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(54) **Household washing machine, in particular a dishwasher, comprising an improved upper hydraulic circuit**

(57) The invention relates to a washing machine, in particular a dishwasher, of the type comprising a wash tub (10), a liquid supply duct (11) connected to a hydraulic outlet (70) located on a wall of said tub (10), and at least one upper rack (20) associated with an upper hydraulic circuit which comprises:

- a sprayer (30) made of plastic material;
- a tubular element (40) comprising a first end (41) and a second end (42);
- connection means (50) providing the hydraulic and mechanic connections between said first end (41) of the tubular element (40) and said sprayer (30); and
- a linking device (60) adapted to engage into said hydraulic outlet (70).

The invention is mainly **characterized in that** said linking device (60) comprises fins (66) adapted to be coupled to at least one rib (74) being present on the hydraulic outlet (70).

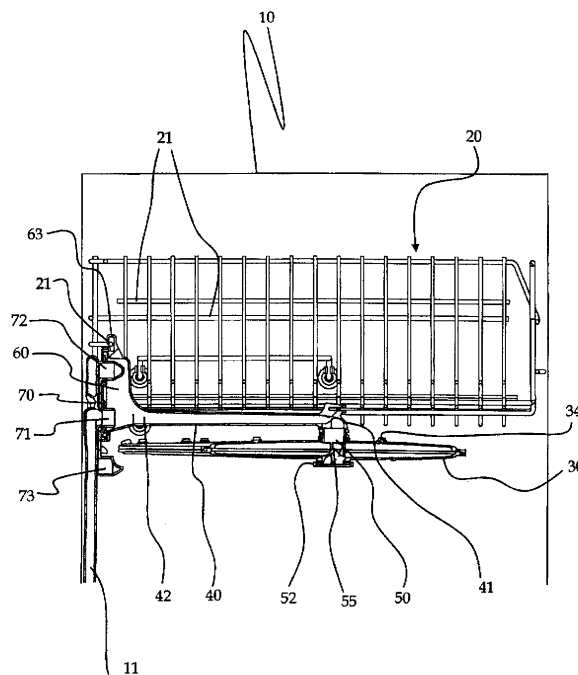


Fig.1

Description

[0001] The present invention relates to a washing machine, in particular a dishwasher, according to the preamble of claim 1.

[0002] It is known that washing machines, in particular dishwashers, usually comprise two load racks for loading the crockery to be washed, in particular an upper load rack and a lower load rack.

[0003] In such washing machines, the crockery is washed by means of two rotating spray arms, which spray a wash fluid toward the load racks and are supplied with pressurized fluid from a wash pump, typically housed in the machine base.

[0004] The lower rotating spray arm is generally supplied and supported from below, by means of a tubular element which is directly connected to the body of the supply pump, whereas the upper rotating spray arm is supplied from above.

[0005] In a first embodiment, the rotating spray arm is supplied from above through a nozzle housed on the ceiling of the wash tub, which is supplied through a duct coming from the supply pump.

[0006] The nozzle outputs a liquid jet downwards, which after having crossed an "air break" reaches a cone-shaped receiving element secured centrally to the upper rack of the machine; the "air break" separating the nozzle from the receiving element is provided in order to allow the rack to slide horizontally, for the purpose of allowing the normal extraction and insertion operations required for loading and removing the crockery. The liquid jet sprayed by the nozzle crosses the "air break" and enters the cone-shaped receiving element at high speed, thus hitting the walls of the latter and generating noise which virtually persists for the whole duration of the wash cycle, thus making the appliance quite noisy.

[0007] Moreover, in the light of the fact that the height of the upper rack of the dishwasher is usually adjustable (i.e. the rack can be adjusted to at least two different positions in the wash tub, a higher one and a lower one, according to the dimensions of the objects to be washed), the "air break" may be longer or shorter depending on the operating condition of the dishwasher.

[0008] It is therefore apparent that when the upper rack is adjusted to the lower position, the air path of the liquid flow will be longer, and thus the wash will be more critical; in fact, in such a situation it is more likely that a portion of the liquid will miss the cone-shaped receiving element, ending up outside of it and thereby decreasing the efficiency of the wash; another adverse effect of such an operating condition is the louder noise generated by the liquid entering the cone-shaped element.

[0009] Aiming at solving the problem of noise and the losses of pressurized fluid suffered by the above-described solution, washing machines have been proposed equipped with means adapted to eliminate the air break between the upper nozzle and the cone-shaped receiving element.

[0010] In particular, the washing machines known in the art comprise a wash tub housing an upper rack, a sprayer being associated with the underside thereof; connection means are also provided which allow to connect said sprayer to a first end of a tubular element made of plastic material, said tubular element being adapted to engage into a hydraulic outlet being present on the back wall of the tub.

[0011] Due to the static and dynamic pressure of the wash fluid, as well as to the weight of the sprayer and of the fluid contained therein, high friction is generated between the sprayer and said connection means, which adversely affects the proper operation and rotation of the sprayer itself.

[0012] In solutions known in the art, it has been attempted to reduce said friction through a lubricating effect provided by the wash fluid; in fact, washing machines are known which comprise connection means between the sprayer and said tubular element, said connection means being so provided as to allow wash fluid to leak.

[0013] In practice, this leakage allows the wash fluid to act substantially as a lubricating medium.

[0014] However, it has been noticed that even these latter solutions do not completely eliminate all friction between the sprayer and said connection means, in particular because of adverse effects caused by the high temperature of the wash fluid and by the impurities normally contained therein.

[0015] A further drawback of the above solution is that the provision of a leakage of wash fluid, in particular at friction points between the sprayer and the connection means connecting it to the tubular element, inevitably implies a higher consumption of wash fluid and a reduction in the wash fluid pressure within the sprayer, resulting in worse crockery washing results.

[0016] It is also known that, in washing machines known in the art, a second end of said tubular element comprises a connection device adapted to engage into a hydraulic outlet being present on the back wall of the wash tub; in practice, said hydraulic outlet is the outlet of a supply duct connected to a supply pump of the washing machine.

[0017] Since the tubular element is usually coupled to the upper rack of the washing machine, in particular in those cases wherein said upper rack can be adjusted to at least two different positions (a higher position and a lower position) inside the wash tub according to the dimensions of the objects to be washed, difficulties often arise when inserting the connection device into the hydraulic outlet being present on the back wall of the wash tub. It is clear that said difficulties in inserting the connection devices into the hydraulic outlet may grow worse as the load placed in the rack of the washing machine gets heavier and as the number of inlets of the connection device increases. In fact, the connection devices of the washing machines known in the art comprise two inlets located vertically one on top of the other, which allow the connection device to be connected to the hydraulic outlet

with the rack mounted in either position (higher or lower) inside the wash tub.

[0018] In this frame, it is the main object of the present invention to provide a washing machine, in particular a dishwasher, which allows to overcome the above-mentioned drawbacks.

[0019] It is further object of the present invention to provide a washing machine, in particular a dishwasher, such that the proper rotation and operation of the sprayer are not jeopardized. It is another object of the present invention to provide a washing machine, in particular a dishwasher, such that friction between the sprayer and the connection means is reduced without having to use a leakage of wash fluid, thus determining neither a higher wash fluid consumption of the washing machine and nor a drop of pressure in the wash fluid within the sprayer, which otherwise would result in worse crockery washing results.

[0020] It is a further object of the present invention to provide a washing machine, in particular a dishwasher, such that the connection device can be plugged into the hydraulic outlet on the back wall of the wash tub more easily, in particular in all those cases wherein the upper rack of the washing machine can be adjusted to at least two different positions inside the wash tub and whenever a heavy load is placed on the upper rack of the washing machine. In order to achieve these objects, the present invention provides a washing machine, in particular a dishwasher, incorporating the features set out in the appended claims, which are intended as an integral part of the present description.

[0021] Further objects, features and advantages of the present invention will become apparent from the following detailed description and from the annexed drawings, which are supplied by way of non-limiting example, wherein:

- Fig. 1 is a sectional side view of the upper portion of a washing machine, in particular a dishwasher, according to the present invention;
- Fig. 2 is an exploded view of a first portion of an upper hydraulic circuit of the washing machine according to the present invention;
- Figs. 3a and 3b are a perspective view and an sectional view, respectively, of some components of the upper hydraulic circuit of the washing machine according to the present invention.

[0022] Referring now to Figs. 1 and 2, reference number 10 designates the upper portion of a wash tub of a washing machine, in particular a dishwasher, manufactured according to the teachings of the present invention.

[0023] Said tub 10 houses an upper rack 20, which is associated with an upper hydraulic circuit comprising:

- a sprayer 30 made of plastic material;
- a tubular element 40 comprising a first end 41 and

a second end 42;

- connection means 50 providing the hydraulic and mechanic connections between said first end 41 of the tubular element 40 and said sprayer 30; and
- a linking device 60, adapted to engage into a hydraulic outlet 70 provided on a wall of the tub 10.

[0024] In practice, hydraulic outlet 70 is the outlet of a supply duct 11 connected to a supply pump of the dishwasher, which is not shown in the drawing for simplicity's sake.

[0025] Tubular element 40 is preferably made of plastic material, whereas linking device 60 is preferably provided in one piece with second end 42 of said tubular element 40. According to the present invention, said connection means comprise a bush 50 made of a material which is different from that used for manufacturing said sprayer 30.

[0026] Sprayer 30 and the bush 50 are made of plastic materials, said plastic materials ensuring good dimensional stability and high compression and shock resistance.

[0027] In particular, said bush 50 is made of acetalic resin, while said sprayer 30 is made of polypropylene.

[0028] The different materials used for manufacturing sprayer 30 and bush 50 reduce the friction between said components as sprayer 30 rotates, thus overcoming the problem of having to ensure a considerable water leakage, which would result in a considerable reduction in the wash fluid flow to upper rack 20, in order to ensure that sprayer 30 can slide properly on bush 50.

[0029] As shown in particular in Fig. 2, sprayer 30 comprises an upper shell 32 and a lower shell 33.

[0030] Sprayer 30 is located underneath upper rack 20, and said upper shell 32 comprises a plurality of nozzles 34 facing in different directions, which allow the wash fluid to be sprayed onto upper rack 20.

[0031] Preferably, said bush 50 comprises a substantially cylindrical body 51, a base 52 having a larger diameter than body 51, and clamping means 53 for connecting it to first end 41 of tubular element 40.

[0032] The rotation of sprayer 30 essentially takes place about body 51 of bush 50, said body 51 being adapted to be inserted into an aperture 31 of said sprayer 30; in particular, said aperture 31 is obtained on upper shell 32 and on lower shell 33.

[0033] Said body 51 comprises a plurality of openings 54 which allow the wash fluid to flow into sprayer 30.

[0034] Bush 50 also comprises a protrusion 55 connected to base 52 and located near said plurality of openings 54, which protrusion divides the wash fluid flow and consequently makes it easier for the wash fluid to flow from the body 51 of bush 50 into sprayer 30.

[0035] In accordance with a preferred embodiment of the present invention, upper rack 20 of the washing machine is adapted to slide in said tub 10 and can be adjusted to two different height positions.

[0036] As shown in particular in Figs. 3a and 3b, hy-

draulic outlet 70 comprises:

- an open outlet 71 hydraulically connected to supply duct 11 of the washing machine,
- a first 72 and a second 73 closed outlets located on opposite sides with respect to said open outlet 71.

[0037] In order to allow tubular element 40 to be connected to the hydraulic outlet 70, the linking device 60 comprises two inlets 61, 62 arranged vertically one on top of the other, in particular an upper inlet 61 and a lower inlet 62.

[0038] When upper rack 20 is in the higher position, as is the case of in Fig. 1, upper inlet 61 of linking device 60 connects to first closed outlet 72 of hydraulic outlet 70 when rack 20 is slid into the dishwasher and pushed against the rear of tub 10.

[0039] In this condition, lower inlet 62 connects to open outlet 71, and when the wash fluid supply pump is started, the wash fluid from supply duct 11 and from hydraulic outlet 70 will flow into linking device 60 through said lower inlet 62 and into the tubular element 40, bush 50 and sprayer 30, thus turning said sprayer 30.

[0040] Vice versa, when upper rack 20 is in the lower position (not shown), the lower inlet 62 of linking device 60 connects to the second closed outlet 73 of hydraulic outlet 70. When the wash fluid supply pump is started, the wash fluid flows into linking device 60 through upper inlet 61, which is coupled to open outlet 71.

[0041] Referring to Figs. 3a and 3b again, it can be noticed that first closed outlet 72 and second closed outlet 73 have a substantially conical shape, so as to facilitate the connection between hydraulic outlet 70 and linking device 60 when the latter enters the dishwasher as rack 20 is pushed against the rear of tub 10.

[0042] According to the present invention, the upper hydraulic circuit of the washing machine comprises compensation means that allow to compensate for any misalignment between inlets 61, 62 of linking device 60 and outlets 71, 72, 73 of hydraulic outlet 70.

[0043] In particular, said compensation means comprise at least one hooking element 63 which provides a loose coupling to a wire 21 of rack 20, so that said upper hydraulic circuit (i.e. the assembly comprising sprayer 30, tubular element 40, bush 50 and linking device 60) is horizontally pivoted about an axis represented by wire 21.

[0044] This pivoting of the upper hydraulic circuit allows to compensate for any misalignment between inlets 61, 62 of linking device 60 and outlets 71, 72, 73 of hydraulic outlet 70, resulting in an easier connection of the hydraulic circuit to hydraulic outlet 70.

[0045] Said hooking element 63 essentially has an upside-down U shape and comprises a vertical slot in which wire 21 of rack 20 can move vertically and turn.

[0046] Hooking element 63 is preferably obtained on the body of linking device 60, in particular on the upper portion of said linking device 60.

[0047] In a preferred embodiment of linking device 60, said upper inlet 61 and said lower inlet 62 are both provided with a gasket 64, in particular made of silicone-based material.

[0048] Said gaskets 64 may be secured to the inside of linking device 60 and at said inlets 61, 62 by using at least one fastening plate 65 comprising apertures matching outlets 71, 72, 73 of hydraulic outlet 70.

[0049] Also, Figs. 3a and 3b show that linking device 60 comprises tongues 66 adapted to be coupled to at least one rib 74 being present on hydraulic outlet 70; this coupling allows to provide an easier and guided connection between linking device 60 and hydraulic outlet 70.

[0050] The features of the present invention, as well as its advantages, are apparent from the above description.

[0051] In particular, the fact that the bush for connecting the tubular element to the sprayer is made of a plastic material being different from that used for manufacturing the sprayer, said bush being preferably made of acetalic resin and the sprayer being preferably made of polypropylene, allows to obtain a washing machine, in particular a dishwasher, such that the proper rotation and operation of the sprayer is not jeopardized.

[0052] Another advantage offered by the particular configuration of the bush and of the sprayer according to the present invention is that this configuration allows to reduce the friction between said elements without having to use a leakage of wash fluid, thus determining neither a higher wash fluid consumption of the washing machine nor a drop of pressure in the wash fluid within the sprayer, which otherwise would result in worse crockery washing results.

[0053] An additional advantage provided by the washing machine, in particular a dishwasher, according to the present invention is that the use of compensation means for the upper hydraulic circuit of the washing machine allows to compensate for any misalignment between the inlets of the connection device and the outlets of the hydraulic outlet, thus making it easier to connect the hydraulic circuit to the hydraulic outlet, in particular in all those cases wherein the upper rack of the washing machine can be adjusted to at least two different positions in the wash tub and whenever a heavy load is placed on said upper rack. The washing machine, in particular the dishwasher, described herein by way of example may be subject to many possible variations without departing from the novelty spirit of the inventive idea; it is also clear that in the practical realization of the invention the illustrated details may have different shapes or be replaced with other technically equivalent elements. It can therefore be easily understood that the present invention is not limited to the above-described washing machine, but may be subject to many modifications, improvements or replacements of equivalent parts and elements without departing from the inventive idea, as clearly specified in the following claims.

Claims

1. Washing machine, in particular a dishwasher, of the type comprising a wash tub (10), a fluid supply duct (11) connected to a hydraulic outlet (70) located on a wall of said tub (10), and at least one upper rack (20) to which is associated an upper hydraulic circuit which comprises:
 - a sprayer (30) made of plastic material;
 - a tubular element (40) comprising a first end (41) and a second end (42);
 - connection means (50) providing the hydraulic and mechanic connections between said first end (41) of the tubular element (40) and said sprayer (30);
 - a linking device (60) at said second end (42) adapted to engage into said hydraulic outlet (70),

characterized in that said linking device (60) comprises fins (66) adapted to be coupled to at least one rib (74) being present on the hydraulic outlet (70).
2. Washing machine according to claim 1, **characterized in that** said connection means comprise a bush (50) made of a plastic material which is different from the plastic material which is different from the plastic material of which said sprayer (30) is made.
3. Washing machine according to claim 2, **characterized in that** said sprayer (30) and said bush (50) are made of plastic materials, said plastic materials ensuring good dimensional stability and high compression and impact strength.
4. Washing machine according to claim 2, **characterized in that** said bush (50) is made of acetalic resin and said sprayer (30) is made of polypropylene.
5. Washing machine according to claim 2, **characterized in that** said bush (50) comprises a substantially cylindrical body (51), a base (52) having a larger diameter than the body (51), and clamping means (53) for connecting it to the first end (41) of the tubular element (40).
6. Washing machine according to claim 1, **characterized in that** said sprayer (30) comprises an upper shell (32) and a lower shell (33).
7. Washing machine according to the preceding claim, **characterized in that** the sprayer (30) is located underneath the upper rack (20), and that said upper shell (32) comprises a plurality of nozzles (34) aimed in different directions, which allow the wash fluid to be sprayed onto the upper rack (20).
8. Washing machine according to any of the preceding claims, **characterized in that** the upper rack (20) of the washing machine is adapted to slide in said tub (10) and can be adjusted to two different height positions.
9. Washing machine according to claim 8, **characterized in that** the hydraulic outlet (70) comprises:
 - an open outlet (71) hydraulically connected to the supply duct (11) of the washing machine,
 - a first (72) and a second (73) closed outlets located on opposite sides with respect to said open outlet (71).
10. Washing machine according to any of claims 8 and 9, **characterized in that** the linking device (60) comprises two inlets (61, 62) arranged vertically one on top of the other, in particular an upper inlet (61) and a lower inlet (62), in order to allow the tubular element (40) to be connected to the hydraulic outlet (70).
11. Washing machine according to claim 10, **characterized in that** the upper hydraulic circuit of the washing machine comprises compensation means which allow to compensate for any misalignment between the inlets (61, 62) of the linking device (60) and the outlets (71, 72, 73) of the hydraulic outlet (70).
12. Washing machine according to claim 11, **characterized in that** said compensation means comprise at least one hooking element (63) which provides a loose coupling to a wire (21) of the rack (20), so that said upper hydraulic circuit is horizontally pivoted about an axis represented by the wire (21).
13. Washing machine according to claim 12, **characterized in that** said hooking element (63) essentially has an upside-down U shape and comprises a vertical slot in which the wire (21) of the rack (20) can move vertically and turn.
14. Washing machine according to claim 12, **characterized in that** said hooking element (63) is obtained on the body of the linking device (60), in particular on a upper portion of said linking device (60).
15. Washing machine according to claim 9, **characterized in that** the first (72) and the second (73) closed outlets have a substantially conical shape.

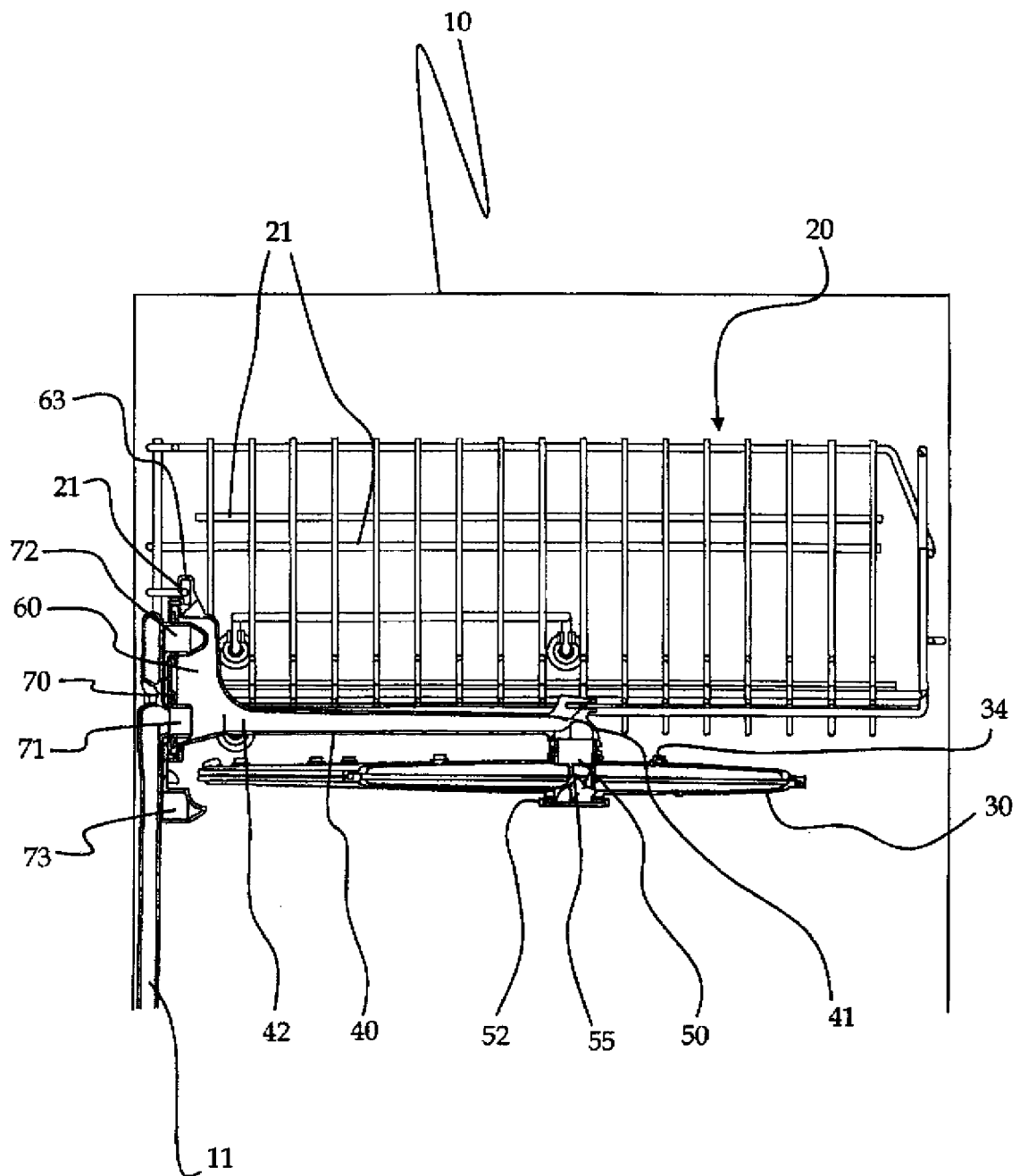


Fig.1

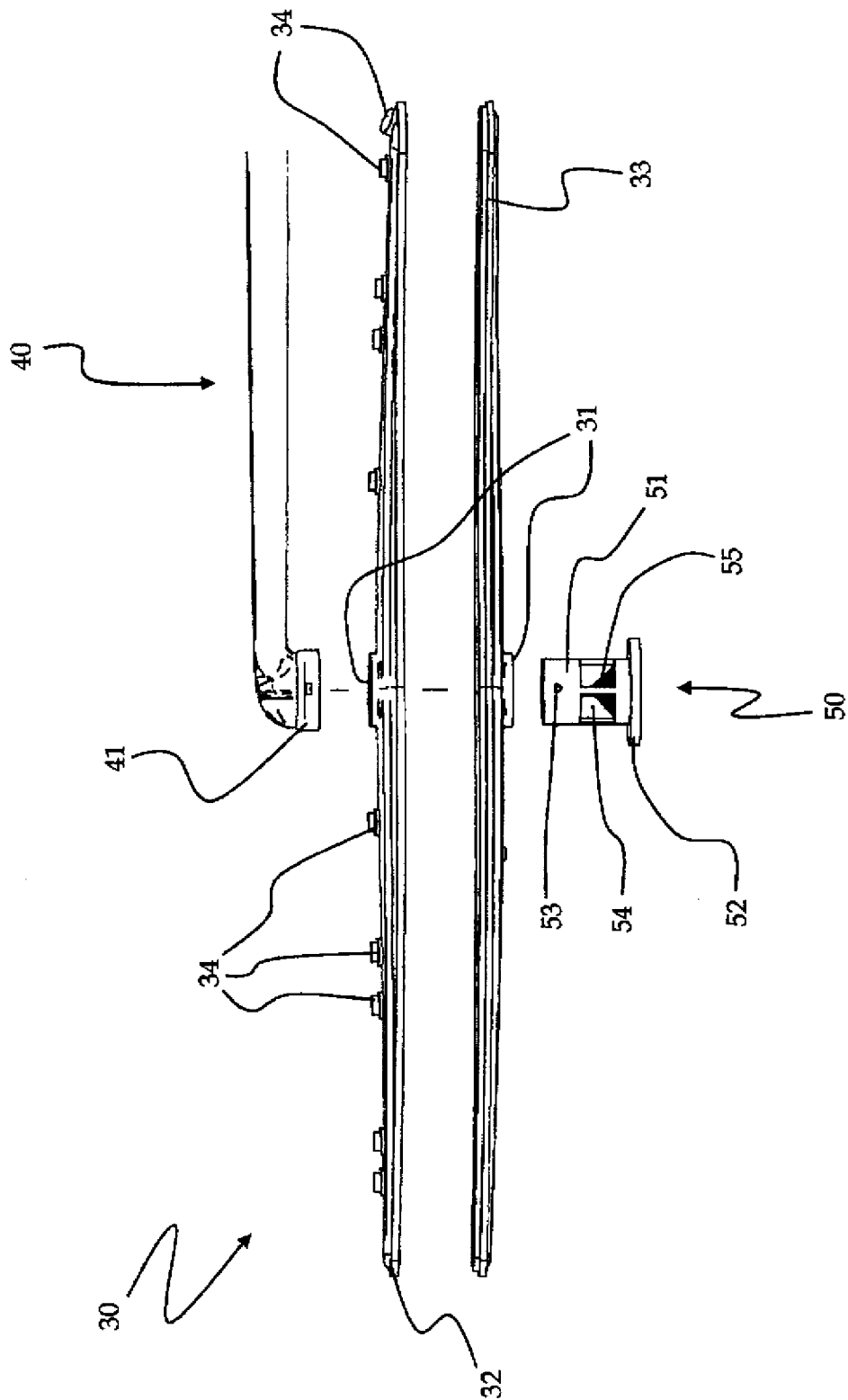


Fig. 2

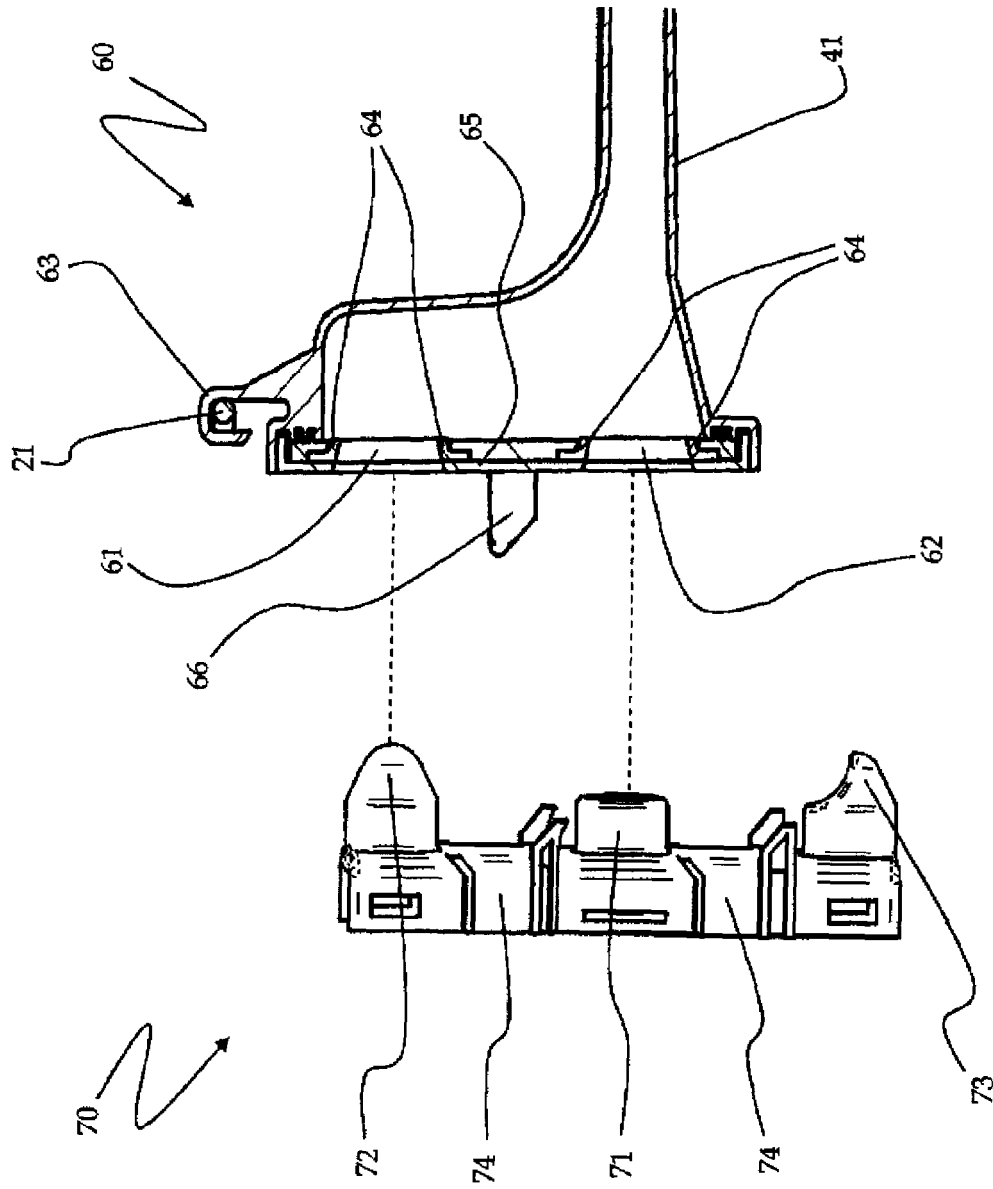


Fig. 3b

Fig. 3a