(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
30 November 2017 (30.11.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/203036 A2

(51) International Patent Classification:
A61L 2/26 (2006.01)

(21) International Application Number:
PCT/EP2017/062771

(22) International Filing Date:
26 May 2017 (26.05.2017)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
102016000055130 27 May 2016 (27.05.2016) IT

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) **Title:** MACHINE FOR TREATING, IN PARTICULAR STERILIZING, OBJECTS

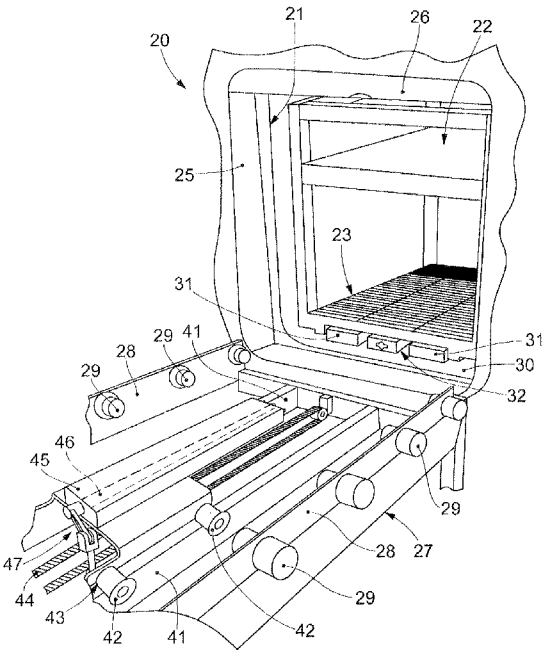

fig. 1

(57) **Abstract:** Machine for treating, in particular sterilizing, objects, comprising at least a treatment chamber (21) and at least one object-carrier container (22, 22a, 22b) houseable in said treatment chamber (21) through at least one aperture (25) of the treatment chamber (21), said machine comprising: at least a first mobile unit (43) positioned outside the treatment chamber (21); at least a second mobile unit (32) positionable inside the treatment chamber (21), and associable with the first mobile unit (43) outside the treatment chamber (21) by means of joint means (35, 51); the second mobile unit (32) is provided with at least a sliding surface (38) near to the object-carrier container (22, 22a, 22b) and at least an attachment element (39) selectively protruding from said sliding surface (38) and provided with elastic return means (40) suitable to keep it in a raised or lowered position with respect to the sliding surface (38) of the second mobile unit (32), the attachment element (39) is also provided with at least one concavity (59) facing toward the aperture (25) of the treatment chamber (21), so as to engage, in the raised position, with the object-carrier container (22, 22a, 22b), so as to extract it from the treatment chamber (21) by means of the first mobile unit (43).

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"MACHINE FOR TREATING, IN PARTICULAR STERILIZING, OBJECTS"

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FIELD OF APPLICATION

The present invention concerns a machine for treating, in particular sterilizing, objects, in particular a so-called "tunnel" treatment machine, in which successive steps of treating objects are carried out in one or more treatment chambers in which treatment zones are disposed one after the other.

Although hereafter we will refer to the particular case given by way of example of sterilization, the term treatment can also be understood as, in general, both the pre-treatment of objects, such as prewash, with hot or cold water and/or with detergents or other chemical products, and also washing operations and drying operations proper. Heat-disinfection operations such as sterilization and decontamination by means of particularly aggressive and hazardous decontamination substances, detergents and/or chemical agents, such as peracetic acid, are also included in the term "treatment".

By way of example, objects that can be treated in the treatment machine in question can be either laboratory instruments for analysis or research, instruments used in the pharmaceutical industry, or medical instruments, surgical instruments or comparable or similar instruments, but without excluding the application of the present invention to the washing of objects in general.

BACKGROUND OF THE INVENTION

It is known to provide machines for treating, in particular sterilizing, objects which are generally contained in object-carrier containers, such as racks or the like, which are fed inside at least one suitable treatment chamber, by feed means, for example a belt, where the desired treatment cycle is performed.

Normally, at least one door is provided, associated with an entrance aperture which is mobile and is driven by an opening and closing mechanism to assume a high or open position in which it allows the objects to be treated to enter the treatment chamber, and a low or closed position, in which, in cooperation with fluidic sealing means, seals the washing chamber from the outside. In "single-door" treatment machines, the entrance and exit occur through the same door. In "pass-through" treatment machines, two doors are provided, that is, an entrance door and also a door associated with an exit aperture opposite the entrance

aperture.

One or more object-carrier containers can be inserted inside the treatment chamber of the machine. If several object-carrier containers are inserted, they are positioned in sequence one after the other in the chamber.

In particular, treatment machines configured for sterilization are generally machines with a deep treatment chamber, for example even a few meters long. Hence, in the state of the art, it is necessary to provide a very long object-carrier container, with a length correlated to the depth of the treatment chamber.

Since in sterilization treatment relatively high temperatures are reached, for example up to about 140°C, it is also a good rule that the sterilization machine is internally free of automatic movement means to move the object-carrier containers and/or sensors detecting their position.

A first disadvantage of known treatment machines, in particular sterilizing machines, is therefore the need to always move the object-carrier containers manually, especially in the delicate step of their removal from the treatment chamber. The step of moving the object-carrier containers takes place by sliding and lifting them by operators responsible for this function.

The absence of detection sensors to detect the position of the object-carrier container or object-carrier containers also does not allow to automatically close the door of the discharge aperture once, for example, the treatment chamber has been completely emptied of the object-carrier container or object-carrier containers.

A further disadvantage of known treatment machines, particularly sterilization machines, is related to their high bulk and connected to the depth of the treatment chamber, depth which, as we said, is also correlated to the size of the object-carrier container which is introduced into it on each occasion and from which it is extracted at the end of the treatment. Normally, the rack, which, as we said, can essentially have the same length as the treatment chamber, is extracted and disposed on a receiver slider, which therefore must also have correlated large sizes. The receiver slider that supports the object-carrier container will then have to be transported by a guide slider, consequently also of a large size. Therefore, particularly in the context of sterilization machines, there are disadvantages in the bulk, due especially to the spaces they need in the zones adjacent to the discharge

aperture to perform the complete extraction and removal of the object-carrier container or object-carrier containers if more than one.

WO-A-2015/033290 describes a known freeze-drying machine, provided with a treatment chamber inside which a plurality of loading planes are positioned. The freeze-drying machine also provides a movement apparatus to move containers to be treated inside the treatment chamber.

Other limitations and disadvantages of conventional solutions and technologies will be clear to a person of skill after reading the remaining part of the present description with reference to the drawings and the description of the embodiments that follow, although it is clear that the description of the state of the art connected to the present description must not be considered an admission that what is described here is already known from the state of the prior art.

There is therefore a need to obtain a machine for treating objects, in particular sterilizing them, which can overcome at least one of the disadvantages of the state of the art.

One purpose of the present invention is therefore to obtain a machine for treating objects, in particular sterilizing them, provided with means to move the object-carrier container or object-carrier containers, which, at least in an extraction step of the object-carrier container or object-carrier containers from the machine, eliminate or at least limit manual operations.

Another purpose of the present invention is to obtain a machine for treating objects, in particular sterilizing them, which offers advantageously reduced bulk and which requires limited spaces, compared to known machines, in zones adjacent to the loading and/or unloading door or doors of the object-carrier container or object-carrier containers.

Another purpose of the present invention is to obtain a treatment machine, in particular sterilization, in which the door associated with the discharge aperture of the object-carrier container or object-carrier containers can be closed automatically when the treatment chamber has been emptied of the object-carrier container or containers.

Another purpose of the present invention is to perfect a fast, effective and safe method to move at least one object-carrier container, in particular during its extraction step from a machine for treating objects, in particular sterilizing them.

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

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, a machine for treating, in particular sterilizing, objects, comprises at least a treatment chamber configured to house at least one object-carrier container.

According to one aspect of the invention, the treatment machine comprises: at least a first mobile unit positioned outside the treatment chamber; at least a second mobile unit positionable inside the treatment chamber and associable with the first mobile unit outside the treatment chamber by means of joint means.

The second mobile unit is provided with at least a sliding surface near to the object-carrier container and with at least one attachment element selectively protruding from said sliding surface and provided with elastic return means suitable to keep it in a raised or lowered position with respect to the surface of the second mobile unit; the attachment element is also provided with at least one concavity facing toward the aperture of the treatment chamber, so as to engage, in the raised position, with the object-carrier container, so as to extract it from the treatment chamber by means of the first mobile unit.

According to another aspect of the invention, the attachment element is inserted, against the action of the elastic return means, inside the second mobile unit in a step of moving the second mobile unit nearer the object-carrier container and of inserting the second mobile unit into the treatment chamber.

In some embodiments, the second mobile unit inside the treatment chamber is substantially aligned with the first mobile unit outside the treatment chamber.

Preferably the treatment machine comprises automatic distancing means to distance the first mobile unit outside the treatment chamber from the second mobile unit associable with the object-carrier container.

Other embodiments concern a movement apparatus for a treatment machine, in particular for sterilizing objects, said treatment machine comprising at least a

treatment chamber and at least one object-carrier container houseable in said treatment chamber through at least one aperture of the treatment chamber. In one embodiment the movement apparatus comprises:

at least one first mobile unit positionable outside the treatment chamber;

at least a second mobile unit positionable inside the treatment chamber and associable with said first mobile unit outside the treatment chamber by means of joint means;

said second mobile unit being provided with at least a sliding surface able to be disposed near to the object-carrier container and with at least one attachment element selectively protruding from said sliding surface and provided with elastic return means suitable to keep it in a raised or lowered position with respect to the sliding surface of said second mobile unit, said attachment element also being provided with at least one concavity able to face toward the aperture of the treatment chamber, so as to engage, in the raised position, with said object-carrier container, so as to extract it from the treatment chamber by means of said first mobile unit.

The invention also concerns a method to move at least one object-carrier container of a machine for treating, in particular sterilizing, objects, provided with a treatment chamber configured to house said object-carrier container.

According to one aspect of the invention, the method comprises at least a step of moving a first mobile unit positioned outside the treatment chamber, toward the object-carrier container; at least a removable connection step of the first mobile unit, by means of corresponding joint means, with a second mobile unit positionable inside the treatment chamber, the second mobile unit is connectable to the object-carrier container by means of at least one attachment element provided with elastic return means suitable to keep it in a raised or lowered position with respect to a surface of the second mobile unit near to the object-carrier container, and provided with at least one concavity facing toward the extraction aperture of the object-carrier container from the treatment chamber; at least an extraction step of the object-carrier container by means of said first mobile unit, in which the attachment element is in a raised position.

Preferably, the extraction of the object-carrier container is divided into a plurality of alternate sub-steps of extraction and approach, in which the first

mobile unit outside the treatment chamber is engaged, by means of the joint means, with the second mobile unit positionable inside the treatment chamber; the second mobile unit is able to engage, in each extraction sub-step, in a zone of the object-carrier container, by means of the raising of the attachment element and the loosening of the elastic return means, so as to allow a part of the object-carrier container to be extracted, and is able to translate freely with respect to the object-carrier container in each sub-step of approach and insertion in the treatment chamber, by lowering said attachment element and compressing said elastic return means.

These and other aspects, characteristics and advantages of the present disclosure will be better understood with reference to the following description, drawings and attached claims. The drawings, which are integrated and form part of the present description, show some forms of embodiment of the present invention, and together with the description, are intended to describe the principles of the disclosure.

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

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

BRIEF DESCRIPTION OF THE DRAWINGS

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

- fig. 1 is a three-dimensional partial view of a treatment machine, in particular a sterilization machine, according to the present invention;
- fig. 2 is a three-dimensional view and on a larger scale of a part of a mobile movement unit of the object-carrier container positioned outside the treatment machine;
- fig. 3 is a three-dimensional partial view of a treatment chamber of the treatment machine in which another mobile unit is positioned;

-fig. 4 is a view of the mobile unit of fig. 3 in position in which it is partly extracted from the treatment machine;

- fig. 5 is a lateral elevation view of the mobile unit inside the treatment chamber;

- fig. 6 is a three-dimensional partial view of the present treatment machine in which the mobile unit outside the treatment chamber has completed a step of approaching the mobile unit inside the treatment chamber;

- fig. 7 is a three-dimensional partial view and on a larger scale of an actuator associated with the mobile unit outside the treatment chamber;

- fig. 8 is a partial plan view of the mobile unit outside the treatment chamber in a position near to the mobile unit inside the treatment chamber;

- fig. 9 is a partial plan view of the mobile unit outside the treatment chamber engaged with the mobile unit inside the treatment chamber;

- fig. 10 is a front view of the mobile unit outside the treatment chamber engaged with the mobile unit inside the treatment chamber;

- fig. 11 is a three-dimensional view of a first extraction step of an object-carrier container from the treatment machine;

- fig. 12 is a three-dimensional view of a further step of moving near and engaging the mobile units with the object-carrier container already partly removed from the treatment chamber;

- fig. 13 is a three-dimensional view of a further step of extracting the object-carrier container;

- fig. 14 is a lateral elevation view of the present treatment machine in the treatment chamber of which two object-carrier containers are housed in sequence;

- fig. 15 is a lateral elevation view of one of the two object-carrier containers completely removed from the machine;

- fig. 16 is a lateral elevation view of a step of discharging the first object-carrier container onto a corresponding slider;

- fig. 17 is a lateral elevation view of the second object-carrier container completely removed from the machine.

To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one embodiment can conveniently

be incorporated into other embodiments without further clarifications.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

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

Before describing these embodiments, we must also clarify that the present description is not limited in its application to details of the construction and disposition of the components as described in the following description using the attached drawings. The present description can provide other embodiments and can be obtained or executed in various other ways. We must also clarify that the phraseology and terminology used here is for the purposes of description only, and cannot be considered as limitative.

With reference to the attached drawings, a treatment machine 20, in particular a sterilization machine, of the so-called "tunnel" type, comprises at least one treatment chamber 21 in which at least one object-carrier container 22 is positioned or positionable, for example a rack container or suchlike.

The object-carrier container 22 has substantially a length equal to that of the treatment chamber 21.

A treatment machine, in particular a sterilization machine, usable in the embodiments described here can be either "single-door" or "pass-through" type.

As we will see, instead of a single object-carrier container 22 housed in the treatment chamber 21, it is possible to provide a sequence of two or more object-carrier containers 22a and 22b inside the treatment chamber 21, see figs. 14 to 17.

In the case of two object-carrier containers 22a and 22b, the length of each of them is preferably equal to about half the length of the treatment chamber 21.

The object-carrier containers 22, 22a, 22b comprise a base 23 that has a series of bars 24, in particular a mesh or grid configuration.

The bars 24 are positioned transversely with respect to the direction D of

inserting and extracting the object-carrier container 22, or the object-carrier containers 22a and 22b, into and from the treatment chamber 21.

The treatment chamber 21 comprises an aperture 25 to insert and extract the object-carrier container 22, or object-carrier containers 22a and 22b. In this case, the insertion and extraction of the object-carrier container 22 or object-carrier containers 22a and 22b is carried out on the same side of the treatment machine 20.

Alternatively, the treatment machine 20 could have two apertures located on opposite sides: one aperture for inserting the object-carrier container 22 or the object-carrier containers 22a and 22b, for example an aperture not visible in the drawings and situated on the opposite side of the treatment machine 20 with respect to the aperture 25, and another aperture for extracting the object-carrier container 22, or the object-carrier containers 22a and 22b, for example the aperture 25.

The aperture 25 can be closed by means of a door 26 able to slide vertically.

A support table 27 is positioned adjacent to the treatment machine 20 and in particular to the access aperture 25 of the treatment chamber 21.

The table 27 comprises sliding guides 28 on which rolls 29 are disposed, preferably idle rolls.

The guides 28 with rolls 29 are disposed substantially at the height at which the base 23 of the object-carrier container 22, 22a, 22b is located. In this way, the table 27 provides a support for inserting and extracting the object-carrier container 22 or object-carrier containers 22a and 22b, into and from the treatment chamber 21.

The treatment chamber 21 comprises a base 30 in which a pair of fixed guides 31 are positioned.

Between the guides 31 a second mobile unit 32 is positioned, which is therefore positioned internally in the treatment chamber 21.

The second mobile unit 32 and a first mobile unit 43 are comprised in a movement apparatus for the treatment machine 20 according to the present description.

The second mobile unit 32 is able to translate in one sense or another in direction D.

The second mobile unit 32 comprises laterally suitable sliding wheels 33 sliding on the base 30.

On a front wall 34 of the second mobile unit 32, a coupling element 35 is made, which substantially comprises a hole 36 at the sides of which two slits 37 are made, see fig. 2 and fig. 10 for example.

The coupling element 35, alternatively, could be directly associated with the object-carrier container 22 or 22a, thus made for example in a suitable front part of the base 23.

The second mobile unit 32 comprises a sliding surface 38 (see figs. 3, 4 and 5 for example) from which at least one attachment element 39 of the object-carrier container 22 or the object-carrier containers 22a and 22b selectively protrudes. In this case, by way of example, two attachment elements 39 are shown.

The sliding surface 38 of the second mobile unit 32 is thus situated near the object-carrier container 22, in particular near its base, where the bars 24 are positioned.

In the sliding surface 38 of the second mobile unit 32 and in correspondence with the attachment element 39, a slit 60 or similar aperture is made, by means of which the attachment element 39 can exit from or enter into the second mobile unit 32 and, therefore, can selectively raise or lower itself with respect thereto and to the respective sliding surface 38.

The attachment element 39 is held in the raised position by means of corresponding elastic return means 40, for example a spring or suchlike, disposed inside the second mobile unit 32 and under the sliding surface 38.

The attachment element 39 is provided, near one end, with a rotation pin 61 by means of which it can be raised or lowered to exit from or enter into the slit 60 of the second mobile unit 32.

At the opposite end to the rotation pin 61, the attachment element 39 is curved and comprises a concavity 59 facing toward the aperture 25 of the treatment chamber 21.

Therefore, the elastic return means 40, when extended and inactive, keep the attachment element 39 in the raised position and outside the second mobile unit 32, whereas when the elastic return means 40 are compressed by the reciprocal movement of the object-carrier container 22 and the second mobile unit 32, the

attachment element 39 is in a lowered position.

In particular, when one of the bars 24 of the object-carrier container 22 passes over the element 39, the latter is forced to lower itself, by the compression of the elastic return means 40.

The lowering of the attachment element 39 inside the second mobile unit 32 may also not be complete, that is, it must be sufficient to allow the passage of the object-carrier container 22 to be inserted into the treatment chamber 21, or allow the insertion of the second mobile unit 32 below the object-carrier container 22 already inserted.

The attachment element 39 is thus able to engage automatically and in snap-in manner with one of the bars 24 of the object-carrier container 22, or the object-carrier containers 22a and 22b, so that when the second mobile unit 32 is extracted from the treatment chamber 21, it draws the object-carrier container 22, or the object-carrier containers 22a and 22b. To this end, as can be seen and as stated above, the attachment element 39 has the concavity 59 facing toward the exit direction of the object-carrier container 22 or the object-carrier containers 22a and 22b from the treatment chamber 21, therefore toward the aperture 25. The attachment element 39 provided with elastic return means 40 represents one of the many possible examples of removable connection means of the second mobile unit 32 with the object-carrier container 22 or with the object-carrier containers 22a and 22b.

On the table 27, further guides 41 are housed along which, by means of respective wheels 42, a first mobile unit 43 outside the treatment chamber 21 can slide.

The first mobile unit 43 can be translated in direction D, in one sense or the other, by any suitable drive means, for example an electric motor or other.

The first mobile unit 43, in this example, is associated with a branch of a motion transmission chain 44, wound around at least one pair of return wheels, one of which will be connected to the suitable drive mean.

The first mobile unit 43 comprises a box-like body 45 inside which a shaft 46 is rotatably housed.

The shaft 46 is associated with an actuator 47 which allows a certain rotation thereof.

The actuator 47, see fig. 7 for example, can comprise a cylinder 48 from which a rod 49 protrudes, able to be connected, by means of suitable motion transmission elements 50, with one end of the shaft 46 protruding from the box-like body 45.

The actuator 47 is translated together with the first mobile unit 43 in direction D, therefore for the actuator 47 suitable guides can be provided, situated for example in the lower part of the table 27.

On the side facing toward the treatment machine 20 and therefore toward the second mobile unit 32, the shaft 46 comprises a pin 51.

The pin 51 preferably is made in a single piece with the shaft 46.

The pin 51 comprises a central body 52 able to be inserted into the hole 36 of the coupling element 35 and two wings 53 able to be inserted into the slits 37 located laterally to the hole 36.

On the front wall 54 of the box-like body 45, two pins 55 are also positioned at the sides of the pin 51.

Each of the pins 55 is associated with corresponding elastic return means 56, for example a compression spring or suchlike.

The pin 51 which can be associated with the coupling element 35 is thus an example of joint means for the removable connection of the first mobile unit 43 with the second mobile unit 32.

As an alternative to what is shown, the pin 51 could also be made in the second mobile unit 32 inside the treatment chamber 21 and the coupling element 35 could be made in the first mobile unit 43 outside the treatment chamber 21.

We will now describe a method for moving the object-carrier container 22, in particular the method to remove the object-carrier container 22 from the treatment chamber 21.

As will be apparent from the description of the method, and as we will see with reference to figs. 14 to 17, the operations carried out for a single object-carrier container 22 can also be repeated in the case of several object-carrier containers 22a and 22b located in sequence.

The object-carrier container 22 is inserted inside the treatment chamber 21 of the treatment machine for the purpose of being subjected to all the appropriate treatment cycles and sequences, for example sterilization.

At the end of the treatment cycle, the door 26 is opened, in this case by means of translation, for example downward, and then the object-carrier container 22 will be extracted, which will contain the treated objects, for example sterilized.

Assuming that the table 27 is in the position of fig. 1, first the first mobile unit 43 will be moved nearer to the treatment chamber 21.

The approach occurs by translating the first mobile unit 43 in direction D and toward the object-carrier container 22.

The translation of the first mobile unit 43, as we said, can be carried out by any suitable drive mean associated, for example, with the motion transmission chain 44.

Following the translation, the box-like body 45 of the first mobile unit 43 moves near to the second mobile unit 32 until the pin 51 is inserted into the corresponding coupling element 35 of the second mobile unit 32.

The central body 52 of the pin 51 is inserted into the hole 36 of the coupling element 35, while the wings 53 of the pin 51 are inserted into the slits 37.

The situation can be, for example, the one shown in Fig. 6, in which the front wall 54 of the box-like body 45 of the first mobile unit 43 is in a position close to the front wall 34 of the second mobile unit 32. Therefore, the mobile units 43 and 32 are substantially at a minimum reciprocal distance.

Once the pin 51 has then entered into the coupling element 35, the actuator 47 is driven, which makes the shaft 46 and thus the pin 51 rotate by a desired angle, for example about 90°.

The rotation of the pin 51 is effected by extracting the rod 49 of the actuator 47 which makes the motion transmission elements 50 and thus the shaft 46 which carries the pin 51 rotate.

Fig. 7 shows by way of example the direction of rotation R, after which the pin 51 is engaged in the coupling element 35 and thus interferes with the latter.

Driving the actuator 47 therefore causes the pin 51 to rotate, see figs. 9 and 10 for example, so that the wings 53 of the pin 51 are positioned behind the front wall 34 and inside the second mobile unit 32.

The wings 53 of the pin 51 therefore substantially abut against the internal surface of the front wall 34 of the second mobile unit 32.

Following the insertion of the pin 51 into the coupling element 35, the pins 55

abut against the front wall 34 of the second mobile unit 32 so that the corresponding elastic means 56 are suitably compressed, in particular compare fig. 8, in which the elastic means 56 are at rest and fig. 9, in which the elastic means 56 are compressed.

The elastic means 56 of the pins 55 are kept in the compressed position of fig. 9 thanks to the insertion and rotation of the pin 51 in the coupling element 35, and therefore thanks to the abutment of the wings 53 of the pin 51 on the internal surface of the front wall 34.

After the correct insertion and correct rotation of the pin 51 in the coupling element 35 is completed, at least a first part of the object-carrier container 22 is extracted, as shown in fig. 11.

In essence, once the first mobile unit 43 has been connected to the second mobile unit 32, the first mobile unit 43 is translated away from the treatment chamber 21 and hence from the treatment machine 20 also extracting at least part of the object-carrier container 22.

For example, it can be provided that the first mobile unit 43 extracts a first half of the object-carrier container 22.

The extraction of the object-carrier container 22 occurs by engaging at least one of the attachment elements 39 of the second mobile unit 32 with one of the bars 24 of the object-carrier container 22.

In essence, upon insertion into the treatment chamber 21, the object-carrier container 22 is translated onto the second mobile unit 32 and onto the guides 31 so that the bars 24 in turn press on the attachment element 39, overcoming the force of the elastic means 40, which tend to hold it in the position shown in fig. 5.

During the insertion pass of the object-carrier container 22, therefore, the attachment element 39 will be lowered inside the second mobile unit 32 against the action of the elastic return means 40.

Therefore, the passage of the object-carrier container 22 in the insertion step will substantially cause a rotation of the attachment element 39 in the sense R1 inside the slit 60 and hence inside the second mobile unit 32, therefore below the sliding surface 38 of the object-carrier container 22.

The rotation R1 of the attachment element 39 can also be determined by the insertion of the second mobile unit 32 inside the treatment chamber 21 and under

the object-carrier container 22, already inserted into the treatment chamber 21.

The insertion mode of the object-carrier container 22 into the treatment chamber 21 in any case determines that, at the end of insertion, at least one bar 24 is engaged with the attachment element 39 held in the raised position by the corresponding elastic means 40.

At the moment of extraction, the attachment element 39, held in the raised position by the elastic means 40 and engaging in at least one bar 24, allows the extraction of the object-carrier container 22.

The extraction of the object-carrier container 22 is thus allowed, thanks to the concavity 59 with which the attachment element 39 is provided, facing toward the outside of the treatment chamber 21, hence toward the aperture 25 and in the direction of extraction of the object-carrier container 22.

At the end of this first step of extracting part of the object-carrier container 22, see fig. 11, in which, however, it would already be possible to remove the object-carrier container manually, a second extraction step is preferably performed.

The first mobile unit 43 is translated again toward the treatment chamber 21, while the object-carrier container 22 remains stationary in the partial extraction position, on this point compare fig. 11 and fig. 12.

In essence, the first mobile unit 43, to which the second mobile unit 32 is still connected by the pin 51, is translated under the base 23 of the object-carrier container 22 in the opposite direction to the extraction direction, hence toward the inside of the treatment chamber 21.

As explained above, the attachment elements 39 provided in the second mobile unit 32 are lowered against the action of the corresponding elastic means 40 each time they come into contact with one of the bars 24.

When the first mobile unit 43 and the second mobile unit 32 have traveled a suitable distance below the object-carrier container 22, one of the bars 24 of the container will again be engaged in an attachment element 39.

At this point, the first mobile unit 43 is again translated away from the treatment chamber 21 and the treatment machine 20 until it reaches the situation shown in fig. 13 in which the object-carrier container 22 has been completely extracted.

The object-carrier container 22 is thus positioned on the table 27, in particular

on the rolls 29 of the table 27.

Assuming that in the first extraction step, the first mobile unit 43, associated with the second mobile unit 32, has extracted a first half of the object-carrier container 22, in this further extraction step it is possible to provide that the first mobile unit 43, associated with the second mobile unit 32, has extracted the second half of the object-carrier container 22.

From the table 27 the object-carrier container 22 could be transferred to a further table or discharge slider 57, shown in figs. 14 to 17.

In the case of two object-carrier containers 22a and 22b located in sequence inside the treatment chamber 21, see figs. 14 to 17, the first mobile unit 43 is connected to the second mobile unit 32 as seen above and the second mobile unit 32 is engaged, by means of the attachment elements 39, with both the first object-carrier container 22a, and also with the second object-carrier container 22b.

The starting situation is thus similar to that shown in fig. 6 for a single object-carrier container 22.

The first mobile unit 43 is translated on the table 27 away from the treatment chamber 21 so that the first object-carrier container 22a completely comes out of the treatment chamber 21, see fig. 15.

The first object-carrier container 22a is also distanced from the aperture 25 of the treatment chamber 21 by sliding on the rolls of the table 27.

At this point the first mobile unit 43, again see fig. 15, is inserted again inside the treatment chamber 21 so that both the attachment elements 39 of the second mobile unit 32 engage with the second object-carrier container 22b, in particular with two bars of the second object-carrier container 22b.

Meanwhile, see fig. 16, the first object-carrier container 22a can be transferred to the support plane 58 of the discharge slider 57.

Once the table 27 has been freed of the first object-carrier container 22a, the second object-carrier container 22b can be translated onto it, by translating the first mobile unit 43 and the second mobile unit 32 toward the outside of the treatment chamber 21.

In the same way as seen for the first object-carrier container 22a, the second object-carrier container 22b is also translated onto the rolls of the table 27 so that it is distanced from the aperture 25 of the treatment chamber 21, see fig. 17.

In fig. 17 the first mobile unit 43 outside the treatment chamber 21 has also again pushed the second mobile unit 32 into the treatment chamber 21.

To separate the first mobile unit 43 from the second mobile unit 32 when the object-carrier container 22 or the object-carrier containers 22a and 22b have been extracted from the treatment machine 20, it is sufficient to drive the actuator 47 so that it rotates the shaft 46 and hence the pin 51 so as to disengage from the coupling element 35.

In this case, the actuator 47 will make the shaft 46 rotate in the opposite direction to the direction of rotation R as shown in fig. 7, so that the wings 53 of the pin 51 are again in correspondence with the slits 37 of the coupling element 35.

Advantageously, the first mobile unit 43, following the counter rotation of disengagement of the pin 51 from the coupling element 35, automatically performs a certain translation travel away from the aperture 25 of the treatment chamber 21.

The automatic distancing travel is effected thanks to the action of the elastic means 56 of the pins 55 which, once the pin 51 has disengaged from the junction element 35, can relax, causing the automatic distancing of the box-like body 45 and therefore of the first mobile unit 43 from the second mobile unit 32.

Thanks to the distancing of the first mobile unit 43 from the aperture 25, in essence, it is advantageously possible to proceed to closing the door 26, with the certainty that there are no elements interfering with the closure.

Advantageously, moreover, by means of a plurality of steps of extraction and approach or insertion of the first mobile unit 43, it is possible to efficiently reduce the space required to move the object-carrier container in the zone adjacent to the insertion and/or extraction aperture of the object-carrier container from the treatment machine.

The first mobile unit 43 can operate with the above advantages both in the case of moving a single object-carrier container 22 and also in the case of two object-carrier containers 22a and 22b located in sequence.

The solution with two or even more object-carrier containers 22a and 22b located in sequence in the treatment chamber 21 allows to further reduce the bulk and maneuvering space in front of the aperture 25 of the treatment chamber 21.

It is clear that modifications and/or additions of parts may be made to the treatment machine, in particular sterilization, as described heretofore, without departing from the field and scope of the present invention.

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 treatment machine, in particular sterilization, having the characteristics as set 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. Machine for treating, in particular sterilizing, objects, comprising at least a treatment chamber (21) and at least one object-carrier container (22, 22a, 22b) houseable in said treatment chamber (21) through at least one aperture (25) of the treatment chamber (21), said machine being **characterized in that** it comprises:

at least a first mobile unit (43) positioned outside the treatment chamber (21);

at least a second mobile unit (32) positionable inside the treatment chamber (21) and associable with said first mobile unit (43) outside the treatment chamber (21) by means of joint means (35, 51);

said second mobile unit (32) being provided with at least a sliding surface (38) near to the object-carrier container (22, 22a, 22b) and with at least one attachment element (39) selectively protruding from said sliding surface (38) and provided with elastic return means (40) suitable to keep it in a raised or lowered position with respect to the sliding surface (38) of said second mobile unit (32), said attachment element (39) also being provided with at least one concavity (59) facing toward the aperture (25) of the treatment chamber (21), so as to engage, in the raised position, with said object-carrier container (22, 22a, 22b), so as to extract it from the treatment chamber (21) by means of said first mobile unit (43).

2. Machine as in claim 1, **characterized in that** said at least one attachment element (39) is lowered, against the action of the elastic return means (40), inside the second mobile unit (32) in a step of moving said mobile unit (32) nearer said object-carrier container (22, 22a, 22b) and of inserting said second mobile unit (32) into said treatment chamber (21).

3. Machine as in claim 1 or 2, **characterized in that** said second mobile unit (32) inside the treatment chamber (21) is aligned with the first mobile unit (43) outside the treatment chamber (21).

4. Machine as in claim 1, 2 or 3, **characterized in that** said at least one attachment element (39) is an automatic snap-in attachment element to attach said object-carrier container (22, 22a, 22b) with said second mobile unit (32) inside the treatment chamber (21).

5. Machine as in claim 1, **characterized in that** said object-carrier container (22, 22a, 22b) comprises a base (23) provided with a series of bars (24), said at least one attachment element (39) being configured to engage with at least one of said

bars (24), each of said bars (24) defining a connection position of the object-carrier container (22, 22a, 22b) to the second mobile unit (32) inside the treatment chamber (21).

6. Machine as in any claim hereinbefore, **characterized in that** said first mobile unit (43) positioned outside the treatment chamber (21) comprises at least a pin (51) configured to be inserted in a first position into a coupling element (35) associable with the object-carrier container (22, 22a, 22b) and to be rotated, by means of a corresponding actuator (47), into at least a second position in which it interferes with said coupling element (35).

7. Machine as in any claim hereinbefore, **characterized in that** said machine comprises automatic distancing means (55, 56) to distance said mobile unit (43) outside the treatment chamber (21) from the second mobile unit (32) associable with the object-carrier container (22, 22a, 22b).

8. Machine as in claims 6 and 7, **characterized in that** said automatic distancing means (55, 56) comprise one or more pins (55) provided with elastic return means (56) configured to compress when the pin (51) interferes with said coupling element (35) and to relax when said pin (51) is free from said coupling element (35).

9. Machine as in any claim hereinbefore, **characterized in that** it comprises a support table (27) on which sliding guides (28) are made for said mobile unit (43) outside the treatment chamber (21).

10. Machine as in claim 9, **characterized in that** said machine comprises a discharge slider (57) positionable alongside said support table (27).

11. Machine as in claim 1, **characterized in that** at least two object-carrier containers (22a, 22b) located in sequence are positionable in said treatment chamber (21), said second mobile unit (32) being configured to engage with both said object-carrier containers (22a, 22b).

12. Movement apparatus for a machine for treating, in particular sterilizing, objects, said treatment machine comprising at least a treatment chamber (21) and at least one object-carrier container (22, 22a, 22b) houseable in said treatment chamber (21) through at least one aperture (25) of the treatment chamber (21), said movement apparatus being **characterized in that** it comprises:

at least one mobile unit (43) positionable outside the treatment chamber (21);

at least a second mobile unit (32) positionable inside the treatment chamber (21) and associable with said first mobile unit (43) outside the treatment chamber (21) by means of joint means (35, 51);

said second mobile unit (32) being provided with at least a sliding surface (38) able to be disposed near to the object-carrier container (22, 22a, 22b) and with at least one attachment element (39) selectively protruding from said sliding surface (38) and provided with elastic return means (40) suitable to keep it in a raised or lowered position with respect to the sliding surface (38) of said second mobile unit (32), said attachment element (39) also being provided with at least one concavity (59) able to face toward the aperture (25) of the treatment chamber (21), so as to engage, in the raised position, with said object-carrier container (22, 22a, 22b), so as to extract it from the treatment chamber (21) by means of said first mobile unit (43).

13. Method to move at least one object-carrier container (22, 22a, 22b) of a machine for treating, in particular sterilizing, objects, provided with a treatment chamber (21) configured to house said object-carrier container (22, 22a, 22b) and provided with an aperture (25) to extract the object-carrier container (22, 22a, 22b), **characterized in that** said method comprises:

at least a step of moving a first mobile unit (43), positioned outside the treatment chamber (21), toward the object-carrier container (22, 22a, 22b); at least a removable connection step of said first mobile unit (43), by means of corresponding joint means (35, 51), with a second mobile unit (32) positionable inside the treatment chamber (21), said second mobile unit (32) being connectable to said object-carrier container (22, 22a, 22b) by means of at least one attachment element (39) selectively protruding from a sliding surface (38) of said second mobile unit (32), near to the object-carrier container (22, 22a, 22b), said attachment element (39) being provided with elastic return means (40) suitable to keep it in a raised or lowered position with respect to the sliding surface (38) of said second mobile unit (32) and said attachment element (39) being provided with at least one concavity (59) facing toward the extraction aperture (25) of the object-carrier container (22, 22a, 22b) from the treatment chamber (21);

at least an extraction step of said object-carrier container (22, 22a, 22b) by

means of said first mobile unit (43), in which said attachment element (39) is in a raised position.

14. Method as in claim 13, **characterized in that** said step of extracting the object-carrier container (22) or the object-carrier containers (22a, 22b) is divided into a plurality of alternate sub-steps of extraction and approach, in which the first mobile unit (43) outside the treatment chamber (21) is engaged, by means of said joint means (35, 51), with said second mobile unit (32) positionable inside the treatment chamber (21), said second mobile unit (32) being able to engage, in each extraction sub-step, with at least a bar (24) of the object-carrier container (22) or object-carrier containers (22a, 22b), by means of the raising of said attachment element (39) and the loosening of said elastic return means (40), so as to allow a part of the object-carrier container (22) to be extracted, and being able to translate freely with respect to said object-carrier container (22) or object-carrier containers (22a, 22b) in each sub-step of approach and insertion in said treatment chamber (21), by means of lowering said attachment element (39) and compressing said elastic return means (40).

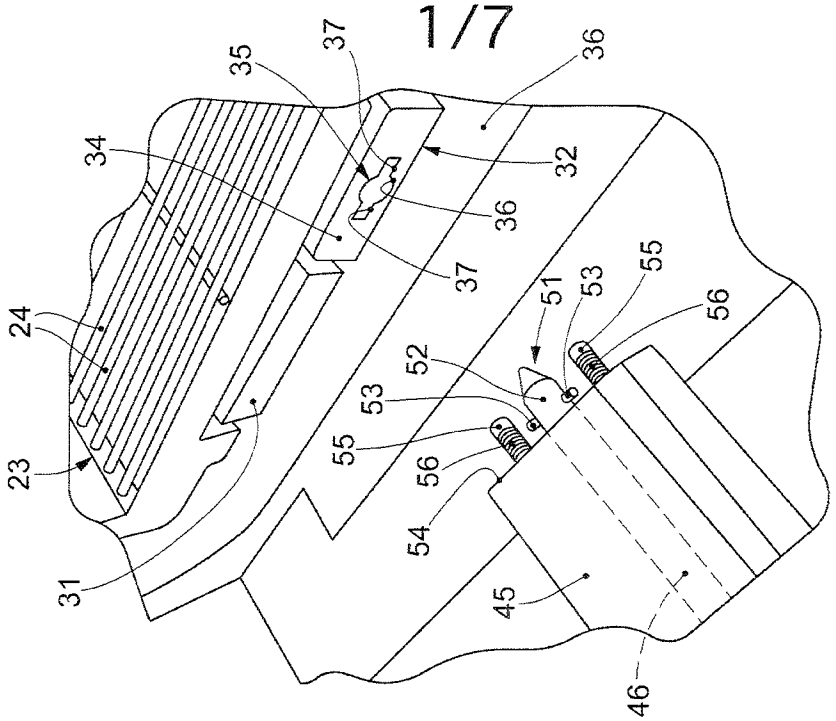
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fig. 2

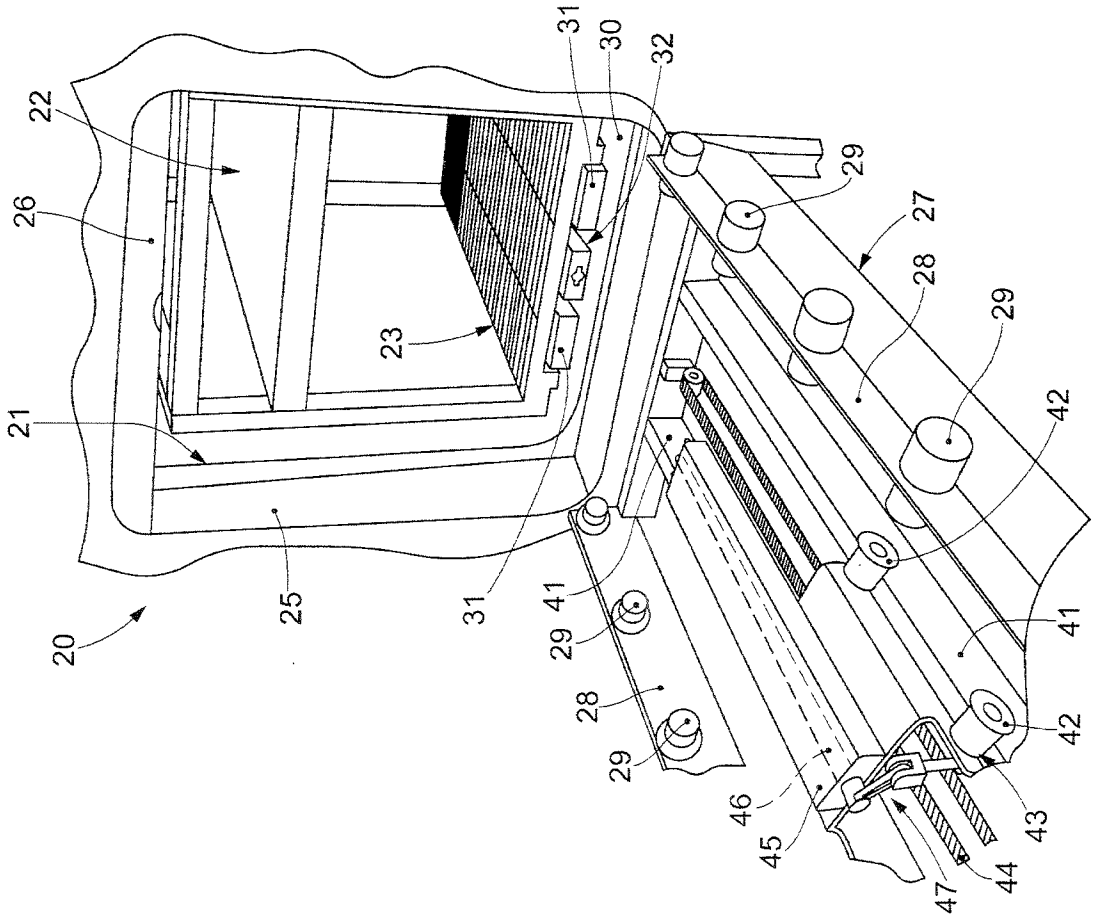
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fig. 1

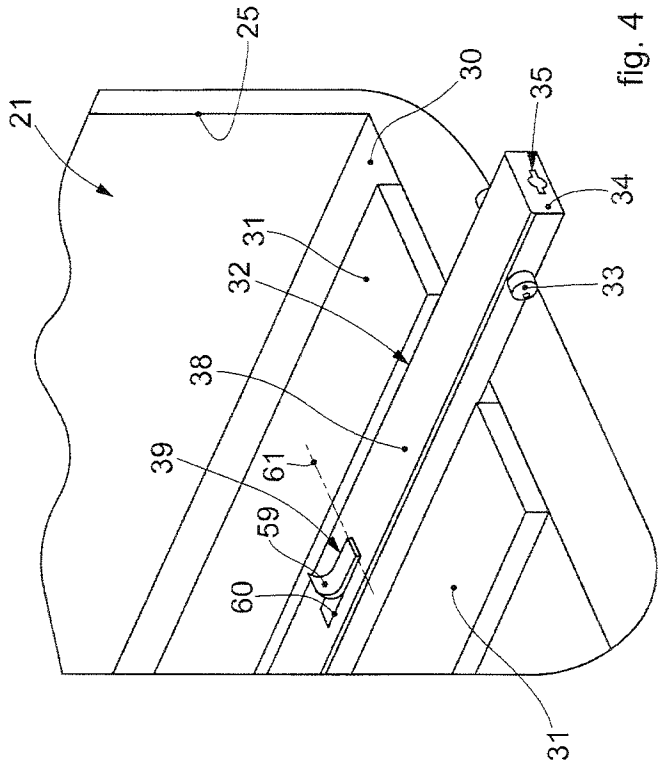

fig. 4

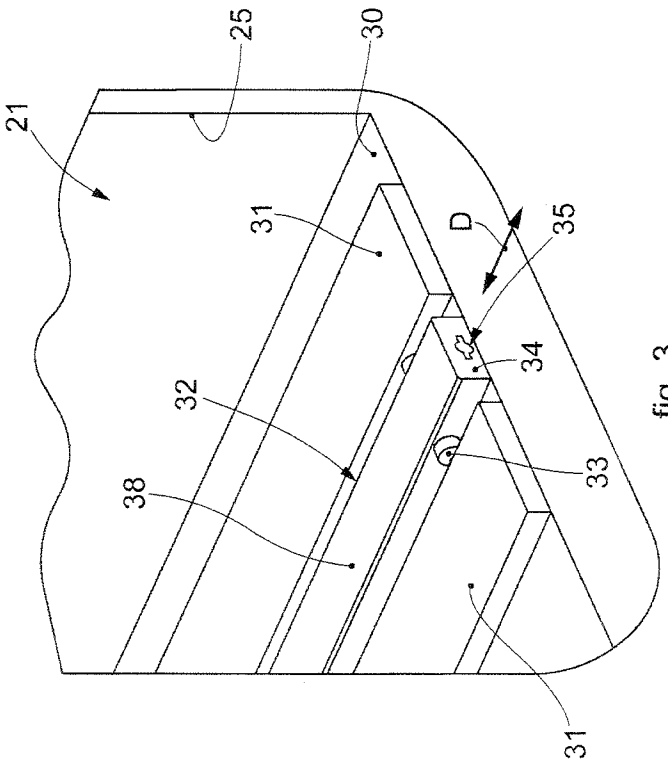

fig. 3

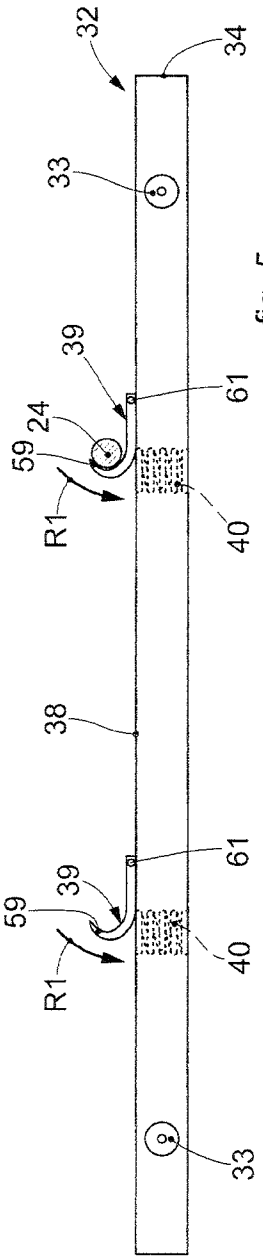

fig. 5

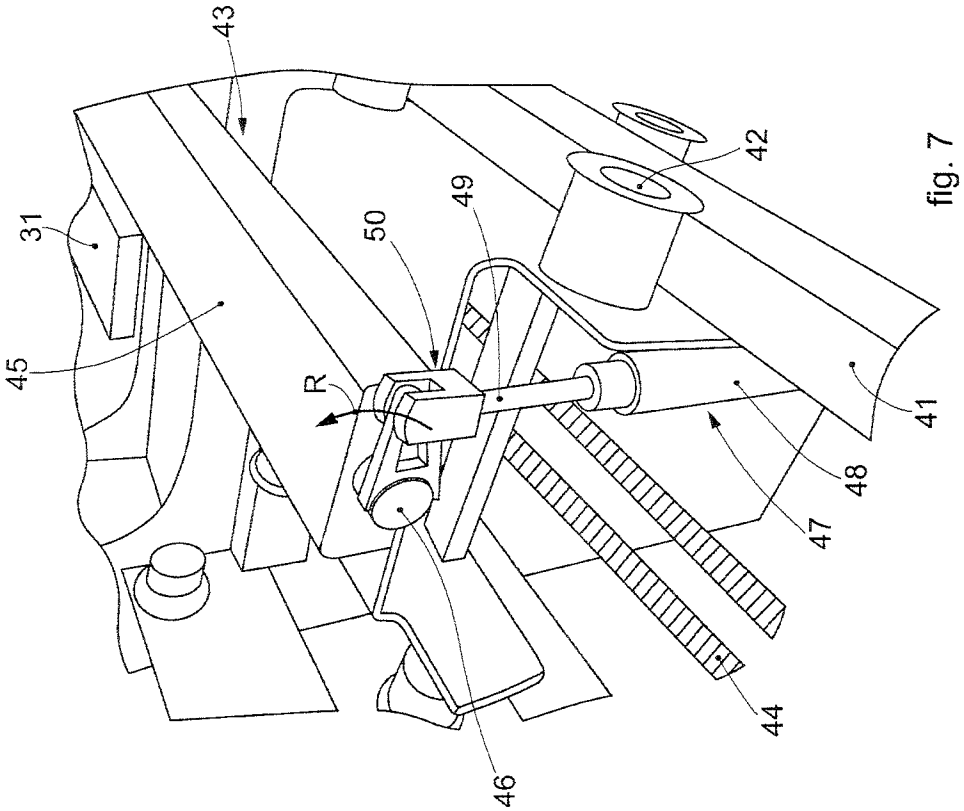
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fig. 7

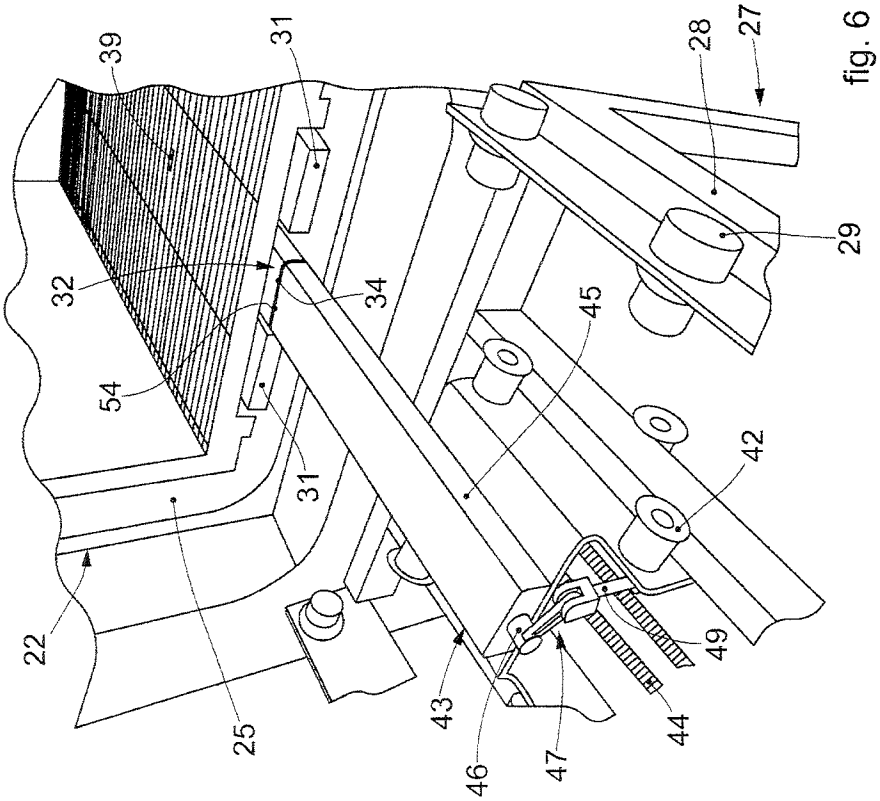
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fig. 6

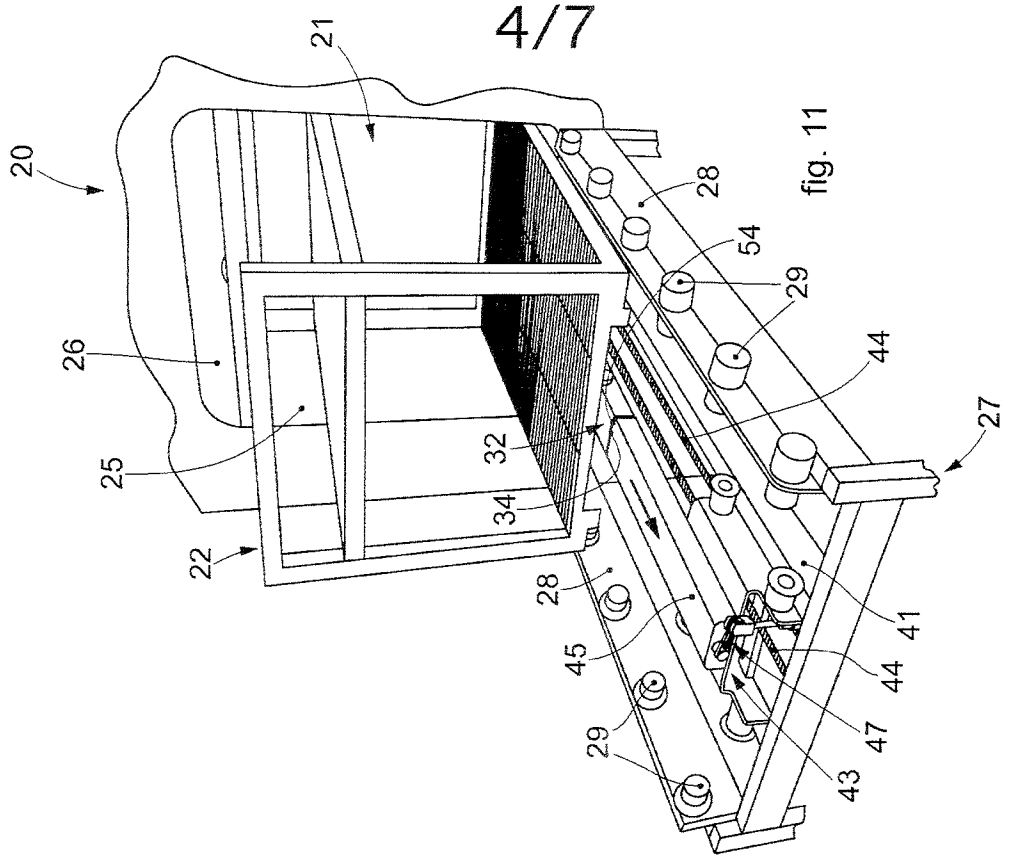

fig. 11

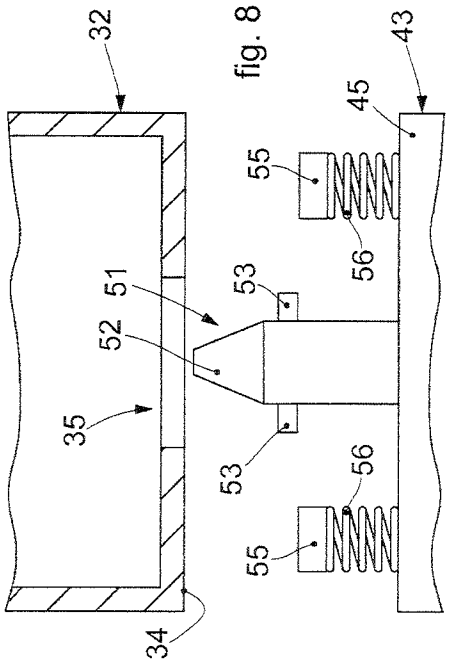

fig. 8

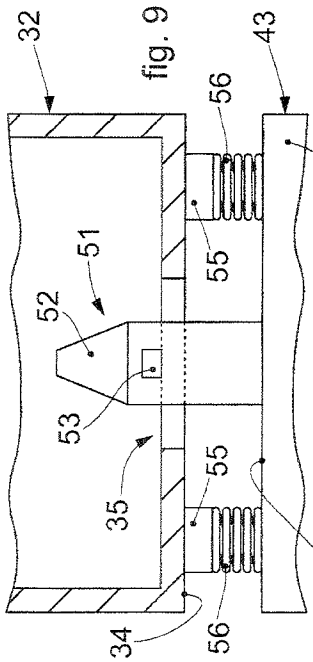

fig. 9

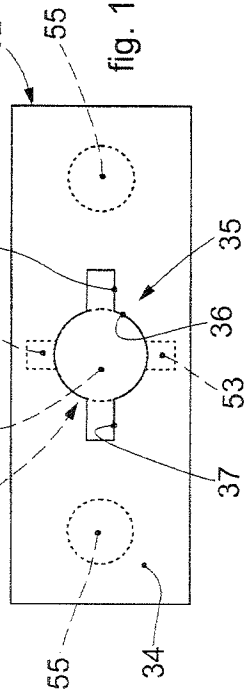

fig. 10

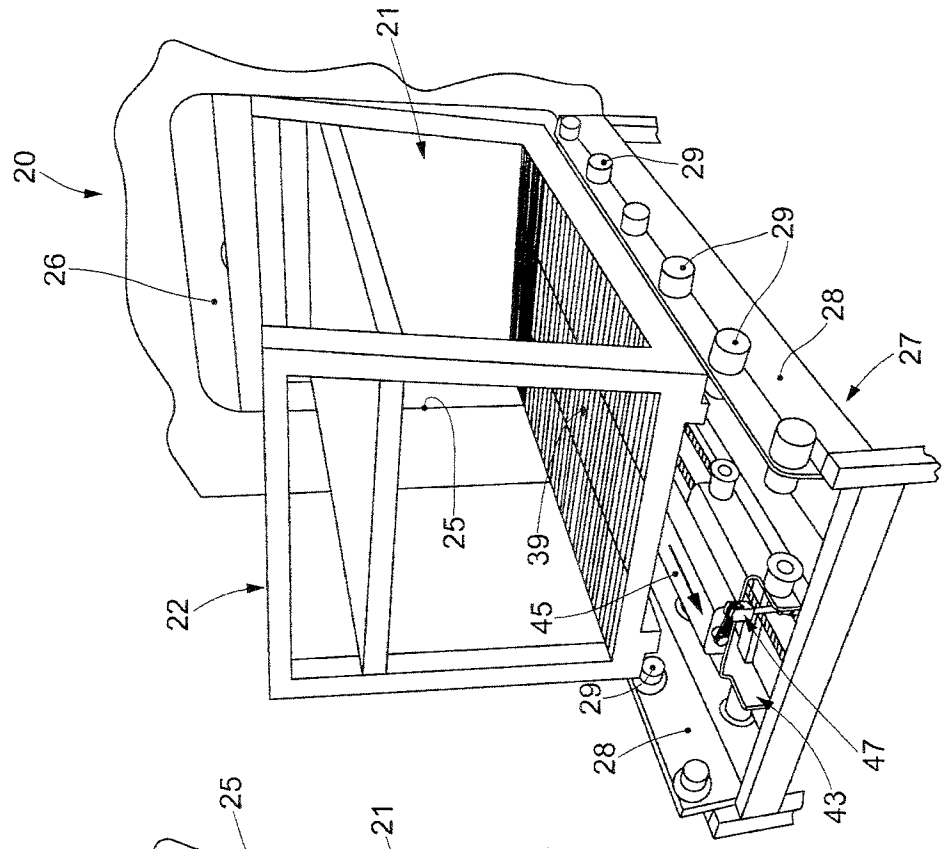
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fig. 13

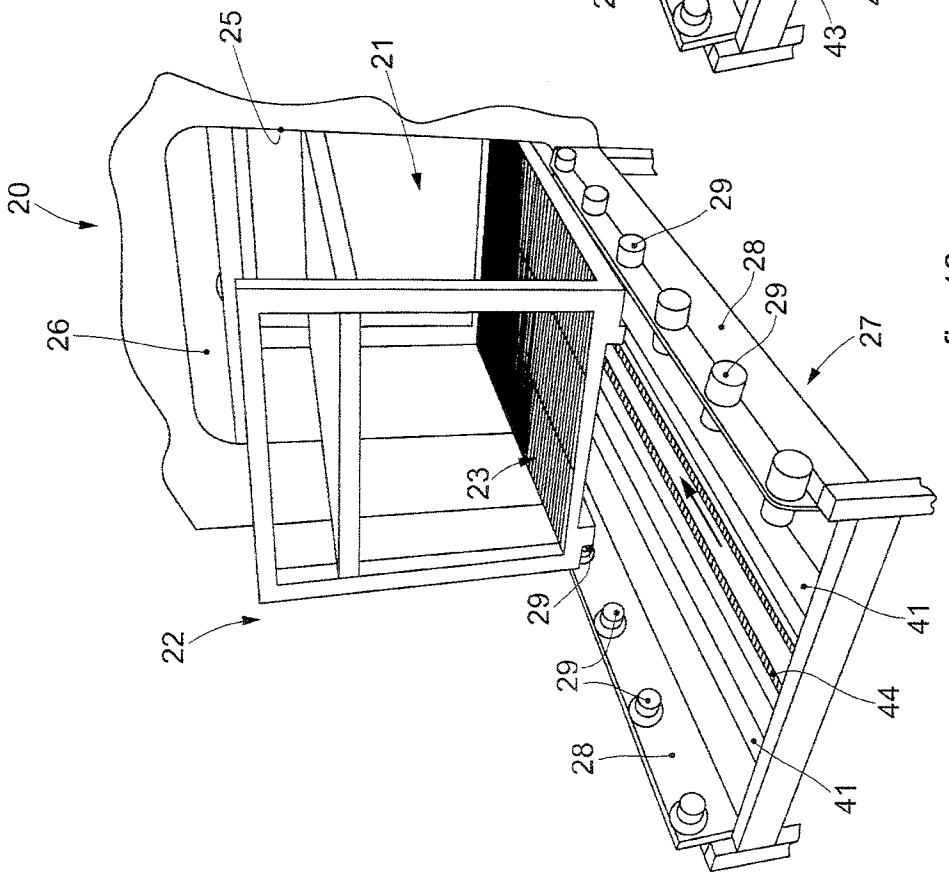
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fig. 12

fig. 14

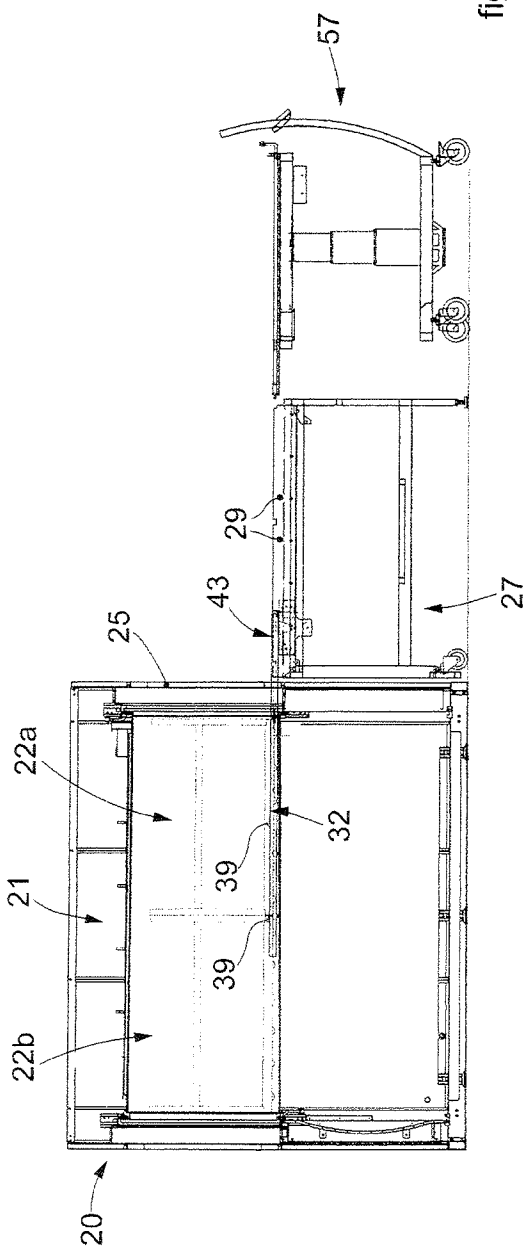
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fig. 15

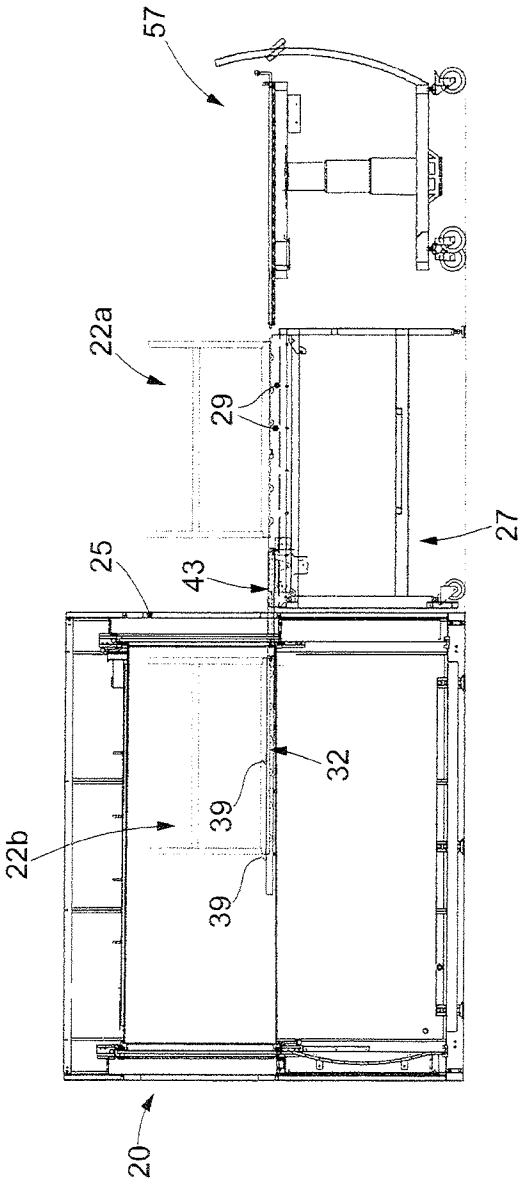
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fig. 16

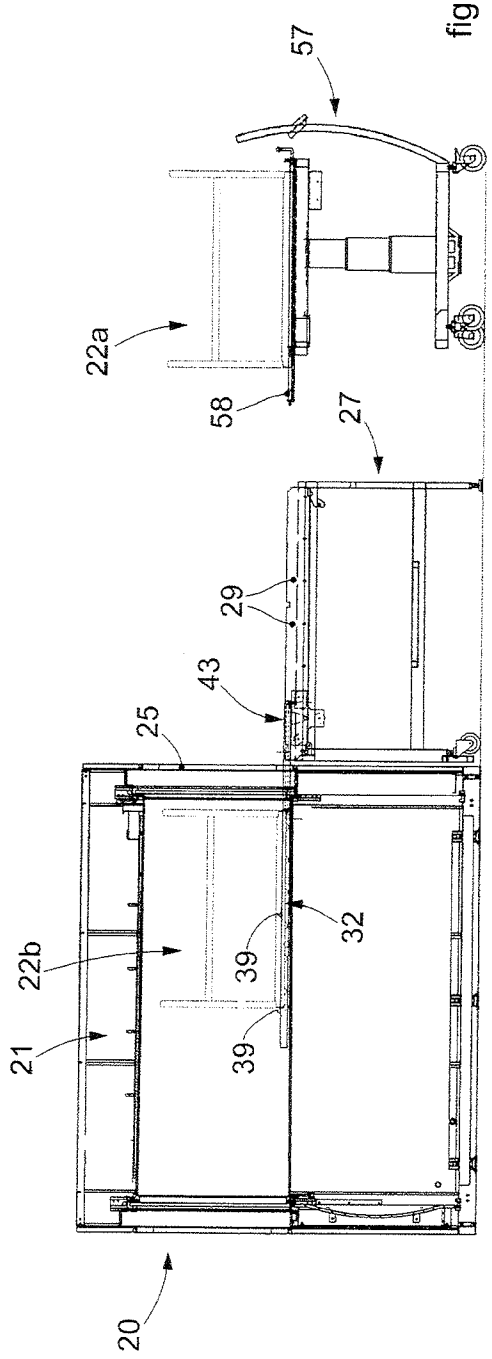
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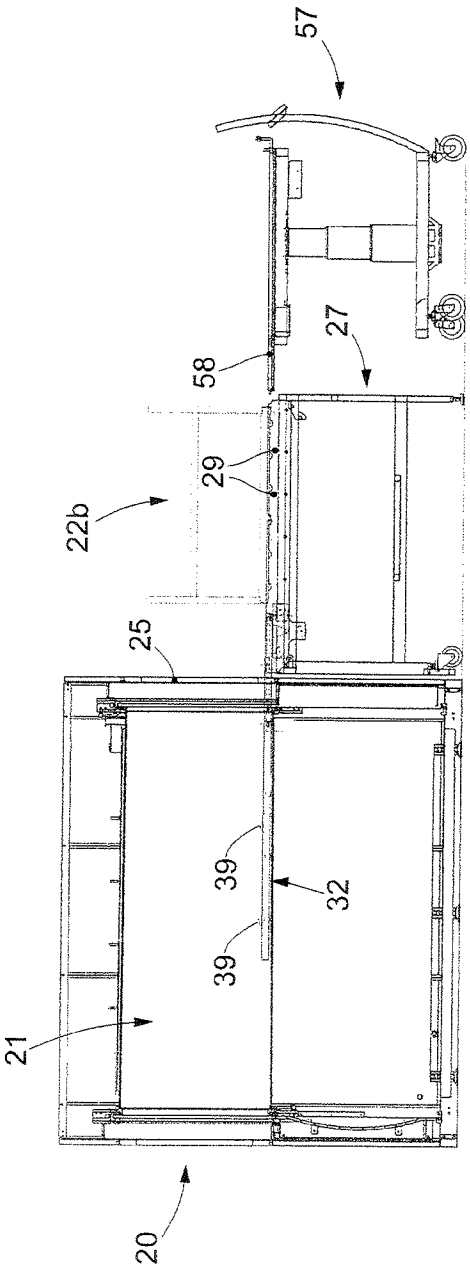
fig. 17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