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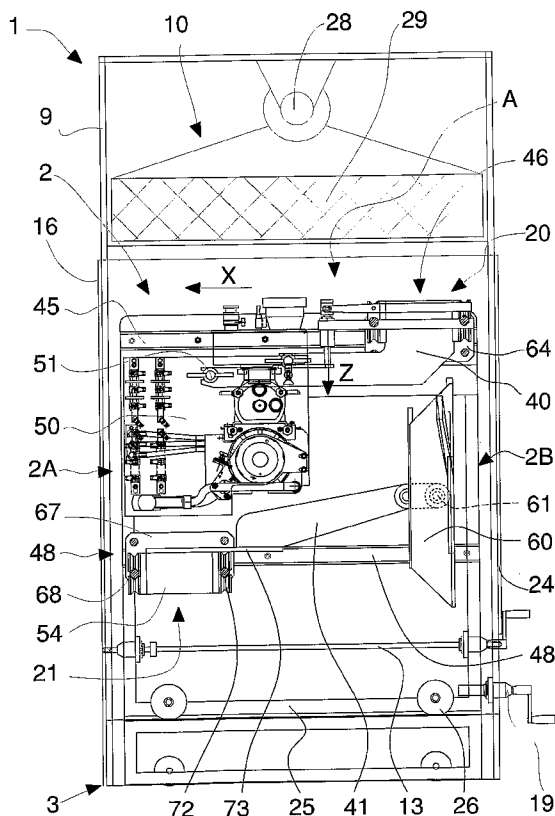
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(54) Title: APPARATUS FOR TRANSFERRING AND MOVING ELEMENTS OF A WORKING MACHINE



(57) Abstract: An apparatus (1) for transferring and moving elements (50, 60, 70) that are removably associable with an operating machine (4, 5) comprises moving means (20, 21, 22) suitable for receiving and supporting the aforesaid elements (50, 60, 70), the moving means (20, 21, 22) being movable for transferring to and/or removing from the said operating machine (4, 5) the elements (50, 60, 70); the operating machine comprises supporting means (30, 36, 82, 86) configured for receiving from and giving to the apparatus (1) said elements (50, 60), said supporting means (30, 36, 82, 86) in turn comprising hooking means (33, 34, 98, 99) suitable for abutting and locking abutting means (52, 62) of said elements (50, 60).

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Apparatus for transferring and moving elements of a working machine

The present invention relates to an apparatus for transferring and moving elements associable with an operating machine, in particular transferring and/or removing elements such as parts, components and operating units of an automatic packaging machine.

The invention further relates to an operating machine suitable for receiving and transferring elements that are associable therewith by means of the aforesaid transferring and moving apparatus.

In the pharmaceutical and biotechnological industries there is often a requirement for product packaging processes to use sterile materials and in sterile environments in order to prevent the products from suffering particle and bacteriological contamination, i.e. contamination due to the presence in the air of solid suspended particles such as ashes, powder, spores, microorganisms.

For this purpose, the production systems comprise packaging machines or lines inserted inside cleanrooms, which separate an internal processing environment, in fact a sterile processing environment, from a surrounding non-sterile external environment, or environment having a different class of sterility or contamination.

The degree of contamination of an environment is defined by the number of polluting particles present in a volume of air unit. Standard tables define contamination classes for each of which there is defined the maximum permissible number of polluting particles of the indicated dimension per cubic foot (US FED STD 209 Cleanroom standards) or per cubic metre of air (ISO 14644-1 Cleanroom standards).

The contamination class required in the process environment is obviously a function of the product to be packaged. For example, for pharmaceutical products to be administered parenterally or nasally, or ophthalmic products packaging in a class ISO 5 (ISO 14644-1) or class 100 (US FED STD 209)

environment is required.

The separation and insulation between the two environments in some applications also aims to prevent the dispersal into the outside environment of products that are potentially toxic and harmful to human health.

The asepsis and/or sterility of the processing environment is ensured by the cleanliness and sterility of each component and element contained inside the cleanroom, and by the presence of a suitable one-way flow of sterile air filtered by suitable high efficiency particulate air (HEPA) filters. The one-way air flow consists of jets of sterile air that move in the same direction almost parallel to one another, at substantially the same speed, in such a way as to create an homogeneous air current without turbulence. The air flow descending from top to bottom forms a front of sterile air that drags away any contaminating particles present and prevents them from rising again from the bottom of the chamber.

Inside the cleanroom there is provided the entrance for the operators assigned to perform a plurality of interventions on the packaging machines, such as, for example, adjustments, assembly and dismantling of parts, operating units, etc., interventions that in all cases must not connect the sterile processing environment with non-sterile zones of the machine such as spaces containing mechanisms and kinematic mechanisms.

The aim is, in fact, to perform operations and interventions on the machine without compromising the sterility of the sterile environment, in order to avoid procedures of restoring sterility that are laborious, long and very costly. For this purpose, in order to avoid the contamination of the sterile environment, and the parts and components with which they come into contact, the operators have to wear suitable protective overalls that cover all parts of their body.

In order to sterile appropriately any object to be introduced into the cleanroom, there is provided an autoclave, provided

with two hatches, which are respectively in communication with the non-sterile external environment and with the cleanroom, in such a way as to prevent a direct connection between the latter.

5 In this way the operator is able to introduce inside the cleanroom elements to be mounted onto the machine, usually standard parts and components and/or operating units and devices, for example product dosing units, to be replaced at the end of production.

10 These elements are transferred manually by one or more operators from the autoclave to the machine on which they are mounted.

Recently however, the need has arisen to limit the intervention by operators to prevent them interacting directly with parts intended to come into contact with the product to be packaged, such as, for example, dosing devices, components for introducing and supplying the product.

15 In fact, it has been observed that although operators are provided with protective gloves and overalls, they constitute a potential source of particle contamination. The close proximity and the contact of said operators with sterile objects may cause the latter to be contaminated.

This possible and potential contamination may be considered to be unacceptable in certain packaging processes.

25 Currently, after each operation and/or direct intervention by the operators on parts intended to come into contact with the product, it is necessary to proceed with the subsequent sterilisation of the latter, with a consequent increase in the cost and time required to set up the packaging machine for production.

30 At the end of production it is generally necessary to dismantle the components of the machine that have come into contact with the product or have a size that is not compatible with the next production batch. These elements
35 have to be transferred outside the clean room to be cleaned, washed and then sterilised, i.e. have to be made suitable for

subsequent use.

The transfer outside the cleanroom occurs through a communicating chamber provided, similarly to the autoclave, with a first door giving access to the cleanroom and with a
5 second door giving access to the non-sterile external environment. In this way the operators in the cleanroom transfer the elements dismantled from the machine to the chamber from which, after the first door has been closed hermetically, other operators remove them to subject them to
10 washing and sterilising operations.

These manual procedures nevertheless have the drawback of forcing the operators to touch and handle parts and components of the machine on which the packaged product is present in varying quantities. This direct, prolonged and
15 repeated contact with pharmaceuticals should be avoided as it exposes the operators to the possible absorption of unspecified quantities of product that may harm the health or cause health diseases of varying gravity. This is particularly true in the case of products in the form of fine
20 powders, which can be easily diffused in the air and thus be inhaled and/or absorbed by the operators.

In order to overcome this problem it is currently necessary to limit the operating time of each operator, i.e. the time during which the latter is in contact with parts and
25 components affected by the product. This is achieved through a frequent turnover of operators, which requires an appropriate number of operators to be made available and prepared for operations inside the cleanroom, with a consequent increase in system running costs.

30 Alternatively, it is necessary to provide the operators with particular equipment, such as completely airtight overalls and masks that are able to insulate the operators completely from the surrounding environment. In addition to being very costly, this equipment places significant limitations on
35 movements and performable manual operations.

An object of the present invention is to obtain an apparatus

that is able to transfer and move elements that are associable with an operating machine, such as parts, components and operating units, without requiring a direct manual intervention by operators on said elements.

5 Another object is to obtain an apparatus that enables elements from an operating machine to be assembled and/or dismantled automatically.

A further object is to obtain an apparatus that enables the elements to be transferred to be kept separately and
10 substantially insulated and to be moved from the surrounding environment in particular by operators operating or near said apparatus.

A still further object is to obtain an apparatus arranged for operating within a controlled environment atmosphere.

15 Still another object is to obtain an operating machine suitable for cooperating with said apparatus for receiving from and giving to the latter elements such as parts, components and operating units.

A further object is to obtain an operating machine that
20 enables operating elements such as operating units and devices to be assembled and dismantled completely.

In a first aspect of the invention there is provided an apparatus for transferring and moving elements that are removably associable with an operating machine characterised
25 in that it comprises moving means that is suitable for receiving and supporting said elements, said moving means being movable for transferring to and/or removing from said operating machine said elements.

Owing to this aspect of the invention it is possible to
30 obtain an apparatus that enables transferring and moving of elements such as parts, components and operating units that are associable with an operating machine, without requiring direct manual intervention by operators.

In particular, the apparatus enables a plurality of several
35 elements to be assembled automatically on the operating machine or to be dismantled therefrom without the operators

coming into direct contact with the elements.

The apparatus, being provided with containing means that encloses the moving means and the elements to be transferred and moved, further enables to keep said elements separate and
5 substantially insulated from the surrounding environment and in particular from the operators operating on or near said apparatus.

This is particular advantageous if the machine is a packaging machine placed inside a processing chamber for packaging
10 products in an aseptic and sterile atmosphere. In this case the operator has to be prevented from coming into direct contact with both sterile elements to be installed on the machine, and with elements soiled with product to be dismantled from the machine at the end of production.

15 In the first case the apparatus enables the elements to be maintained at the same level of sterility (contamination class) that they possess exiting from a sterilising autoclave.

In the second case the apparatus preserves the operators from
20 contact with the product and prevents possible absorption of unspecified quantities of said product, that may harm the health of or cause health diseases in operators.

The apparatus further enables the soiled elements to be
25 positioned on a washing operating machine to perform the cleaning and automatic washing thereof, without the need for manual intervention by operators.

In a second aspect of the invention there is provided an operating machine suitable for cooperating with the apparatus for transferring and moving according to the first aspect of
30 the invention, comprising supporting means suitable for receiving and supporting respective elements, characterised in that said supporting means is configured for receiving from and giving said elements to said apparatus, said supporting means comprising hooking means suitable for
35 abutting and locking abutting means of said elements.

Owing to this aspect of the invention it is possible to

obtain an operating machine that is able to receive from and give to said apparatus elements such as parts, components and operating units. In particular, said machine, as it comprises supporting means provided with hooking means, enables said elements to be assembled and connected rapidly and automatically to operating circuits of the machine, without manual intervention by operators. In particular, the operating machine may be a packaging machine and comprise means for connecting the elements to supply circuits and/or to kinematic mechanisms and to moving mechanisms of said machine.

The operating machine can also be a washing machine and comprise means for delivering cleaning and washing fluids inside said elements.

The invention can be better understood and implemented with reference to the attached drawings, which illustrate a preferred embodiment by way of non-limiting example, in which:

- Figure 1 is a schematic and fragmentary longitudinal section of an apparatus for transferring and moving elements according to the invention, in association with a first and a second element;

- Figure 2 is a fragmentary rear view of the apparatus in Figure 1, in which for the sake of clarity the first element has not been shown;

- Figure 3 is a schematic and fragmentary longitudinal section of the apparatus in Figure 1, in association with a first and a third element;

- Figure 4 is a fragmentary rear view of the apparatus in Figure 3;

- Figure 5 is a schematic and fragmentary side view of the apparatus in Figure 1 in association with a packaging operating machine, showing first moving means of the first element in an operating position;

- Figure 6 is a schematic and fragmentary side view of the apparatus in Figure 1 in association with a packaging

operating machine, showing second moving means of the second element in an operating position;

- Figure 7 is a schematic plan view of the apparatus in Figure 1 in association with a packaging operating machine, showing said apparatus in two hooking positions of hooking to said machine;

- Figure 8 is a fragmentary enlarged view of a detail in Figure 7, showing a first element associated with first supporting means of the operating machine;

- Figure 9 is a schematic plan view of the apparatus in Figure 1 in association with an operating washing machine, in which said apparatus is in two hooking positions hooked to said machine.

With reference to the attached Figures 1 to 9, 1 generally indicates an apparatus for transferring and moving elements 50, 60, 70 associable with an operating machine consisting, for example, in an automatic packaging machine 4 (Figures 5 and 7), operating within a controlled-atmosphere processing chamber, or in a washing machine 5 (figure 9), operating in a service room adjacent to and communicating with the aforesaid processing chamber.

The elements 50, 60, 70 consist of parts, components, operating units and devices of said packaging machine 4, which is for example a dosing/capping machine suitable for dosing a pharmaceutical product inside containers (not shown) and capping the latter.

As better illustrated in Figure 4 and in Figures 1 and 2, the apparatus 1 may contain and convey simultaneously a first element 50, consisting for example of a dosing unit consisting of two separate parts 50A, 50B that are substantially the same and specular with respect to a longitudinal plane of symmetry, and a second element 60, consisting for example of a vibrating supply device for caps for closing containers.

The apparatus 1 in addition to the operating unit 50, may further contain and convey elements 70 intended to supply the

product to be packaged in the packaging machine 4, for example a supply pipe 70 (Figures 3 and 4).

According to what has been shown in Figures 1, 2 and 3, the apparatus 1 comprises first carriage means 2 provided with
5 moving means 20, 21, 22 suitable for receiving and supporting the elements 50, 60, 70 and movable for transferring to the operating machine 4 and/or removing from said machine 4 said elements 50, 60, 70.

The moving means 20, 21, 22 comprises respective gripping
10 means 40, 41, 42 suitable for hooking or engaging respective supporting portions 51, 61, 71 of said elements 50, 60, 70.

The first carriage means 2 comprises a supporting frame 25 provided with supporting and moving wheels 26.

The supporting frame 25 comprises a plurality of elongated
15 elements, for example square tubular profiles, connected together to form a substantially parallelepipedon-shaped structure suitable for slidably supporting the moving means 20, 21, 22. The latter are in fact movable between respective internal positions, in which said moving means 20, 21, 22 is
20 entirely contained inside the apparatus 1, i.e. inside the first carriage means 2, and respective external positions in which they partially protrude outwards, for example for removing and/or transferring elements 50, 60, 70.

In order to enable the moving means to emerge partially, the
25 first carriage means 2 has two opposite sides, first front 2A and second rear 2B, which are opened and possibly closed by corresponding doors.

With particular reference to Figures 1 and 2, the apparatus 1 comprises first moving means 20 suitable for supporting and
30 moving the operating unit 50 and are fixed to an upper portion of the supporting frame 25.

The first moving means 20 comprises first carriage means 44 (Figures 2, 3, 4 and 5) that is slidable along a first longitudinal direction X on first guides 45 fixed to the
35 frame 25, on opposite sides of the latter. In particular, the first carriage means 44 comprises two first sliding blocks 64

connected by first cross bars 65 and provided with first wheels 66 arranged for engaging said first guides 45.

On the first cross bars 65 there is slidably mounted first slide means 46 comprising a pair of first carriages 47 provided with respective wheels 47a, that are slidable on said first cross bars 65, along a second transverse direction Y, substantially orthogonal to said first direction X.

To the first slide means 46 there is fixed first gripping means 40, consisting of a pair of L-shaped elongated arms 40a, 40b, each of which is connected to a respective first carriage 47 and is suitable for supporting a corresponding part 50A, 50B of the operating unit 50.

The free end of each elongated arm 40a, 40b has housings 40c suitable for receiving respective first supporting portions 51 of the operating unit 50. In particular, the arm has two open slots suitable for engaging respective supporting pins 51 of the operating unit 50.

If the element 50 is a single body, the first slide means 46 may comprise a single first carriage 47 supporting a corresponding elongated arm 40.

In an embodiment that is not shown of the apparatus 1, the first gripping means 40 is slidably connected to the second slide means 46 in such a way as to be able to slide according to a third direction Z that is substantially orthogonal to the first direction X and to the second direction Y.

The first moving means 20 is driven manually by one or more operators through mechanisms and controls, which are of known type and are not shown, that act on the first carriage means 44 and on the first slide means 46. These latter slide means 46 may comprise, for example, lead nuts or nut screws coupled with respective screws, rotated manually by handwheels or cranks. Instead of the latter, portable driving means can be used, for example electric screwdrivers.

According to what has been illustrated in Figures 1, 2 and 5, second moving means 21 is provided per supporting and moving the second element 60.

This second moving means 21 comprises second carriage means 48 slidable along the first direction X on second guides 49 fixed to the frame 25 on opposite sides of the latter, below the first moving means 20. In particular, the second carriage
5 means 48 comprises two second sliding blocks 67 connected by second cross bars 68 and provided with respective wheels 69 arranged for engaging said second guides 49.

On said second cross bars 68 there is slidably mounted second slide means 54 (Figure 2) that supports second gripping means
10 41, consisting of an articulated elongated arm, the free end of which is configured for hooking and supporting said second element 60.

According to what has been illustrated in Figures 1 and 2, the second slide means 54 substantially comprises a carriage,
15 provided with respective wheels 72, that slide on said second cross bars 68, along the second direction Y. To the carriage there is fixed a respective plate 73 to which the articulated arm 41 is connected.

This latter arm 41 (Figure 6) comprises a first elongated
20 portion 41a to the free end of which there is fixed a second portion 41b configured for engaging with a second supporting portion 61 of the second element 60. The second portion 41b can be rotated by respective driving members, for example manual control driving members.

25 The second moving means 21 is driven manually through mechanisms and controls, which are of known type and are not shown, that act on the second carriage means 48 and on the second slide means 54.

With reference to Figures 3 and 4, the apparatus 1 further
30 comprises third movement means 22 suitable for supporting and moving the supply pipe 70.

The third moving means 22 comprises third carriage means 55 slidable along the first direction X on third guides 56 fixed to the frame 25, on opposite sides of the latter, below the
35 second moving means 21. In particular, the third carriage means 55 comprises a pair of third sliding blocks 74 (figure

4) connected by third cross bars 75 and provided with respective wheels 76 arranged for engaging with said third guides 56.

5 On said third cross bars 75 there is slidably mounted third slide means 57 that supports third gripping means 42, comprising a pair of elongated supports 42a, 42b suitable for supporting the supply pipe 70.

10 The third slide means 57 substantially comprises a carriage, provided with respective wheels 77, that slide on said third cross bars 75, along the second direction Y.

The carriage 57 is provided with a respective plate 78 to which are fixed the two elongated supports 42a, 42b. Each of said supports has seats 42c suitable for housing third supporting portions 71 of the supply pipe 70, consisting, for
15 example, in two or more supporting pins.

Also the third movement means 22 is driven manually by means of respective mechanisms and controls, which are of known type and are not shown, that act on the third carriage means 55 and on the third slide means 57.

20 The manual drive or by means of portable driving means, and the absence of electric or pneumatic motors and actuators on the apparatus 1 is due to the fact that the latter has to be washable and above all sterilisable in an autoclave. Normal electric motors and actuators and the corresponding control
25 and management systems are in fact not able to withstand the high temperatures necessary for correct sterilisation.

For this purpose the first carriage means 2 are made of materials that are suitable to washing and sterilisation, for example stainless steel, silicone rubber, etc.

30 It is provided for that the elements 50, 60, 70 before being introduced into the sterile processing chamber, are sterilised together with the first carriage means 2 inside a suitable autoclave, provided with two hatches, respectively in communication with the non-sterile external environment
35 and with said chamber.

In an embodiment that is not shown of the apparatus 1, the

movement means 20, 21, 22, 23 can be driven by respective motors and/or actuators that are removably mounted on said first carriage means 2, in such a way as to be able to be dismantled during the washing and sterilising steps.
5 Alternatively, the motor and/or actuator means can be arranged for resisting washing agents and sterilising temperatures.

According to what has been illustrated in Figures 1 to 4, the apparatus 1 further comprises second carriage means 3
10 arranged for housing, supporting and moving the first carriage means 2 and then the elements 50, 60, 70 contained therein, for example within a sterile atmosphere processing chamber.

In particular, the second carriage means 3 has an upper
15 supporting plane 27 on which there are fixed rails 38 suitable for slidably receiving wheels 26 of frame means 25, for maintaining the first carriage means 2 separated and distant from the floor of the cleanroom.

In fact, although the atmosphere within the latter is
20 sterile, with a contamination class that is suitable for the type of process to be carried out, the floor of said chamber can be considered to be of a contamination class that is less or coarser as thereupon, or near it, by virtue of the one-way vertical air flow, the polluting solid particles remain
25 confined that are possibly present in the chamber.

The second carriage means 3 of the apparatus 1 thus prevents the frame means 25, exiting the autoclave, from coming into direct contact with the aforesaid floor, so as to compromise the sterility of the first carriage means 2 and, above all
30 of the elements 50, 60, 70 that it contains and conveys.

The supporting plane 27 of the second carriage means 3 is arranged at the same level or height as the bottom surface of the autoclave.

According to what has been shown in Figure 1, removing means
35 19, fixed to the second carriage means 3, is provided for hooking the first carriage means 2 and dragging it onto

and/or pushing it outside said second carriage means 3.

The removing means 19 comprises, for example, an extendible telescopic or pantograph arm that can be lengthened and shortened and is provided with a free end suitable for grasping a portion of the supporting frame 25. The removing means 19 can be driven manually by means of a crank 19a or a handwheel or by using an electric screwdriver.

The aforesaid second carriage means 3 is further provided with containing means 9 (Figures 1, 3 and 5) suitable for providing a cover structure for entirely enclosing the first carriage means 2. The containing means 9 is substantially box-shaped and comprises two closed side walls, for example by transparent panels, the remaining two opposite walls being provided with respective first 16 and second 24 hatches for the entering and the exiting of the first carriage means 2.

Conditioning means 10 is provided in the upper portion of the containing means 9 to generate a one-way air flow that is almost vertical and directed from top to bottom.

According to what has been illustrated in Figure 1, the conditioning means 10 comprises one or more fans or blowers 28 that is able to suck air from the processing chamber and direct it through filtering means 29, for example HEPA type absolute filters, to the first carriage means 2 and to the elements 50, 60, 70.

As shown in particular in Figure 5 and in Figure 7 respectively, the transferring apparatus 1 can be moved manually by an operator who pushes it from a side 1B that is behind and opposite a front side 1A through which the first carriage means 2 enters inside the second carriage means 3 and coinciding with the side of the containing means 9 in which there is positioned the first access hatch 16.

In order to facilitate the movement of the second carriage means 3 there can be provided the use of a possibly motor-driven transpallet 39 (figure 5) that is able to lift and move the entire apparatus 1.

In an embodiment that is not shown, it is also provided that

the second carriage means 3 is provided with driving means and with controlling means configured for moving said second carriage means 3 independently and automatically, without the assistance of operators, according to set trajectories and paths. The second carriage means 3 may comprise, for example, an AGV (Automated Guided Vehicle) unit of known type that is movable along magnetic tracks obtained in the floor of the processing chamber or guided by radio or GPS navigation systems.

10 The apparatus 1 is further provided with connecting means 13 arranged for locking said apparatus 1 to the packaging machine 4 in different hooking positions G1, G2, to enable elements 50, 60, 70 (Figures 5-7) to be transferred and/or removed.

15 In particular, the connecting means 13 is configured for engaging with attaching means 84, 85 provided in a lower front version of said machine 3.

According to what has been illustrated in Figures 1 and 6, the connecting means 13 comprises, for example, a pair of threaded pins 13a that are rotatably connected to the supporting frame 25, respectively at the first front side 2A and at the second rear side 2B of the first carriage means 2, said pins being connected together by a rod 13b.

Each of the two threaded pins 13a is arranged for being inserted and screwed into respective threaded seats of the attaching means 84, 85 of the machine 4 or for being removably coupled with a driving crank or handwheel 13c, for rotating the rod 13b. In this way, the connecting means 13 enables the first carriage means 2, i.e. the apparatus 1, to be fixed to the packaging machine 4 on both the front 2A and rear 2B sides of said first carriage means 2.

The connecting means 13, i.e. the pins 13a can be rotated manually by the operator using the cranks 13c or by portable driving means, for example electric screwdrivers coupled with the threaded pins that are not engaged in the attaching means.

In an embodiment that is not shown of the apparatus 1, the connecting means 13 is fixed to the second carriage means 3 to lock these latter on the machine 3. In this case, the removing means 19 keeps the first carriage means 2 fixed to the second carriage means 8.

The packaging machine 4 comprises supporting means that enables the elements conveyed by the transferring apparatus 1 to be mounted and/or dismantled.

In particular, as better illustrated in Figures 5 to 8, the machine comprises, for example, first supporting means 30 and second supporting means 36 suitable for receiving and supporting respectively the first element 50 and the second element 60.

The first supporting means 30 comprises a first supporting element 31 fixed to a horizontal plane 18 of the machine 4 and provided with first hooking means 33 (figure 8) suitable for abutting and locking abutting means 52 provided in the operating unit 50.

The hooking means 33 are, for example, shaped seats arranged for receiving abutting means 52 in the form of respective locking pins.

The first supporting means 30 further comprises connecting means 32, configured for engaging respective connectors 53 of the operating unit 50 and thus connecting the latter to a pneumatic circuit and/or product supply circuit of the packaging machine 4.

Mechanical coupling means 35 is provided on the first supporting element 31, to kinetically connect mechanical devices of the operating unit 50 to a motor of the packaging machine 4.

The second supporting means 36 comprises a second supporting element 37 which is also fixed to the horizontal plane 18 of the machine 4 and is provided with second hooking means 34 that is suitable for abutting and locking second abutting means 62 provided in the vibrating supply device 60.

The packaging machine 4 further comprises centring means 11,

12 that enables the apparatus 1 to be arranged with precision in one or more hooking positions.

The hooking positions are for example two (Figure 7) and correspond to respective specific operating zones of the machine 3. A first hooking position G1 corresponds to a first operating zone 71, in which the first element 50 has to be assembled; a second hooking position G2 corresponds to a second operating zone 72, in which the second element 60 has to be mounted.

10 According to what has been shown in Figure 7, the centring means may comprise, for example, one or more pairs of prongs or elongated elements, typically a first pairs of prongs 11 and a second pair of prongs 12, each of which is fixed orthogonally to a front portion of the machine 3, at the respective operating zone 71, 72..

15 The prongs of each pair 11, 12 are spaced apart from one another and divergent to the exterior of the machine 4 in such a way as to abut, for example, lower side walls of the second carriage means 3 for guiding and progressively centring the apparatus 1, which is pushed to the machine 4, to a defined respective hooking position G1, G2.

20 At the centring means 11, 12 there is positioned the aforesaid attaching means 84, 85. In particular, first attaching means 84 is associated with the first pair of prongs 11 and second attaching means 85 associated with the second pair of prongs 12.

25 As shown in Figure 9, it is provided for that the transferring apparatus 1 can interact with an operating washing machine 5, arranged for washing internally and/or externally elements of the packaging machine 4 that have come into contact with the product.

30 The washing machine 5 may, for example, be positioned inside the service room adjacent to and communicating with the processing chamber.

35 Similarly to what occurs with the packaging machine 4, the transferring apparatus 1 can be located with respect to the

washing machine 5 in different hooking positions. For this purpose, the washing machine 5 comprises respective centring means 91, 92 that is substantially identical to the centring means 11, 12 of the packaging machine 4.

5 In each hooking position, the apparatus 1 is removably locked on the washing machine 5 owing to the connecting means 13 arranged for engaging with respective attaching means 94, 95 provided on a front portion of said washing machine 5, at the centring means 91, 92.

10 The attaching means 94, 95 of the washing machine 5 is identical to the attaching means 84, 85 of the packaging machine 4.

The hooking positions of the transferring apparatus 1 to the washing machine 5 may, for example, be two: a third
15 connecting position G3 for transferring the first element 50 to the washing machine 5, and a fourth connecting position G4 for transferring the second element 60.

The washing machine 5 includes a protecting cover 90, which is provided with one or more doors and defines an internal
20 washing space 14.

The washing machine 5 comprises further respective supporting means 82, 86 that is substantially similar to the supporting means 30, 36 of the packaging machine 4 and is configured for enabling elements to be mounted and dismantled.

25 The further supporting means 82, 86 comprises respective supporting elements 83, 87 fixed to a plane of the washing machine 5 and provided with respective hooking means 98, 99 suitable for hooking and supporting the elements 50, 60.

The further supporting means 82, 86 may comprise fixtures and
30 connections suitable for conveying washing fluids inside the elements 50, 60.

Still with particular reference to Figure 9, the washing machine 5 is arranged, for example, for receiving and operating on the first element 50, and which can be fixed to
35 third supporting means 82, and to the second element 60, which on the other hand can be fixed to fourth supporting

means 86.

The first element 50 is the dosing unit that is fixed to the third supporting means 82 in such a way that respective further connecting means 63 of the washing machine 5 is
5 connected to the respective connectors 53 of the operating unit 50, to deliver to conduits, pipes and internal passages of the latter suitable washing fluids.

The washing machine 5 is further provided with dispensing means 96, arranged in the internal space 14 for washing the
10 external surfaces of the elements 50, 60.

The dispensing means 96 comprises, for example, a plurality of sprayers or nozzles 97 that are suitably distributed spaced apart from one another in the internal space 14.

The operation of the transferring apparatus 1 provides a
15 sequence of operating steps for transferring and/or mounting elements 50, 60, 70 on the packaging machine 4, and a sequence of operating steps for, on the other hand, removing and/or dismantling said elements from the packaging machine, for example at the end of production.

20 Substantially identical operating steps are applied during transferring and removal of the elements on the washing machine 5.

In the transferring procedure, the elements 50, 60, 70 have to be mounted and assembled on the packaging machine 4,
25 placed inside a sterile atmosphere processing chamber.

The elements 50, 60, 70, which have been previously washed and positioned on the first carriage means 2 of the apparatus 1, for example in the service room, are sterilised together with the aforesaid first carriage means 2 inside a suitable
30 autoclave.

At the end of the sterilising step, an operator opens the internal hatch of the autoclave communicating with the processing chamber, and positions the second carriage means 3, with the first access hatch 16 open for receiving the
35 first carriage means 2. The operator acts on the removing means 19 that hooks and drags the first carriage means 2

inside the second carriage means 3.

The conditioning means 10 of the second carriage means 3 is operational for directing a vertical one-way air flow downwards onto the elements and to maintain the atmosphere inside the containing means 9 of the apparatus 1 in slight pressure with respect to the processing chamber, in order to prevent the entry of possible contaminating particles.

When one of the movable hatches 16, 24 of the containing means 9 is open, the operator acts on the second carriage means 3, for example to drive the removing means 19, always being arranged on the side opposite said open hatch, in such a way that possible polluting particles released thereby do not penetrate inside the containing means.

Before making the apparatus 1 approach the packaging machine 4, the operator, positioned on the rear side 1B of the apparatus, opens the first access hatch 16 of the containing means 9, the doors of a cover structure 17 (figure 7) of the machine 4 having been previously opened.

If the operating unit 50 has to be mounted on the packaging machine 4 the operator makes the apparatus 1 approach in such a way that the first centring means 11 precisely positions said apparatus 1 at the first operating zone 71 of the packaging machine 4, the first carriage means 2 abutting the latter with the first front side 2A.

After positioning has been carried out, the operator can drive the connecting means 13 in such a way as to lock the apparatus 1 in the first hooking position G1.

It is then possible to drive the first moving means 20 to position the operating unit 50 on the first supporting means 30.

In particular, starting from a first operating position A (figure 1), in which the first moving means 20 is arranged completely inside the apparatus 1, the first carriage means 44 is moved along the first longitudinal direction X in a second operating position B (figure 5), in which the first gripping means 40 positions the two parts 50A, 50B of the

operating unit 50 at the sides of the first supporting element 31 of the first supporting means 30 of the packaging machine 4.

Subsequent driving of the first slide means 46 in a third operating position C (Figures 5 and 8), enables the two parts 50A, 50B to be hooked to the first supporting element 31.

In particular, the two first carriages 47 of the first slide means 46 are driven, simultaneously or in sequence, along the second transverse direction Y, to permit translation of the respective elongated arms 40a, 40b that support the two parts 50A, 50B of the operating unit 50. In this way, the locking pins 52 of the two parts 50A, 50B are inserted into the respective shaped seats 33 of the first supporting element 31, the connecting means 32 of the first supporting means 30 is connected to the respective connectors 53 of the operating unit 50, and the coupling means 35 of the first supporting element 31 is connected to the mechanical devices of the operating unit 50.

Manually or automatically drivable arresting means removably locks the operating unit 50 on the first supporting means 30. This arresting means, which is of known type and is not shown, comprises for example one or more threaded fixing knobs.

The operating unit 50 is then mounted on the packaging machine 4 and is ready for operation.

The first moving means 20 of the apparatus 1 is then disengaged from the operating unit 50 and returned to the first operating position A. The transferring apparatus 1 can be released from the packaging machine 4 thus disengaging the connecting means 13 from the first attaching means 84.

At this point the apparatus 1 can be removed from the packaging machine 4.

If the operating unit 50 has to be dismantled and removed from the packaging machine 4 the operating steps disclosed for mounting are repeated in reverse order. In this case, the first moving means 20 hooks and then removes the operating

unit 50 from the first supporting means 30.

For the mounting of the second element 60 - the vibrating supply device for caps - the apparatus 1 is moved to the second operating zone 72 of the packaging machine 4. Owing to
5 the structure of the second moving means 21, the apparatus 1 is made to approach the packaging machine 4 in such a way that it is the second rear side 2B of the carriage means 2 that abuts on said machine. For this purpose, the operator is positioned on the front side 1A of the apparatus 1, and it is
10 the second access hatch 24 of the containing means 9 that is opened.

The operator makes the apparatus 1 approach in such a way that the second centring means 12 precisely places said apparatus 1 at the second operating zone 72 of the packaging
15 machine 4.

After positioning, the operator can drive the connecting means 13 that engages the second attaching means 85 in such a way as to lock in the second hooking position G2 the apparatus 1 (Figure 6).

20 It is then possible to drive the second moving means 21 to place the second element 60 on the second supporting means 36 of the packaging machine 4. In particular, from a respective first operating position D (figure 6), in which the second moving means 21 and the second element 60 are arranged
25 completely inside the apparatus 1, the second carriage means 48 is moved along the first longitudinal direction X to a respective second operating position E (Figure 6), in which the second gripping means 41 protruding from the apparatus 1 is driven to rotate and to position said second element 60 on
30 the second supporting element 37 of the second supporting means 36. The second portion 41b, fixed on the first portion 41a of the second gripping means 41, is rotated by approximately 90° clockwise and possibly translated vertically, to arrange the second element 60 in such a way
35 that the second abutting means 62 of the latter engages the hooking means 34 of the second supporting means 36.

At this point the gripping means 41 is disengaged from the second supporting portion 61 of the second element 60, and the second moving means 21 is returned to the respective first operating position D.

5 The transferring apparatus 1 can then be released from the packaging machine 4 disengaging the connecting means 13 from the second attaching means 85 and distanced from the packaging machine 4.

10 If the second element 60 has to be dismantled and removed from the packaging machine 4 the operating steps disclosed for mounting are repeated in reverse order.

For transferring the third element 70 - the supply pipe - the apparatus 1 is moved, for example, to the first operating zone 71 of the packaging machine 4 and made to approach the first centring means 11, the first carriage means 2 abutting
15 on the packaging machine 4 with the first front side 2A.

After positioning, the operator can drive the connecting means 13 that engages with the first attaching means 84 in such a way as to lock the apparatus 1 in the first hooking
20 position G1.

It is then possible to drive the third moving means 22 to transfer the supply pipe 70 inside the packaging machine 4.

In particular, from a respective first operating position F, in which the second moving means 22 is arranged completely
25 inside the transferring apparatus 1, the third carriage means 55 is moved along the first longitudinal direction X inside the packaging machine 4. Subsequent driving of the third slide means 57 enables the supply pipe 70 to be positioned at removing means of the packaging machine, which are of known
30 type and are not shown, which removes from the third gripping means 42 of the third slide means 57 the supply pipe 70 and in case fix it to the packaging machine 4 in the required position.

When the third gripping means 42 is disengaged from the third
35 supporting portion 71 of the supply pipe 70, the third moving means 22 is returned to the respective first operating

position F (Figure 3).

The transferring apparatus 1 can then be released from the packaging machine 4, disengaging the connecting means 13 from the first attaching means 84 and distanced from the packaging machine 4.

If the supply pipe 70 has to be removed from the packaging machine 4 the operating steps disclosed for transferring are repeated in reverse order.

The same sequence of steps that is necessary for mounting and dismantling the first element 50 and the second element onto or from the packaging machine 4 can be repeated for the washing machine 5.

If the apparatus 1 comprises the second carriage means 3, the corresponding containing means 9 prevents contact of the operator with the conveyed elements 50, 60, 70 that are contaminated with product.

If the apparatus 1 is used without the second carriage means 3, it is advisable for the operator to interact with the apparatus 1, placing himself on the opposite side or behind the movement direction to prevent himself from coming into contact with residual product that is possibly present on the elements 50, 60, 70.

Now with reference to Figure 9, the apparatus 1, devoid of the second carriage means 3, is abutted on the washing machine 5 removably locked in relation thereto in one of the two connecting positions G3, G4.

In the third hooking position G3, the first moving means 20 transfers and mounts the operating unit 50 on the third supporting means 82 of the washing machine 5, in such a way that the first abutting means 52 of the operating unit 50 engages respective hooking means 98 of the third supporting means 82. In addition thereto, mounting enables further connecting means 63 of the washing machine 5 to be connected to respective connectors 53 of the operating unit 50, to deliver suitable washing fluids to conduits, pipes and internal passages of the latter.

In the fourth hooking position G4 the second moving means 21 transfers and mounts the second element 60 on the fourth supporting means 86, in such a way that the second abutting means 62 of said second element 60 engages with respective
5 hooking means 99 of the fourth supporting means 86.

As the second element 60 is not provided with conduits and internal passages, the presence on the fourth supporting means 86 of specific connections and fixtures for dispensing washing fluids is not requested.

10 The washing machine 5 can be configured in function of the elements to be washed and thus comprise further supporting means suitably arranged for receiving and supporting respective elements, provided or not with connections and fixtures for internal washing.

15 At the end of the elements 50, 60 washing procedure, it is possible to remove said elements using the transferring apparatus 1, repeating in reverse order the operating steps disclosed for mounting. In this case, the moving means 21, 22 will hook and then remove the elements 50, 60 from the
20 supporting means 82, 86.

It should be noted that the apparatus that is the object of the present invention enables elements of an operating machine to be transferred and moved, without the direct manual intervention on said elements by operators being
25 required.

This is particularly important both in the mounting step to prevent possible particular contamination of the washed and sterilised elements, and during the dismantling step to prevent the operator from coming into contact with the
30 packaged product.

In the various operating steps disclosed above the apparatus 1 is moved and the various operating means, i.e. the moving means 20, 21, 22, of the removing means 19, and of the connecting means 13 are driven manually by one or more
35 operators.

There can also be provided motors and driving means and

corresponding management and control means, that are of known type and are not shown, that are arranged for moving the transferring apparatus and driving the various operating means independently and automatically, without the direct
5 intervention of operators.

If the operating machine is a packaging machine 4 arranged for operating within a sterile atmosphere processing chamber, for example for packaging drugs, the aforesaid embodiment of the apparatus 1 enables all the aforesaid operating
10 procedures to be performed automatically without the presence of operators inside said chamber being required.

CLAIMS

1. Apparatus (1) for transferring and moving elements (50, 60, 70) that are removably associable with an operating machine (4, 5) characterised in that it comprises moving
5 means (20, 21, 22) that are suitable for receiving and supporting said elements (50, 60, 70), said moving means (20, 21, 22) being movable for transferring to and/or removing from said operating machine (4, 5) said elements (50, 60, 70).
- 10 2. Apparatus according to claim 1, wherein said moving means (20, 21, 22) comprises respective gripping means (40, 41, 42) arranged for abutting supporting portions (51, 61, 71) of said elements (50, 60, 70).
3. Apparatus according to claim 1 or 2, wherein said moving
15 means (20, 21, 22) is movable between respective first operating positions (A, D, F), wherein it is arranged inside said apparatus (1) and respective second operating positions (B, C, E) wherein it partially protrudes from said apparatus (1) for removing and/or transferring elements (50, 60, 70).
- 20 4. Apparatus according to any preceding claim, wherein said moving means (20, 21, 22) is drivable manually.
5. Apparatus according to any one of claims 1 to 4, comprising actuating means for driving said moving means (20, 21, 22).
- 25 6. Apparatus according to any preceding claim, comprising first carriage means (2) provided with a supporting frame (25) provided with wheels (26) and suitable for slidably supporting said moving means (20, 21, 22).
7. Apparatus according to claim 6, comprising second
30 carriage means (3) suitable for receiving and supporting said first carriage means (2).
8. Apparatus according to claim 7, wherein said second carriage means (3) comprises an upper supporting plane (27) provided with rails (38) suitable for receiving said wheels
35 (26) of said first carriage means (2).
9. Apparatus according to claim 8, wherein said second

carriage means (3) comprises containing means (9) arranged for enclosing said first carriage means (2).

10. Apparatus according to claim 9, wherein said containing means (9) comprises a first access hatch (16) and a second
5 access hatch (24).

11. Apparatus according to claim 9 or 10, wherein said second carriage means (3) comprises conditioning means (10) arranged in an upper portion of said containing means (9) and suitable for generating a air flow inside said containing
10 means (9).

12. Apparatus according to claim 11, wherein said conditioning means (10) comprises fan means (28) and filtering means (29).

13. Apparatus according to any one of claims 7 to 12,
15 wherein said second carriage means (3) is movable manually or by means of a driven carriage (39).

14. Apparatus according to any one of claims 7 to 12, wherein said second carriage means (3) comprises driving means and control means suitable for automatically moving
20 said second carriage means (3) along set trajectories and paths.

15. Apparatus according to any one of claims 7 to 14, wherein said second carriage means (3) comprises removing means (19) suitable for hooking and locking said first
25 carriage means (2), said removing means (19) being movable for introducing into and/or ejecting from said second carriage means (3) said first carriage means (2).

16. Apparatus according to claim 15, wherein said removing means (19) comprises an extendible arm provided with an end
30 suitable for grasping a portion of said first carriage means (2).

17. Apparatus according to claim 15 or 16, wherein said removing means (19) is drivable manually.

18. Apparatus according to any preceding claim, comprising
35 connecting means (13) suitable for removably fixing said apparatus (1) to said operating machine (4, 5) in a hooking

position (G1, G2, G3, G4).

19. Apparatus according to claim 18, wherein said connecting means (13) is configured for engaging attaching means (84, 85, 94, 95) of said operating machine (4, 5).

5 20. Apparatus according to claim 18 or 19, as claim 18 is appended to any one of claims 7 to 17, wherein said connecting means (13) is associated with said first carriage means (2) or with said second carriage means (3).

10 21. Apparatus according to any one of claims 18 to 20, wherein said connecting means (13) is drivable manually.

22. Apparatus according to any one of claims 18 to 21, wherein said connecting means (13) comprises at least a threaded pin (13a) rotatably mounted and arranged for being inserted and tightened in a threaded seat (84, 85, 94, 95) of
15 said operating machine (4, 5).

23. Apparatus according to any preceding claim, comprising first moving means (20) provided with first carriage means (44) movable on first guides (45) and slidably supporting first slide means (46) associated with first gripping means
20 (40).

24. Apparatus according to claim 23, wherein said first carriage means (44) is movable along a first longitudinal direction (X), said first slide means (46) being movable along a second transverse direction (Y), substantially
25 orthogonal to said first longitudinal direction (X).

25. Apparatus according to claim 24, wherein said first gripping means (40) is slidably connected to said first slide means (46), said first gripping means (40) being movable along a third direction (Z) substantially orthogonal to said
30 a first longitudinal direction (X) and to said second transverse direction (Y).

26. Apparatus according to claims 6 and 23, wherein said first guides (45) are fixed to said supporting frame (25).

35 27. Apparatus according to any one of claims 23 to 26, wherein said first slide means (46) comprises at least a first carriage (47) that is slidable on first cross bars (65)

of said first carriage means (44).

28. Apparatus according to claim 27, wherein said gripping means (40) comprises at least an elongated arm (40a, 40b) fixed to said first carriage (47) and suitable for supporting
5 a first element (50).

29. Apparatus according to claim 28, wherein said elongated arm (40a, 40b) comprises housings (40c) arranged for receiving respective first supporting portions (51) of said first element (50).

10 30. Apparatus according to any preceding claim, comprising second moving means (21) provided with second carriage means (48) movable on second guides (49) and slidably supporting second slide means (54) bearing second gripping means (41).

15 31. Apparatus according to claims 24 and 30, wherein said second carriage means (48) is movable along said first longitudinal direction (X), said second slide means (54) being movable along said second transverse direction (Y).

32. Apparatus according to claims 6 and 30, wherein said second guides (49) are fixed to said supporting frame (25).

20 33. Apparatus according to any one of claims 30 to 32, wherein said second slide means (54) comprises at least a carriage that is slidable on second cross bars (68) of said second carriage means (48).

25 34. Apparatus according to any one of claims 30 to 33, wherein said second gripping means (41) comprises an articulated arm suitable for supporting a second element (60).

30 35. Apparatus according to claim 34, wherein said articulated arm (41) comprises a first elongated portion (41a) to the free end of which there is rotatably connected a second portion (41b) configured for receiving a second supporting portion (61) of said second element (60).

35 36. Apparatus according to any preceding claim, comprising third moving means (22) provided with third carriage means (55) movable on third guides (56) and slidably supporting third slide means (57) associated with third gripping means

(42).

37. Apparatus according to claims 24 e 36, wherein said third carriage means (55) is movable along said first longitudinal direction (X), said third slide means (57) being
5 movable along said second transverse direction (Y).

38. Apparatus according to claims 6 and 37, wherein said third guides (56) are fixed to said supporting frame (25).

39. Apparatus according to any one of claims 36 to 38, wherein said third slide means (57) comprises at least a
10 carriage that is slidable on third cross bars (75) of said third carriage means (55).

40. Apparatus according to any one of claims 36 to 39, wherein said third gripping means (42) comprises a pair of elongated supports (42a, 42b) suitable for supporting a third
15 element (70).

41. Apparatus according to claim 40, wherein said elongated supports (42a, 42b) comprise respective seats (42c) suitable for receiving third supporting portions (71) of said third
element (70).

20 42. Apparatus according to any preceding claim, wherein at least said first carriage means (2), said moving means (20, 21, 22), and said connecting means (13) are sterilisable in an autoclave.

43. Operating machine suitable for cooperating with the
25 apparatus (1) according to any preceding claim, comprising supporting means (30, 36; 82, 86) suitable for receiving and supporting respective elements (50, 60), the machine (4; 5) being characterised in that said supporting means (30, 36; 82, 86) is configured for receiving from and giving to said
30 apparatus (1) said elements (50, 60), said supporting means (30, 36; 82, 86) comprising hooking means (33, 34; 98, 99) suitable for abutting and locking abutting means (52, 62) of said elements (50, 60).

44. Machine according to claim 43, wherein said supporting
35 means (30; 82) comprises connecting means (32; 63) suitable for connecting said elements (50, 60) to circuits of said

machine (4).

45. Machine according to claim 43 or 44, comprising centring means (11, 12; 91, 92) suitable for defining hooking positions (G1, G2; G3, G4) of said apparatus (1) to said
5 machine (4; 5).

46. Machine according to claim 45, wherein said centring means (11, 12; 91, 92) comprises at least a pair of elongated elements arranged for laterally containing said apparatus (1).

10 47. Machine according to claim 46, wherein said elongated elements are spaced apart from one another and are substantially parallel, and are fixed almost orthogonally to said machine (4; 5).

48. Machine according to any one of claims 45 to 47,
15 comprising attaching means (84, 85; 94, 95) arranged for locking said apparatus (1) in each of said hooking positions (G1, G2; G3, G4).

49. Machine according to claim 44, comprising connecting means (32) configured for engaging with respective connector
20 means (53) of said elements (50) in such a way as to connect the latter to at least a supply circuit of said packaging operating machine (4), for example a pneumatic circuit, a supply circuit of product to be packaged.

50. Machine according to claim 49, wherein said supporting
25 means (30) further comprises coupling means (35) for connecting said elements (50) to kinematic and moving mechanisms of said packaging machine (4).

51. Machine according to claim 44, comprising further
30 connecting means (63) configured for engaging with respective connector means (53) of said elements (50) in such a way as to deliver inside the latter cleaning and washing fluids.

52. Apparatus for transferring and moving elements that are removably associable with an operating machine, substantially as disclosed and claimed and for the specified purposes.

35 53. Operating machine, substantially as disclosed and claimed and for the specified purposes.

Fig. 1

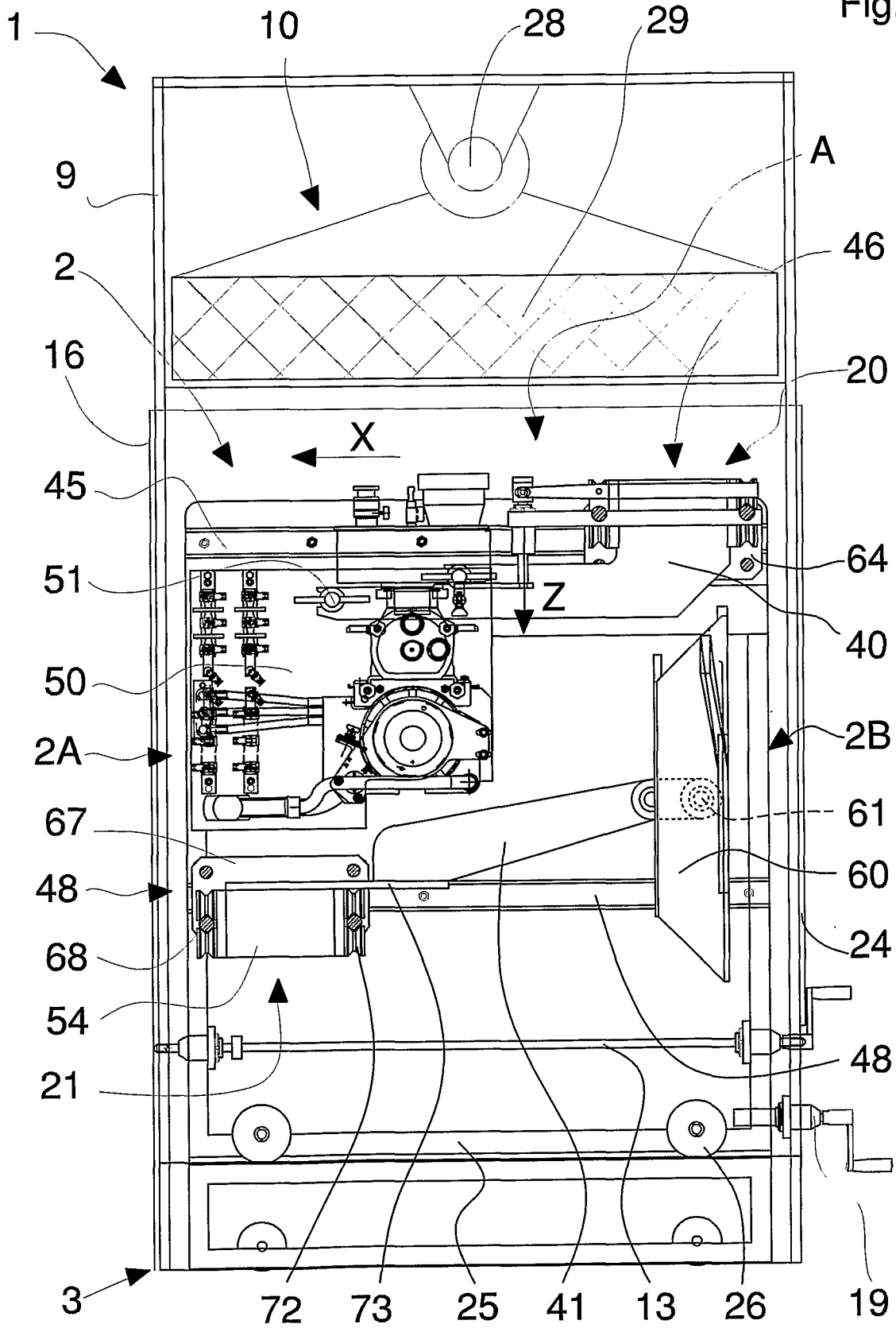


Fig. 2

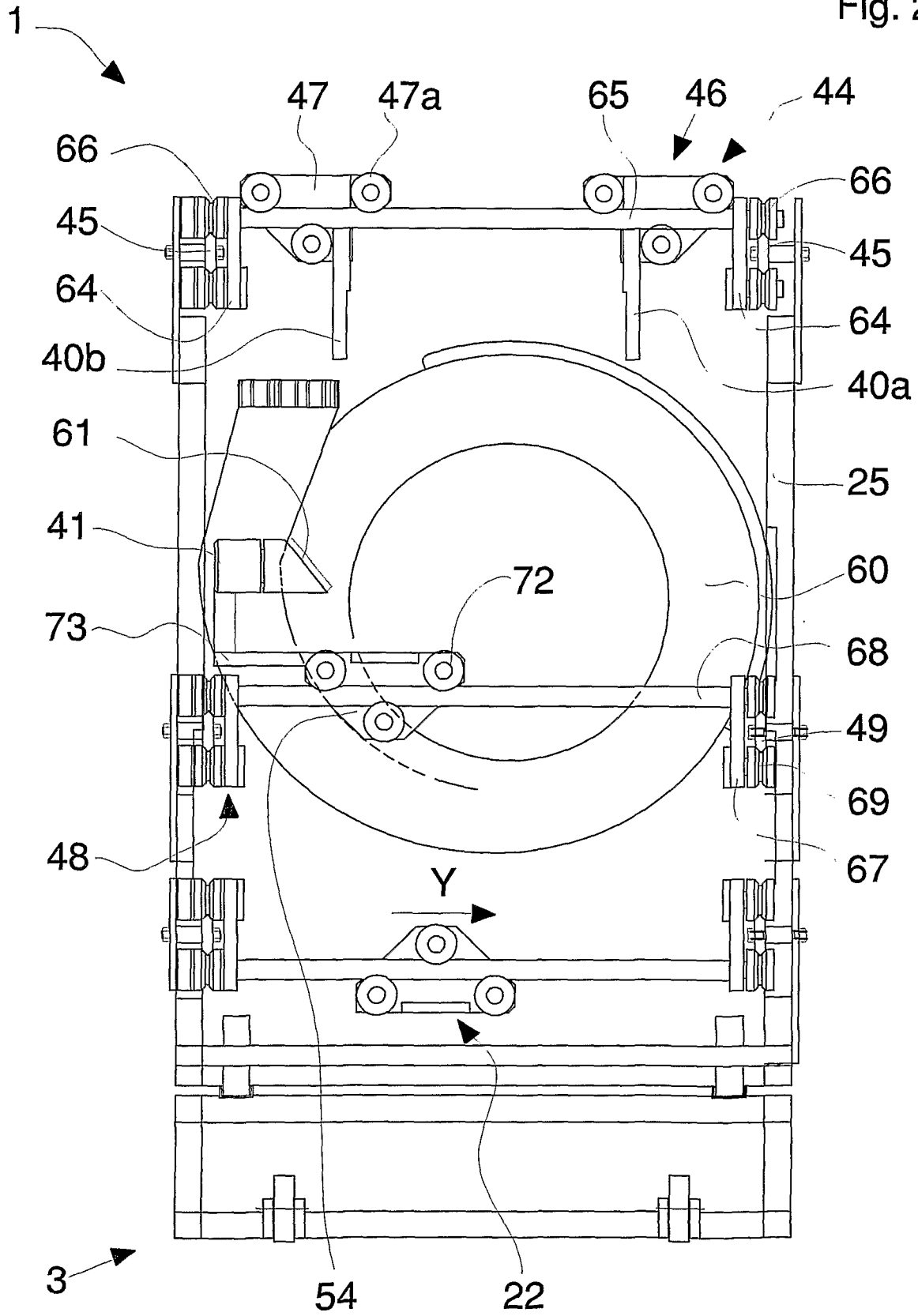


Fig. 3

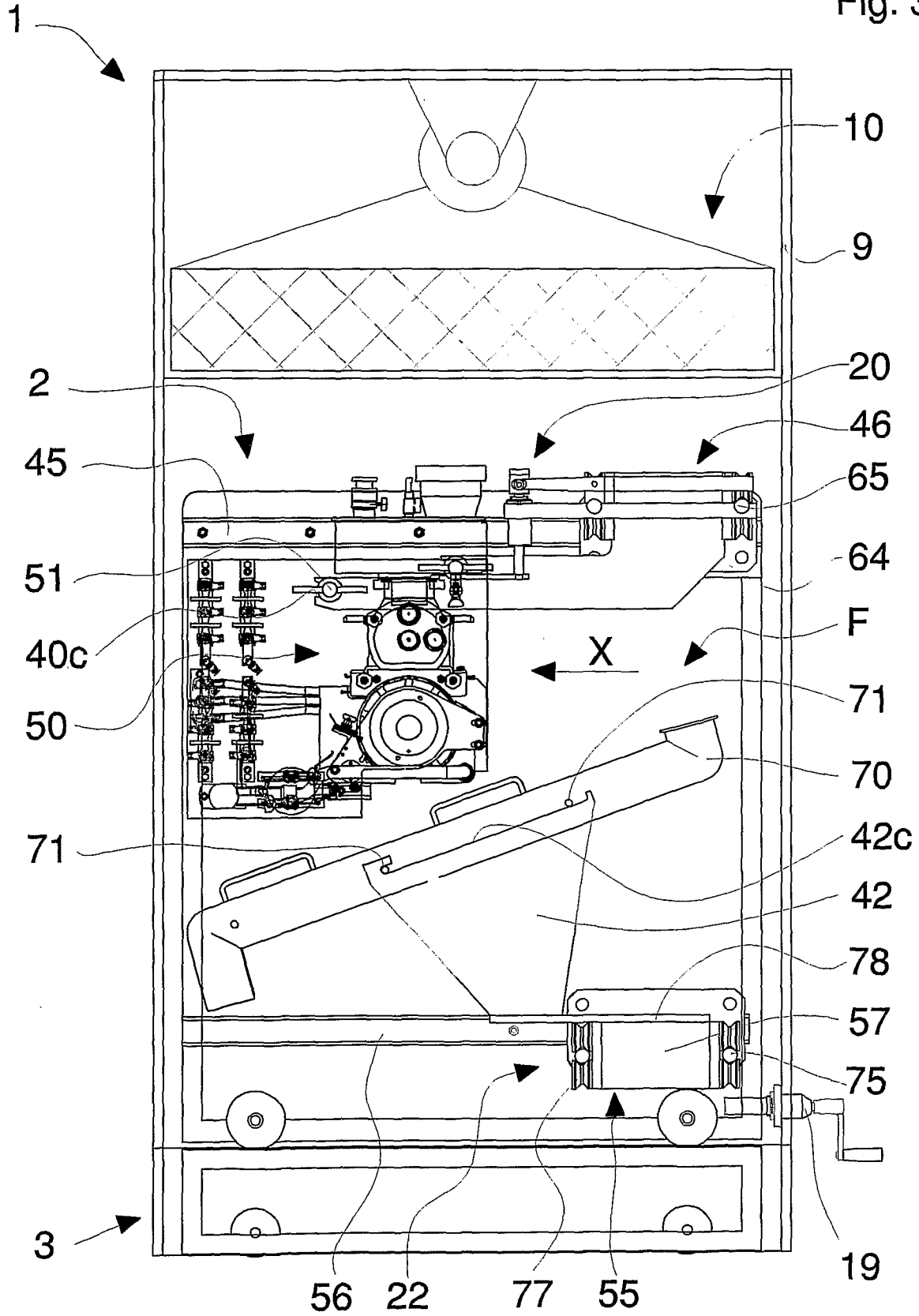


Fig. 4

