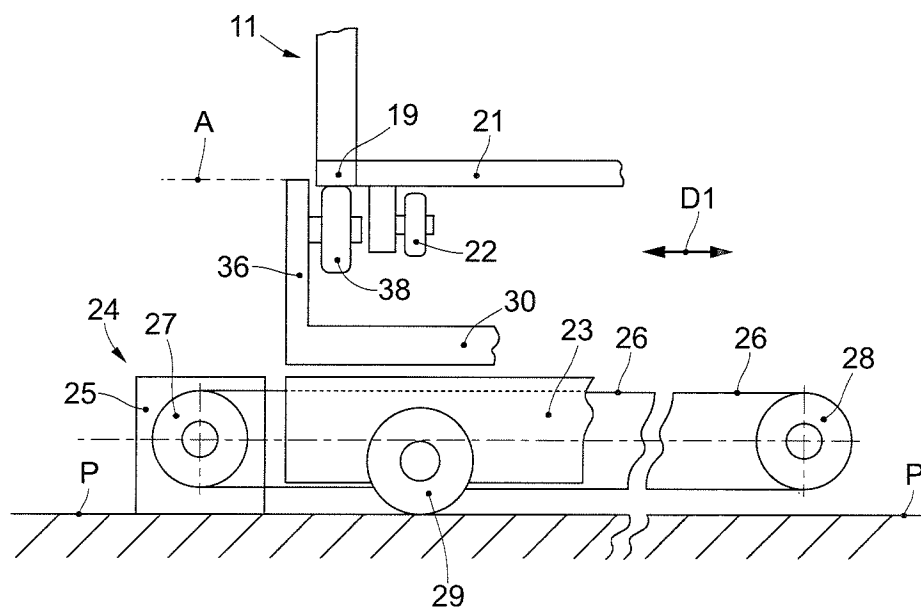


fig. 4

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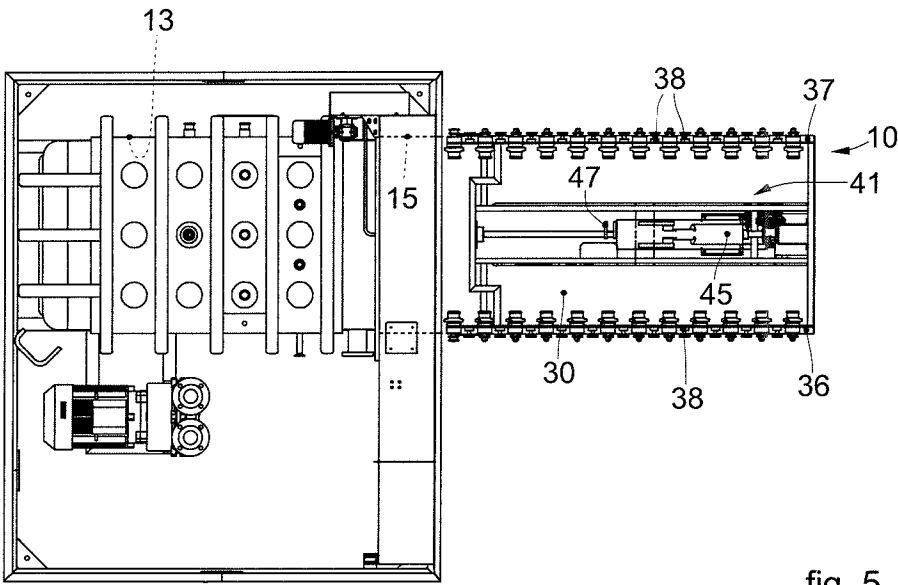


fig. 5

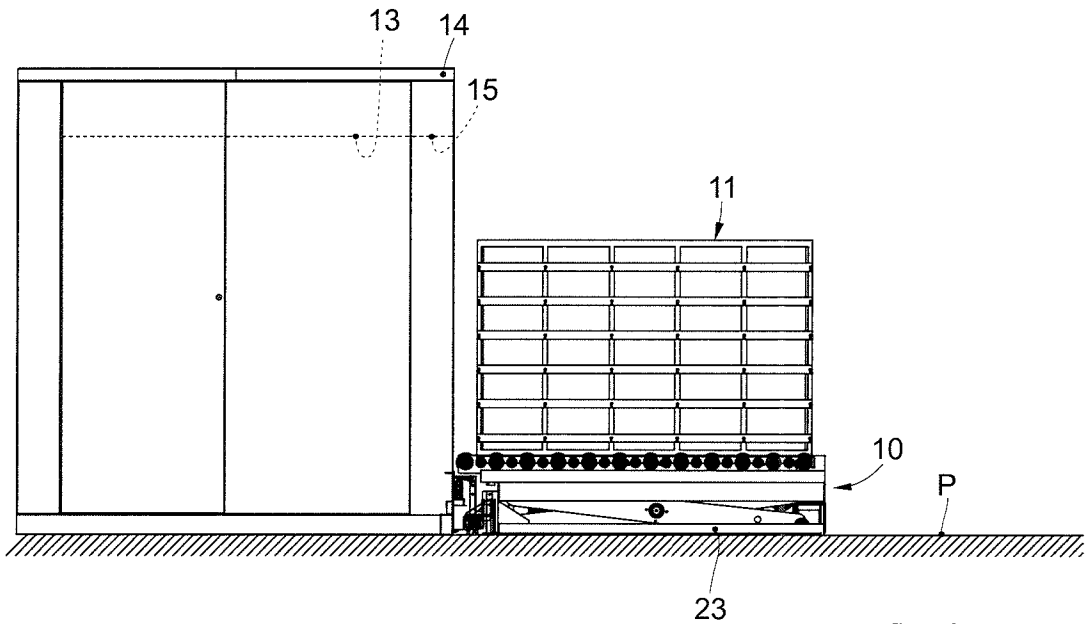
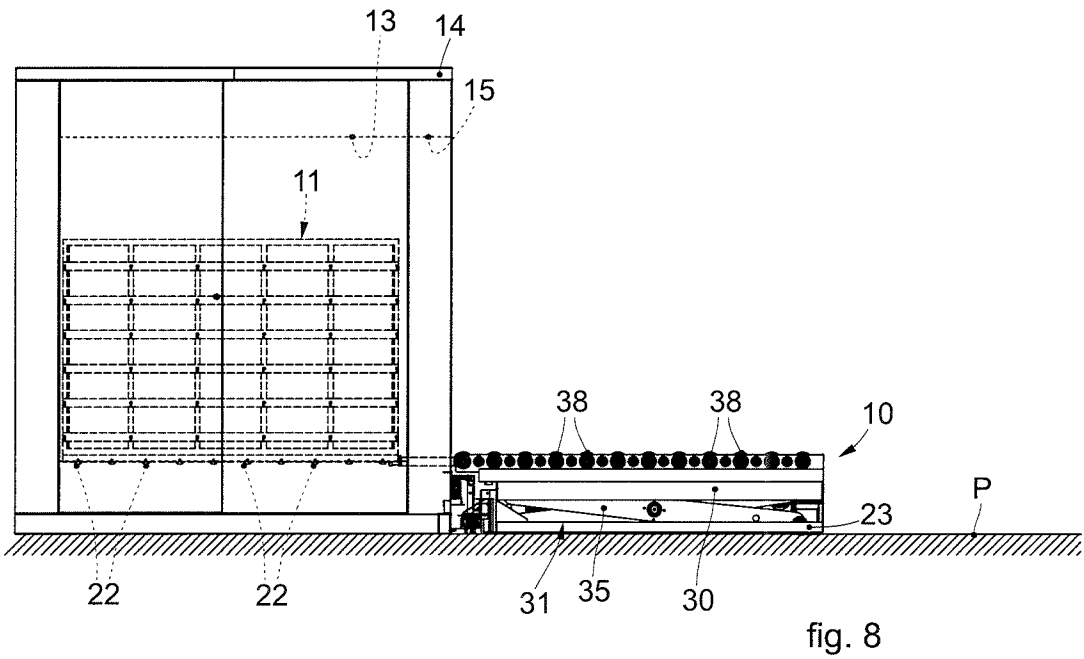
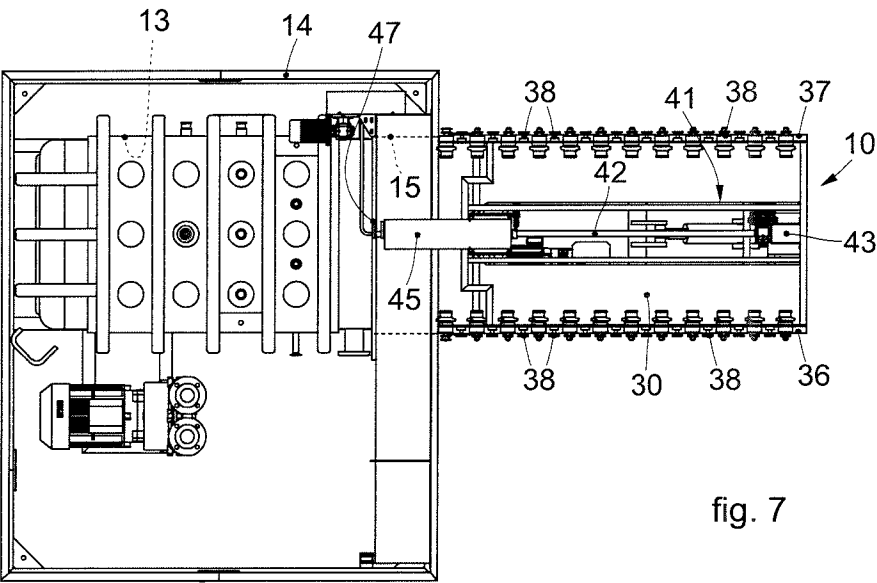


fig. 6

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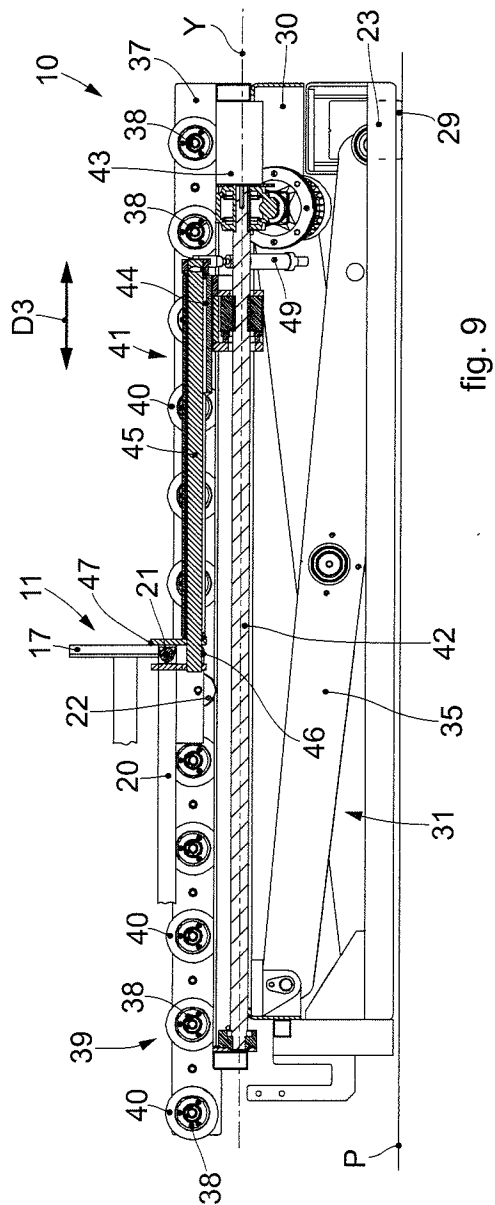


fig. 9

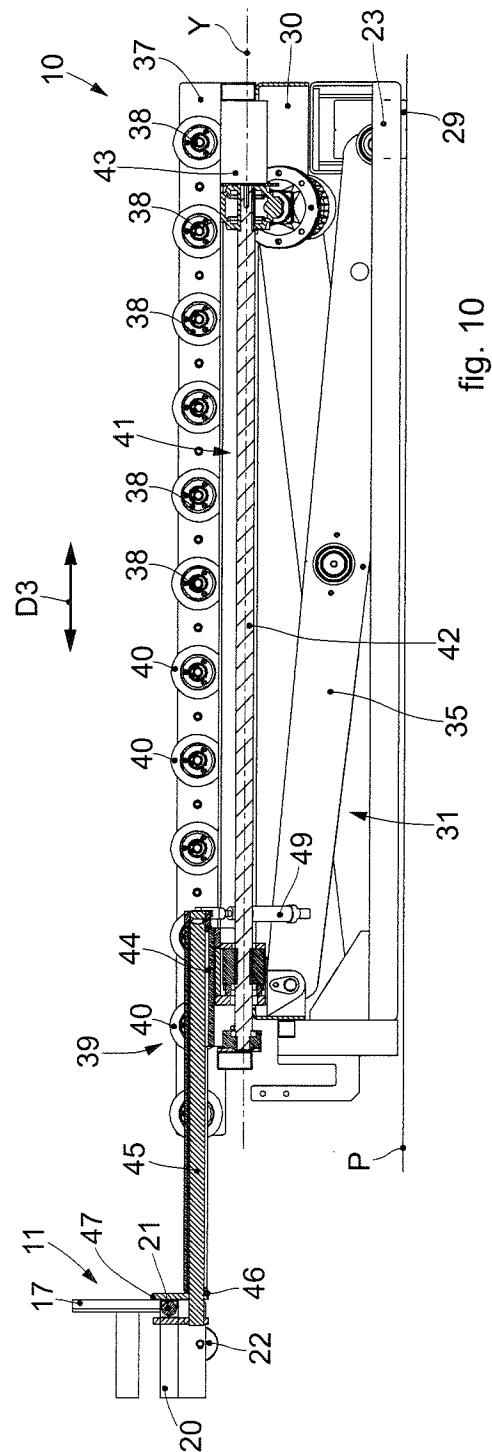


fig. 10