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(54) **Apparatus and system for the external cleaning of containers for loose substances**

(57) An apparatus (10) and a system for the external cleaning of containers (12) for loose substances comprise a table (13) supporting the containers (12) having a spraying zone (14) provided with a plurality of openings, a plurality of spray nozzles (16) and a hopper (17) for collecting a cleaning fluid, dirt or pollutants, in a position below the support table (13). The apparatus and the

cleaning stations (10) of the system comprise air sucking side walls (23) arranged peripherally on the support table (13) for the containers (12). A single device (11) for grasping the containers (12) transfers the dirty containers (12) to a spraying zone (14) of the apparatus, or of the system, respectively transfers the clean containers from the spraying zone (14) to a deposition point.

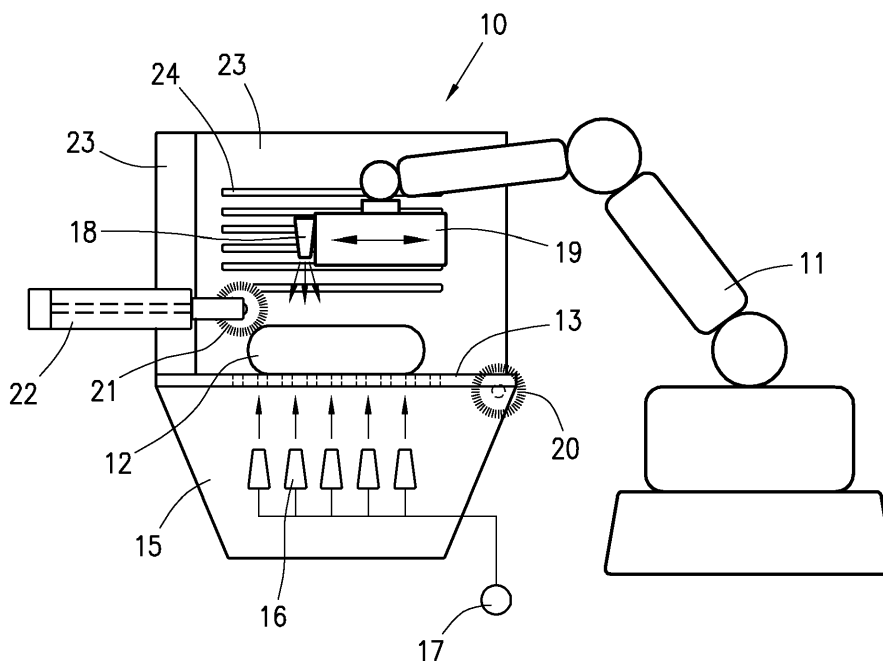


Fig. 2

Description

BACKGROUND OF THE INVENTION

[0001] The present invention refers to an apparatus and a cleaning system that are suitable for removing dirt or polluting substances that have adhered to the external surface of containers, in particular containers for loose substances, intended for automatic opening and emptying plants.

[0002] For the purposes of the present description, the term "container" is defined as any type of bag, box, stiff or flexible package made of paper, cardboard, fabric, plastics or a combination thereof. Further, the loose substance inside the containers can be of any type; for example, it can consist of powder, granular, liquid or pasty substances. Lastly, the containers can be cleaned by spraying any type of liquid, gas or powder fluid, for example, air, water, sterilising gas or liquids, disinfecting gas or liquids, fluidising powders in general, or combinations thereof, in function of the type of container, of the material with which the container has been made, and/or of the loose substance contained therein.

[0003] The apparatus and the cleaning system according to the invention lend themselves to be applied to any technological field, for example to the food, chemical, industrial sector, i.e. in all those cases in which the containers, before being automatically emptied, have to be washed or cleaned to ensure suitable conditions for avoiding that dirt or polluting substances that have adhered to the external surface of the containers during conveying and/or storing thereof, can become mixed, during automatic opening of the containers, with the substance contained therein, and contaminate said substance.

PRIOR ART

[0004] As already mentioned, containers for loose substances, such as bags, boxes or the like, before being automatically opened and emptied, have to be suitably washed and/or cleaned to avoid dirt or extraneous substances, which have adhered to the external surface of the containers, during opening and emptying can pollute the substance or the product contained therein, or be dispersed towards the external environment. Currently, for cleaning containers, in general, a manual procedure is followed, using brushes, jets of pressurised water or air on each single container, before opening.

[0005] Cleaning containers manually, in addition to requiring much time, does not ensure a thorough degree of hygiene and cleaning, and an appropriate protection of the external environment, negatively affecting the work cycle and the automatic opening systems.

[0006] Using simple conveyors provided with spray nozzles, would not in itself solve the problem of automation avoiding recontamination of the containers and dispersal of contaminating substances in the external envi-

ronment.

[0007] Further, the tendency today to increase the productivity of automatic plants for opening containers requires automatic cleaning solutions and devices that are extremely versatile that are able to meet the most diverse needs.

OBJECTS OF THE INVENTION

[0008] One object of the present invention is thus to provide an apparatus that is suitable for the external cleaning of containers for loose substances, which requires a high degree of automation, minimising, if not wholly eliminating any risk of contamination of the environment and of the product during opening and emptying of the containers.

[0009] A further object of the invention is to provide a system suitable for external cleaning of containers, that is extremely versatile and is able to permit a high degree of productivity.

[0010] Another object of the invention is to provide a system for external cleaning of containers, as previously mentioned, which enables successive cleaning steps to be executed using the same cleaning fluid, or using different cleaning fluids, depending on the features of the containers to be cleaned and on the nature of the loose substance contained therein.

SHORT DESCRIPTION OF THE INVENTION

[0011] The objects referred to above are achievable with an apparatus suitable for the external cleaning of containers for loose substances, according to claim 1, respectively with a system according to claim 9.

[0012] In particular, according to the invention, an apparatus is provided that is suitable for the external cleaning of containers for loose substances, where the external surface of the containers is contaminated by dirt and/or polluting substances that have to be removed before opening the containers, characterised by comprising:

a support table for the containers having at least one spraying zone for a cleaning fluid, configured with a plurality of passage openings for the passage of the fluid;

a plurality of lower spray nozzles for the cleaning fluid, underneath the spraying zone the support table for the containers;

a hopper for collecting the cleaning fluid, dirt and pollutant removed from the containers; and protective and air-sucking side walls peripherally arranged on the support table for the containers.

[0013] According to another aspect of the invention, a system is provided for external cleaning of containers by the cleaning apparatus referred to above comprising a first and at least a second cleaning station, each config-

ured with a spraying zone, and a single grasping device for grasping the containers, configured for sequentially transferring the dirty containers from a removal zone to a spraying zone, respectively the clean containers from the spraying zone to a deposition point.

SHORT DESCRIPTION OF THE DRAWINGS

[0014] The apparatus and the system for the external cleaning of containers, according to the present invention, will be explained in greater detail here below, with reference to the attached drawings, in which:

Fig. 1 shows schematically a plan view of the cleaning apparatus;

Fig. 2 is a longitudinal section according to the line 2-2 of figure 1, in combination with an automatic robot for removing and transferring the containers;

Fig. 3 shows a dual cleaning system comprising two cleaning apparatuses that are alongside one another and functionally integrated;

Fig. 4 shows a cleaning system of turnable type;

Fig. 5 shows a multiple-station cleaning system of tunnel type.

DETAILED DESCRIPTION OF THE INVENTION

[0015] With reference to figures 1 and 2 the general features of a cleaning apparatus according to the invention will now be disclosed, suitable for cleaning bags for containing loose products; nevertheless, what will be said here below with reference to the cleaning of bags in general must be understood to apply to the external cleaning of any type of container.

[0016] As shown, the cleaning apparatus 10 according to the example in figures 1 and 2 comprises a table 13 for supporting a bag 12, in combination with a robot 11 or other suitable device for moving dirty bags to be cleaned from a pallet and for transferring the dirty bags to the support table 13.

[0017] The support table 13 for the bag 12 to be cleaned can be configured in any manner provided it is suitable for enabling the bag 12 to be cleaned by a plurality of jets of a fluid directed upwards, through a plurality of passage openings of the support table 13; in this regard, the support table 13 can consist of a tough metal grid or can comprise a plurality of holes at a spraying zone for cleaning the bags 12, schematically indicated by reference 14 in figure 1, or can consist of idle or driven rollers, or of a table of brushes configured for enabling a cleaning fluid to be sprayed.

[0018] Still with reference to figures 1 and 2, the device 11 for removing and transferring the bags 12 has been schematically represented in the form of a robot; nevertheless, it is clear that instead of the robot shown in figure 2 it is possible to use any other known device for removing and transferring the bags 12, provided that it is suitable for the envisaged use.

[0019] The table 13 for supporting and for cleaning the bags 12 is supported by a hopper 15 for collecting the cleaning fluid and polluting substances that fall, dragged by the fluid, whereas they are removed by jets of fluid during a cleaning step for the bags. If the cleaning fluid is a liquid, the hopper 15, in addition to collecting the sludge, is also used to contain the excess liquid; if desired, in certain cases the hopper 15 for collecting the cleaning fluid and polluting substances can operate in a slight vacuum condition by connecting the hopper 15 to a suitable air sucking device.

[0020] Inside the hopper 15, at the spraying zone 14 and the table 13 supporting the bags 12, a plurality of lower spray nozzles 16 oriented upwards are provided and connected to a suitable source 17 of a pressurised cleaning fluid of the type referred to previously; the pressurised jets of fluid that exit the nozzles 16, through the meshes of the grid or openings of the table 13, are directed upwards against the lower and the side surfaces of the bag 12, removing the dirt and the polluting substances, which are dragged by the fluid until they fall into the hopper underneath.

[0021] In addition to the lower spray nozzles 16, it is possible to provide a plurality of upper spray nozzles 18 oriented downwards, to clean the side of the bag 12 facing upwards. The upper spray nozzles 18 can be positioned in any manner; in the case shown, the upper spray nozzles 18 are fixed to a side of a holding head 19 for removing the bags 12, the holding head 19 being fixed to the articulated arm of the robot 11. The holding head 19 can be of any type, for example a mechanical or pneumatic head that can be moved vertically and/or horizontally, as shown.

[0022] In addition to fluid-jet cleaning of the bags 12, the cleaning apparatus 10 can be optionally provided with one or more mechanical cleaning devices; in the case shown in figure 2, a first mechanical cleaning device 20 schematically represented on the front side of the support table 13, consisting, for example, of a rotating brush, and a second mechanical cleaning device on the rear side of the table 13, for example consisting of a rotating brush 21 fixed to the stem of a linear actuator or pneumatic cylinder 22; thus the brush 21 can be moved longitudinally in contact with the bag 12. Alternatively to or in combination with the mechanical cleaning devices shown, any other mechanical cleaning device can be used.

[0023] It has been specified that the cleaning apparatus according to the present invention, in addition to preventing contamination of the substance contained in the bag 12, also has to be able to prevent repollution of the bag or container 12 during the cleaning step, and to prevent the dispersal of polluting substances externally; thus, according to another feature of the cleaning apparatus 10, above the table 13 for supporting and cleaning the bags 12, air-sucking means are provided along the peripheral edges of the support table 13 for the bags.

[0024] In the case shown in figures 1 and 2, the air-sucking devices consist of sucking walls 23 that extend

upwards on the two longitudinal sides and on the rear transverse side of the table 13, forming a protective barrier.

[0025] For example, the sucking walls 23 can consist of hollow walls, having on the internal side facing the cleaning zone 14 provided with sucking holes or slits 24, as shown in figure 2; the hollow walls 23, above or on an external side have a hole 25 for connection to a system of sucking conduits. Lastly, in figure 1, with reference 26 two side bars are indicated for centring the bags 12 on the table 13, at the cleaning zone 14.

[0026] The operation of the cleaning apparatus disclosed is briefly as follows: robot 11, after removal of a dirty bag 12, deposits the dirty bag 12 on the cleaning zone 14 of the support table 13; during the insertion of the bag 12, the lower side thereof can be partially cleaned by the brush 20, if present.

[0027] Once the bag 12 has been deposited on the table 13 and released by the holding head 19 of the robot 11 at the cleaning zone 14, both the lower spray nozzles 16 and the upper spray nozzles 18 are activated, the latter moving by means of the articulated arm of the robot 11; obviously, the drive sequence of the lower and upper spray nozzles can also be different from the drive sequence referred to above. Whilst the cleaning fluid is being sprayed, the rotating brush 21 can be moved by the actuator 22.

[0028] Once spray nozzles 16 and/or 18 have been activated, the washing fluid that is sprayed against the bag 12 at a certain pressure, removes all the dirt and the polluting substances that have adhered over time, or have been deposited on the bag, which are dragged by the cleaning fluid so as to fall into the collecting hopper 15. During the spraying step of the cleaning fluid, the air sucking walls 23 are activated, preventing the dirt or polluting substances suspended in the air from being able to fall and again contaminate the bag 12, or the exterior.

[0029] When the operation of cleaning a bag 12 has terminated the robot 11 is again driven to remove the clean bag and deposit the bag in a collecting point, from which it is moved to a subsequent opening and emptying step; at this point the operative cycle can be started again to clean another bag 12.

[0030] As mentioned before, the disclosed cleaning apparatus permits a high degree of integration and automation to significantly reduce work times; this can be illustrated with reference to the examples of the remaining figures.

[0031] In figure 3 a system has been shown comprising two cleaning stations 10A and 10B that are alongside one another, consisting of cleaning apparatuses similar to or completely identical to those of figures 1 and 2; thus also in figure 3 the same reference numbers have been used to indicate similar or equivalent parts. For reasons of drawing simplicity, in figure 3 the robot 11 has not been shown that alternatively serves the two stations 10A and 10B, as explained before. Further, in figure 3 with 30 and 31 the removing and/or deposition point for the bags 12A

and 12B has been indicated.

[0032] The operative method of the cleaning system of figure 3 is completely similar to that of the apparatus of figures 1 and 2, with the only difference that now a single robot 11 is used to serve in sequence the two cleaning stations 10A and 10B, in this way enabling a higher automation degree and a consequent reduction of the work cycle.

[0033] In brief, the system operates in the following manner: as mentioned previously, a single robot that is not shown, or more generally a single grasping device for moving and transferring the bags 12, removes a bag 12A from the removal point 30 and positions the bag 12A in the spraying zone 14 of the station 10A, where it is subjected to cleaning by spray jets of gas and/or liquid, and to a possible mechanical brushing action, depending on the type of bag and/or of the contents thereof; during the cleaning operation, the dirt or possible polluting substances become detached from the bag, most fall into the hopper 15 underneath, with the same cleaning fluid, and partially, if they are present in the air, they are sucked by the walls 23.

[0034] The robot or moving and transferring device, after taking and positioning a dirty bag 12A in the axially aligned cleaning station 10A, immediately afterwards removes a clean bag 12B from the station 10B, which in the meantime has completed the cleaning operations, and after depositing the bag, replaces the clean bag with a new bag to be cleaned.

[0035] During the removing step and replacing a clean bag 12B, the cleaning operation of the bag 12A in the station 10A is completed; then the robot, or moving and transferring device, removes the clean bag from the station 10A and replaces the clean bag with a new bag to be cleaned. The removing and cleaning operations of the bags 12A and 12B are then repeated in sequence in the two stations 10A and 10B, as disclosed previously.

[0036] The figure 4 shows a second solution, still relating to a double cleaning system, in which the two stations 10A and 10B are axially aligned and are integrated into a single structure 32 rotatably around a vertical axis 33 operationally connected to a rotary actuator 34; also in figure 4 the same reference numbers as the previous figures have been used to indicate similar or equivalent parts. The support structure 32 of the two cleaning stations 10A and 10B can rotate in a single direction or alternatively in the two opposite directions, providing in both cases a suitable rotating distributor connecting nozzles 16 to a source of pressurised cleaning fluid. Also in this case, a single robot or device for removing and transferring the bags, which is not shown, can be provided as in the previous cases, further, both the cleaning stations 10A and 10B can be optionally provided with mechanical cleaning devices, for example of the roller type, as in the previous cases.

[0037] The operation of the cleaning system of figure 4 is substantially similar to that of figure 3, with the sole difference that now the dirty bags or containers are load-

ed, and the clean bags or containers are unloaded with the supporting structure 32 of the two cleaning stations 10A and 10B that is stationary and in a position aligned with the loading and unloading device, whereas the cleaning operation can be initiated and made to continue during rotation. Also in this case system productivity and versatility is increased, enabling in all cases the desired objects to be achieved.

[0038] Figure 5 shows a further solution in which the single bags 12 are moved along a cleaning path in a tunnel type system, comprising a plurality of successive cleaning stations 10A 10N, in each of which a determined cleaning, washing and/or sterilisation operation can be performed with a suitable gaseous and/or powder fluid, depending on the case.

[0039] Also in this latter case the cleaning system is served by a single robot or device for removing and transferring the bags, which is not shown, which loads the dirty bags at one end A of the cleaning line and unloads the clean bags at the other end B; again in figure 5 the same reference numbers have been used to indicate parts that are similar or equivalent to those of the preceding figures.

[0040] In this respect, as shown in figure 5, the cleaning line extends along a U-shaped path, i.e. a path comprising a first linear portion 35A along which the bags 12 are advanced in one direction by a first conveyor 36A, for example of the roller type, and a second linear portion 35B, alongside and parallel to the previous one, along which the bags 12 are advanced in a direction opposite the previous one, for example by a second roller conveyor 36B; the rollers of the two conveyors 36A and 36B, in a manner that is *per se* known, are operationally connected to a driven reduction unit by a suitable chain or other type of transmission, which is not shown.

[0041] The bags 12 can be transferred from the portion 35A to the portion 35B of the cleaning system in any manner, for example by a transverse conveyor 37 of the belt type, or in another manner.

[0042] Again, the air sucking walls 23 are provided peripherally on the external and internal sides of the two portions 35A and 35B of the cleaning line, as shown, again making use of the same reference numbers to indicate similar or equivalent parts.

[0043] In figure 5, three cleaning stations 10 have been shown along each portion 35A and 35B providing spray nozzles 16 and hoppers for collecting the fluid and the pollutants independent for each axially aligned cleaning station, or common to several stations 10, depending on design requirements and needs.

[0044] The operation of the cleaning system of figure 5 is briefly as follows: the dirty bags 12 are loaded singularly onto the front end A of the first portion of line 35A, and are then made to advance by the roller conveyor 36A, through the three cleaning stations 10 where they are washed and cleaned with a same or with different types of cleaning fluids, undergoing possible brushing in the intermediate axially aligned cleaning station by means of one or more rotating brushes 21.

[0045] The single bags 12, already partially cleaned, when they arrive at the rear end of the first portion of line 35A, opposite the loading end, are transferred by the transverse belt conveyor 37 to the rear end of the second cleaning line portion 35B along which they are made to advance by the second roller conveyor 36B, in a direction opposite the previous connection. Whilst the single bags 12 advance along the second portion of line 35B they undergo further cleaning treatments in the various spraying stations 10, reaching the final unloading station 10N.

[0046] It is clear that, depending on the type of bag or container 12, of the material with which the bag or container 12 is made, on the type of substance, whether liquid, powder or in pasty state, contained in the single bags or containers 12, and on the type of dirt or pollutant to be cleaned, each portion 35A and 35B of the cleaning line comprise a greater or lesser number of stations 10 than those shown, providing a number and type of spray nozzles that are the same or different for each axially aligned cleaning station 10, depending on the different needs with regard to cleaning the bags or containers 12.

[0047] What has been said and shown with reference to the examples of the enclosed figures has been provided by way of illustrative example of the technical features of the cleaning apparatus 10, and of the entire system; accordingly other modifications or variations can be made to the cleaning apparatus of figure 1 or to the single cleaning stations of the entire system, without departing from the claims.

Claims

1. An apparatus (10) suitable for the external cleaning of containers (12) for loose substances, wherein the external surface of the containers (12) is contaminated by dirt and/or by polluting substances that have to be removed before opening the containers (12), **characterised by** comprising:

a table (13) supporting the containers having at least one spraying zone (14) for a cleaning fluid configured with a plurality of passage openings of the fluid;

a plurality of lower spray nozzles (16) of the cleaning fluid, underneath the spraying zone (14') of the support table (13) for the containers (12);

a hopper (15) for collecting cleaning fluid, dirt and/or the pollutant removed from the containers (12); and

protective and air-sucking side walls (23), peripherally arranged on the support table (13) for the containers (12).

2. The apparatus (10) suitable for the external cleaning of containers (12) according to claim 1, **characterised in that** it further comprises upper spray nozzles

(22) for a cleaning fluid, in position above the support table (13) for the containers (12).

3. The apparatus (10) suitable for the external cleaning of containers (12) according to claim 2, **characterised in that** the upper spray nozzles (22) are movably supported along the spraying zone (14) of the support table (13) for the containers (12).
4. The apparatus (10) suitable for the external cleaning of containers (12) according to any preceding claim, **characterised by** comprising at least one mechanical device (20, 21) for cleaning the containers (12).
5. The apparatus (10) suitable for the external cleaning of containers (12) according to claim 4, **characterised in that** the mechanical cleaning device (21) is movable longitudinally to the support table (13) for the containers (12).
6. The apparatus (10) suitable for the external cleaning of containers (12) according to any one of claims 1 to 5, **characterised in that** the protective walls (23) consist of hollow walls, a side of the protective walls (23) facing the spraying zone (14) being configured with a plurality of air-sucking openings (24).
7. The apparatus (10) suitable for the external cleaning of containers according to any one of claims 1 to 6, **characterised by** comprising centring members (20) for centring the containers (12) at the spraying zone (14).
8. The apparatus (10) suitable for the external cleaning of containers (12) according to claim 1, **characterised in that** the hopper (15) is operatively connected to an air sucking device.
9. A system suitable for external cleaning of containers (12) for loose substances, by at least one cleaning apparatus (10) according to any one of claims 1 to 8 **characterised by** comprising a first and at least a second cleaning station (10), each configured with a spraying zone (14), and a single grasping device for the containers (12) configured for sequentially transferring the dirty containers (12) from a removal zone, to a spraying zone (14), respectively the clean containers (12) from the spraying zone (14) to a deposition point.
10. The system suitable for external cleaning of containers according to claim 9, **characterised by** comprising a first and at least a second cleaning station (10A, 10B) parallelly arranged alongside one another.
11. The system suitable for external cleaning of containers (12) according to claim 9, **characterised by** comprising a first and a second axially aligned cleaning

station (10A, 10B), wherein said cleaning stations (10A, 10B) are integrated into a rotating structure (32) according to a vertical axis (33).

12. The system suitable for external cleaning of containers (12) according to claim 9, **characterised by** comprising a plurality of cleaning stations (10A-10N) arranged along a first and a second linear path (35A, 35B), each linear path (35A, 35B) being provided with a conveyor (36) for the containers (12) that runs parallel to the other conveyor (36) between a front end and a rear end; and in which at the rear end of said linear conveyors (36) a transverse conveyor (37) is provided.
13. The system suitable for external cleaning of containers (12) according to claim 12, characterised that the spray nozzles (16) of different cleaning stations (10A-10N) are operatively connected to different sources of pressurised cleaning fluids.
14. The system suitable for external cleaning of containers (12) according to claim 12, **characterised by** comprising at least one cleaning device consisting of a rotating brush (21), in at least one axially aligned cleaning station (10A-10N).

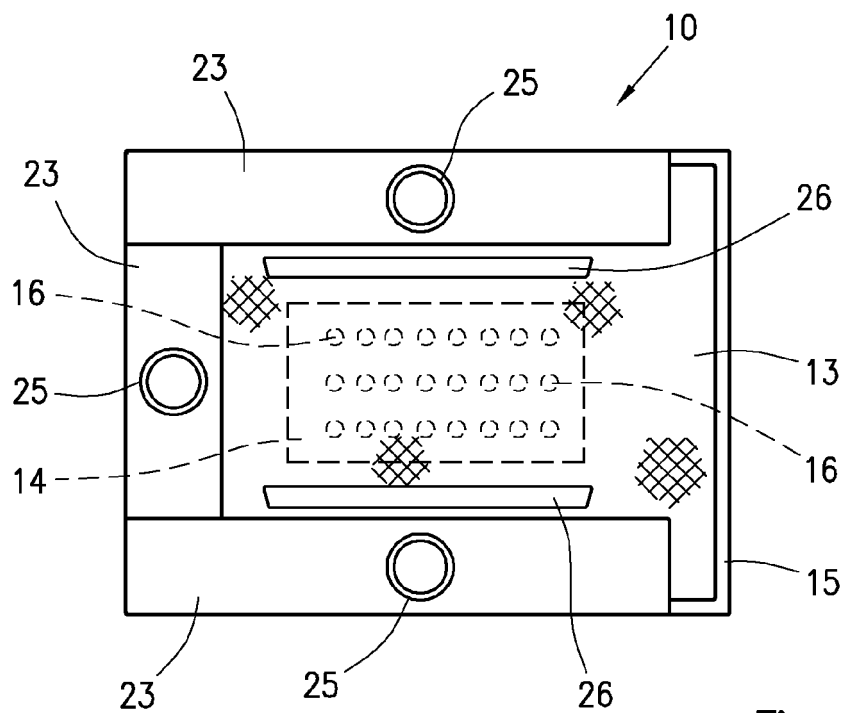


Fig. 1

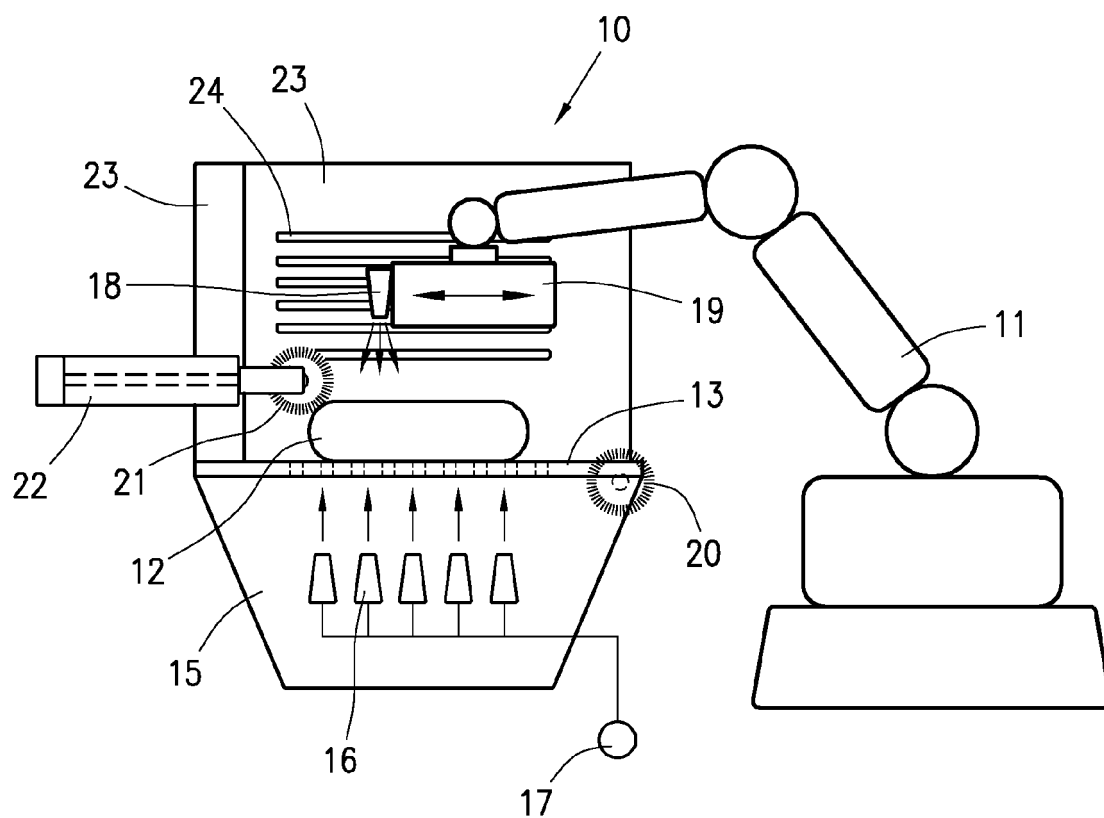


Fig. 2

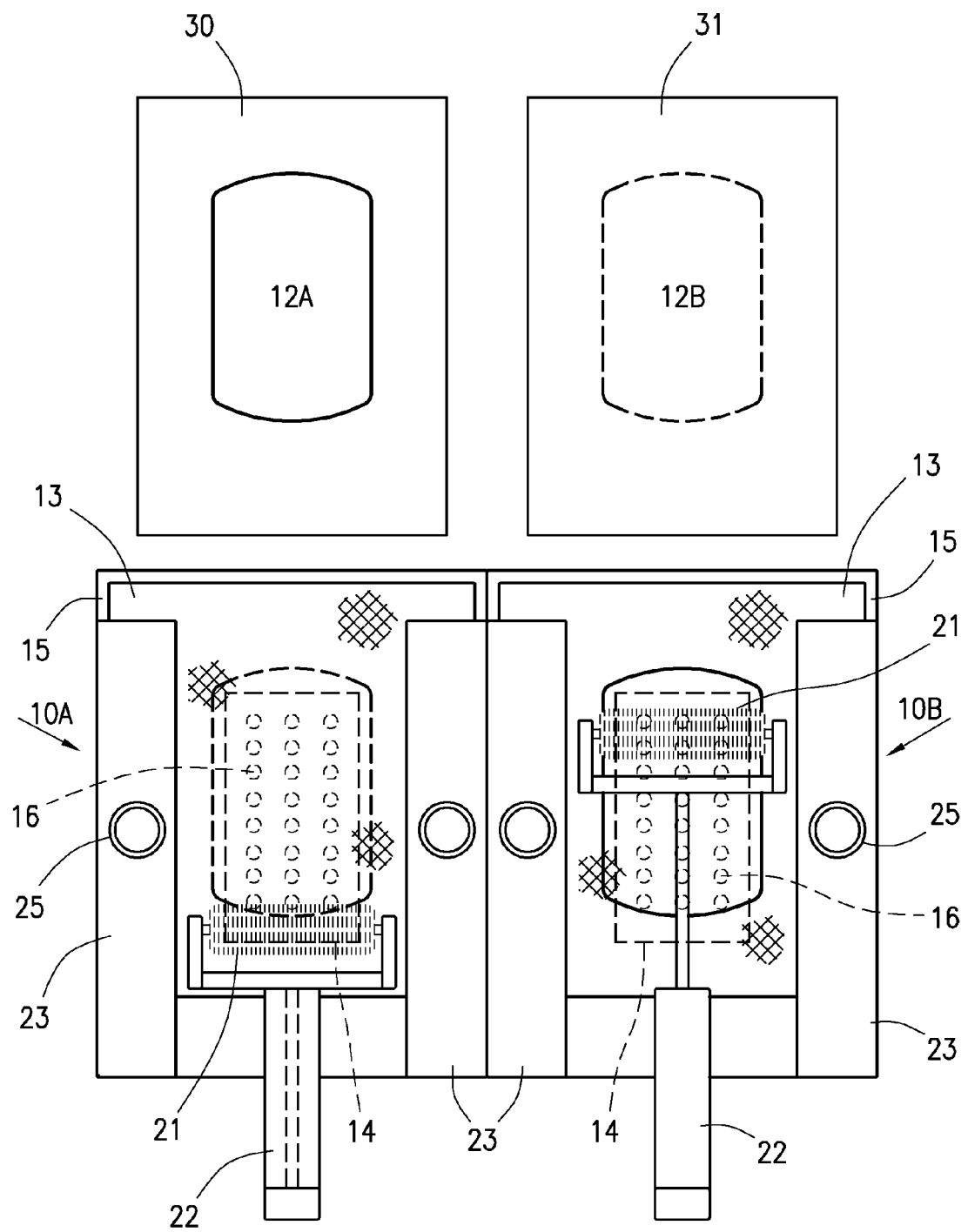


Fig. 3

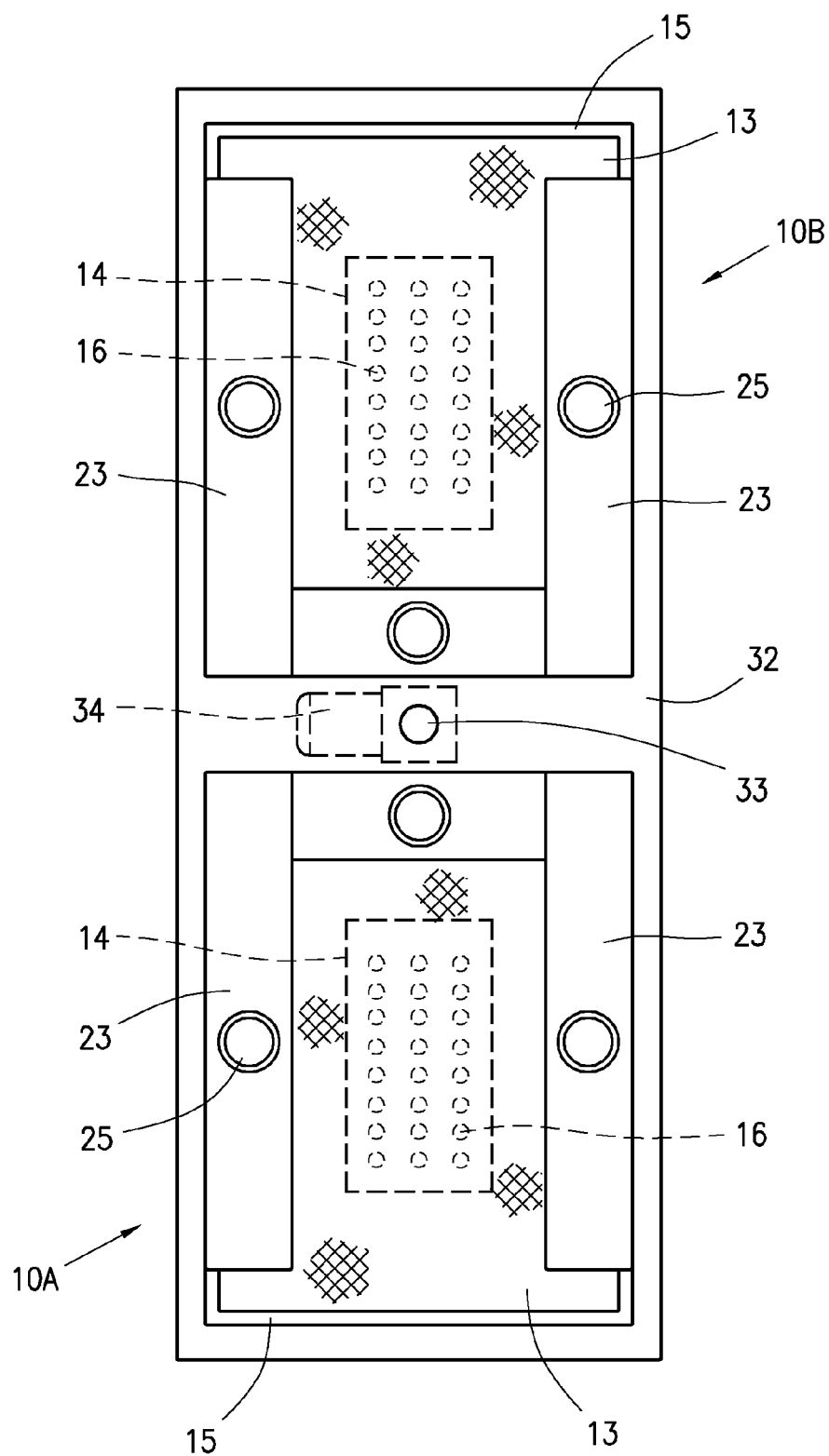


Fig. 4

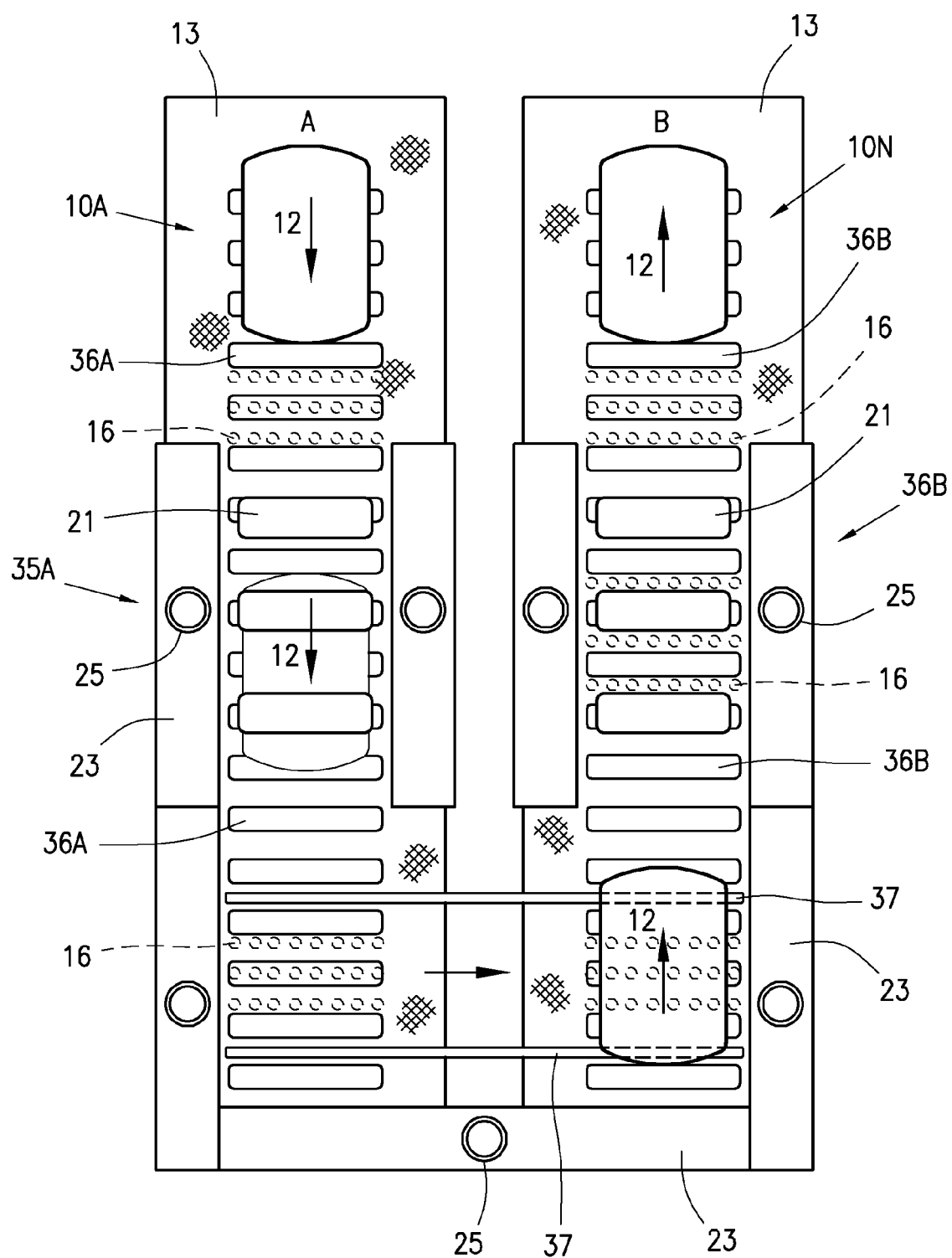


Fig. 5



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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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