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(54) **A DEVICE AND METHOD FOR WASHING STORAGE CONTAINERS**

(57) A device and method for washing storage containers, especially wire ones with internal lining, having an enclosure with a transport conveyor mounted inside, the enclosure being divided by bulkheads into at least one washing chamber, at least one rinsing chamber and a drying chamber, wherein the washing chamber and the rinsing chamber are fitted with a spray system external and internal in relation to a storage container, connected to a washing liquid tank or rinsing liquid tank respectively, the device being connected to an automated control system and being compatible with a device for feeding and receiving containers, characterised in that in each washing chamber (4) and in each rinsing chamber (5), the spray system external (7) in relation to a storage container is connected to a cylinder (8) from above and slidably attached in vertical guides (9) arranged on opposite walls of the washing chamber (4), and the spray system internal (10) in relation to a storage container is connected to a cylinder (11) from below, wherein in the upper section of each washing chamber (4) and each rinsing chamber (5) an assembly of blowing-off nozzles (12) is arranged facing against the direction of travel of a storage container, while in the lower section of each washing chamber (4) and each rinsing chamber (5), below the transport conveyor (2) a compressed air nozzle (13) is arranged facing upwards, while inside the drying chamber (6) a cold air blowing system external (27) and internal (28) in relation to a storage container, and a hot air blowing system (29) are slidably attached in the vertical direction. A method for washing storage container, especially wire ones with internal lining, using a washing station accord-

ing to the invention.

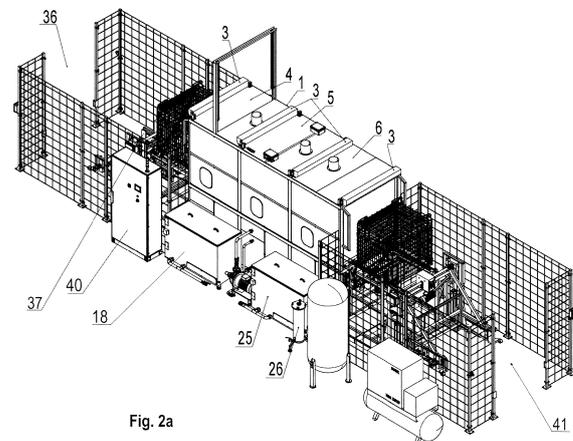


Fig. 2a

Description

[0001] The subject matter of the invention is a device and method for washing storage containers, especially wire containers with internal lining, designed for storing small products, in particular PET-preforms and PET bottles.

[0002] Storage pallet containers are known in the art which are designed for storing small products, made of a base compatible with a forklift truck and a folding pallet collar with a structure made of metal bars welded in the shape of grid and fitted with internal plastic liners detachably connected to the collar. Such storage containers are highly durable and protect the small items stored therein against falling. When containers are used multiple times, there arises a problem with ensuring appropriate cleanliness and appropriate drying of containers, since conventional washing stations are not fully adapted to clean the wire structure on the outside and the full structure on the inside of a container at the same time and the known container washing and drying technologies do not meet the quality requirements set especially in the food and pharmaceutical industries. Further, internal liners are made of material of low thickness and when loaded with water from above, they form a pan where water accumulates, the water being difficult to drain at the subsequent container washing process step. On the other hand, removing liners from containers for washing is labour-intensive and requires the use of another washing station adapted for cleaning them.

[0003] Various types of washing stations adapted for washing specific products are known in the art.

[0004] For example, a device is known from the utility model description PL62623 for automatically washing smoking containers and sticks, wherein a washing room is divided into washing and rinsing zones, and a conveyor is arranged inside for moving containers, the washing and conveyor travel processes being controlled by a programmer.

[0005] Further, a device is known from the Polish patent description PL171661 for washing containers which is divided into three washing zones, i.e. a pre-washing zone, main washing zone and final washing zone and which has a final washing zone water tank outlet connected to a pump supplying water with a pressure not lower than 0.15 MPa to the pre-washing zone where a drain is located to discharge water outside. Besides the above, in the final washing zone there is an assembly supplying water to spray nozzles, the water flowing down to a water tank in this zone. The final washing zone water tank is connected to the main washing zone water tank via compensating line.

[0006] The solutions described are designed for washing openwork containers which do not need to be washed on the outside and on the inside at the same time.

[0007] An installation is known from patent EP 2501501 and patent EP 0847813 for cleaning cases used for plant products, wherein cases are reversed and then

washed on the outside and inside by means of spray nozzles. In patent EP 2501501, an installation is fitted with an automated system to assess the case soiling and select appropriate washing parameters for each case individually, which leads to a non-uniform washing time for each case.

[0008] All the solutions identified are not suitable for washing wire containers with internal liners, since there is still no solution for the problem of water accumulating on the deformable internal container liner arranged at the top, which occurs with a reversed container in the washing process or the problem of thoroughly washing and drying containers designed in this way. Thorough drying of containers is especially important as washed containers are stacked, which leads to water flowing onto the floor and facilitates corrosion of containers. Further, for containers designed for handling PET-preforms and PET bottles, which are mostly used in the food industry, a very high quality is required as regards the container cleanliness and its drying. The high requirements are imposed both by the PET packaging production process and the sanitary requirements applicable to the food industry. The known washing technologies and washing stations used in these technologies do not meet the expectations of customers and in consequence, to meet the quality requirements set, manufacturers stick to a conventional method for washing containers, i.e. manual washing using highpressure washers, which contributes to a higher employment rate and longer working time involved in a container washing operation. On account of the high number of containers brought for washing, the existing state of art thus gives rise to production problems in this industry.

[0009] It is an object of the invention to develop a device and method for washing wire storage containers, with internal linings, in such a device, which will ensure thorough washing and drying of containers designed in this way.

[0010] A device for washing storage containers, especially wire ones with internal lining, having an enclosure with a transport conveyor mounted inside, the enclosure being divided by bulkheads into at least one washing chamber, at least one rinsing chamber and a drying chamber, wherein the washing chamber and the rinsing chamber are fitted with a spray system external and internal in relation to a storage container, connected to a washing liquid tank or rinsing liquid tank respectively, the device being connected to an automated control system and being compatible with a device for feeding and receiving containers, according to the invention is characterised in that in each washing chamber and in each rinsing chamber, the spray system external in relation to a storage container faces the bottom and sides of the container and is connected to a cylinder from above, while being slidably attached in vertical guides arranged on opposite walls of the washing chamber, and the spray system internal in relation to a storage container faces the bottom and sides of the container and is connected

to a cylinder from below, wherein in the upper section of each washing chamber and each rinsing chamber an assembly of blowing-off nozzles is arranged facing against the direction of travel of a storage container, while in the lower section of each washing chamber and each rinsing chamber, below the transport conveyor a compressed air nozzle is arranged facing upwards, while inside the drying chamber a cold air blowing system external and internal in relation to a storage container and a hot air blowing system are slidably attached in the vertical direction.

[0011] Preferably, the external spray system in the washing chamber is arranged circumferentially around a storage container and has the form of two pipes arranged opposite each other, with a rigid design and capped ends and bent in the arm-like shape, the rigid pipes further having a plurality of spray nozzles facing a storage container at various angles. Preferably, the spray nozzles facing the bottom of a storage container and the spray nozzles facing the sides of a storage container are controlled separately. Preferably, the internal spray system in the washing chamber has the form of a rigid rectangle-shaped pipe connected to a latticework consisting of rigid pipes arranged above the internal spray system, the rigid pipes of such a system having a plurality of spray nozzles facing a storage container at various angles. Preferably, the spray nozzles arranged on the rectangle-shaped pipe face the sides of a storage container, while the spray nozzles arranged on latticework pipes face the bottom of a storage container. Preferably, the spray nozzles on the rectangular-shaped pipe and the nozzles on the latticework pipes are controlled separately. Preferably, the lifting system the internal spray system in the washing chamber is connected to has the form of a scissor jack connected to a cylinder.

[0012] Preferably, the external spray system in the rinsing chamber is arranged circumferentially in relation to a storage container and has the form of at least one rectangle-shaped rigid, bent pipe having a plurality of spray nozzles facing a storage container at various angles. Preferably, the external spray system pipe is divided into at least two pipes. Preferably, the system of nozzles facing the bottom of a storage container and the system of nozzles facing the sides of a storage container are controlled separately. Preferably, the internal spray system in the rinsing chamber is arranged circumferentially in relation to the inside of a storage container and has the form of at least one rigid pipe having a plurality of spray nozzles facing a storage container at various angles. Preferably, the system of nozzles facing the bottom of a storage container and the system of nozzles facing the sides of a storage container are controlled separately.

[0013] Preferably, in the drying chamber, the cold air blowing system external in relation to a storage container has the form of a frame-shaped pipe having a plurality of outlet openings, the pipe configured as above is slidably attached in vertical guides and connected to a cylinder. Preferably, the cold air blowing system, internal in

relation to a storage container, has the form of a frame-shaped rigid pipe connected to a cylinder from below and having a plurality of spray nozzles facing a storage container at various angles. The external and internal cold air blowing systems are connected to a fan assembly.

[0014] Preferably, in the drying chamber, the hot air blowing system consists of at least one outlet pipe compatible with a fan connected to a heater.

[0015] Preferably, the washing station bulkheads are movable.

[0016] Preferably, the washing liquid tank and the rinsing liquid tank have filtering devices.

[0017] A method for washing storage containers, especially wire ones with internal liners, consisting in that soiled containers are reversed and fed to a transport chain conveyor, then its internal and external surface is washed with a washing liquid and rinsed and dried in a chamber-type washing station, the washing and rinsing agents being supplied by means of spray nozzles, then containers are reversed and stacked, the entire process being controlled automatically, according to the invention is characterised in that a soiled storage container is reversed and placed on a transport chain conveyor at a loading station, then the storage container is moved through the opened bulkheads to the washing chamber of the device for washing storage containers designed according to the invention, then all the bulkheads are closed and a washing process in the washing chamber starts by supplying a washing liquid to the spray system external in relation to a storage container and the spray system internal in relation to a storage container at the same time, the bottom of the container is washed, then the sides of the container are washed, then the described cycle of washing the outside and inside of the container is repeated many times, over the period of 2 to 5 min., depending on the container soiling level, the washing liquid preferably having the temperature of 50 to 95°C depending on the container soiling level and being supplied to both spray systems under the pressure of 4 to 6 bar, then the washing liquid flow to both spray systems is cut off, a compressed air nozzle is enabled to remove excess water from the top liner of the storage container, then bulkheads are opened and the spray systems return to their initial position, then in the next cycle, the container moves to the rinsing chamber and as it is moving, its upper surface is blasted by nozzles located over bulkheads and facing against the direction of travel of a container, then the cycle in the washing chamber is repeated for a subsequent container and a rinsing cycle is conducted in the rinsing chamber using a rinsing liquid with surfactants added, having the temperature of 50-70°C, supplied at the pressure of 4-6 bar, the rinsing process being conducted in such a way that the bottom and sides of a container on the outside and inside of the container are rinsed at the same time, this process being repeated many times over the same period as determined for the washing process, then the rinsing liquid flow is cut off, a compressed air nozzle is enabled to remove excess wa-

ter from the top liner of the container, bulkheads are opened and the external and internal spray systems return to their initial position, then in the next cycle, the container moves to the drying chamber and as it is moving, its upper surface is blasted by blasting nozzles located over bulkheads in the rinsing chamber and facing against the direction of travel of a storage container, then the cycle in the washing chamber and rinsing chamber is repeated, and a process is conducted in the drying chamber of drying with air heated to the temp. of 60 to 80°C and supplied under pressure and of blasting with air having the ambient temperature, by means of cold air systems external and internal in relation to a container and a hot air system, and in the next cycle, the container is moved out of the drying chamber, reversed on a discharge station and stacked, and each cycle in the washing, rinsing and drying chambers is repeated for subsequent containers, the duration of each process cycle is the same for each chamber.

[0018] Preferably, the washing liquid is supplied to the external spray system arranged in the washing chamber in two steps i.e. first, the washing liquid is supplied to the nozzles facing the bottom of a storage container, the liquid is sprayed under pressure, then the liquid flow to these nozzles is shut off, then as the external spray system moves along vertical guides, the washing liquid is supplied under the same pressure to the spray nozzles facing the sides of a storage container.

[0019] Preferably, the washing liquid is supplied to the internal spray system arranged in the washing chamber in two steps, i.e. first the washing liquid is supplied to the nozzles arranged on the platform pipes, a container is sprayed, then the liquid flow to these nozzles is shut off and the washing liquid flow to the nozzles facing the sides of a storage container is opened, while the jack of the internal spray system is lowered.

[0020] Preferably, the rinsing liquid is supplied to the external and internal spray system arranged in the rinsing chamber in one step, using one external pipe and one internal pipe with nozzles facing the bottom and sides of a storage container.

[0021] Preferably, the rinsing liquid is supplied to the external and internal spray system arranged in the rinsing chamber in two steps i.e. first, the rinsing liquid is supplied to the nozzles facing the bottom on the inside and outside of a storage container respectively, a container is sprayed under pressure, then the liquid flow to these nozzles is shut off, then the rinsing liquid is supplied under the same pressure to the spray nozzles facing the external and internal sides of a storage container respectively.

[0022] Preferably, the washing liquid and rinsing liquid flow down by gravity to trays, then are filtered and recycled for washing or rinsing.

[0023] A device and method for washing storage containers provide a comprehensive solution for problems involved in the washing of wire storage containers, especially those with internal linings. The high washing quality combined with the use of ecological washing and

rinsing liquids and the repeated use of the used liquid by its treatment make a washing station environmentally friendly. With the use of an appropriate spray nozzle system and appropriate control, washing liquid streams reach all over a container. The use of an air blower which forces out the liquid retained in the upper section of a container and the use of blasting nozzles as a container is moving facilitate its subsequent drying, while simultaneous operation in all the chambers allows for the reduction of the container washing cycle.

[0024] A device according to the invention is shown in a drawing, wherein Fig.1 shows a first embodiment of the device in a longitudinal section and a cross section, Fig.2 shows the same devices located in a process line, Fig.2a shows a full diagram of a process line providing a method according to the invention in an axonometric view, Fig.3 shows a second embodiment of the device in a longitudinal section and a cross section, Fig.4 shows an external spray system in a washing chamber in various views, Fig.5 shows an internal spray system in a washing chamber in various views, Fig.6 shows an external spray system in a rinsing chamber in various view, in the form of a closed frame, Fig.6a shows an external spray system in a split-frame variant, Fig.7 shows an internal blowing system in a rinsing chamber in various views, Fig.8 shows an internal spray system in a rinsing chamber in a two-pipe variant, Fig.9 shows an external blowing system in various views, Fig.10 shows an internal blowing system in various views and Fig.11 shows an assembly of blowing-off nozzles in various views.

[0025] In an embodiment, a device for storage containers, especially wire ones with internal lining, shown in Fig.1, Fig.2 and Fig.2a, comprises a frame enclosure 1, along which a chain-design transport conveyor 2 moves which is adapted for transporting storage containers and projects out of the enclosure 1 on both sides. The enclosure 1 is divided along the transport conveyor 2 with crosswise bulkheads 3 into a washing chamber 4, rinsing chamber 5 and drying chamber 6, the crosswise bulkheads 3 having the form of movable curtains. Bulkheads 3 are also located at the beginning and end of the enclosure 1. A corresponding drip tray 4.1, 5.1 and 6.1 is located below the transport conveyor 2, under each chamber 4, 5 and 6. In another embodiment shown in Fig.3, the device can have more bulkheads 3 depending on the number of washing chambers 4 and rinsing chambers 5 used in the washing process.

[0026] An external spray system 7 is arranged in the washing chamber 4, for washing a storage container on the outside, and is connected to cylinders 8 from above and slidably attached in vertical guides 9 located on opposite walls of the washing chamber 4. Further, a spray system 10 is arranged in the washing chamber 4, for washing a storage container on the inside, and is connected from below to a jack 11 with a scissor design, compatible with the cylinder. In its home position, the internal spray system 10 is arranged below the chains of

the transport conveyor 2. Further, in the upper section of the washing chamber 4 on the side of a bulkhead 3 dividing the enclosure 1 into the washing chamber 4 and rinsing chamber 5, an assembly of blowing-off nozzles 12 is arranged to supply compressed air, facing the bottom of a storage container. The outlets of blowing-off nozzles 12 face against the direction of travel of this container and at such an angle as to blow off excess accumulating water to a maximum degree. In the lower section of each washing chamber 4, a compressed air nozzle 13 is arranged in the inside area of a container and below the transport conveyor 2, facing the bottom of a storage container and whose task is to force out the water accumulating on the lining of a storage container. The external spray system 7 arranged in the washing chamber 4, as shown in Fig.4, has the form of two pipes 14 with a rigid design, whose ends are capped and bent in the arm-like shape 14a. The pipes 14 are arranged opposite each other such that together with arms 14a they embrace externally an entire storage container as shown in Fig.1. The pipes 14 have a plurality of spray nozzles 15, facing a storage container at various angles, preferably the first spray nozzles 15 face the external surface of the bottom of a storage container and the washing liquid flow thereto is controlled separately, and the second spray nozzles 15 face the sides of a storage container and the liquid flow thereto is also controlled separately, which makes it possible to wash the outside of the bottom and sides of a container without expending the washing liquid unnecessarily. The internal spray system 10 in the washing chamber 4 as shown in Fig.5 has the form of a rectangular frame-shaped pipe 16 with a rigid design, connected to a latticework 17 consisting of pipes 17a arranged above the internal spray system. The pipes 16 and pipes 17a of such a system have a plurality of spray nozzles 15, facing a storage container at various angles, wherein the spray nozzles 15 arranged on the pipes 17a of the platform 17 face the bottom of a storage container, the washing liquid flow thereto being preferably controlled separately, and the spray nozzles 15 arranged on the pipe 16 face the side walls of a container, the washing liquid flow thereto being preferably controlled separately. The external spray system 7 and internal spray system 10 are connected to a washing liquid tank 18 preferably by means of flexible pipes. The washing liquid tank 18 is divided inside into a filtering section where the washing liquid from the drip tray 4.1 flows and a principal section where the washing liquid is heated by a heating system, the liquid temperature being signalled by an appropriate sensor.

[0027] An external spray system 19, shown on Fig.6, is arranged in the rinsing chamber 5, for rinsing a storage container on the outside, and is connected to cylinder 20 from above and moves in vertical guides 9. Further, a spray system 21, shown on Fig.7, is arranged in the rinsing chamber 5, for rinsing a storage container on the outside, and is connected to cylinder 22, shown in Fig.1, from below, moving in the vertical direction. In its home

position, the spray system 21 is located below the chain of the transport conveyor 2. Further, in the upper section of the rinsing chamber 5 on the side of a bulkhead 3 dividing the enclosure 1 into the rinsing chamber 5 and drying chamber 6, an assembly of blowing-off nozzles 12, shown in Fig.11, is arranged to supply compressed air onto the outside of the bottom of a storage container, the outlets of these blowing-off nozzles 12 facing against the direction of travel of a container and at an angle allowing for blowing off the accumulating rinsing liquid to a maximum degree. The blowing-off nozzles 12 are located on a pipe 12a. In the lower section of the rinsing chamber 5, a compressed air nozzle 13, shown in Fig.1 and 2, is arranged below the transport conveyor 2, facing upwards and whose task is to force out the water accumulating on the upper lining of a container. An external spray system 19 in the rinsing chamber 5, as shown in Fig.6, has the form of a rectangular frame-shaped pipe 23 having a plurality of spray nozzles 15, facing a storage container at various angles, preferably the first spray nozzles 15 face the external surface of the bottom of a storage container and the rinsing liquid flow thereto is controlled separately, and the second spray nozzles 15 face the sides of a storage container and the liquid flow thereto is also controlled separately by means of solenoid valves, which makes it possible to rinse the outside of the bottom and sides of a container without expending the rinsing liquid unnecessarily. In another embodiment, the spray system 19 shown in Fig.6a may comprise a pipe 23 divided into two parts and comprising arms 23a. The internal spray system 21, as shown in Fig.7, has the form of a rectangular frame-shaped pipe 24 having a plurality of spray nozzles 15, facing a storage container at various angles, preferably the first spray nozzles 15 face the external surface of the bottom of a storage container and the second spray nozzles 15 face the sides of a storage container. The pipe 24 is connected to cross-pieces 24a. In another embodiment, as shown in Fig.8, the internal spray system 21 may have the form of two pipes 24b and 24c connected to each other, having a plurality of spray nozzles 15 facing upwards in the pipe 24b and sidewise in the pipe 24c, the liquid flow to these pipes being controlled separately by means of solenoid valves. The external spray system 19 and internal spray system 21 are connected to a rinsing liquid tank 25 by means of flexible pipes. The rinsing liquid tank 25 has a rinsing liquid heating system and sensors to control the temperature and is connected to a separate filter 26, as shown in Fig.2a.

[0028] In the drying chamber 6, a blowing system is arranged which consists of an external cold air blowing system 27 and internal cold air blowing system 28, and further a hot air blowing system 29. The external cold air blowing system 27, as shown in Fig.9, comprises a rectangular frame-shaped closed pipe 30 having a plurality of outlet opening 31 facing a storage container and comprises a cylinder 30a and a fan connected to this pipe, not shown in the drawing. The pipe 30 moves along vertical guides 9. The internal cold air blowing system 28

shown in Fig. 10, comprises a frame-shaped closed pipe 32 having a plurality of nozzles 33 facing the inside of a storage container and comprises an arrangement of cross-pieces 32a connected to a pipe 32 through which the pipe 32 is connected to a cylinder 32b. The pipe 32 is also connected to a fan not shown in the drawing. The pipe 32 is moved in the vertical direction by means of the cylinder 32b. The hot air blowing system 29 comprises a blowing pipe 34 and fan 35 connected to a heater.

[0029] A method for washing storage containers, especially wire ones with internal liners, using a device according to the invention, consists in that a storage container is, at a loading station 36 arranged at the floor level, clamped by means of two lateral clamping strips 37 actuated by pneumatic cylinders 38, and then lifted up by means of two pneumatic cylinders 39. Then the storage container is reversed upside down and placed on the transport conveyor 2, upon which the vertical cylinders return to their initial position, the lateral clamping strips 37 are released and return automatically to their initial position. In this position, another container may be placed in the space between the lateral clamping strips 37. With the bulkheads 3 open, all the spray systems are arranged in their home positions, i.e. the external spray systems 7 and 19 are in their upper position, while the internal spray systems 10 and 21 are in their lower position. When receiving a signal from a sensor that a container is present before the washing chamber 4, a controller installed in a control cabinet 40 enables the transport conveyor 2, then another sensor arranged in the washing chamber 4 signals the right position of the storage container, which results in stopping the transport conveyor 2 and closing the bulkheads 3 by means of subsequent pneumatic cylinders. Once the bulkheads 3 are closed, the controller enables cylinders 8 and 11 connected to the spray systems 7 and 10, which results in moving these systems many times in the vertical direction, i.e. the external spray system 7 downwards, and the internal spray system 10 upwards, the washing liquid being supplied by means of nozzles 15 under the pressure of 4 - 6 bar at the same time. The position of spray systems is signalled by subsequent sensors. The washing liquid has the form of an aqueous solution of an ecological detergent used in the proportion 2/100, the washing liquid solution being heated in the washing liquid tank 18 to the temperature of 50 to 95°C depending on the container soiling level. The temperature and level of the washing liquid in the tank 18 are signalled by and adjustable by means of the controller 40. The washing liquid is supplied first to the nozzles 15 facing the bottom of a container on the outside and inside and in this position the spray systems 7 and 10 do not move, then the liquid flow to these nozzles 15 is shut off, the liquid is supplied to the nozzles 15 facing the sides of a container on the outside and inside, and the spray systems 7 and 10 make a movement in the vertical direction. This method for supplying the washing liquid makes it possible to optimise the liquid pressure and avoid any unnecessary liquid expenditure.

The operation time of each spray nozzle is adjusted by the controller 40. The washing frame moving cycle is repeated many times over the period of 2 to 5 minutes depending on the container soiling level. Once the washing cycle is completed, the pump which supplies the washing liquid turns off and a compressed air stream is guided through the nozzle 13 to the inside of the container, the air, forcing the bottom liner upwards, removes the accumulated washing liquid. At the same time, the spray systems 7 and 10 return to their initial position. Then the bulkheads 3 are opened, then the transport conveyor 2 is enabled to move the container to the rinsing chamber 5 and bring another container to the washing chamber 4. At the same time, during the container transport, the system of blowing-off nozzles 12 is enabled to remove a residue washing liquid from the top surface of the container. Once the transport conveyor 2 stops, the bulkheads 3 are lowered and a washing process for the second container is conducted in the washing chamber 4, a rinsing process for the first container is conducted in the rinsing chamber 5 by means of the external spray system 19 and internal spray system 21. The rinsing process is conducted in a similar manner as in the washing chamber 4, i.e. if two pipes 24b and 24c are used in the internal spray system 21, first the bottom of a container is rinsed on the inside and outside, and the spray systems 19 and 21 do not move, and then the sides of the container are rinsed on the outside and inside and the spray systems move in the vertical direction. For rinsing, water with the temperature of 50 to 70°C is used, with surfactants added, the water being supplied to the spray systems 19 and 21 under the pressure of 4-6 bar, from the rinsing liquid tank 25. The rinsing cycle is repeated many times over the same time as in the washing cycle 4. If one internal pipe 24 is used, the bottom and sides of the container are rinsed at the same time. The rinsing water is filtered and recycled to the rinsing liquid tank 25. Once the rinsing cycle is completed, similarly to the washing chamber 4, an auxiliary pump 13 is enabled in the rinsing chamber 5, through which a compressed air stream is guided to the inside of the container, the air, forcing the bottom liner upwards, removes the accumulated water. At the same time, the spray systems 19 and 21 return to their initial position. Then the bulkheads 3 are opened, then the transport conveyor 2 is enabled to move the container to the drying chamber 6 and bring more containers to the rinsing chamber 5 and washing chamber 4 respectively. At the same time, during the container transport to the drying chamber 6, the system of blowing-off nozzles 12 arranged in the rinsing chamber 5 is enabled to remove a residue rinsing liquid from the top surface of the container. Once the bulkheads 3 are closed, the washing process for another container starts in the washing chamber 4, the rinsing process starts in the rinsing chamber 5 and the container drying process starts in the drying chamber 6, and a loading device picks another soiled container for washing. In the drying chamber 6, hot air is blown from below via the hot air blowing system 29 con-

sisting of an outlet pipe 34 compatible with a fan 35 connected to a heater. In addition, the storage container is blasted with cold air on the outside and inside, by an external blasting system 27 and internal blasting system 28, whose pipes 30 and 32 respectively make movements in the vertical direction. Upon drying, each blowing system frame returns to its initial position, the bulkheads 3 open, the transport conveyor 2 is enabled and the storage container moves out of the enclosure 1 and waits at a discharge station 41. The other containers move to subsequent chambers. Once the bulkheads 3 are closed, the storage container is clamped by the lateral strips 37 of a discharge device, the container is lifted upwards and removed from the transport conveyor 2, then it is reversed right side up and moved onto the floor level and picked for stacking.

Claims

1. A device for washing storage containers, especially wire ones with internal lining, having an enclosure with a transport conveyor mounted inside, the enclosure being divided by bulkheads into at least one washing chamber, at least one rinsing chamber and a drying chamber, wherein the washing chamber and the rinsing chamber are fitted with a spray system external and internal in relation to a storage container, connected to a washing liquid tank or rinsing liquid tank respectively, the device being connected to an automated control system and being compatible with a device for feeding and receiving containers, **characterised in that** in each washing chamber (4) and in each rinsing chamber (5), the spray system external (7) in relation to a storage container is connected to a cylinder (8) from above and slidably attached in vertical guides (9) arranged on opposite walls of the washing chamber (4), and the spray system internal (10) in relation to a storage container is connected to a cylinder (11) from below, wherein in the upper section of each washing chamber (4) and each rinsing chamber (5) an assembly of blowing-off nozzles (12) is arranged facing against the direction of travel of a storage container, while in the lower section of each washing chamber (4) and each rinsing chamber (5), below the transport conveyor (2) a compressed air nozzle (13) is arranged facing upwards, while inside the drying chamber (6) an external cold air blowing system (27) and internal cold air blowing system (28), and a hot air blowing system (29) are slidably attached in the vertical direction.
2. A device according to claim 1, **characterised in that** the external spray system (7) in the washing chamber (4) is arranged circumferentially around a storage container and has the form of two pipes (14) arranged opposite each other, with a rigid design and capped ends and bent in the arm-like shape (14a), the rigid pipes (14) further having a plurality of spray nozzles (15) facing a storage container at various angles.
3. A device according to claim 1, **characterised in that** the internal spray system (10) in the washing chamber (4) has the form of a rigid rectangle-shaped pipe (16) connected to a latticework (17) consisting of rigid pipes (17a) arranged above the internal spray system, the rigid pipes (16) and (17a) of such a system having a plurality of spray nozzles (15) facing a storage container at various angles.
4. A device according to claim 1, **characterised in that** the external spray system (19) in the rinsing chamber (5) is arranged circumferentially in relation to a storage container and has the form of at least one rigid, bent pipe (23) having a plurality of spray nozzles (15) facing a storage container at various angles.
5. A device according to claim 1, **characterised in that** the internal spray system (21) in the rinsing chamber (5) is arranged circumferentially in relation to the inside of a storage container and has the form of at least one rigid pipe (24) having a plurality of spray nozzles (15) facing a storage container at various angles.
6. A device according to claim 1, **characterised in that** in the drying chamber (6), the hot air blowing system (29) comprises at least one outlet pipe (34) compatible with a fan (35) connected to a heater.
7. A device according to claim 1, **characterised in that** an external cold air blowing system (27) has the form of a frame-shaped pipe (30) having a plurality of outlet openings (31), the pipe (30) configured as above is slidably attached in vertical guides (9) and connected to a cylinder (30a).
8. A device according to claim 1, **characterised in that** an internal cold air blowing system (28) has the form of a rigid frame-shaped pipe (32) having nozzles (33) facing a storage container at various angles, the pipe (32) being connected via an arrangement of cross-pieces (32a) to a cylinder (32b).
9. A device according to claim 1, **characterised in that** the external cold air blowing system (27) and internal cold air blowing system (28) are connected to a fan assembly.
10. A method for washing storage containers, especially wire ones with internal liners, in a device for washing containers according to claims 1 to 9, consisting in that soiled containers are reversed and fed to a transport chain conveyor, then its internal and external surface is washed with a washing liquid and rinsed

and dried in a chamber-type washing station, the washing and rinsing agents being supplied by means of spray nozzles, then containers are reversed and stacked, the entire process being controlled automatically, **characterised in that** a soiled storage container is reversed and placed on a transport chain conveyor (2) at a loading station (36), then the storage container is moved through the opened bulkheads (3) of the device according to claims 1 to 9 to the washing chamber (4) of the device, then all the bulkheads (3) are closed and a washing process in the washing chamber (4) starts by supplying a washing liquid to the spray system external (7) in relation to a storage container and the spray system internal (10) in relation to a storage container at the same time, the bottom of the container is washed, then the sides of the container are washed, then the described cycle of washing the outside and inside of the container is repeated many times, over the period of 2 to 5 min., the washing liquid preferably having the temperature of 50 to 95°C and being supplied to both the external spray system (7) and internal spray system (10) under the pressure of 4 to 6 bar, then the washing liquid flow to both spray systems (7) and (10) is cut off, a compressed air nozzle (13) is enabled to remove excess water from the top liner of the storage container, then bulkheads (3) are opened and the spray systems (7) and (10) return to their initial position, then in the next cycle, the container moves to the rinsing chamber (5) and as it is moving, its upper surface is blasted by blowing-off nozzles (12) located over bulkheads (3) and facing against the direction of travel of a container, then the washing cycle in the washing chamber (4) is repeated for a subsequent container and a rinsing cycle is conducted in the rinsing chamber (5) using a rinsing liquid with surfactants added, having the temperature of 50-70°C, supplied at the pressure of 4-6 bar, the rinsing process being controlled in such a way that the bottom and sides of a container on the outside and inside of the container are rinsed at the same time, by means of the spray system external (19) and internal (21) in relation to a storage container, this process being repeated many times over the same period as determined for the washing process, then the rinsing liquid flow is cut off, a compressed air nozzle (13) is enabled to remove excess water from the top liner of the container, bulkheads (3) are opened and the spray systems (19) and (21) return to their initial position, then in the next cycle, the container moves to the rinsing chamber (6) and as it is moving, its upper surface is blasted by blowing-off nozzles (12) located over bulkheads (3) in rinsing chamber (5), then the cycle in the washing chamber (4) and rinsing chamber (5) is repeated for subsequent containers, and a process is conducted in the drying chamber (6) of drying with air heated to the temp. of 60 to 80°C by means of the hot air system (29) and of blasting with

air having the ambient temperature, by means of blowing systems (27) and (28) and in the next cycle, the container is moved out of the drying chamber (6), reversed on a discharge station (41) and stacked, and each cycle in the washing chamber (4), rinsing chamber (5) and drying chamber (6) is repeated for subsequent containers, the duration of each process cycle is the same for each chamber (4), (5) and (6).

11. A method according to claim 10, **characterised in that** the washing liquid is supplied to the external spray system (7) arranged in the washing chamber (4) in two steps i.e. first, the washing liquid is supplied to the nozzles (15) facing the bottom of a storage container, the liquid is sprayed under pressure, then the liquid flow to these nozzles is shut off, then as the external spray system (7) moves along vertical guides (9), the washing liquid is supplied under the same pressure to the spray nozzles (15) facing the sides of a storage container.
12. A method according to claim 10, **characterised in that** the washing liquid is supplied to the internal spray system (10) arranged in the washing chamber (4) in two steps, i.e. first the washing liquid is supplied to the nozzles (15) arranged on the pipes (17a) of the latticework (17), it is sprayed under pressure, then the liquid flow to these nozzles is shut off and the washing liquid flow to the nozzles (15) facing the sides of a storage container is opened, while the jack (11) of the internal spray system (10) is lowered.
13. A method according to claim 10, **characterised in that** the rinsing liquid is supplied to the external spray system (19) and internal spray system (21) arranged in the rinsing chamber (5) in one step, using an external pipe (23) and internal pipe (24) with nozzles facing the bottom and sides of a storage container.
14. A method according to claim 10, **characterised in that** the rinsing liquid is supplied to the external spray system (19) and internal spray system (21) arranged in the rinsing chamber (5) in two steps i.e. first, the rinsing liquid is supplied to the nozzles (15) arranged on the pipe (24b) and facing the bottom of a storage container, the liquid is sprayed under pressure, then the liquid flow to these nozzles is shut off, then the rinsing liquid is supplied under the same pressure to the spray nozzles (15) arranged on the pipe (24c) and facing the sides of a storage container.

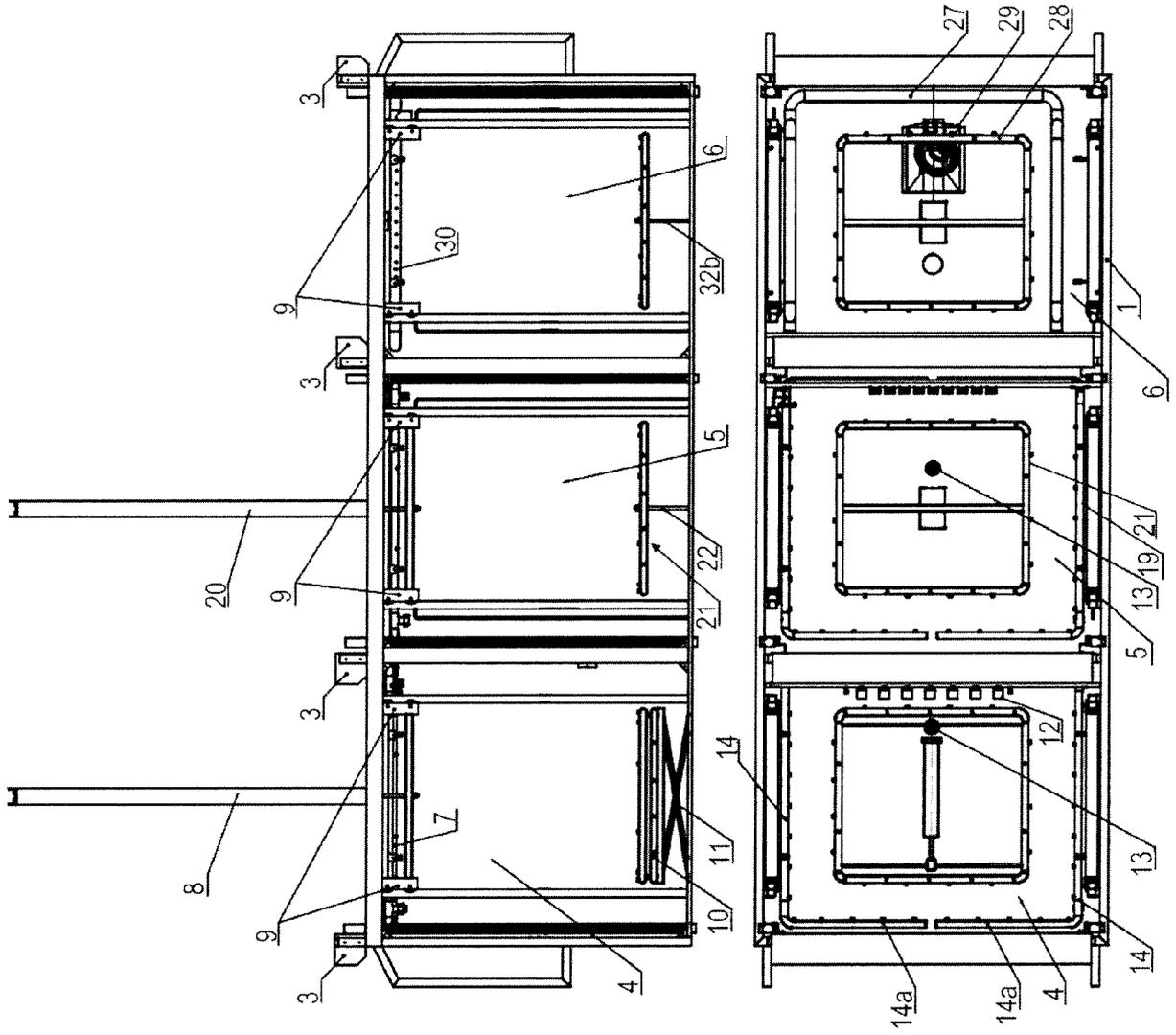


Fig. 1

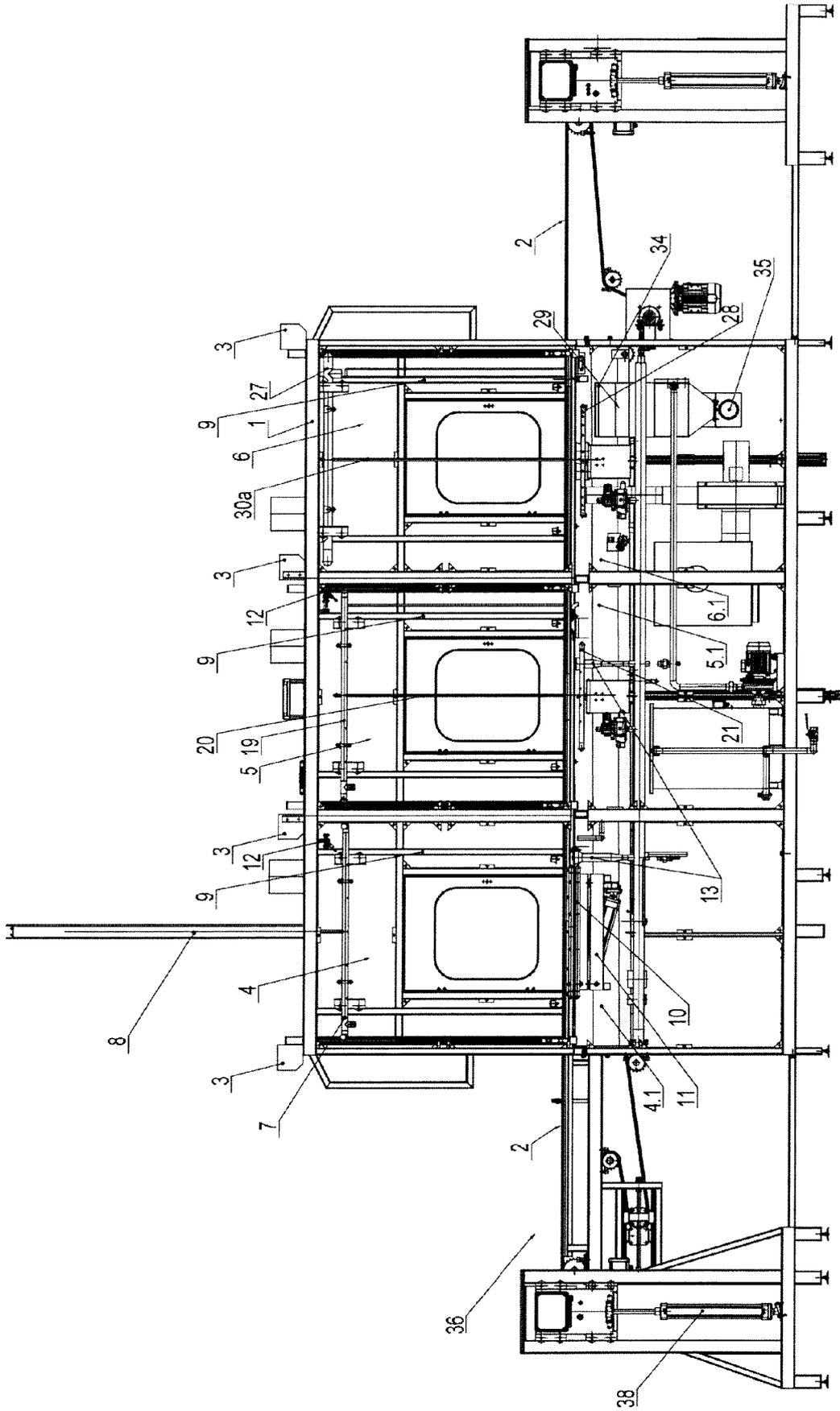


Fig. 2

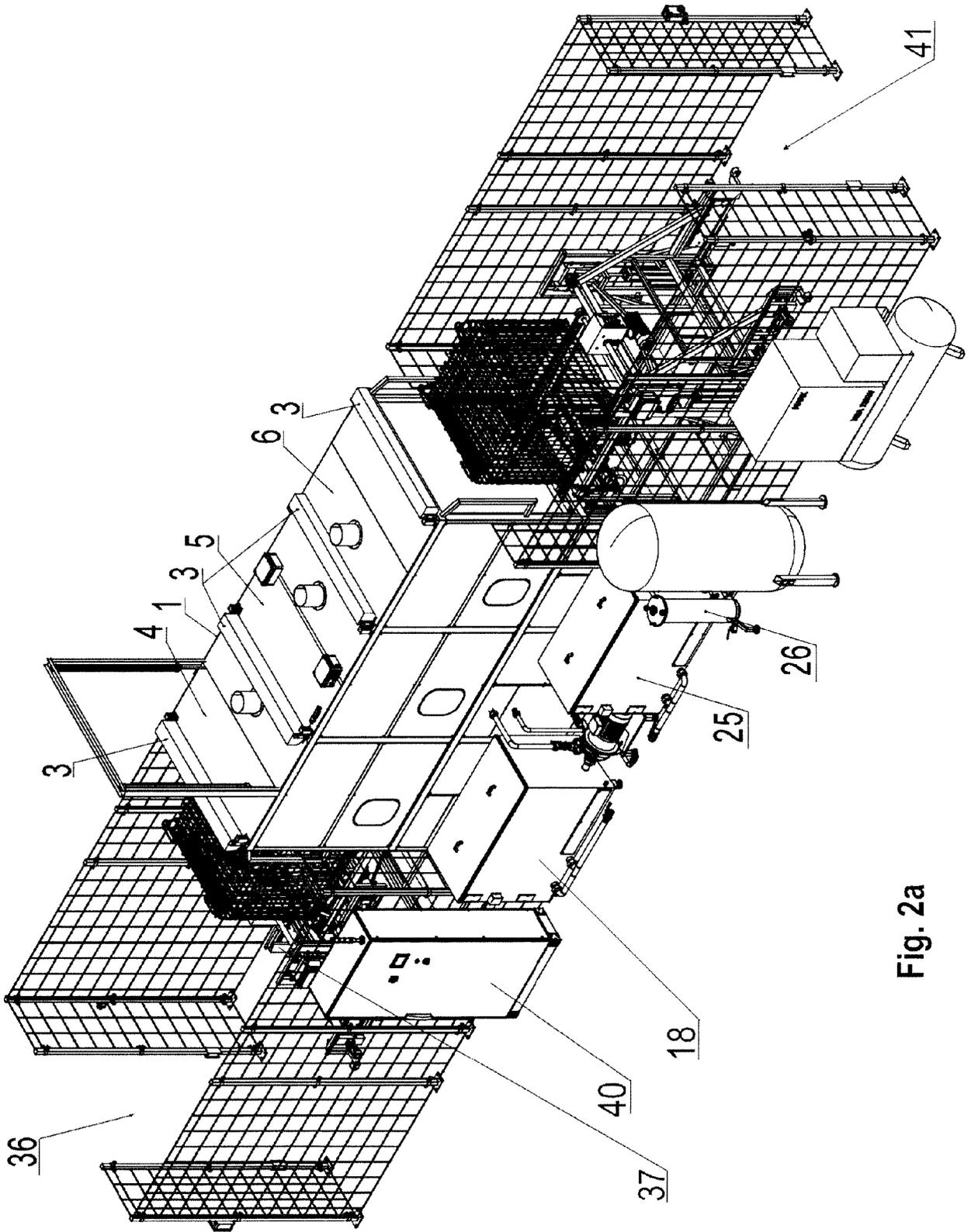


Fig. 2a

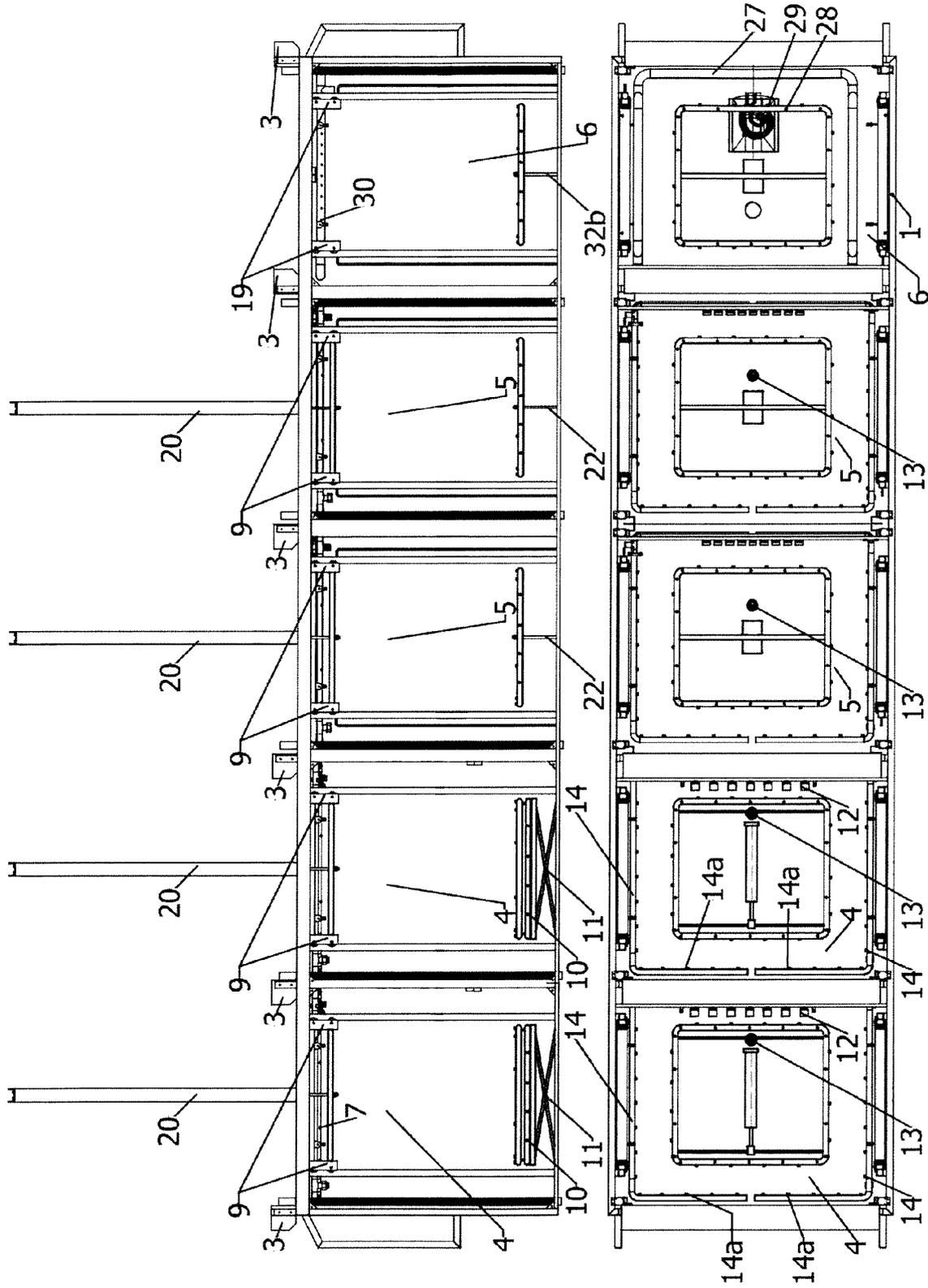


Fig. 3

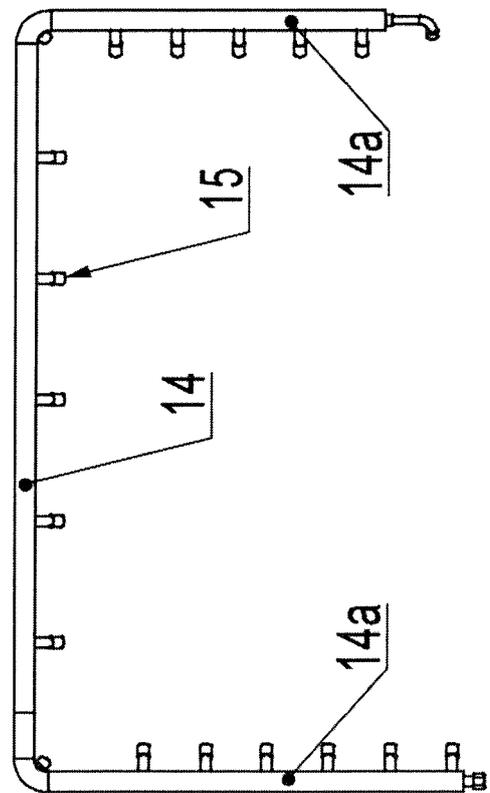
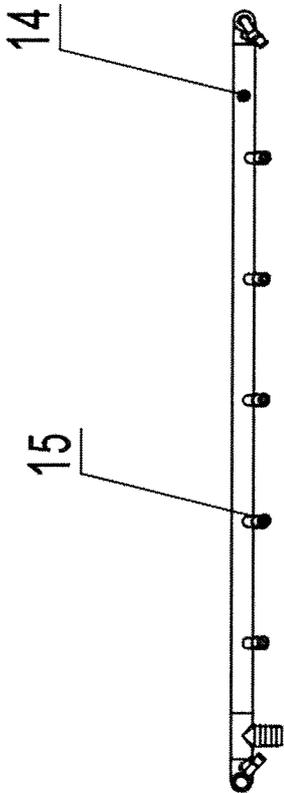
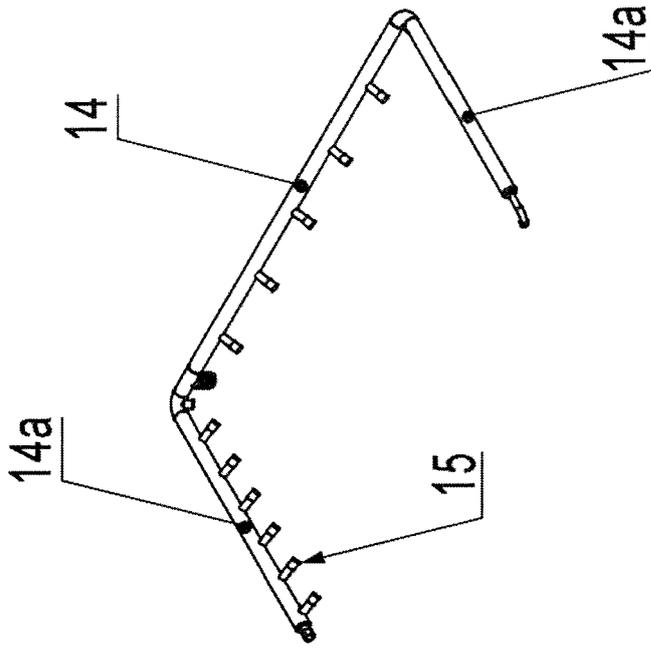


Fig. 4

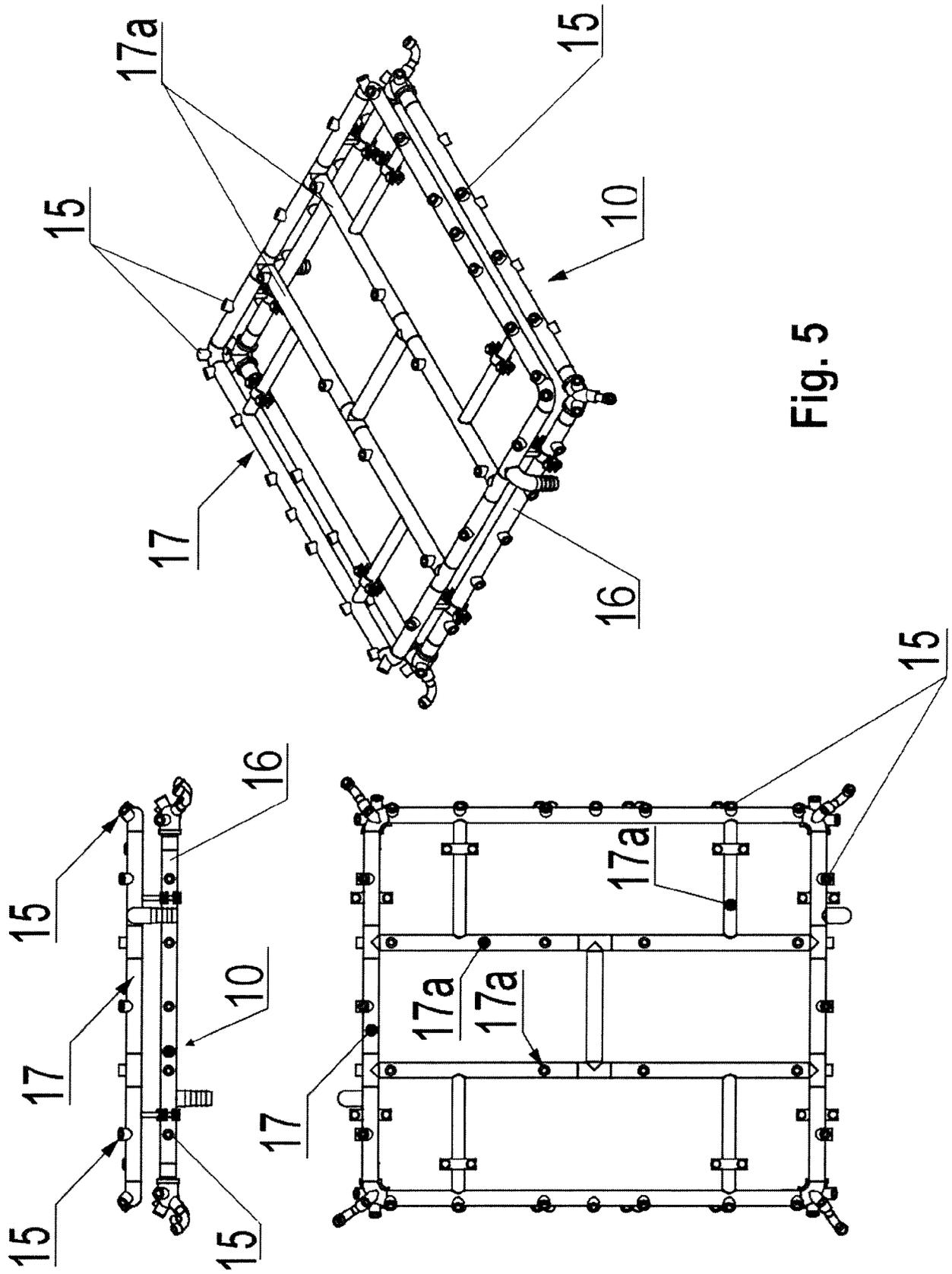


Fig. 5

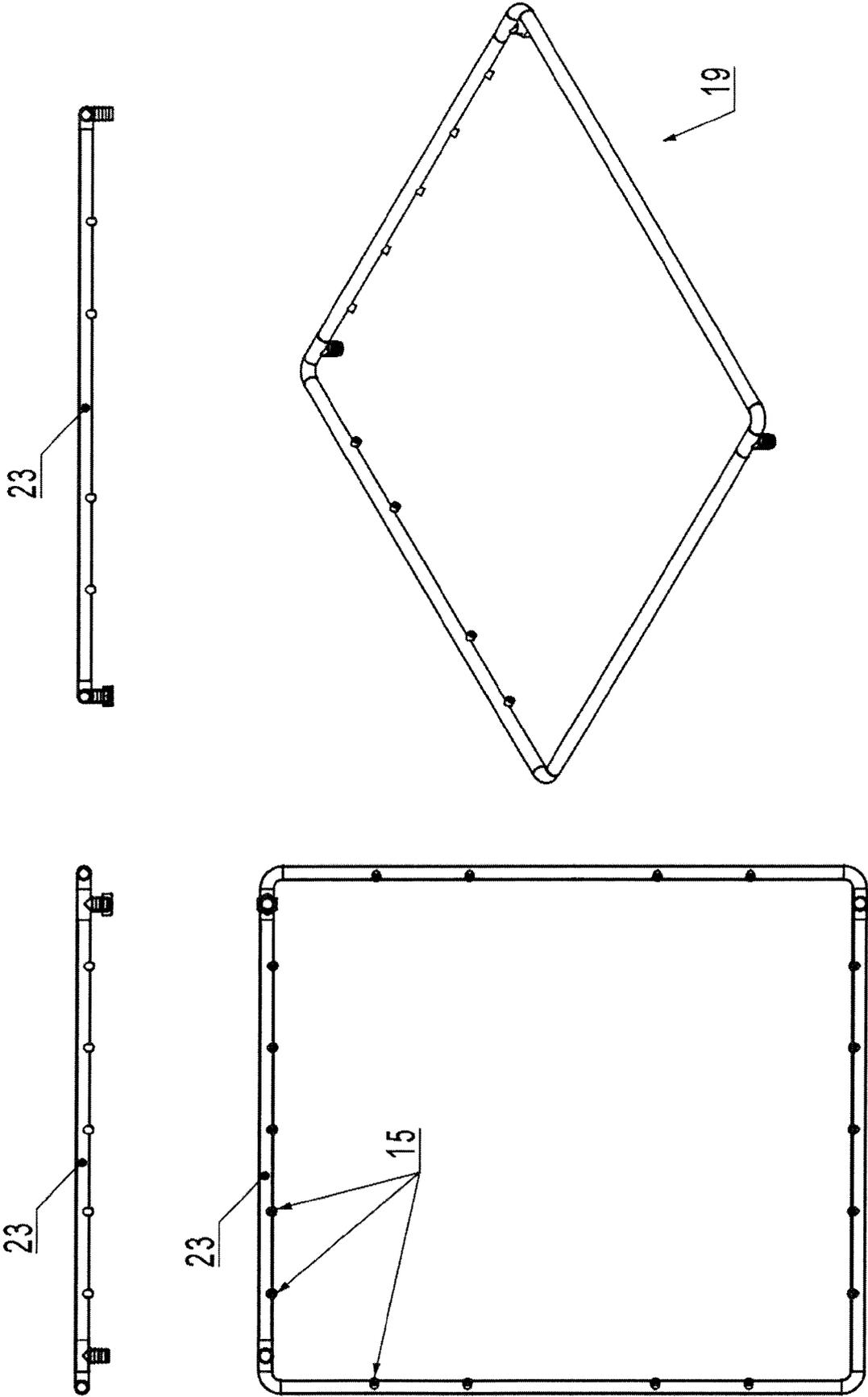


Fig. 6

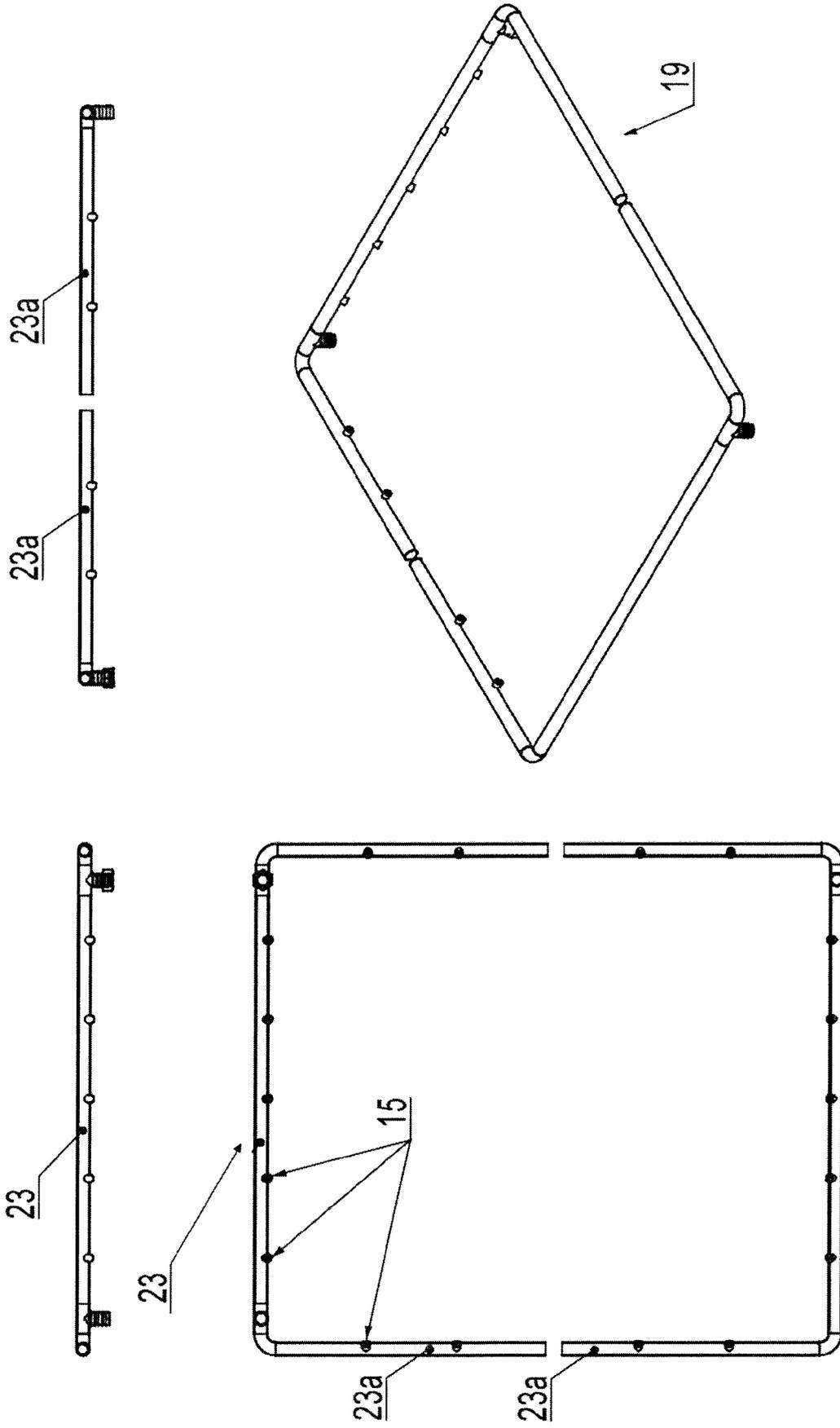


Fig. 6a

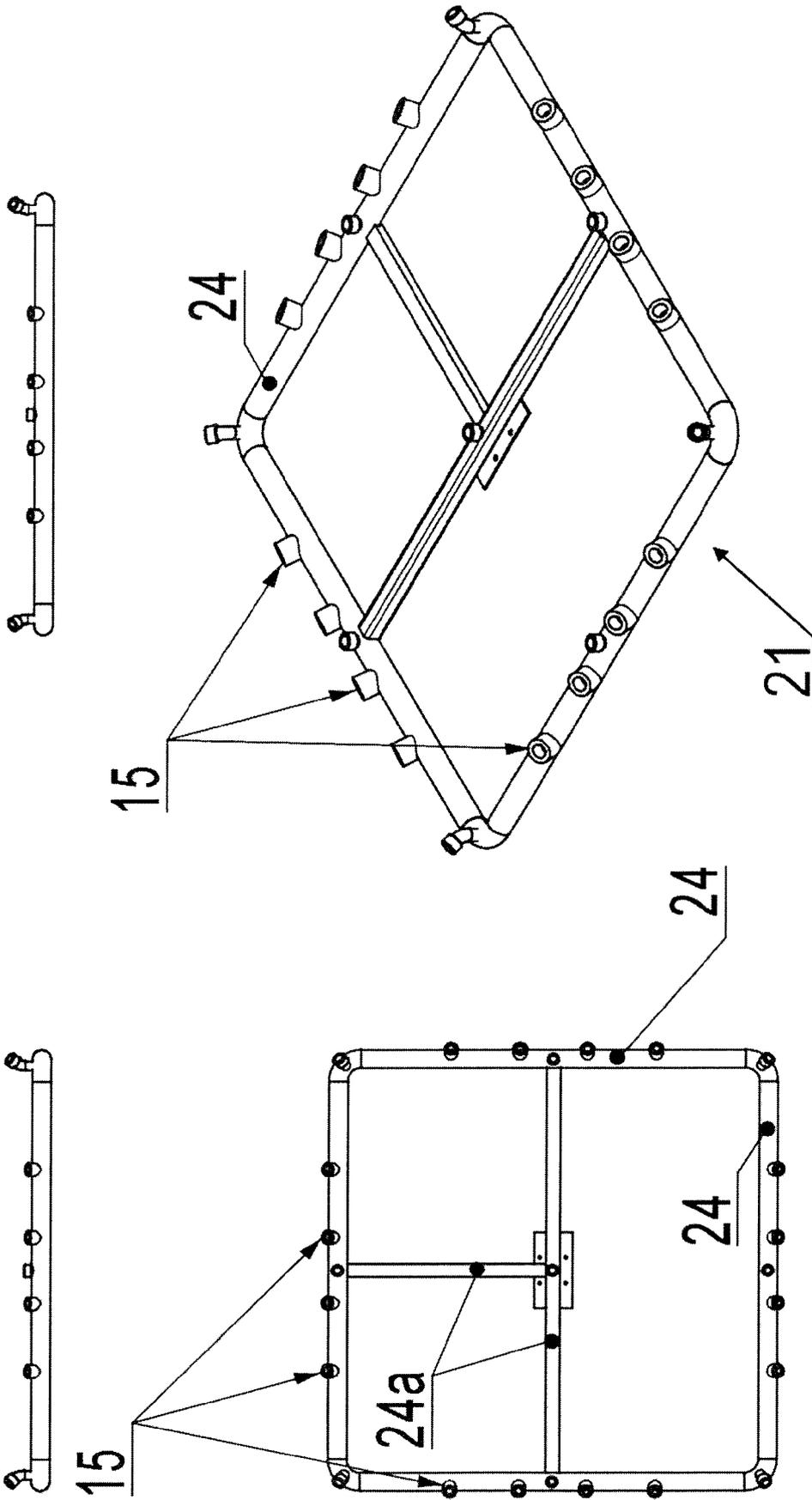


Fig. 7

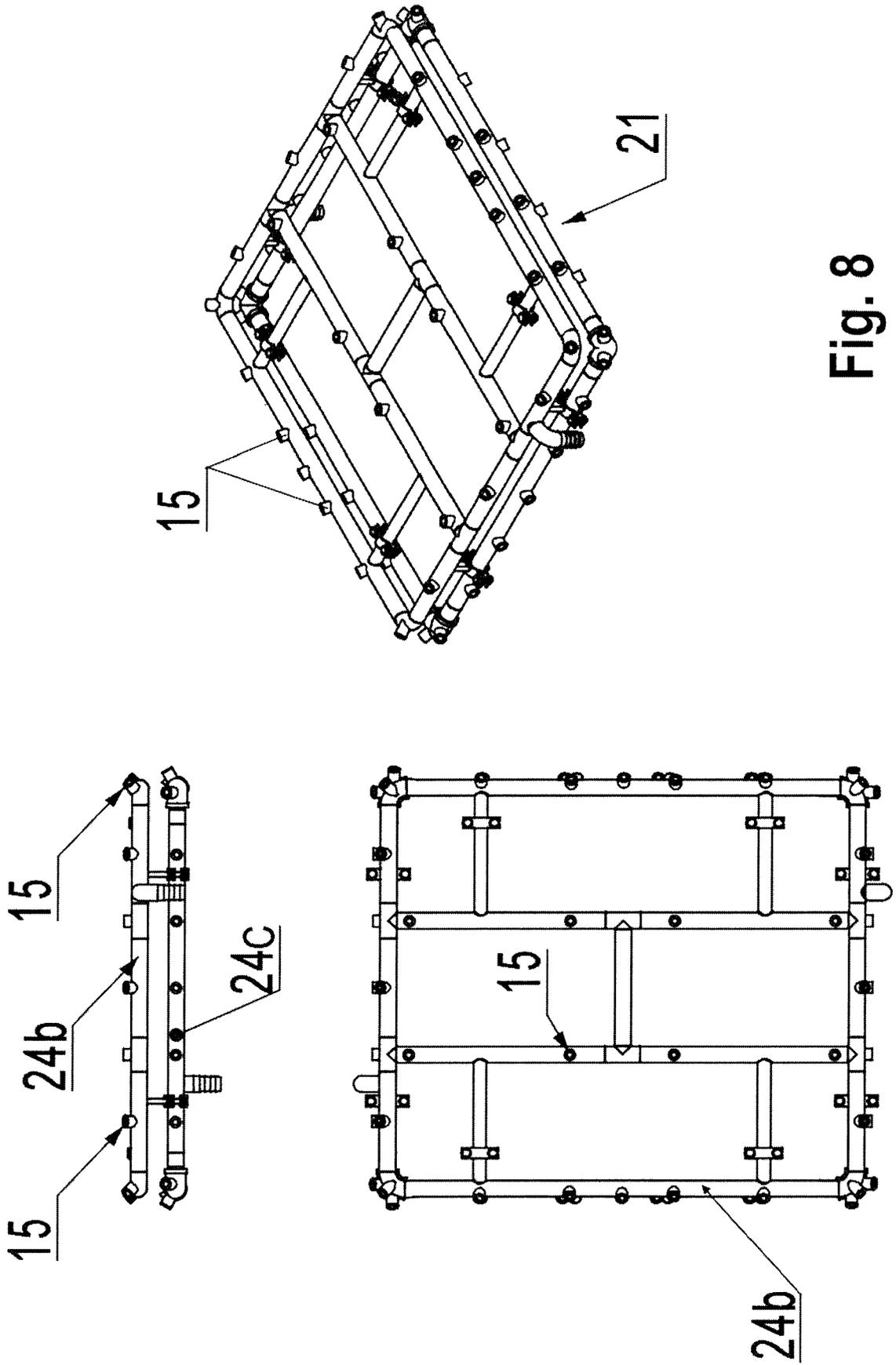


Fig. 8

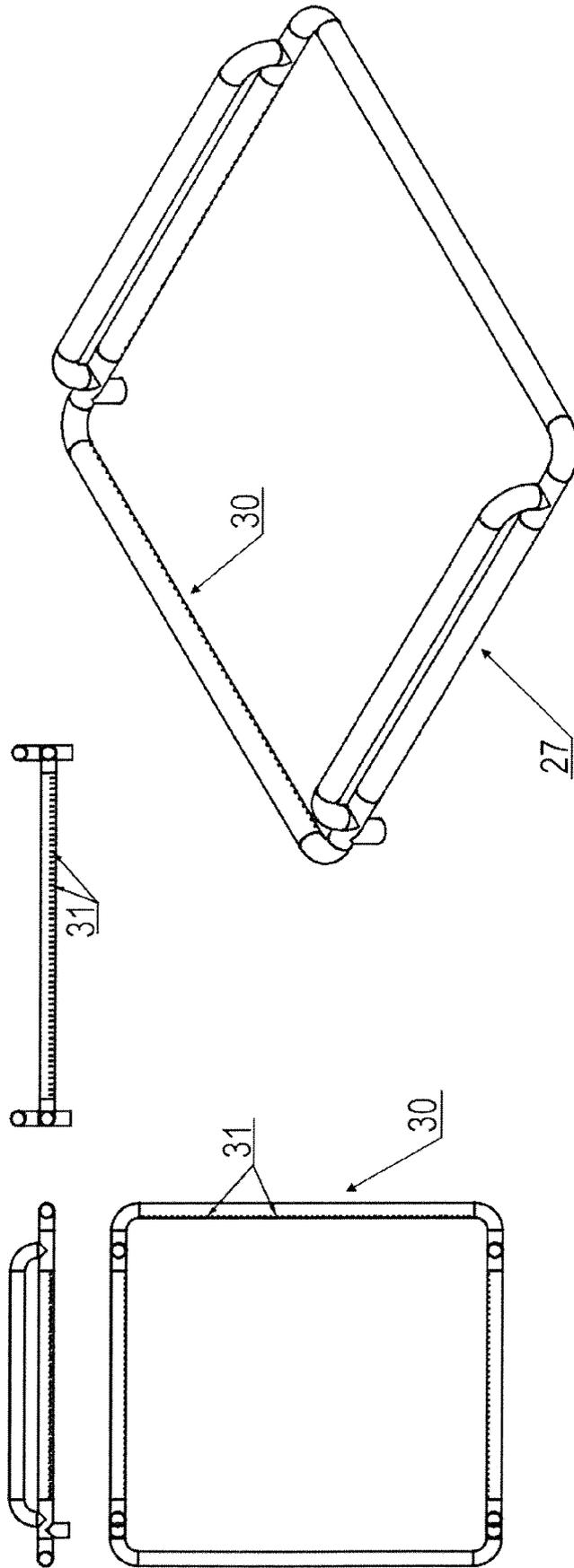


Fig. 9

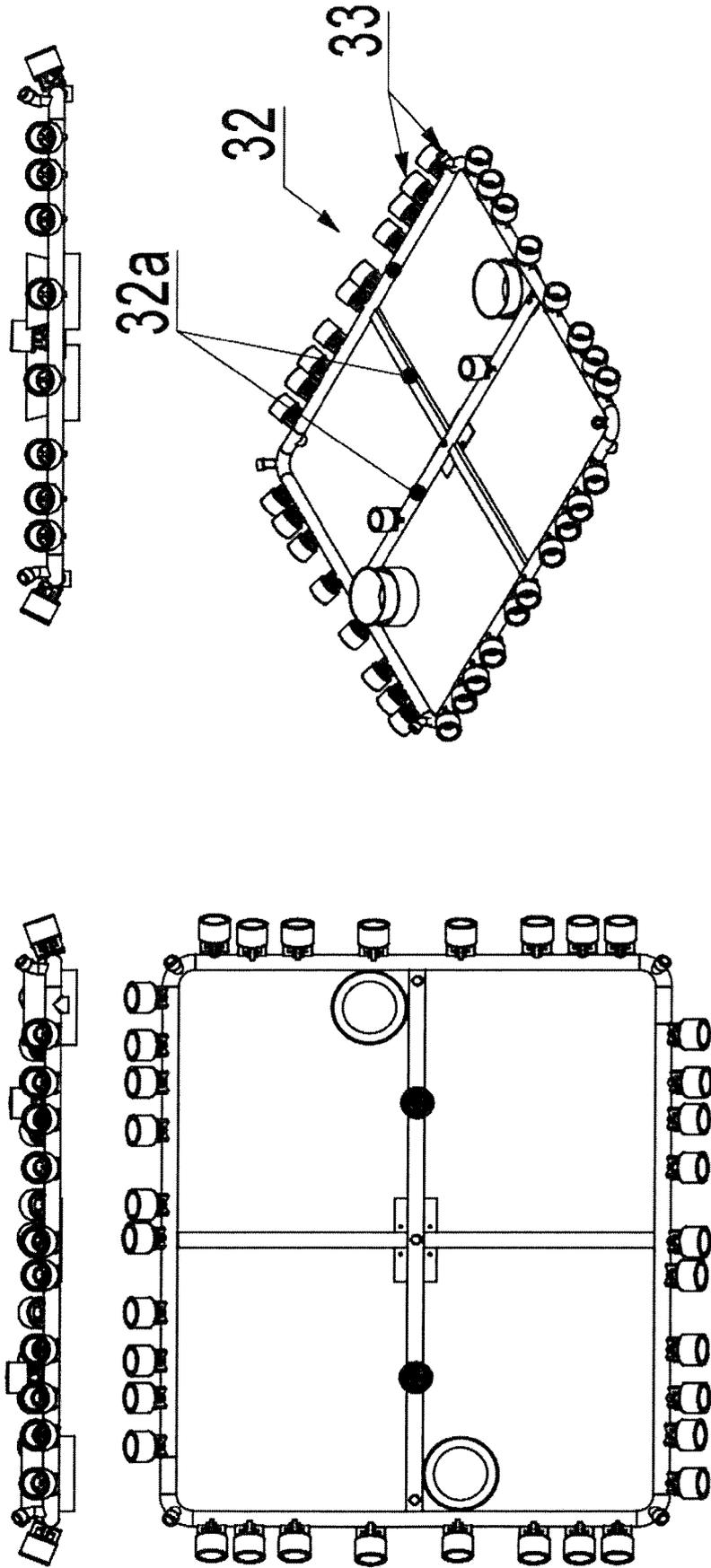


Fig. 10

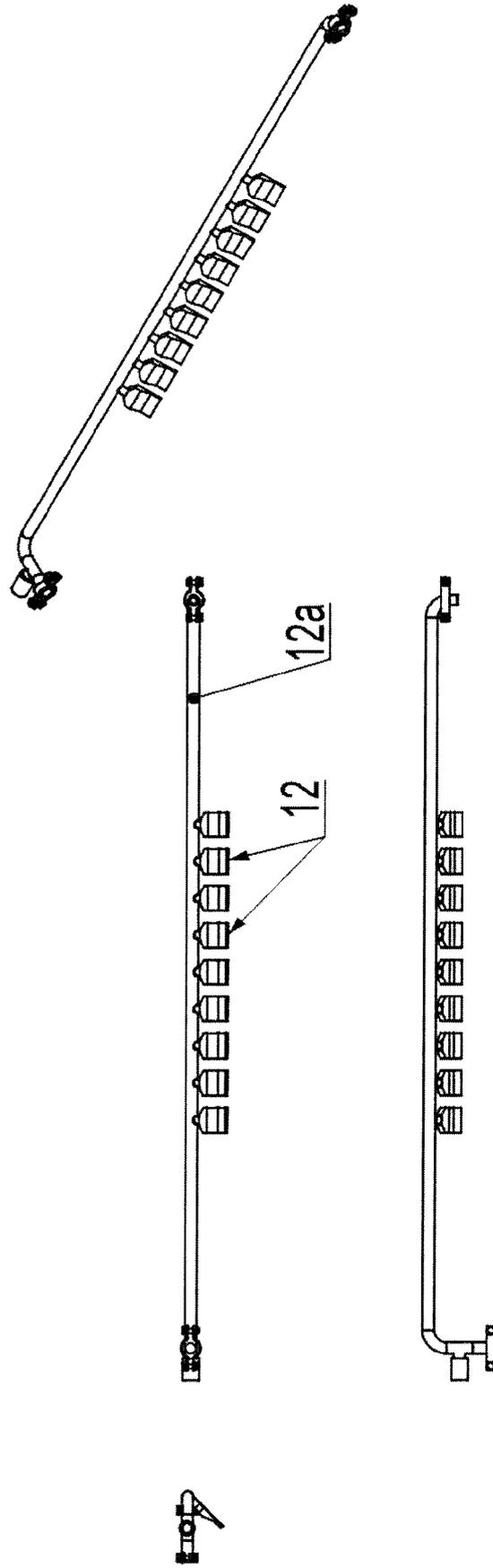


Fig. 11



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Place of search The Hague		Date of completion of the search 31 January 2020	Examiner Cassiat, Clément
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