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(54) **HOUSEHOLD DISH-WASHING MACHINE**

HAUSHALTSGESCHIRRSPÜLMASCHINE

LAVE-VAISSELLE DOMESTIQUE

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Description

Field of the invention

[0001] The present invention relates to a dish-washing machine having an open-circuit drying system, according to the preamble of Claim 1.

Prior art

[0002] Drying systems that equip present-day dish-washers are substantially of a closed-circuit or open-circuit type, it being possible for the latter to be further divided into natural-air-circulation systems and forced-air-circulation systems.

[0003] In dish-washers with closed-circuit drying systems, a fan draws moist air into the tub and then sends it back into the tub following upon dehumidification thereof. For this purpose, provided between the outlet for the moist air of the tub and the suction mouth of the fan is a condenser device or the like, whilst between the delivery section of the fan and the inlet for the air into the tub a heating element may be operative, to render the drying process more efficient (see, for example, FR 2491322 A).

[0004] In open-circuit dish-washers with natural ventilation, instead, a flow of air is induced in a non-forced way between an inlet and an outlet of the tub, i.e., without the aid of a fan, with the air coming from outside that replaces the moist air present in the tub (see, for example, EP 752232 A). In the case of forced-ventilation open-circuit machines, instead, the outlet for the moist air is in fluid communication with the inlet of an aspirator, the outlet of which is instead in fluid communication with the environment external to the tub by way of a duct, possibly shaped to perform functions of condenser. In these machines, the tub is also provided with at least one opening aimed at enabling air change, i.e., intake into the tub of air coming from the external environment in a non-forced way (see, for example, EP 556773 A) or else by way of a purposely provided aspirator (see, for example, WO 2009/008828 A).

[0005] The outlet for the moist air extracted from the tub may be defined at the front of the machine, for example, in the case of built-in machines or in the case of free-standing machines the back of which is to be set up against a wall of the domestic environment. In these solutions, the system for extraction of the moist air from the tub, which usually includes a radial fan with centrifugal impeller, is located in the door of the machine (see, for example, EP 0721762 A or the aforementioned WO 2009/008828). These solutions generally complicate production of the machine.

[0006] From US 2008/0202557 A an extraction system is also known, including a main duct for discharge of the moist air, which extends over the upper wall of the tub, with a respective outlet portion above an upper edge of the front door of the machine. In this case, the moist air is drawn in by way of a first radial fan, the suction branch of which is in fluid communication with a corresponding outlet passage provided in the upper part of the washtub, in a position close to the rear wall of the latter. The extraction system moreover comprises a second fan, set alongside the first fan. The second fan is operative for drawing in air from the environment overlying the washtub and for sending it into the duct for discharge of the moist air, downstream of the first fan, via a corresponding auxiliary duct, basically in order to reduce the humidity of the air extracted from the tub. Also this solution proves relatively complicated, cumbersome, and costly.

[0007] *Document* US2004/080219A1 *discloses a ventilation system for household appliances that comprises shuttering means capable of performing movement, the shuttering means comprising a linear component extending in the same axial direction of the suction duct through which damp air is sucked. Document* EP0521815A1 *discloses a dish-washer having a door with a ventilation hole and a fresh air inlet vent. Document* EP0920380A1 *discloses a dish-washer wherein during the drying phase moist and fresh air separately injected radially into a fan and are mixed, the proportions of moist and fresh air being adjustable by means of baffles. Document* EP0862893A2 *discloses a dish-washer which extracts warm moist air through a duct with a shut-off valve activated by an extraction fan. Document* EP1127532A2 *discloses a dish-washer including a grid for adjusting the intake of dry ambient air through a duct for the mixing with moist air before the exhaustion.*

Object and summary of the invention

[0008] In view of what has been set forth above, the main aim of the present invention is basically to provide a dish-washer equipped with a system for drying dishes with an open circuit for the air that is simple to produce, inexpensive, and compact. This object is achieved, according to the present invention, by a dish-washing machine having the characteristics referred to in Claim 1. Preferred characteristics of the invention are specified in the dependent claims. The claims form an integral part of the technical teaching provided herein in relation to the invention.

[0009] In brief, a dish-washing machine has a load-bearing structure and a washtub, there being articulated to the load-bearing structure a front door of the tub. The machine moreover has a system for extraction of moist air from the tub, which comprises a fan or suction assembly and a discharge duct. The suction assembly comprises a radial fan having a fan casing, housed in which is a centrifugal impeller, the fan casing defining a suction mouth and a delivery section, wherein the suction mouth is in fluid communication with an outlet opening formed in one of the upper wall and a stationary side wall of the tub. The discharge duct has an inlet portion, in fluid communication with the delivery section of the fan casing, and an outlet portion at the front of the machine.

[0010] Thanks to characteristics **listed in claim 1**, the

machine according to the invention may be equipped with a compact fan or suction assembly, which enables both suction of air charged with steam from the tub and suction of dry air from the environment external to the tub to be obtained, in particular in order to reduce the relative humidity of the air extracted from the tub prior to its expulsion via the discharge duct.

[0011] In a preferred embodiment, the fan casing is set in the box-shaped casing with its suction mouth set at a distance from the first and second suction inlets and staggered with respect thereto in such a way that the fan is designed to draw into the suction mouth of the corresponding casing substantially moist air from the first suction inlet and substantially dry air from the second suction inlet. In this way, the fan casing may be provided with a single suction opening, and is hence of simple conception and inexpensive.

[0012] In a preferred embodiment, the first suction inlet is formed in a bottom wall of the box-shaped casing, facing which is the suction mouth of the fan casing. In this way, the suction mouth of the fan generally faces the first suction inlet so that, notwithstanding the fact that the mouth and the inlet are at a certain distance from one another and staggered with respect to one another, an adequate draught effect is enabled by the fan, in regard to the air to be extracted from the tub. Advantageously, in an embodiment of this sort, the fan casing may be associated to an upper wall of the box-shaped casing of the suction assembly.

[0013] Preferentially, the outlet connection and/or the second suction inlet of the box-shaped casing is/are formed in a peripheral wall of the box-shaped casing. This positioning of the outlet connection and/or of the second suction inlet enable containment of the dimensions of height of the box-shaped casing of the suction assembly, which can hence be housed also in extremely small spaces - such as those existing between the upper wall of the tub and a corresponding top of the dish-washer or of a kitchen (in the case of built-in the machines) or between the side wall of the tub and a side wall of the cabinet of the dish-washer (when provided), thus guaranteeing in any case the necessary suction of air from the environment external to the washtub. On the other hand, not excluded from the scope of the invention is the case where the outlet connection and/or the second suction inlet are/is defined in an upper wall of the box-shaped casing.

[0014] In accordance with the invention, the suction assembly comprises a first valve arrangement that can be controlled for opening and closing the first suction inlet in particular when the fan is active or inactive, respectively, the first valve arrangement including a first electric actuator within the box-shaped casing.

[0015] The presence of the first valve arrangement prevents the undesired entry of moist air and/or steam into the box-shaped casing and passage thereof into the discharge duct, in the course of the steps of a treatment program different from the drying step, i.e., steps in which the fan is not active, as well as proving useful for reducing dispersion of heat and noise. The fact that the actuator is housed in the casing enables increase of the compactness of the device and facilitates assembly of the extraction system. Advantageously, also the mechanical transmission members operatively set between the actuator and the open/close element may be housed in the box-shaped casing.

[0016] In accordance with the invention, the suction assembly comprises a second valve arrangement, which can be controlled for opening and closing the second suction inlet, the second valve arrangement including a second electric actuator within the box-shaped casing.

[0017] The presence of the second valve arrangement makes it possible - according to the need - to enable or disable mixing of the moist air extracted from the tub with dry air taken in from outside the tub. Also in this case, housing of the second actuator within the box-shaped casing is to the advantage of compactness of the system and its simplicity of installation in the machine.

[0018] Preferentially, the machine further comprises control means, for controlling the first actuator independently of the second actuator. In this way, opening and closing of the first suction inlet may occur at distinct times with respect to opening and closing of the first suction inlet in order to enable different drying strategies. Very preferably, the aforesaid control means - possibly provided also for control of the fan - may be at least in part integrated in an electric/electronic board, which is also housed in the box-shaped casing of the suction assembly.

[0019] In a preferred embodiment, the fan casing is configured as a component distinct from the box-shaped casing. In this way, for implementation of the suction assembly, commercially available fans may be used. On the other hand, not excluded from the scope of the invention is the case where the casing of the fan is totally or in part defined by the box-shaped casing.

[0020] In one embodiment, the first valve arrangement comprises an open/close member, which is mounted substantially coaxial with respect to the first suction inlet and is able to assume a raised closing position and a lowered opening position with respect to a corresponding seat belonging to the first suction inlet. This configuration proves advantageous in so far as it contributes to guaranteeing a compact configuration of the suction assembly.

[0021] In accordance with the invention, the second valve arrangement comprises a sliding open/close element with a plate-like body having a plurality of first through openings, the sliding open/close element being set up against a wall of the box-shaped casing having a plurality of second through openings that form the second suction inlet, the sliding open/close element being displaceable between a closing position, in which the first through openings are staggered with respect to the second through openings, and an opening position, in which the first through openings are aligned to the second

through openings. Also this configuration proves advantageous in order to guarantee a compact configuration of the suction assembly.

[0022] In a preferred embodiment,

- the discharge duct has a portion intermediate to the inlet and outlet portions, the height of which decreases, preferably in a substantially progressive way, towards the outlet portion, and the width of which increases, preferably in a substantially progressive way, towards the outlet portion;
- at least the outlet portion and the intermediate portion of the discharge duct extend over an upper wall of the tub, with the outlet portion above an upper edge of the door; and
- the outlet opening is formed in one of the upper wall and a stationary side wall of the tub, with the box-shaped casing that is mounted on the aforesaid wall with the respective first suction inlet set in a position corresponding to the outlet opening and substantially coaxial thereto.

[0023] Thanks to the above characteristics, also the discharge duct may have a very compact configuration, with extremely small dimensions in height, which make possible positioning of its more extensive parts in the space available above the washtub, albeit enabling expulsion of the moist air from the front of the machine.

[0024] The outlet opening may therefore be formed in the upper wall of the tub, with the inlet portion of the discharge duct that also extends over the aforesaid upper wall, or else the outlet opening may be formed in a stationary side wall of the tub, in which case the inlet portion of the discharge duct also extends at least in part on the outside of said side wall, towards the upper wall of the tub.

[0025] In one embodiment, the outlet portion of the discharge duct comprises an outlet divided into a plurality of sub-outlets by means of a plurality of intermediate walls or formations. In this way, the flow at outlet from the duct can be divided into a plurality of sub-flows, with the aforesaid walls or formations that contribute to bestowing the necessary structural strength on the thinnest portion of the discharge duct, i.e., its outlet portion.

[0026] In one embodiment, at least one of an upper wall and a lower wall of the intermediate portion of the discharge duct is generally plane and set horizontally, whereas the other of the upper wall and the lower wall of the intermediate portion is generally inclined starting from the inlet portion of the discharge duct towards its outlet portion. This generally tapered conformation of the prevalent part of the discharge duct guarantees an expulsion that is efficient from the fluid-dynamic standpoint.

[0027] In one embodiment, the load-bearing structure of the machine includes an upper structural cross member, with the outlet portion of the discharge duct that extends at least partially over the structural cross member and is provided with means for fixing thereto. In this way, the discharge duct may be effectively constrained also to its end region opposite to that of connection to the suction assembly, the casing of which is in turn fixed to the tub.

[0028] The aforesaid fixing means preferably comprise one or more elements, which are formed integrally with the discharge duct and/or are elastically deformable, to the advantage of simplicity of construction and of recovery of any possible tolerances of assembly.

Brief description of the drawings

[0029] Further objects, characteristics, and advantages of the invention will emerge clearly from the ensuing detailed description of an embodiment provided purely by way of explanatory and non-limiting example, with reference to the annexed plates of drawings, wherein:

- Figure 1 is a partial and schematic perspective view of a dish-washing machine according to a possible embodiment of the invention;
- Figure 2 is a partial and schematic perspective view of the machine of Figure 1, with some further elements and an extraction system represented in partial exploded view;
- Figure 3 is a schematic perspective view of an extraction system according to an embodiment of the invention;
- Figure 4 is an exploded schematic view of a duct of an extraction system according to an embodiment of the invention;
- Figure 5 is a schematic perspective view of a suction assembly of an extraction system according to an embodiment of the invention;
- Figure 6 is a perspective view of a first part of a casing of the assembly of Figure 5, with some components that are to be mounted thereon;
- Figure 7 is a perspective view of a second part of a casing of the assembly of Figure 5, with some components that are to be mounted thereon;
- Figure 8 is a perspective view of the first casing part of Figure 6, with the corresponding components mounted;
- Figure 9 is a perspective view of the second casing part of Figure 7, with the corresponding components mounted;
- Figure 10 is a schematic top plan view of a suction assembly of an extraction system according to an embodiment of the invention, with a casing part removed;
- Figures 11 and 12 are perspective views of a suction assembly of an extraction system according to an embodiment of the invention; and
- Figure 13 is a view similar to that of Figure 2, regarding a further embodiment of the invention.

Description of preferred embodiments of the invention

[0030] Reference to *"an embodiment"* or *"one embod-*

iment" in the framework of the present description is intended to indicate that a particular configuration, structure, or characteristic described in relation to the embodiment is comprised in at least one embodiment. Hence, phrases such as *"in an embodiment"* or *"in one embodiment"* and the like that may be present in various parts of the present description do not necessarily all refer to one and the same embodiment. Furthermore, the particular configurations, structures, or characteristics may be combined in any adequate way in one or more embodiments. The references used in what follows are merely for convenience and do not define the sphere of protection or the scope of the embodiments.

[0031] It is moreover pointed out that in the sequel of the present description only the elements useful for an understanding of the invention will be described, taking for granted, for example, that the machine according to the invention comprises all the elements in themselves known for operation of a dish-washing machine, including a possible external cabinet thereof, a user interface, a control system, pumps, level sensors, heating elements, a sprinkler system for spraying the dishes, etc.

[0032] In Figures 1 and 2, represented in a partial and schematic way is a dish-washing machine 1 having a system for drying dishes according to one embodiment of the invention. The machine 1 is illustrated limitedly to the parts of immediate interest for an understanding of the present invention.

[0033] The machine 1 has a load-bearing structure, which comprises a base 2 that supports a washtub 3. The base 2, made, for example, of injection-moulded plastic material, defines a housing space within which various functional components of the machine 1 are positioned, amongst which, for example, a washing pump, a discharge pump, a pressure switch, a sump for collecting the washing liquid, etc. (which are not visible). The washtub 3 is of a conception as a whole known and hence comprises a lower wall, an upper wall, and four side walls. Represented in Figure 1 are only the upper wall 3a and the three stationary side walls of the tub 3, i.e., the rear wall 3b and the right-hand and left-hand walls, designated by 3c; the fourth side wall of the tub 3, i.e., its front wall, is constituted by an inner shell of the door of the machine, designated by 4 in Figure 2, which is articulated to the load-bearing structure of the machine, for example, to its base 2. In the example, the load-bearing structure also includes metal upright elements and cross members, amongst which an upper cross member 5, which extends substantially parallel over the upper edge of the door 4, when closed, in a position set-in with respect thereto. Designated by 6 in Figure 2 are two side walls of a body of the machine 1, fixed in an upper area thereof to the cross member 5. The walls 6 may be fixed in their lower part to the base 2. The side walls 6 may be omitted in the case of built-in machines.

[0034] In one embodiment, one of the side walls 3c of the tub 3 (for example, the left-hand wall 3c) is provided with an opening A (Figure 2), where - on the outside of the tub - a known multipurpose device is mounted, which may integrate the so-called "airbreak", through which the water coming from the water mains is drawn into the tub, according to modalities in themselves known. This device, which is also of a construction in itself known and is not shown, is prearranged for setting the inside of the tub 3 in air communication with the external environment, substantially for antisyphoning functions, in order to prevent any undesirable return to the water mains of water already charged into the machine 1, and for venting functions, in order to prevent, in the course of operation of the machine 1, over-pressures from possibly arising within the tub 3, as well as for enabling air change within the tub 3, in the course of a step of forced extraction of moist air from the tub itself, as described hereinafter.

[0035] Alternatively, air change in the tub in the course of drying may be guaranteed via a tubular chimney, which extends through a corresponding passage provided in the lower wall of the tub 3, preferably in a corner area thereof, with interposition of sealing means and fixing means. Such a chimney, which is also of a type in itself known and hence not represented, has an upper end and a lower end, which open on opposite sides of the lower wall of the tub, with the upper end that is located at a height greater than the maximum level that can be reached by the water in the course of washing or rinsing operations performed by the machine 1. Associated to the upper end of the chimney is a cap or lid, which defines a substantially shielded or labyrinthine path, whilst the lower end of the chimney opens in the space circumscribed by the base 2 of the machine, for setting the tub 3 in air communication with the outside. Furthermore, the air change in the tub is guaranteed also by leakage that occurs, for example, at the interface between the stationary part of the tub 3 and the part constituted by the inner shell of the door 4.

[0036] With reference also to Figures 3-5, the drying arrangement of the machine 1 includes a system for extraction of moist air or steam from the tub 3, which comprises a fan or suction assembly 7 and a discharge duct 8. The assembly 7 has a respective box-shaped casing in which a centrifugal fan is housed, described hereinafter. As may be seen in particular in Figures 4-5, the discharge duct 8 comprises a hollow body having a generally flattened shape, which has an inlet portion 10 and an outlet portion 11 between which an intermediate portion 12 extends having a height that decreases, preferably in a substantially progressive way, towards the outlet portion 11, and a width that increases, preferably in a substantially progressive way, towards the outlet portion 11.

[0037] In the portions 10 and 11, the duct 8, and in particular its hollow body, defines an inlet and an outlet, respectively. Preferentially, this outlet extends substantially over the entire front of the portion 11. As will be seen hereinafter, in a preferred embodiment, the aforesaid outlet - designated as a whole by 14 in Figure 3 - is divided into a plurality of sub-outlets. These sub-outlets may be defined by intermediate walls or formations,

some of which are designated by 14a in Figure 4, provided in the portion 11 or a part thereof, in particular the terminal part. These walls 14a also perform a structural function, rendering the duct 8 less vulnerable to deformation, which over time might cause an undesired variation of its geometry.

[0038] The generally flattened hollow body of the duct 8 may be made of a single piece of plastic material, for example, via blow moulding. However, in preferred embodiments, the body of the duct 8 is made of a number of parts joined longitudinally together. In the case illustrated in Figure 4, for example, the body of the duct 8 comprises a lower half-shell 8a and an upper half-shell 8b made of plastic material joined together, for example, by hot-blade or vibration welding or else via mechanical connection means such as hooks that couple with eyelets obtained on the opposite half-shell. In such an embodiment, one of the two half-shells, for example, the lower half-shell 8a, may define integrally also the inlet portion 10, obtained by a substantially tubular formation 10a, here having a quadrangular cross section. Once again with reference to the case of a body of the duct 8 made of two half-shells, one of them - for example, the lower half-shell 8a - may define integrally the intermediate walls or formations 14a.

[0039] In a preferred embodiment, associated to the body of the duct 8 are means for fixing thereof to the structure of the machine 1. In the example illustrated - see, for example, Figure 4 - these means comprise two elements 13, which project laterally from the body of the duct 8, in the proximity of, or at, an outlet portion 11 thereof, and are provided for anchorage to the cross member 5 of the structure of the machine 1, for example, via screws or hooking clips, or again define appendages that can be engaged in corresponding openings provided in the cross member 5. Preferably, the elements 13 are obtained in a single piece with a half-shell of the body of the duct 8, in particular the lower half-shell 8a.

[0040] In a preferred embodiment, also the box-shaped casing of the suction assembly 7 has a generally flattened shape and is formed in at least two parts, such as a lower part 7a and an upper part 7b, as may be seen, for example, in Figure 5. Preferentially, the lower part 7a is generally hollow, i.e., has a bottom wall and a peripheral wall, whilst the part 7b forms a lid. Also the two parts 7a and 7b may be obtained via simple operations of moulding of plastic material, for example, a thermoplastic material, and are rendered fixed with respect to one another, preferably but not necessarily in a separable way, for example, via snap-action couplings or screws.

[0041] In the example illustrated, the casing part 7a defines integrally an outlet connector 15, which is to form a connection between the inlet portion 10 of the duct 8 and the delivery section of the fan previously mentioned, described hereinafter.

[0042] In the example, the outlet connector 15 is defined in the form of a tubular portion of the casing part 7a, on which the portion 10 of the body of the duct 8 is designed to be fitted.

[0043] In one embodiment, the portion 10 and the outlet 15 have means for mutual coupling, such as, for example, snap-action couplings, In the example illustrated, the outlet 15 is provided with external teeth, possibly elastically deformable ones, represented only in Figure 5, where they are designated by 16a. On the other side, the portion 10 is provided with corresponding engagement seats, designated by 16b only in Figure 4.

[0044] Figure 6 illustrates a possible embodiment of the casing part 7a, which comprises a bottom wall 20 and a peripheral wall 21. The bottom wall 20 has a through opening 22 associated to a tubular connector 23, which is clearly visible in Figures 11 and 12, in order to form a main suction inlet of the casing of the assembly 7. The diameter of the connector 23 is preferentially larger than the diameter of the opening 22.

[0045] In one embodiment, the extraction system 7-8 comprises a first valve arrangement, which includes an open/close member operated by a corresponding actuator, for enabling or preventing passage of moist air into the duct 8 when the suction assembly 7 is active or inactive, respectively. As already mentioned, such a valve arrangement proves useful for preventing any dispersion of heat and/or moist air during hot steps of the treatment cycle (pre-washing, washing, rinsing) that precede the drying step in order to improve the energy efficiency of the machine and prevent any condensation of moist air that might flow naturally into the duct 8. This measure proves also useful for the purposes of long-term protection of the fan used.

[0046] For this purpose, in the embodiment exemplified, a first open/close member 24 is designed to be mounted at the opening 22, in particular within the connector 23, so that an upper surface thereof can operate substantially in a fluid-tight way with respect to the edge of the opening 22, which functions substantially as valve seat. Preferentially, the open/close member 24 is displaceable in a direction substantially perpendicular with respect to the bottom wall 20 in which the opening 22 is defined, and elastic means are preferably associated thereto, which are operative for urging the member itself into a generally raised position, i.e., such that the open/close element 24 occludes the inlet opening 22.

[0047] In one embodiment, associated to the wall 20 - and preferably formed integrally with the wall 20 - is a support 25 for a first transmission member 26. In the example, the member 26 is in the form of a fork lever, having an end provided with an opening 26a for engagement of a side pin (24b, Figure 10) associated to a stem 24a of the open/close member 24, here substantially of the disc or mushroom type. The opposite end of the member 26 defines two fork arms, each of which having a pin 26b for engagement in a respective seat 25a of the support 25. In one embodiment, associated to the support 25 and/or to the transmission member 26 are the aforementioned elastic means that urge the member 24 towards the corresponding closing position. In the example, the

aforesaid elastic means comprise a spring designated by 27.

[0048] The peripheral wall 21 of the casing part 7a has an interruption or side passage 28, where a slide guide 29 is defined - substantially in a position corresponding to the bottom wall 20 - for a second open/close member, described hereinafter. As will emerge from what follows, the passage 28 is part of a second inlet of the casing 7a-7b of the fan or suction assembly 7. In the example, the guide comprises an axially extensive relief of the wall 20.

[0049] In a preferred embodiment, defined within the casing part 7a is a sort of subchamber 30, where the outlet connector 15, the opening 22, and the passage 28 are located. Preferentially, for this purpose, the casing part 7a has an intermediate wall 31, which rises from the bottom 20 and connects together two different points of the peripheral wall 21, where in the stretch of the wall 21 comprised between these two points the outlet connector 15 and the side passage 28 are located and where, in the region of the bottom wall 20 delimited by the aforesaid stretch of the peripheral wall 21 and by the intermediate wall 31, the opening 22 is located. In the example, the wall 31 moreover has an interruption 31a in a position corresponding to the support 25.

[0050] Once again in Figure 6, designated by 32 is a fluid-tight gasket, designed to co-operate with a wall projecting from the casing part 7b, as described hereinafter. Preferentially, this gasket 32 is mounted on the bottom wall 20 within the subchamber 30 so as to follow the peripheral profile of the latter.

[0051] In the example illustrated, the bottom wall 20 has a further opening 20a, for an electrical-connection wiring (not represented). Alternatively, the opening designed for passage of the wiring may be obtained in the peripheral wall 21.

[0052] Figure 7 illustrates a possible embodiment of the casing part 7b, comprising a preferably plane main wall 33 having a peripheral relief 34, with a profile largely extent corresponding to that of the peripheral wall 21 of the casing part 7a in order to enable precise coupling therewith.

[0053] From the main wall 33 there rises a wall 35, having a development substantially corresponding to the perimeter of the subchamber 30, but of slightly smaller dimensions. In this way, during assembly, the wall 35 can fit into the subchamber 30, with its bottom edge that bears upon the gasket 32.

[0054] The wall 35 has a first passage 36, which - in the condition where the parts 7a, 7b are assembled - is in a position corresponding to the outlet connector 15 of the casing part 7a. The wall 35 then has, in an external stretch thereof, a second passage that forms a secondary suction inlet of the assembly 7. In the aforesaid assembled condition, this second passage is in a position corresponding to the passage 28 of the peripheral wall 21 of the casing part 7a. In a preferred embodiment, the second passage of the wall 35 is made of a plurality of through openings 37, here in the form of generally vertical slits. Consequently, in the assembled condition, the slits 37 come to face the passage 28 of the wall 21. Alternatively, the windowing obtained by the slits 37 may be provided on the part 7a in the portion occupied by the passage 28.

[0055] In an internal stretch of the wall 35, a further through opening 38 is defined, where a displacement seat 39 is obtained for a corresponding second transmission member 40. In one embodiment, the member 40 is able to slide through the cylindrical opening 38 and in the seat 39 and is substantially wedge-shaped, or in any case defines a top inclined surface 40a that is designed to co-operate with the first actuation member 26 associated to the casing part 7a, in order to bring about angular movement thereof about an axis of rotation defined by the corresponding pins 26 (see Figure 6).

[0056] Mounted within the area circumscribed by the wall 35 is the aforementioned radial fan 41. The fan 41 has a fan casing 42 with a preferably circular suction mouth 42a and a delivery section 42b. In the assembled condition, the delivery section 42b is in a position corresponding to the passage 36 and, hence, to the outlet connector 15 of the casing part 7a. Housed in the fan casing 42 is a centrifugal impeller 43, operated via an electric motor 43a. The fan casing 42 is preferably fixed to the casing part 7b, with modalities in themselves known (for example, via screws or mechanical attachments). Equivalently, installation of the fan casing 42 on the box-shaped casing of the assembly 7 may be obtained on the part 7a by means of similar fixing means.

[0057] Designated as a whole by 44 is a first electric actuator. In a preferred embodiment, the actuator 44 is a linear actuator, very preferably a thermoelectric actuator. Actuators of this sort are well-known and do not require a detailed description (see, for example, EP0940577 A). Here, let it suffice to recall that a thermoelectric actuator includes a cylinder containing a material which is able to increase in volume when heated (typically a wax) and in which a piston is at least partially immersed. The actuator comprises a casing in which an electric heater is present, typically a PTC resistor, and inside which also the first end of a drive shaft is located, which is to be moved by the piston, countering the action of an elastic element, typically a spring. When the heater is supplied, it heats the body of the piston, causing an increase in volume of the aforesaid material and hence an advance of the piston towards the outside of the cylinder, with consequent advance of the shaft against the action of the corresponding elastic element. When electric power supply ceases, the material progressively cools and reduces in volume, enabling re-entry of the piston into the cylinder, as a result of the action of the elastic element that acts on the drive shaft. It will be appreciated that operation of this type of actuators is subject to operating inertia, due to the times necessary for heating and cooling the material the volume of which varies.

[0058] The actuator 44 is mounted on the casing part 7b with its shaft (visible in 44a) coupled to the transmis-

sion member 40 in such a way as to cause a linear reciprocating movement. For this purpose, preferentially, rising from the wall 33 of the body 7b are formations for positioning the actuator 44, designated by 45 in Figure 7. Equivalently, the actuator 44 may be mounted on the box-shaped casing of the assembly 7 on the part 7a, and in this case the positioning formations 45 and the displacement seat 39 are provided on the part 7a.

[0059] As already mentioned, the casing 7a-7b of the suction assembly 7 is provided with a secondary suction inlet, here obtained via the slits 37. This inlet can be used for enabling pre-mixing of the moist air extracted from the tub 3 with air present outside the tub 3 (here above the tub), when the fan 41 is operating. This measure may prove useful, for example, for reducing the relative humidity of the air extracted from the tub in order to prevent risks of condensation within the duct 8 and, in particular, at the outlet portion 11, where drops of condensate that may possibly have formed would more easily wet in an undesirable way parts of the machine 1 accessible to the user, especially the control panel 4a (Figure 2) located in the upper portion of the door 4 or else in the stationary part of the machine 1 above the door 4.

[0060] Preferentially, associated to the aforesaid secondary suction inlet is a corresponding second valve arrangement.

[0061] With reference, for example, to the embodiment illustrated, designated by 46 is a second electric actuator, which is also preferably a linear actuator, very preferably a thermoelectric actuator of the same type as the actuator 44. The actuator 46 is designed to move a second open/close member, designated as a whole by 47, operative at the secondary suction inlet constituted by the slits 37. In the example, the open/close element 47 basically comprises a body in the form of a generally elongated plate, having a plurality of through openings 47a, preferably in the form of slits similar to the slits 37 of the wall 35. The body of the open/close element 47 may advantageously be shaped at an end thereof to define a seat for coupling with a corresponding end of the shaft of the actuator 46.

[0062] Consequently, preferentially, the open/close element 47 is a sliding open/close element, which is to be mounted directly adjacent to the portion of wall 35 having the slits 37. For this purpose, as will be seen, the sliding seat 29 provided on the casing part 7a is exploited. There are then provided means (not illustrated) in the casing part 7b for positioning the actuator 47, which may for example include formations similar to those designated by 45. Alternatively, the arrangement of the sliding seat 29 and of the means for positioning the actuator 47 may be reversed, so that the former is provided on the casing part 7b, whereas the latter are provided on the casing part 7a.

[0063] Finally, designated as a whole by 48 in Figure 7 is a control board, comprising a PCB support, mounted on which are the electrical and/or electronic components that supervise operation of the fan 41 and of the actuators 44 and 46. Associated to the PCB support is an electrical connector 49 for connection of a supply and control wiring (not represented). In the assembled condition, the part of the connector 49 to which the aforesaid wiring is connected is located substantially at the opening 20a of the casing part 7a. Also the actuators 44 and 46 are electrically connected to the board 48 via corresponding electrical leads (not represented).

[0064] It is to be noted that the presence of a control board within the casing 7a-7b of the suction assembly 7 must be understood as optional characteristic, it being possible for the functions of the board 48 to be transferred totally or in part to a main control board of the machine 1 or to other sub-systems of its control circuit, in a remote position with respect to the assembly 7.

[0065] Visible in Figures 8 and 9 are, respectively, the casing parts 7a and 7b, with the corresponding components mounted thereon, it remaining understood that each of the functional components may in actual fact be mounted on any one of the parts 7a-7b.

[0066] From Figure 8 it may be noted how the wall 21 defines an interruption or slit 31b, substantially aligned axially to the passage 28 and to the corresponding slide guide 29. Partially displaceable through this slit is the open/close element 47 associated to the casing part 7b.

[0067] From Figure 9, it may be noted how the casing 42 of the fan 41 is positioned within the region circumscribed by the wall 35 and how the open/close element 47 is adjacent to the stretch of the wall 35 provided with the slits 37 of Figure 7. It may also be noted how the outlet mouth 42b of the fan 41 is located in a position corresponding to the passage 36 of Figure 7.

[0068] For the purposes of assembly, after the various components have been mounted on the casing parts 7a and 7b, as in the example illustrated in Figures 8 and 9, the casing part 7b is set on top of the part 7a so that its region circumscribed by the wall 35 fits into the subchamber 30 defined by the intermediate wall 31 and by part of the peripheral wall 21 of the casing part 7a. Following upon this positioning, the lower edge of the wall 35 and a corresponding part of the casing 42 of the fan 41 bear upon the gasket 32 carried by the casing part 7a. Following upon this assembly, the lower edge of the sliding open/close element 47 couples to the guide 29, adjacent to the wall 35, with part of the open/close element itself that traverses the interruption 31b (Figure 8) of the wall. The suction mouth 42a of the fan casing 42 faces the bottom wall 20 of the casing part 7a, at a certain distance therefrom. The assembled condition may partially be seen in the schematic representation of Figure 10, where the casing part 7b is not represented, and the open/close element 47 is instead represented in cross-sectional view.

[0069] From this figure it may be noted how, according to one aspect of the invention, the fan 41 is positioned within the casing 7a-7b so that its suction mouth 42a is in a position at least partially staggered with respect to the opening 22 of the casing 7a-7b, i.e., not coaxial there-

to. It will likewise be appreciated that the suction mouth 42a of the fan is also set at a distance from, and staggered with respect to, the secondary suction inlet of the casing.

[0070] In this way, as may be appreciated, the fan is able to draw off, in the appropriate proportions, both moist air from the main suction inlet and dry air from the secondary suction inlet. An optimal suction from both of the suction inlets is guaranteed, among other things, also by an appropriate spacing between the suction mouth 42a and the bottom 20 of the part 7a, this spacing generating in effect an accumulation of air adequately mixed immediately upstream of the fan 41.

[0071] In one embodiment, the casing 7a-7b of the fan or suction assembly 7 is mounted on the tub 3, with the inlet 22 (i.e., the corresponding connector 23) in fluid communication with an outlet opening of the tub 3. In the embodiment referred to Figures 1 and 2, the assembly 7 is mounted on the upper wall 3a of the tub 3, which is purposely provided with the aforesaid outlet opening, designated by OUT in Figure 2. The outlet opening OUT preferentially consists of a substantially circular hole, fitted in which is the connector 23 of the casing 7a-7b of the assembly 7. Preferentially, the connector 23 is cylindrical and externally threaded (see, for example, Figures 11 and 12). In this way, after the connector 23 has been fitted into the opening OUT, on its part projecting towards the inside of the tub 3 a suitable ring nut can be screwed, with possible interposition of a gasket, to fix the casing 7a-7b to the wall 3a of the tub.

[0072] The inlet portion of the discharge duct 8 is connected to the outlet connector 15 of the casing 7a-7b of the suction assembly 7, whereas the outlet portion 11 of the duct 8 is located at the front of the machine 1, with its outlet 14 above the upper edge of the door 4, in particular above the control panel 4a.

[0073] The arrangement is such that, during operation of the fan 41, the moist air is drawn in from the outlet opening OUT of the upper wall 3a of the tub 3 through the suction inlet 22-23 of the assembly 7 and then reaches the suction mouth 42a of the fan 41 and is forced by the impeller 43 in a radial direction in order to pass into the discharge duct 8, through the delivery section 42b and the outlet connector 15 of the assembly 7. The moist air then passes into the duct 8, to be then expelled from its outlet portion 11, at the front of the machine 1.

[0074] In a preferred embodiment, such as the one represented in Figures 1-2, at least the outlet portion 11 and the intermediate portion 12 of the discharge duct 8 (or a prevalent part of the intermediate portion) extend over the upper wall 3a of the tub 3, with the outlet portion 11 above the upper edge of the door 4. In the embodiment of Figures 1-2 also the inlet portion of the duct 8 thus extends over the upper wall 3a of the tub 3.

[0075] The particular shape of the intermediate portion 12 of the duct 8, tapered in height from the inlet portion 10 to the outlet portion 11 and tapered in width from the outlet portion 11 to the inlet portion 10, is very compact. Indicatively, the inlet portion 10 of the duct 8 may have a height comprised between 15 and 30 mm, preferably approximately 20 mm, whereas the outlet portion 11 may have a height of less than 10 mm, for example, between 1 and 5 mm. The width of the duct 8 may be comprised between 35-50 mm at the inlet portion 10, and 180-400 mm at the outlet portion 11. Sizings of this sort enable installation of the extraction system described on machines of standard dimensions, even when they are provided with a corresponding cabinet equipped with an upper panel or "top". The outlet of the duct 8, which is comparatively much wider and much lower than its inlet, enables in any case the values of flow rate of the fan 41 to be achieved, without causing any significant loss of head, and guarantees that the rate of the flow of air that leaves the duct 8 is sufficiently high to prevent condensation of the steam in the vicinity of the outlet 14. In this perspective, the duct 8 does not necessarily have to be provided with a discharge for the condensate. The shape suggested for the duct 8 also enables formation, at the outlet 14, of a sort of air "blade" that is very thin and wide, with the result that the fact that moist air is coming out is hardly noticeable.

[0076] The arrangement indicated for the assembly 7 in any case makes it possible to obtain a practically direct draught of the moist air expelled from the tub 3. This draught, in addition to enabling an improved extraction of the moist air, ensures a constancy of volume of the air drawn out of the tub, even with an outlet opening OUT of a diameter smaller than the diameter of the openings usually provided in solutions in which a suction channel extends between the suction mouth of the fan and the outlet opening for the moist air from the tub, thereby enabling a greater flexibility in sizing in the design stage. The efficiency of extraction of the moist air consequently also improves the air change in the tub.

[0077] For the purposes of positioning, on the upper wall 3a of the tub 3 it is preferable for at least part of one of the larger walls of the duct 8, in particular its lower wall, to be generally plane or only slightly inclined so as to favour evacuation of possible condensate towards the assembly 7, where possible draining means could be provided, whereas the other larger wall, in particular the upper wall, is generally inclined starting from the inlet portion 10 towards the outlet portion 11; such a preferred embodiment may be seen, for example, in Figures 3 and 4, where the body of the duct 8 is formed in two parts.

[0078] According to a preferred embodiment, the outlet portion 11 of the duct 8 extends over the structural cross member 5 and is fixed to this via the purposely provided elements 13. As has been mentioned, preferentially these fixing elements are formed integrally with the body of the duct 8, or with a part thereof, and have a certain longitudinal elasticity or flexibility, which enables compensation of possible assembly tolerances.

[0079] With the actuators 44 and 46 not supplied, the open/close element 24 and the open/close element 47 are in respective positions where they close the main suction inlet 22-23 and the secondary suction inlet rep-

resented by the slits 37. In this condition, in the course of the normal operations of washing and rinsing performed during a treatment cycle of the machine 1, inlet of water and/or steam into the casing 7a-7b of the suction assembly is prevented. The extraction system 7-8 of the machine 1 is then rendered active in the terminal step of a treatment cycle, i.e., in the course of a drying step.

[0080] In one embodiment, the motor 43a of the fan 41 and the actuator 44 are connected in parallel, i.e., supplied simultaneously. In such an embodiment, on account of the time necessary for the actuator 44 to cause passage of the open/close element 24 into the position of opening of the main suction inlet, it is preferable to govern opening of the secondary suction inlet in advance. This solution prevents the fan 41 from generating negative pressures within the casing of the assembly 7, which is still closed towards the outside, as well as any troublesome hissing sounds due to operation.

[0081] For this purpose, in one embodiment, the control system of the machine sends a command signal to the board 48, which brings about power supply of the actuator 46, with consequent displacement linear of the open/close element 47. At the end of displacement of the open/close element, opening of the secondary suction inlet is obtained, i.e., alignment of the slits 47a of the open/close element 47 with the slits 37 of the wall 31. Figures 11 and 12 illustrate the condition of closing and the condition of opening of the open/close element 47, respectively.

[0082] Next, the board 48 governs power supply of the fan 41 and of the actuator 44. For this purpose, the fan motor 43a and the actuator 44 can be connected in parallel. Operation of the actuator 44 causes an advance of the transmission member 40, the inclined surface 40a of which causes angular movement of the transmission member 26 in the sense of causing lowering of the open/close element 24, and hence opening of the main suction inlet 22-23. On account of the operating inertia of the actuator 44, the fan 41 is initially able to draw in only substantially dry air from the environment overlying the tub 3, via the slits 47a and 37, this air being expelled by the fan into the duct 8.

[0083] In one embodiment, after a pre-defined time, necessary to obtain passage of the open/close element 24 into the opening position, electric power supply to the actuator 46 is interrupted. In this way, re-closing of the secondary suction inlet is brought about, and in a first part of the drying process the fan 41 introduces into the discharge duct 8 only air charged with humidity extracted from the tub 3. This moist air is expelled from the outlet 14 of the duct 8 with a substantially blade-like flow.

[0084] In a second part of the drying process, the actuator 46 can be once again supplied in order to re-open the secondary suction inlet. In this part of the process, then, the moist air extracted from the tub is mixed, inside the casing 7a-7b of the assembly 7 and at inlet to the fan 41, with substantially dry air taken in from above the tub. As has been explained, this measure can be implemented for reducing the relative humidity of the air extracted from the tub in order to prevent risks of condensation, in particular on the front of the machine. This measure may be implemented also in order to slow down expulsion of steam and hot air at the front of the machine, as well as to reduce the temperature of the air expelled.

[0085] Of course, also various other logics are possible for driving the actuators 44, 46 and the motor 43a of the fan 41; for example, the motor 43a and the actuator 44 may be governed separately so that the fan is operated only after the time necessary for the actuator 44 to bring about opening of the open/close element 24; likewise, the actuator 46 may be kept active for the entire duration of the drying process so as to bring about mixing between dry air and moist air right from the start of the process, or again the actuator 46 may be kept active only in a first part of the process, when the amount of steam extracted from the tub is greater, and then be deactivated in a second part of the process, when the residual amount of steam to be extracted is modest.

[0086] Illustrated schematically in Figure 13 is a further embodiment of the invention. In this figure, the same reference numbers as those of Figures 1-12 are used in order to designate elements that are technically equivalent to the ones already described above; moreover, the representation of the side wall 6 of the body of the machine 1 has been omitted, for reasons of greater clarity.

[0087] In the machine 1 of Figure 13, the suction assembly 7 is to be mounted on one of the stationary side walls of the tub 3, here the right-hand wall 3c, at the corresponding outlet opening OUT. Preferentially, the opening OUT is made in an upper area of the wall in question, on its upper half. The duct 8 is preferably supported by the upper wall 3a of the tub and by the assembly 7.

[0088] Also in this embodiment, the outlet portion 11 and the intermediate portion 12, or at least its prevalent part, of the discharge duct 8 extend over the upper wall 3a of the tub 3, with the outlet portion 11 above the upper edge of the door 4. Unlike the embodiment of Figures 1-12, instead, the inlet portion 10 of the duct 8 extends at least in part on the outside of the wall 3c, from the casing of the assembly 7 to the upper wall 3a. In the case exemplified, the inlet portion 10 and the intermediate portion 12 define between them a generally curved region of transition. Preferentially, the portions 10 and 12 extend in length substantially orthogonal to one another. Also in an embodiment of this sort, the hollow body of the duct 8 may include a plurality of intermediate walls or formations (see Figure 4, references 14a) at least in the portion 11, for strengthening the outlet portion of the duct and/or defining a plurality of sub-outlets therein.

[0089] Operation of the machine 1 of Figure 13 is practically the same as what has previously been described with reference to the machine of Figures 1-12.

[0090] Preferentially, the fan 41 used is a fan with reduced vertical encumbrance. For this purpose, in one embodiment, the fan has an electric motor 43a that is set concentrically with respect to its impeller 43, i.e., with the

impeller that surrounds the motor. For such a case, the motor is preferentially a motor protected from the hygroscopic standpoint.

[0091] From the foregoing description the characteristics and advantages of the present invention emerge clearly, which are mainly represented by the simple, inexpensive, and compact structure of the air-extractor system described.

[0092] It is clear for the person skilled in the art that numerous variations may be made to the dish-washing machine described by way of example herein, without thereby departing from the scope of the invention as defined in the ensuing claims.

[0093] The fan 41 may be driven at a constant speed for the entire drying step or, advantageously, at a variable speed so that the flow rate of evacuated air is higher in an initial part of said drying step and lower subsequently. For example, a control of the speed of the motor of the fan may be hypothesised such that its impeller turns faster in the first ten minutes of the drying step and more slowly thereafter. In this way, benefits are obtained from the energy standpoint in so far as the speed of the fan can be reduced in the second part of the drying step, where the amount of moist air to be extracted from the tub is lower. In the case, instead, where there exist significant risks of formation of condensate, it is preferable to drive the fan 41 so that in the initial part of the drying step it turns at a lower speed, after which, when the relative humidity of the air has been adequately reduced, the speed of the fan 41 is increased in order to ensure maximum expulsion of moist air.

[0094] The duct 8 may be appropriately provided with a passage for discharge of any possible condensate set in a suitable position, for example, in its lowest point in the case of the embodiment of Figures 1-12 or in the lowest point of the portion 11 or 12 in the case of the embodiment of Figure 13.

Claims

1. A dish-washing machine having a load-bearing structure (2) and a tub (3) as washtub (3), a front door (4) of the tub (3) being articulated to the load-bearing structure (2), the machine (1) moreover having a system (7-8) for extraction of moist air from the tub (3) that comprises a suction assembly (7) and a discharge duct (8),

   wherein the suction assembly (7) comprises a fan (41), in particular a radial fan (41), having a fan casing (42) housed in which is a centrifugal impeller (43), the fan casing (42) defining a suction mouth (42a) and a delivery section (42b), the suction mouth (42a) being in fluid communication with an outlet opening (OUT) formed in one of an upper wall (3a) and a stationary side wall (3c) of the tub (3),

   wherein the discharge duct (8) has an inlet portion (10) and an outlet portion (11), the inlet portion (10) being in fluid communication with a delivery section (42b) of the fan casing (42),

   wherein the suction assembly (7) comprises a box-shaped casing (7a-7b) located within which is the fan casing (42), the box-shaped casing (7a-7b) being mounted on an outside of the tub (3) on said one of an upper wall (3a) and a stationary side wall (3c) of the tub and having

   - an outlet connection (15) that connects the delivery section (42b) of the fan casing (42) to the inlet portion (11) of the discharge duct (8);
   - a first suction inlet (22, 23), connected to the outlet opening (OUT) of the tub (3); and
   - a second suction inlet (37), which opens towards the space that surrounds the tub (3),

   wherein the suction assembly (7) comprises a first valve arrangement (24-27, 44) controllable for opening and closing the first suction inlet (22, 23), the first valve arrangement (24-27, 44) being in particular configured for opening and closing the first suction inlet (22, 23) upon activation and deactivation of the fan (41), respectively, and

   wherein the suction assembly (7) comprises a second valve arrangement (46, 47) controllable for opening and closing the second suction inlet (28, 37),

   characterized in that

   the outlet portion (11) of the discharge duct (8) is at a front of the machine (1),

   that the first valve arrangement (24-27, 44) includes a first electric actuator (44) within the box-shaped casing (7a-7b) and the second valve arrangement (46, 47) includes a second electric actuator (46) within the box-shaped casing (7a-7b), and that

   the second valve arrangement (46, 47) comprises a sliding open/close member (47) with a plate-like body having a plurality of first through openings (47), the sliding open/close member (47) being set up against a wall of the box-shaped casing (7a-7b), which has a plurality of second through openings (37) that form the second suction inlet, the sliding open/close member (47) being linearly displaceable between a closing position, where the first through openings (47) are staggered with respect to the second through openings (37), and an opening position, where the first through openings (47) are substantially aligned with the second through openings (37).

2. The dish-washing machine according to Claim 1, wherein the fan casing (42) is arranged in the box-shaped casing (7a-7b) with its suction mouth (42a) in a position at a distance from the first and second suction inlets (22, 37) and in a position staggered with respect thereto, in such a way that the fan (41) is able to draw in through the suction mouth (42a) of the fan casing (42) substantially moist air from the first suction inlet (22, 23) and substantially dry air from the second suction inlet (37).

3. The dish-washing machine according to Claim 1 or Claim 2, wherein the first suction inlet (22, 23) is formed in a bottom wall (20) of the box-shaped casing (7a-7b), facing which is the suction mouth (42a) of the fan casing (42).

4. The dish-washing machine according to any one of the preceding claims, wherein at least one of the outlet connection (15) and the second suction inlet (37) is formed in at least one of a peripheral wall (21, 35) and an upper wall (33) of the box- shaped casing (7a-7b).

5. The dish-washing machine according to any one of the preceding claims, , further comprising control means (49) for controlling the first electric actuator (44) independently of the second electric actuator (46).

6. The dish-washing machine according to any one of the preceding claims, wherein the fan casing (42) is configured as a component distinct from the box-shaped casing (7a-7b).

7. The dish-washing machine according to Claim 5, wherein the first valve arrangement (24-27, 44) comprises an open/close member (24), which is mounted substantially coaxial with respect to the first suction inlet (22, 23) and is able to assume a raised closing position and a lowered opening position with respect to a corresponding seat (22) belonging to the first suction inlet (22, 23).

8. The dish-washing machine according to Claim 1, wherein:

- the discharge duct (8) has an intermediate portion (12) intermediate between the inlet and outlet portions (10, 11), the height of which decreases, preferably in a substantially progressive way, towards the outlet portion (11) and the width (W) of which increases, preferably in a substantially progressive way, towards the outlet portion (11);
- at least the outlet portion (11) and the intermediate portion (12) of the discharge duct (8) extend over an upper wall (3a) of the tub (3), with the outlet portion over an upper edge of the door (4);
- the outlet opening (OUT) is formed in one of the upper wall (3a) and a stationary side wall (3c) of the tub (3), with the box-shaped casing (7a-7b) that is mounted on said wall (3a; 3c) with the respective first suction inlet (22, 23) set in a position corresponding to the outlet opening (OUT) and substantially coaxial thereto.

9. The dish-washing machine according to Claim 1, wherein the outlet opening (OUT) is formed in the upper wall (3a) of the tub (3), and the inlet portion (10) of the discharge duct (8) extends over the upper wall (3a) of the tub (3).

10. The dish-washing machine according to Claim 1, wherein the outlet opening (OUT) is formed in a stationary side wall (3c) of the tub (3), and the inlet portion (10) of the discharge duct (8) extends at least in part on the outside of said stationary side wall (3c), towards the upper wall (3a) of the tub (3).

11. The dish-washing machine according to any one of the preceding claims, wherein the outlet portion (11) of the discharge duct (8) comprises an outlet (14) divided into a plurality of sub-outlets by means of a plurality of intermediate walls or formations (14a).

12. The dish-washing machine according to claim 8, , wherein a lower wall of the intermediate portion (12) of the discharge duct (8) is generally plane and set horizontally, whereas an upper wall of the intermediate portion is generally inclined starting from the inlet portion (10) of the discharge duct (8) towards its outlet portion (11).

13. The dish-washing machine according to any one of the preceding claims, wherein:

- the load-bearing structure (2, 5) includes an upper structural cross member (5);
- the outlet portion (11) of the discharge duct (8) extends at least partially over the structural cross member (5) and is provided with means for fixing thereof to the structural cross member (5), the fixing means preferably comprising one or more elements (13), which are formed integrally with the discharge duct (8) and/or are elastically deformable.

Patentansprüche

1. Geschirrspülmaschine, die eine lasttragende Struktur (2) und eine Wanne (3) als Waschwanne (3), eine Vordertür (4) der Wanne (3), die an der lasttragenden Struktur (2) artikuliert ist, aufweist, wobei die Ma-

schine (1) außerdem ein System (7-8) zum Extrahieren von feuchter Luft aus der Wanne (3) aufweist, das eine Sauganordnung (7) und eine Abführleitung (8) umfasst,

wobei die Sauganordnung (7) ein Gebläse (41), insbesondere ein Radialgebläse (41) umfasst,

das ein Gebläsegehäuse (42) aufweist, in dem ein Zentrifugallaufrad (43) untergebracht ist, wobei das Gebläsegehäuse (42) einen Saugmund (42a) und einen Abgabebereich (42b) definiert, wobei der Saugmund (42a) in Fluidkommunikation mit einer Auslassöffnung (OUT) ist, die an einem einer oberen Wand (3a) und einer stationären Seitenwand (3c) der Wanne (3) gebildet ist,

wobei die Abführleitung (8) einen Einlassabschnitt (10) und einen Auslassabschnitt (11) aufweist, wobei der Einlassabschnitt (10) in Fluidkommunikation mit einem Abgabebereich (42b) des Gebläsegehäuses (42) ist,
wobei die Sauganordnung (7) ein kastenförmiges Gehäuse (7a-7b) umfasst, in dessen Inneren das Gebläsegehäuse (42) gelegen ist, wobei das kastenförmige Gehäuse (7a-7b) an einer Außenseite der Wanne (3) an dem einen einer oberen Wand (3a) und einer stationären Seitenwand (3c) der Wanne montiert ist und Folgendes aufweist:

- einen Auslassanschluss (15), der den Abgabebereich (42b) des Gebläsegehäuses (42) mit dem Einlassabschnitt (11) der Abführleitung (8) verbindet;
- einen ersten Saugeinlass (22, 23), der mit der Auslassöffnung (OUT) der Wanne (3) verbunden ist; und
- einen zweiten Saugeinlass (37), der sich zu dem Raum hin öffnet, der die Wanne (3) umgibt,

wobei die Sauganordnung (7) eine erste Ventilanordnung (24-27, 44) umfasst, die zum Öffnen und Schließen des ersten Saugeinlasses (22, 23) steuerbar ist, wobei die erste Ventilanordnung (24-27, 44) insbesondere zum Öffnen und Schließen des ersten Saugeinlasses (22, 23) nach Aktivierung beziehungsweise Deaktivierung des Gebläses (41) konfiguriert ist, und
wobei die Sauganordnung (7) eine zweite Ventilanordnung (46, 47) umfasst, die zum Öffnen und Schließen des zweiten Saugeinlasses (28, 37) steuerbar ist,
dadurch gekennzeichnet, dass der Auslassabschnitt (11) der Abführleitung (8) vorne an der Maschine (1) ist, dass die erste Ventilanordnung (24-27, 44) ein erstes elektrisches Stellglied (44) innerhalb des kastenförmigen Gehäuses (7a-7b) einschließt und die zweite Ventilanordnung (46, 47) ein zweites elektrisches Stellglied (46) innerhalb des kastenförmigen Gehäuses (7a-7b) einschließt, und dass
die zweite Ventilanordnung (46, 47) ein gleitendes Öffnungs-/Schließelement (47) mit einem plattenförmigen Körper umfasst, der ein Vielzahl von ersten Durchgangsöffnungen (47) aufweist, wobei das gleitende Öffnungs-/Schließelement (47) gegen eine Wand des kastenförmigen Gehäuses (7a-7b) aufgestellt ist, die eine Vielzahl von zweiten Durchgangsöffnungen (37) aufweist, die den zweiten Saugeinlass bilden, wobei das gleitendes Öffnungs-/Schließelement (47) linear verschiebbar ist zwischen einer geschlossenen Position, in der die ersten Durchgangsöffnungen (47) in Bezug auf die zweiten Durchgangsöffnungen (37) versetzt sind, und einer offenen Position, in der die ersten Durchgangsöffnungen (47) im Wesentlichen an den zweiten Durchgangsöffnungen (37) ausgerichtet sind.

2. . Geschirrspülmaschine nach Anspruch 1, wobei das Gebläsegehäuse (42) in dem kastenförmigen Gehäuse (7a-7b) mit dessen Saugmund (42a) in einer Position in einem Abstand von dem ersten und zweiten Saugeinlass (22, 37) und in einer Position versetzt in Bezug darauf so angeordnet ist, dass das Gebläse (41) fähig ist, durch den Saugmund (42a) des Gebläsegehäuses (42) im Wesentlichen feuchte Luft von dem ersten Saugeinlass (22, 23) und im Wesentlichen trockene Luft von dem zweiten Saugeinlass (37) einzuziehen.

3. . Geschirrspülmaschine nach Anspruch 1 oder Anspruch 2, wobei der erste Saugeinlass (22, 23) an einer Bodenwand (20) des kastenförmigen Gehäuses (7a-7b) gebildet ist, zu der der Saugmund (42a) des Gebläsegehäuses (42) weist.

4. . Geschirrspülmaschine nach einem der vorstehenden Ansprüche, wobei mindestens einer des Auslassanschlusses (15) und des zweiten Saugeinlasses (37) in mindestens einem einer Umfangswand (21, 35) und einer oberen Wand (33) des kastenförmigen Gehäuses (7 a- 7b) gebildet ist.

5. . Geschirrspülmaschine nach einem der vorstehenden Ansprüche, weiter umfassend Steuermittel (49) zum Steuern des ersten elektrischen Stellglieds (44) unabhängig von dem zweiten elektrischen Stellglied (46).

6. . Geschirrspülmaschine nach einem der vorstehenden Ansprüche, wobei das Gebläsegehäuse (42) als

ein unterschiedliches Bauteil von dem kastenförmigen Gehäuse (7a- 7b) konfiguriert ist.

7. . Geschirrspülmaschine nach Anspruch 5, wobei die erste Ventilanordnung (24-27, 44) ein Öffnungs-/Schließelement (24) umfasst, das im Wesentlichen koaxial in Bezug auf den ersten Saugeinlass (22, 23) montiert ist und fähig ist, eine angehobene geschlossene Position und eine abgesenkte offenen Position in Bezug auf einen entsprechenden Sitz (22) einzunehmen, der zu dem ersten Saugeinlass (22, 23) zugehörig ist.

8. . Geschirrspülmaschine nach Anspruch 1, wobei:

- die Abführleitung (8) einen Zwischenabschnitt (12) aufweist, der zwischen dem Einlass- und dem Auslassabschnitt (10, 11) zwischenliegend ist, wobei dessen Höhe vorzugweise auf eine im Wesentlichen fortschreitende Weise zu dem Auslassabschnitt (11) hin abnimmt und dessen Breite (W) vorzugweise in eine im Wesentlichen fortschreitende Weise zu dem Auslassabschnitt (11) hin zunimmt;
- sich mindestens der Auslassabschnitt (11) und der Zwischenabschnitt (12) der Abführleitung (8) über eine obere Wand (3 a) der Wanne (3) mit dem Auslassabschnitt über einer oberen Kante der Tür (4) erstrecken;
- die Auslassöffnung (OUT) in einem der oberen Wand (3 a) und einer stationären Seitenwand (3c) der Wanne (3) gebildet ist, wobei das kastenförmige Gehäuse (7a-7b) mit dem jeweiligen ersten Saugeinlass (22, 23) in einer Position, die der Auslassöffnung (OUT) entspricht und im Wesentlichen koaxial dazu ist, an der Wand (3a; 3c) montiert ist.

9. . Geschirrspülmaschine nach Anspruch 1, wobei die Auslassöffnung (OUT) in der oberen Wand (3a) der Wanne (3) gebildet ist und sich der Einlassabschnitt (10) der Abführleitung (8) über die obere Wand (3a) der Wanne (3) erstreckt.

10. . Geschirrspülmaschine nach Anspruch 1, wobei die Auslassöffnung (OUT) in einer stationären Seitenwand (3c) der Wanne (3) gebildet ist und sich der Einlassabschnitt (10) der Abführleitung (8) mindestens teilweise an der Außenseite der stationären Seitenwand (3c) zu der oberen Wand (3a) der Wanne (3) hin erstreckt.

11. . Geschirrspülmaschine nach einem der vorstehenden Ansprüche, wobei der Auslassabschnitt (11) der Abführleitung (8) einen Auslass (14) umfasst, der mittels einer Vielzahl von Zwischenwänden oder -formationen (14a) in ein Vielzahl von Unterauslässen unterteilt ist.

12. . Geschirrspülmaschine nach Anspruch 8,

wobei eine untere Wand des Zwischenabschnitts (12) der Abführleitung (8) im Allgemeinen plan und horizontal ist, während eine obere Wand des Zwischenabschnitts im Allgemeinen von dem Einlassabschnitt (10) der Abführleitung (8) beginnend zu deren Auslassabschnitt (11) hin geneigt ist.

13. . Geschirrspülmaschine nach einem der vorstehenden Ansprüche, wobei:

- die lasttragende Struktur (2, 5) ein oberes strukturelles Kreuzelement (5) einschließt;
- sich der Auslassabschnitt (11) der Abführleitung (8) mindestens teilweise über das strukturelle Kreuzelement (5) erstreckt und mit Mitteln zum Befestigen davon an dem strukturellen Kreuzelement (5) bereitgestellt ist, wobei die Befestigungsmittel vorzugweise ein oder mehrere Elemente (13) umfassen, die einstückig mit der Abführleitung (8) gebildet sind und/oder elastisch verformbar sind.

Revendications

1. Lave-vaisselle présentant une structure porteuse (2) et une cuve (3) en tant que cuve de lavage (3), une porte avant (4) de la cuve (3) étant articulée sur la structure porteuse (2), le lave-vaisselle (1) présentant en outre un système (7-8) pour l'extraction d'air humide de la cuve (3) qui comprend un ensemble d'aspiration (7) et un conduit d'évacuation (8),

dans lequel l'ensemble d'aspiration (7) comprend un ventilateur (41), en particulier un ventilateur radial (41),

présentant un boîtier de ventilateur (42) dans lequel est logée une turbine centrifuge (43), le boîtier de ventilateur (42) définissant une embouchure d'aspiration (42a) et une section de distribution (42b), l'embouchure d'aspiration (42a) étant en communication fluidique avec une ouverture de sortie (OUT) formée dans l'une parmi une paroi supérieure (3a) et une paroi latérale stationnaire (3c) de la cuve (3),

dans lequel le conduit d'évacuation (8) présente une partie d'entrée (10) et une partie de sortie (11), la partie d'entrée (10) étant en communication fluidique avec une section de distribution (42b) du boîtier de ventilateur (42),
dans lequel l'ensemble d'aspiration (7) comprend un boîtier en forme de boîte (7a-7b) à l'in-

térieur duquel est situé le boîtier de ventilateur (42), le boîtier en forme de boîte (7a-7b) étant monté sur un extérieur de la cuve (3) sur ladite parmi une paroi supérieure (3a) et une paroi latérale stationnaire (3c) de la cuve et présentant

- un raccord de sortie (15) qui raccorde la section de distribution (42b) du boîtier de ventilateur (42) à la partie d'entrée (11) du conduit d'évacuation (8) ;
- une première entrée d'aspiration (22, 23), raccordée à l'ouverture de sortie (OUT) de la cuve (3) ; et
- une seconde entrée d'aspiration (37), qui donne sur l'espace qui entoure la cuve (3),

dans lequel l'ensemble d'aspiration (7) comprend un premier agencement de soupape (24-27, 44) commandable pour ouvrir et fermer la première entrée d'aspiration (22, 23), le premier agencement de soupape (24-27, 44) étant en particulier configuré pour ouvrir et fermer la première entrée d'aspiration (22, 23) lors de l'activation et de la désactivation du ventilateur (41), respectivement, et
dans lequel l'ensemble d'aspiration (7) comprend un second agencement de soupape (46, 47) commandable pour ouvrir et fermer la seconde entrée d'aspiration (28, 37),
caractérisé en ce que la partie de sortie (11) du conduit d'évacuation (8) se situe à l'avant du lave-vaisselle (1), **en ce que** le premier agencement de soupape (24-27, 44) inclut un premier actionneur électrique (44) à l'intérieur du boîtier en forme de boîte (7a-7b) et le second agencement de soupape (46, 47) inclut un second actionneur électrique (46) à l'intérieur du boîtier en forme de boîte (7a-7b), et **en ce que**
le second agencement de soupape (46, 47) comprend un élément d'ouverture/fermeture coulissant (47) avec un corps en forme de plaque présentant une pluralité de premières ouvertures traversantes (47), l'élément d'ouverture/fermeture coulissant (47) étant installé contre une paroi du boîtier en forme de boîte (7a-7b), qui présente une pluralité de secondes ouvertures traversantes (37) qui forment la seconde entrée d'aspiration, l'élément d'ouverture/fermeture coulissant (47) pouvant être déplacé linéairement entre une position de fermeture, dans laquelle les premières ouvertures traversantes (47) sont décalées par rapport aux seconds ouvertures traversantes (37), et une position d'ouverture, dans laquelle les premières ouvertures traversantes (47) sont sensiblement alignées sur les secondes ouvertures traversantes (37).

2. Lave-vaisselle selon la revendication 1, dans lequel le boîtier de ventilateur (42) est agencé dans le boîtier en forme de boîte (7a-7b) avec son embouchure d'aspiration (42a) en une position à une certaine distance des première et seconde entrées d'aspiration (22, 37) et en une position décalée par rapport à celles-ci, de sorte que le ventilateur (41) soit apte à aspirer à travers l'embouchure d'aspiration (42a) du boîtier de ventilateur (42) l'air sensiblement humide à partir de la première entrée d'aspiration (22, 23) et l'air sensiblement sec à partir de la seconde entrée d'aspiration (37).

3. Lave-vaisselle selon la revendication 1 ou la revendication 2, dans lequel la première entrée d'aspiration (22, 23) est formée dans une paroi de fond (20) du boîtier en forme de boîte (7a-7b), qui est orientée vers l'embouchure d'aspiration (42a) du boîtier de ventilateur (42).

4. Lave-vaisselle selon l'une quelconque des revendications précédentes, dans lequel au moins l'un parmi le raccord de sortie (15) et la seconde entrée d'aspiration (37) est formé dans au moins l'une parmi une paroi périphérique (21, 35) et une paroi supérieure (33) du boîtier en forme de boîte (7a-7b).

5. Lave-vaisselle selon l'une quelconque des revendications précédentes, comprenant en outre des moyens de commande (49) destinés à commander le premier actionneur électrique (44) indépendamment du second actionneur électrique (46).

6. Lave-vaisselle selon l'une quelconque des revendications précédentes, dans lequel le boîtier de ventilateur (42) est configuré sous forme de composant distinct du boîtier en forme de boîte (7a-7b).

7. Lave-vaisselle selon la revendication 5, dans lequel le premier agencement de soupape (24-27, 44) comprend un élément d'ouverture/fermeture (24), qui est monté de manière sensiblement coaxiale par rapport à la première entrée d'aspiration (22, 23) et est apte à adopter une position de fermeture relevée et une position d'ouverture abaissée par rapport à un siège correspondant (22) appartenant à la première entrée d'aspiration (22, 23).

8. Lave-vaisselle selon la revendication 1, dans lequel :

- le conduit d'évacuation (8) présente une partie intermédiaire (12) située entre les parties d'entrée et de sortie (10, 11), dont la hauteur diminue, de préférence de manière sensiblement progressive, vers la partie de sortie (11) et dont la largeur (W) augmente, de préférence de manière sensiblement progressive, vers la partie de sortie (11) ;

- au moins la partie de sortie (11) et la partie intermédiaire (12) du conduit d'évacuation (8) s'étendent sur une paroi supérieure (3a) de la cuve (3), la partie de sortie s'étendant sur un bord supérieur de la porte (4) ;
- l'ouverture de sortie (OUT) est formée dans l'une parmi la paroi supérieure (3a) et une paroi latérale stationnaire (3c) de la cuve (3), le boîtier en forme de boîte (7a-7b) qui est monté sur ladite paroi (3a ; 3c) avec la première entrée d'aspiration (22, 23) respective étant défini en une position correspondant à l'ouverture de sortie (OUT) et sensiblement coaxial à celle-ci.

9. Lave-vaisselle selon la revendication 1, dans lequel l'ouverture de sortie (OUT) est formée dans la paroi supérieure (3a) de la cuve (3), et la partie d'entrée (10) du conduit d'évacuation (8) s'étend sur la paroi supérieure (3a) de la cuve (3).

10. Lave-vaisselle selon la revendication 1, dans lequel l'ouverture de sortie (OUT) est formée dans une paroi latérale stationnaire (3c) de la cuve (3), et la partie d'entrée (10) du conduit d'évacuation (8) s'étend au moins en partie sur l'extérieur de ladite paroi latérale stationnaire (3c), vers la paroi supérieure (3a) de la cuve (3).

11. Lave-vaisselle selon l'une quelconque des revendications précédentes, dans lequel la partie de sortie (11) du conduit d'évacuation (8) comprend une sortie (14) divisée en une pluralité de sorties secondaires par le biais d'une pluralité de parois ou formations intermédiaires (14a).

12. Lave-vaisselle selon la revendication 8,

dans lequel une paroi inférieure de la partie intermédiaire (12) du conduit d'évacuation (8) est généralement plane et définie horizontalement, alors qu'une
paroi supérieure de la partie intermédiaire est généralement inclinée à partir de la partie d'entrée (10) du conduit d'évacuation (8) vers sa partie de sortie (11).

13. Lave-vaisselle selon l'une quelconque des revendications précédentes, dans lequel :

- la structure porteuse (2, 5) inclut un élément transversal structural supérieur (5) ;
- la partie de sortie (11) du conduit d'évacuation (8) s'étend au moins partiellement sur l'élément transversal structural (5) et est dotée de moyens destinés à fixer celle-ci à l'élément transversal structural (5), les moyens de fixation comprenant de préférence un ou plusieurs éléments (13), qui sont formés d'un seul tenant avec le conduit d'évacuation (8) et/ou sont déformables élastiquement.

Fig. 1

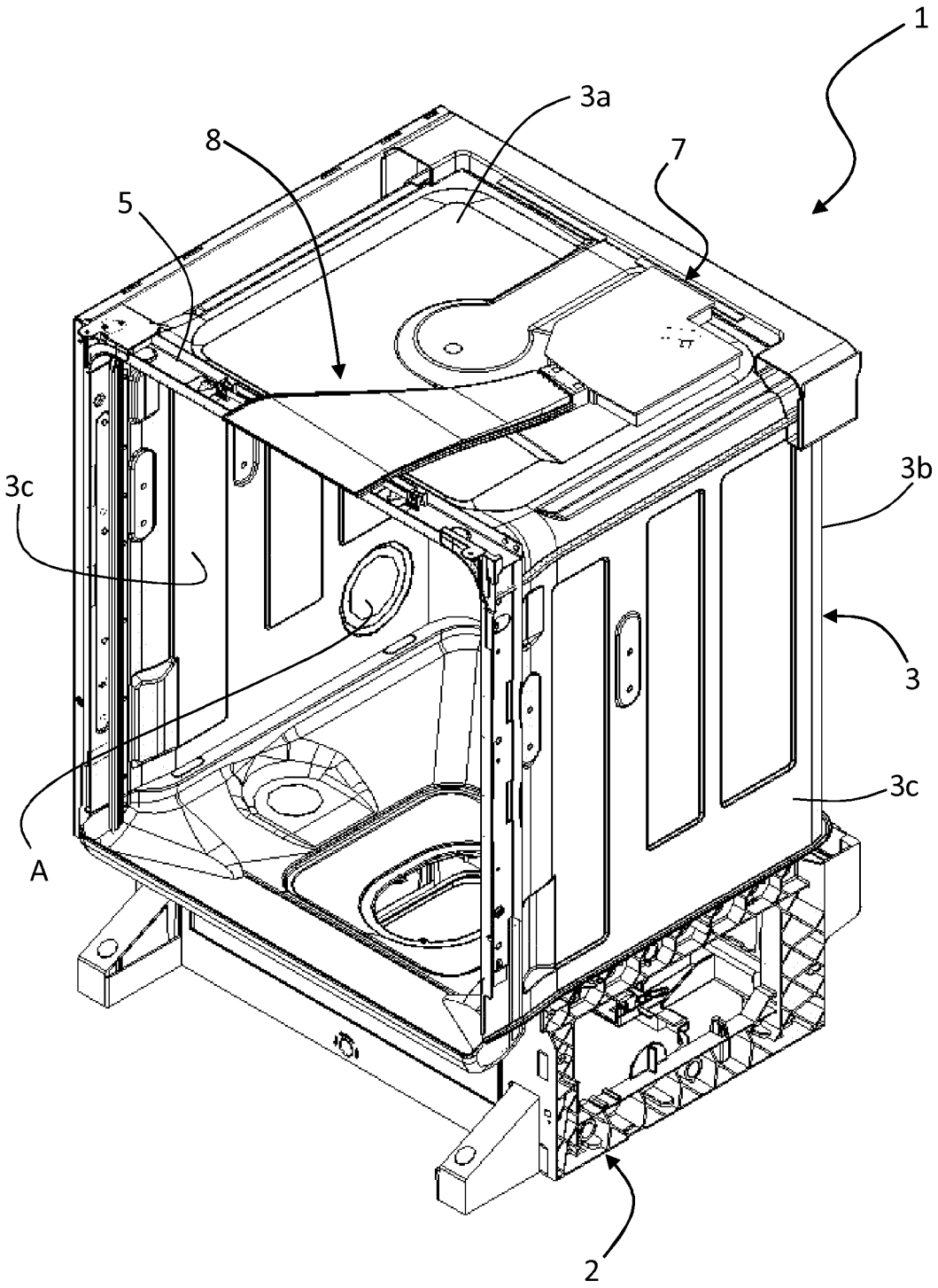


Fig. 2

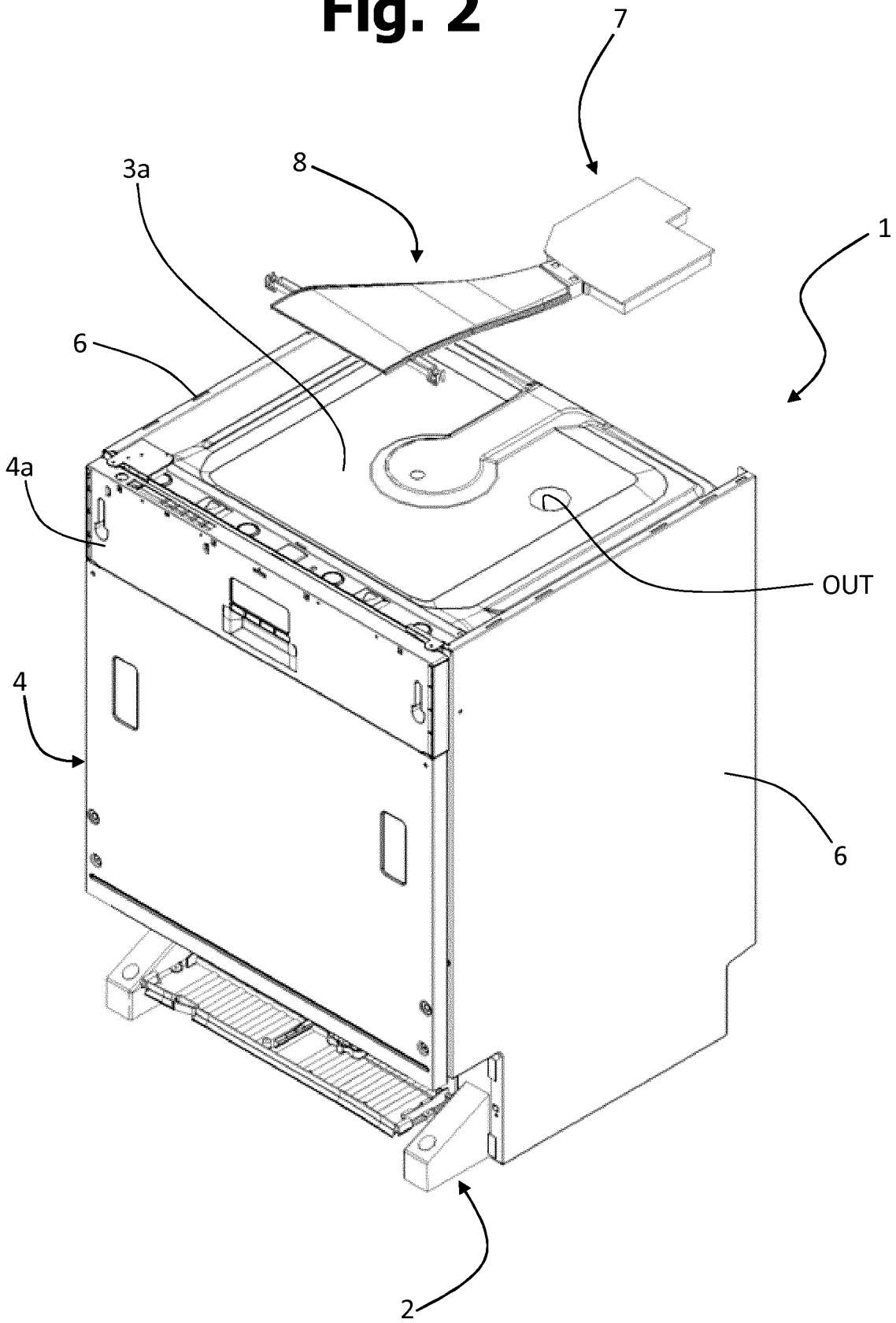


Fig. 3

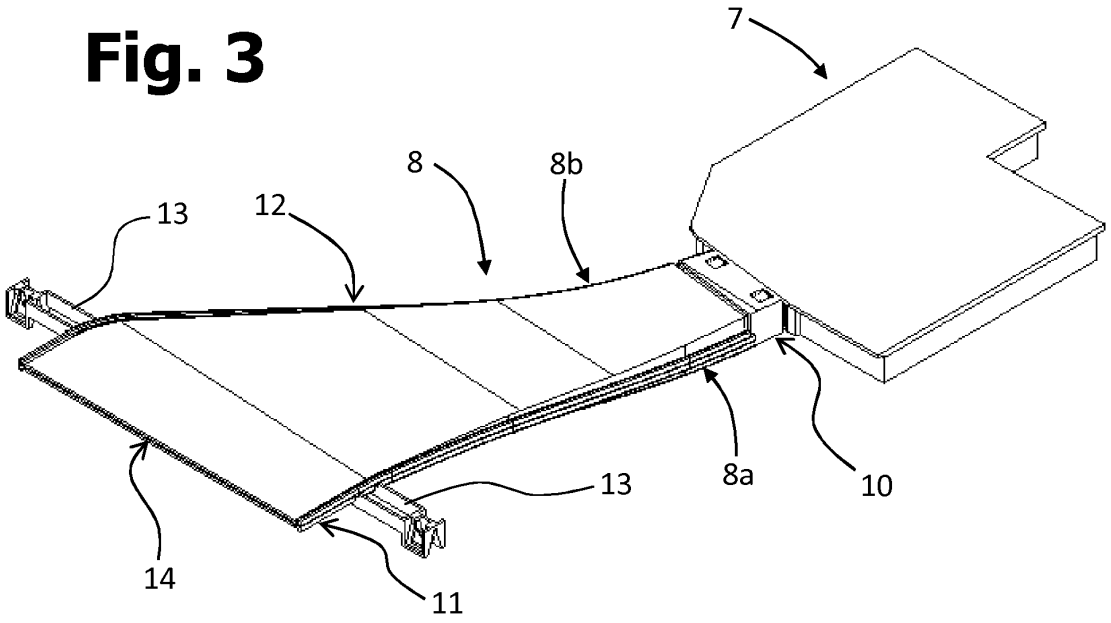


Fig. 4

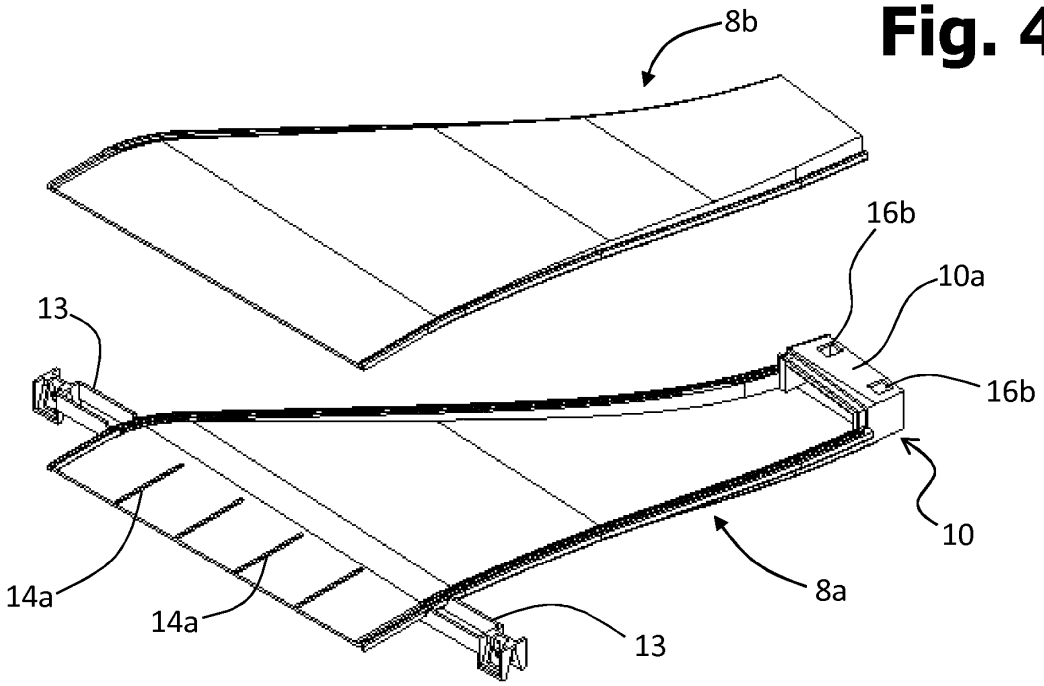


Fig. 5

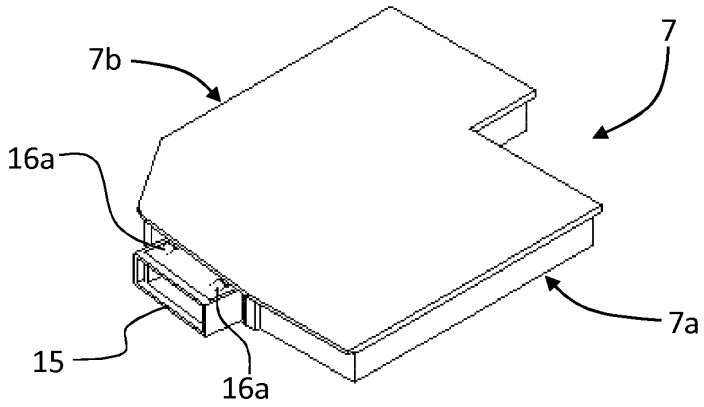
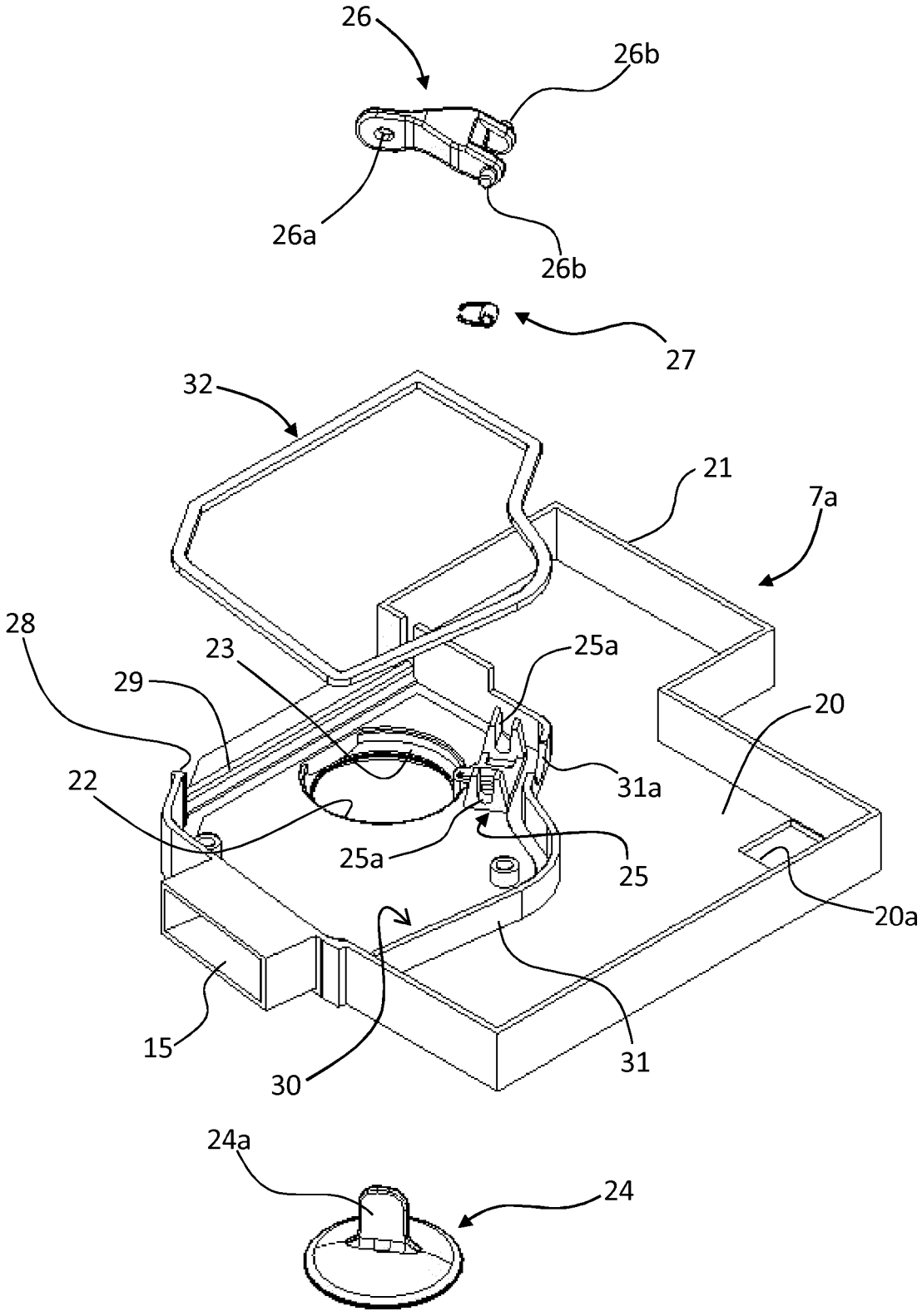


Fig. 6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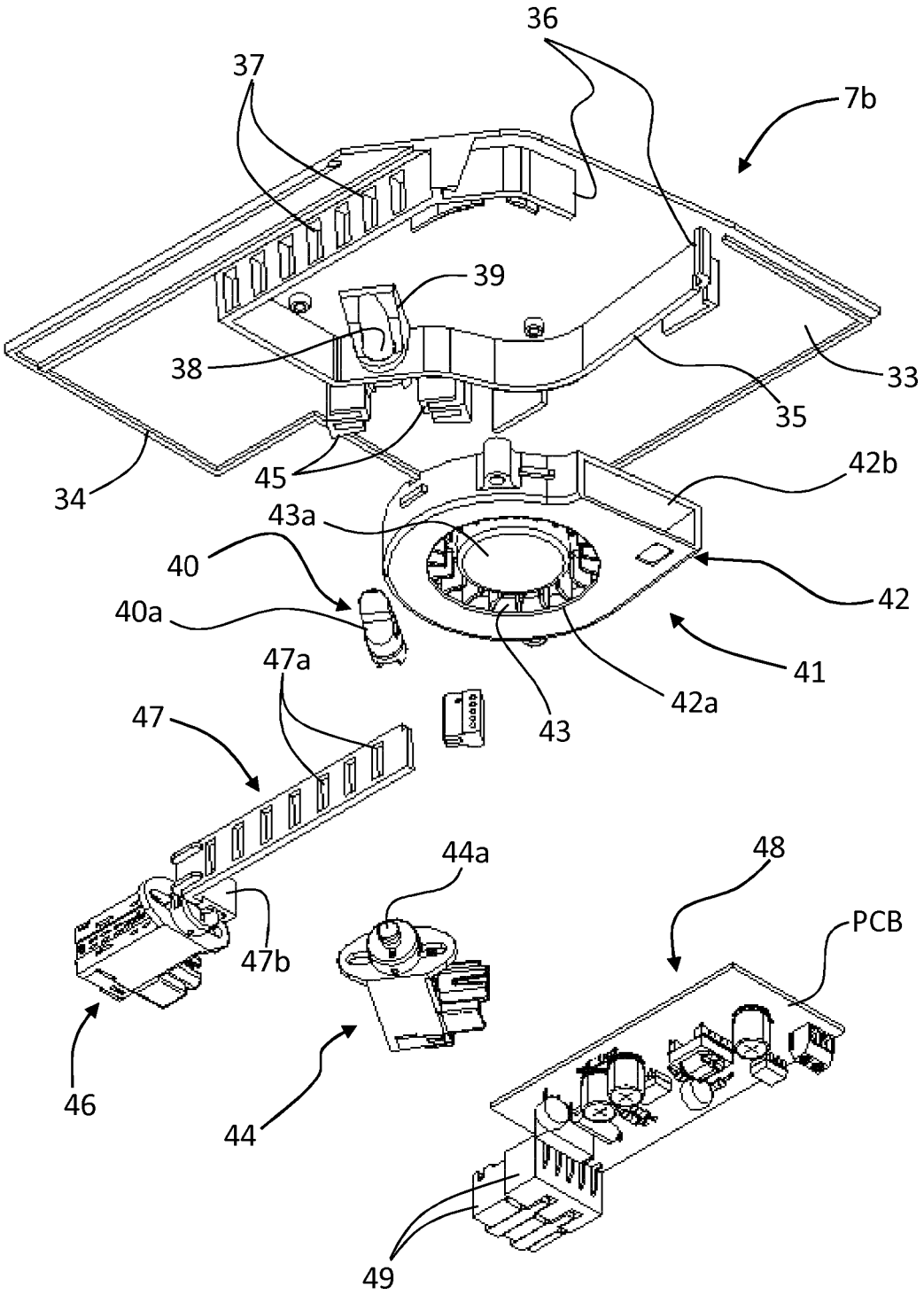
31
24a
24

Fig. 7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44a
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PCB
47b
46
44
49

Fig. 8

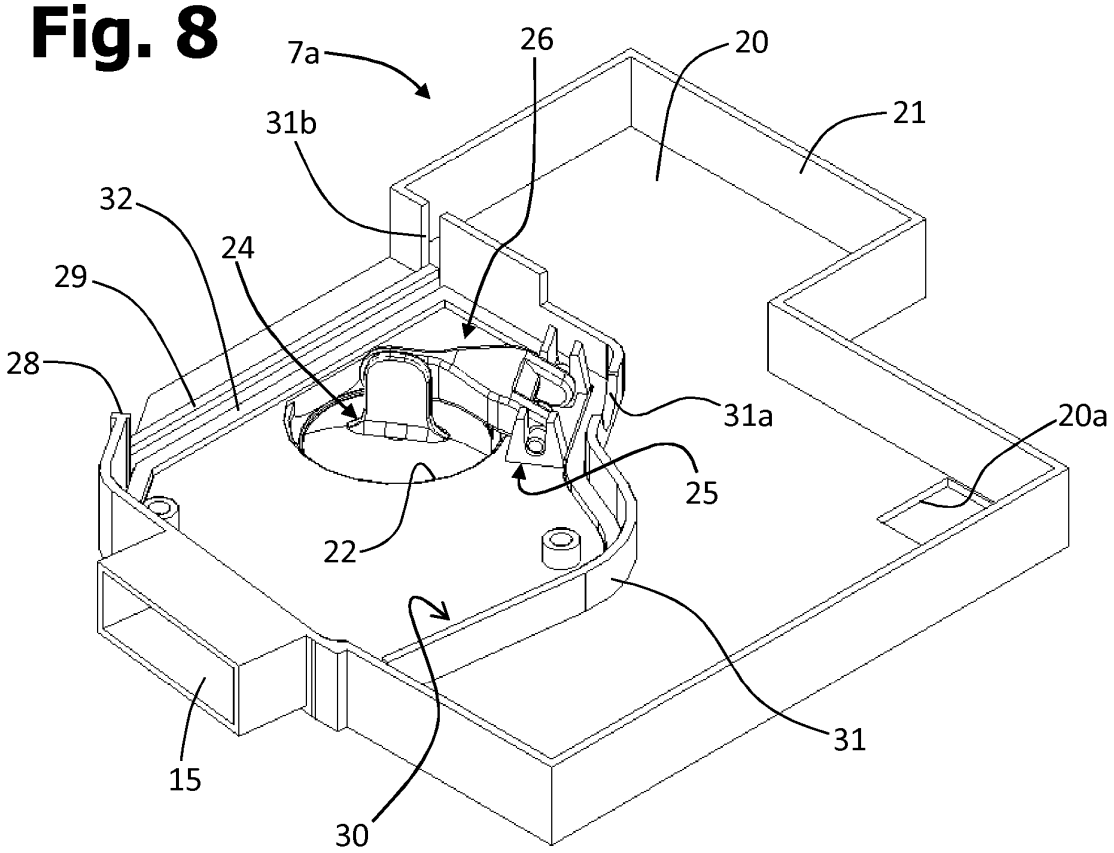
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Fig. 9

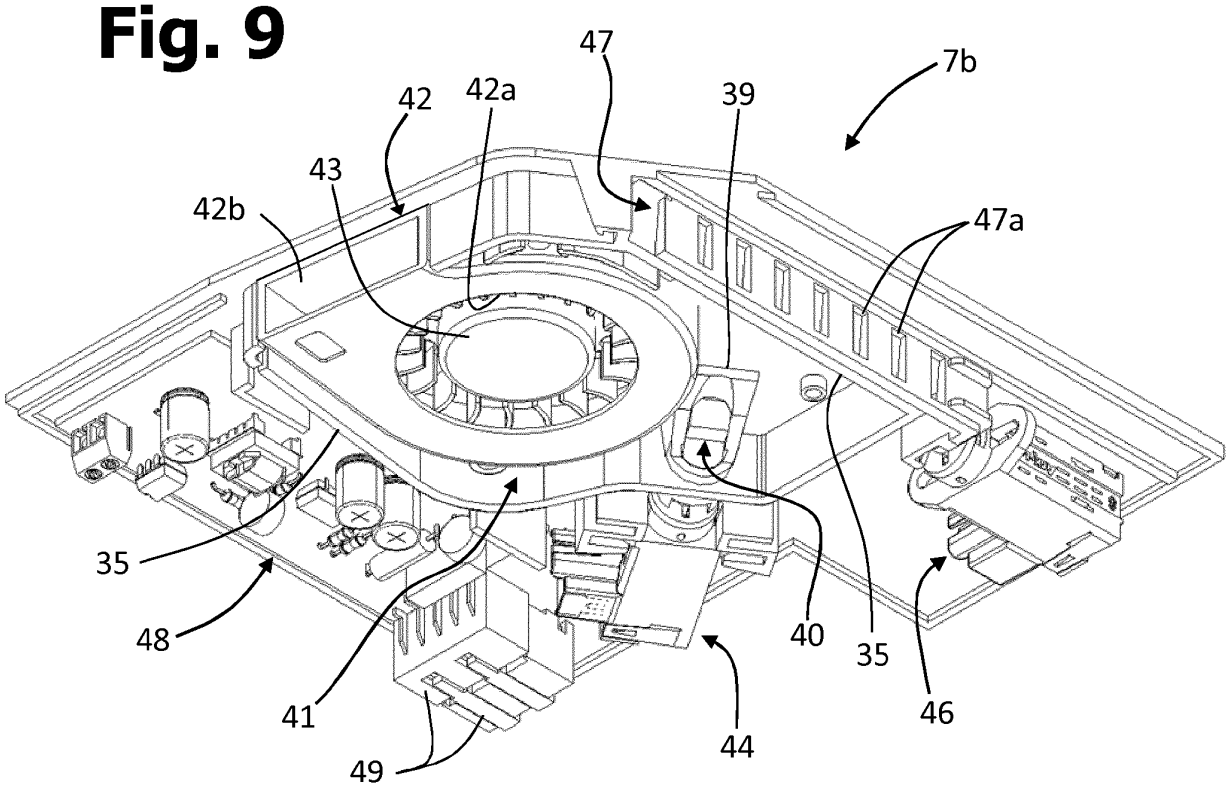
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Fig. 10

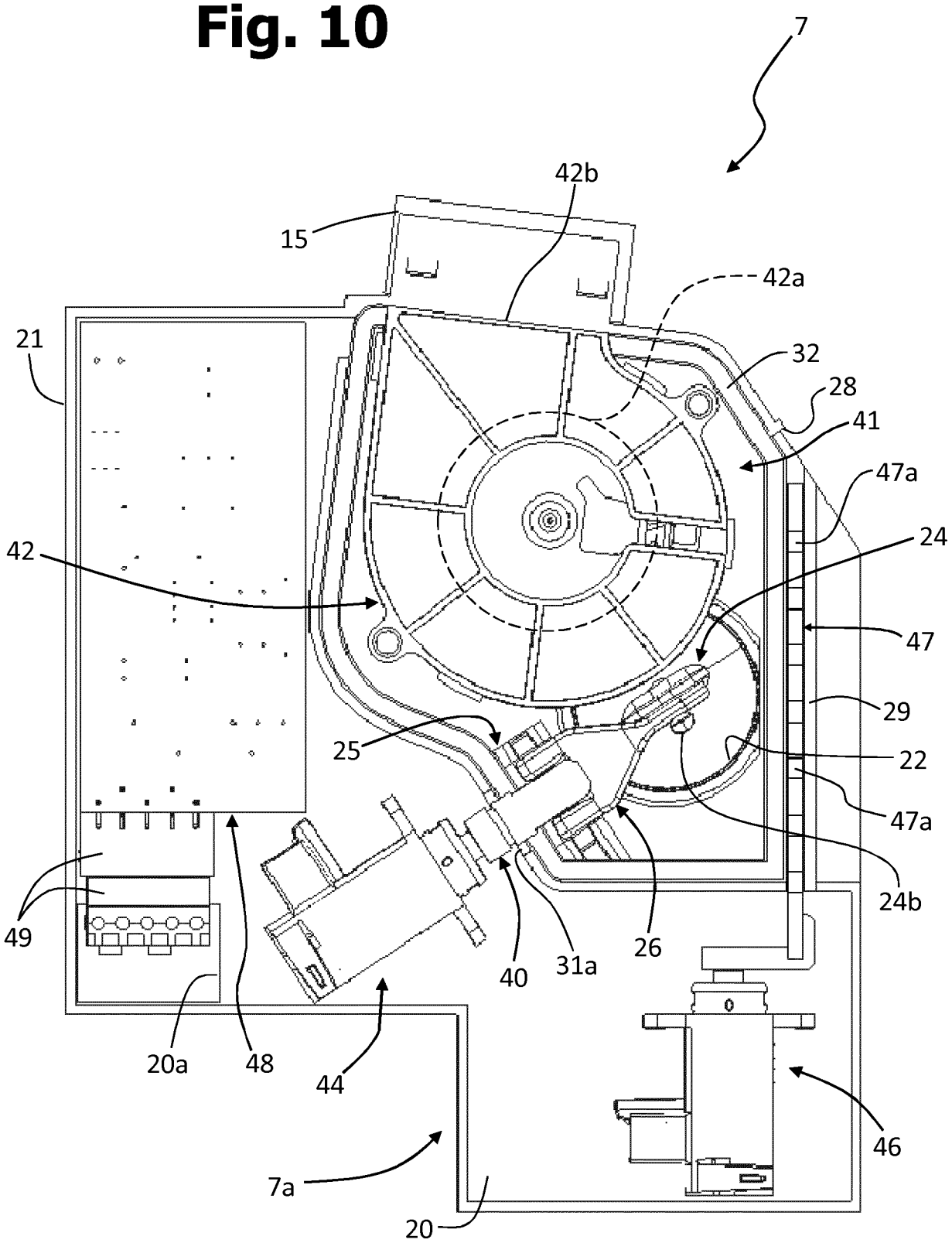
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Fig. 11

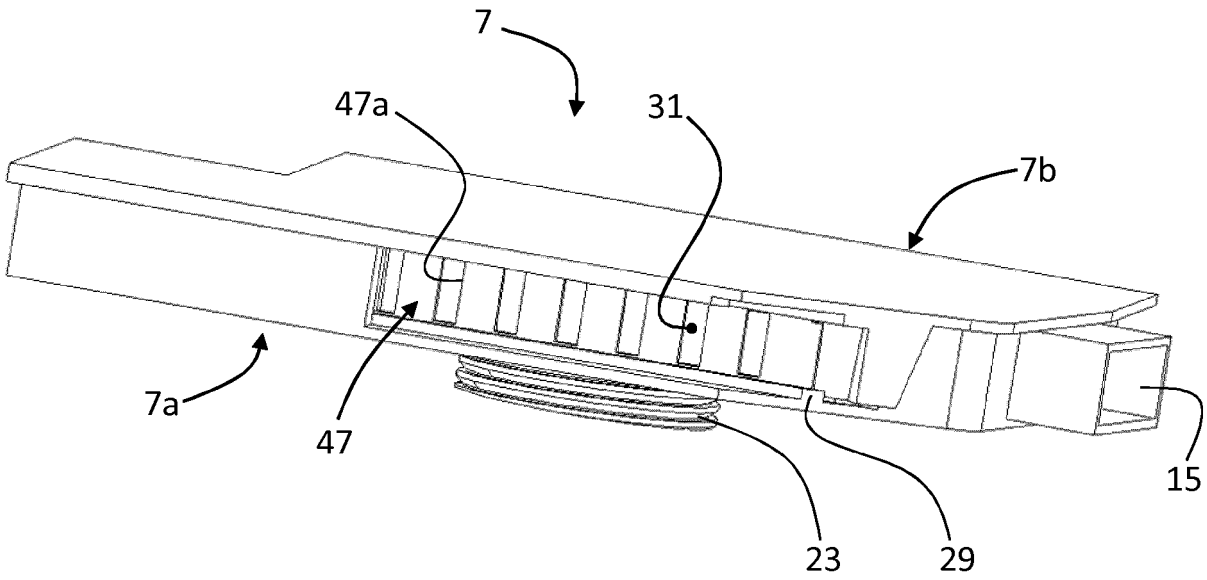


Fig. 12

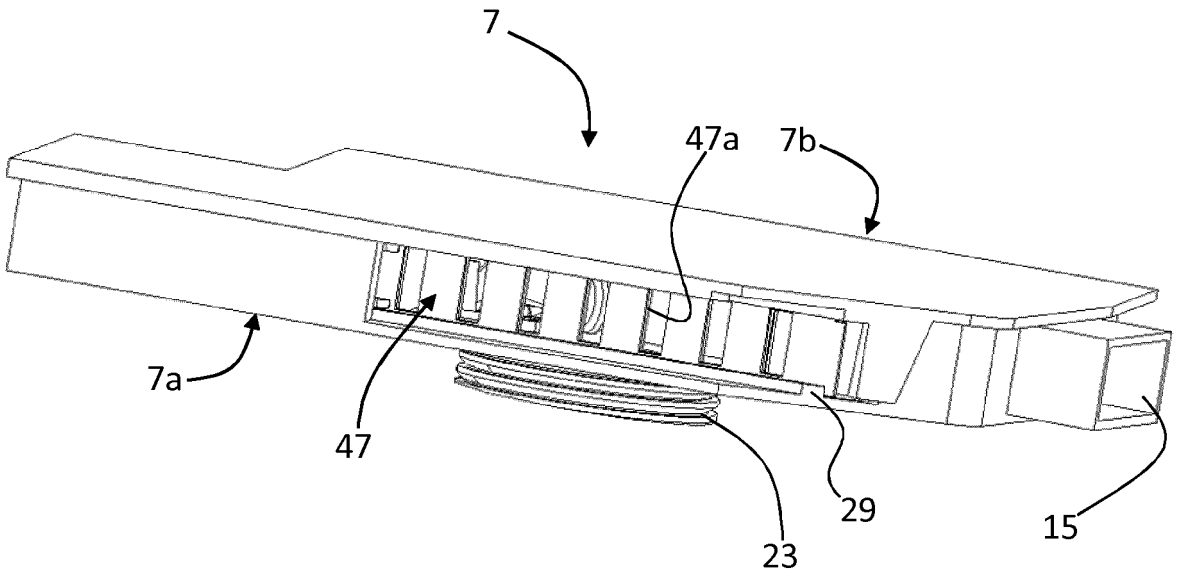
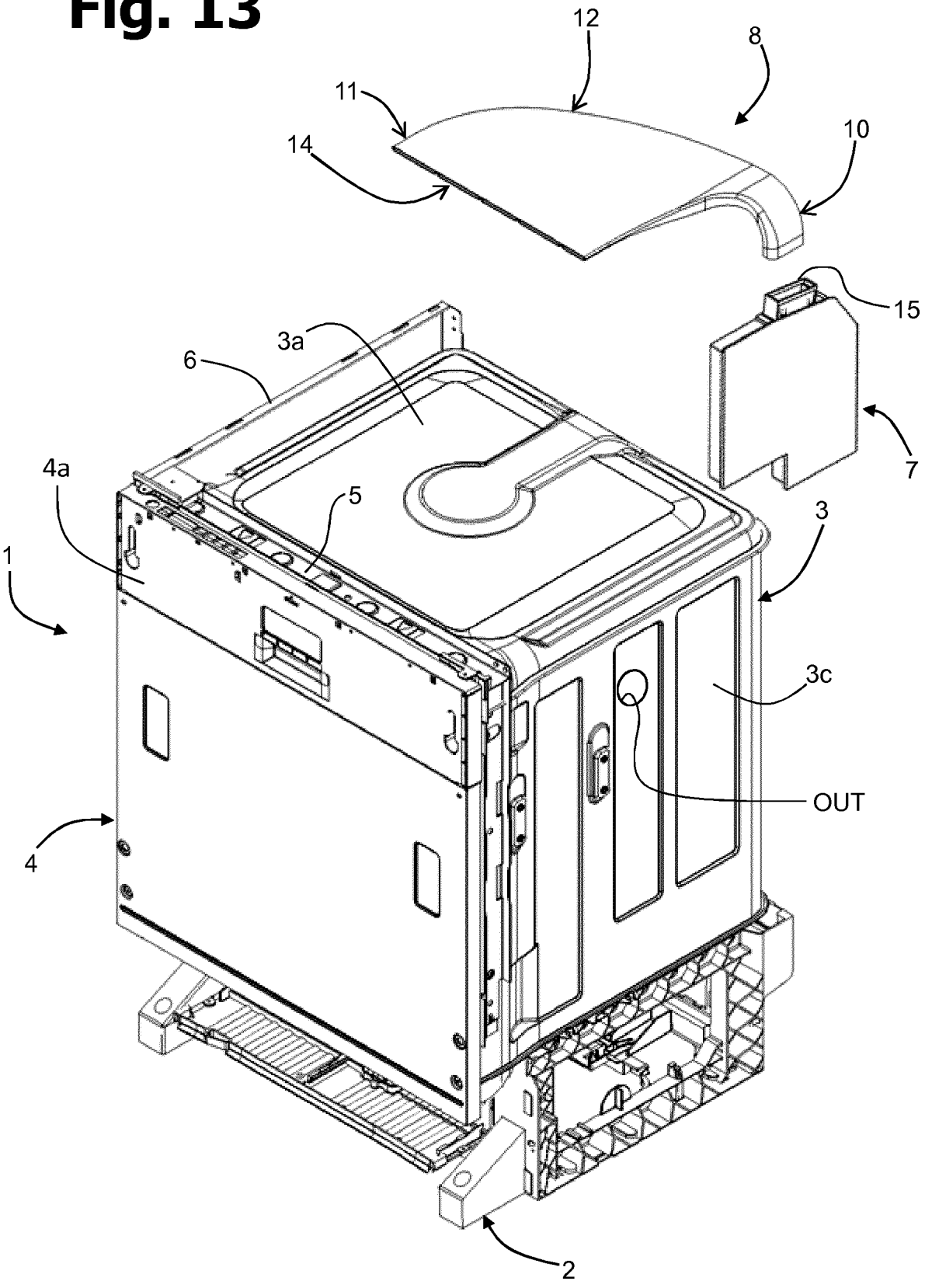


Fig. 13



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