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(54) **Laundry-drier with a panel-type front door and extractable tank for collecting condensation water**

(57) Laundry-drying machine with a panel-type front door (24) and extractable tank (10) for collecting the condensation water, accommodated removably in a cassette housing (27) formed in the front door together with a filter (5) for fluff and down which can be removed separately from the tank, and in which a nozzle (21), which is freely open on the opening (16) for loading the laundry, feeds the collecting tank through a filling mouth (36) of the tank, which freely faces the nozzle and simultaneously functions as a vent mouth.

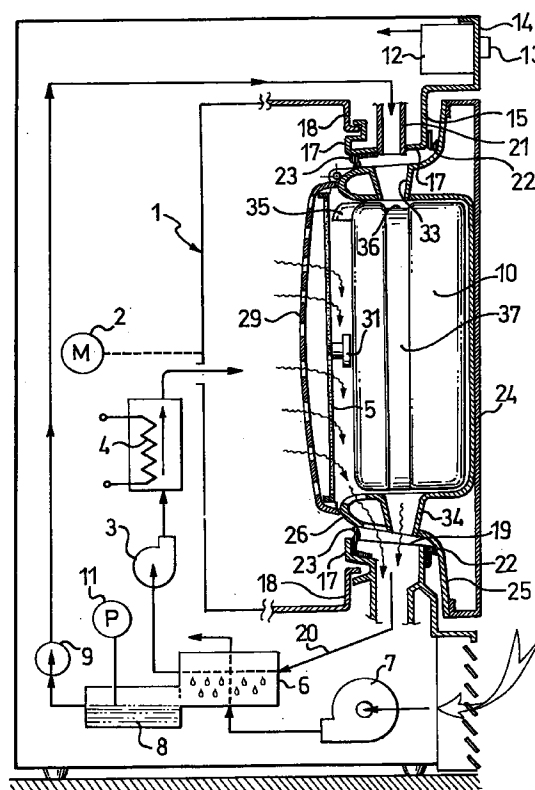


FIG.1

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Description

The present invention relates to the laundry-drying machines of the domestic type, with a panel-type front door and extractable tank for collecting the condensation water.

Front-loading laundry-drying machines are known, both of the type in which the loading opening is closed by a porthole and of the type in which the loading opening is closed by a continuous panel which covers the entire front surface of the machine excluding the single control panel and a lower base.

For reasons of space and rational utilization of the limited volume available, there is a trend towards providing said laundry-drying machines with a tank for collecting the condensation water, which is removably accommodated in the space formed by the loading opening and supported by the closing door.

If this solution is adopted, it is necessary to solve various technical problems:

It is necessary to ensure that the drying circuit is sealed relative to the external atmosphere to avoid humid air escaping.

It is necessary to provide in the drying circuit, at the exit of the drying chamber, an easily removable and cleanable filter for catching the fluff and down released by the fabrics, to avoid these being carried along and accumulated in a condenser.

It is necessary to ensure that the tank for collecting the condensation water does not become pressurized by the gradual filling and that, in the event that the tank is completely filled, the operation of the machine is stopped to avoid the accumulation of water in the condenser which is provided with a reservoir of limited capacity for collecting the condensate.

Various solutions have been proposed for solving these problems, none of which fully satisfies the requirements, resulting in constructional complications which reduce the reliability of the machines and involve great difficulty of operation.

According to the present invention, these problems are effectively solved in a constructionally simple and reliable manner which ensures extreme ease of operation, by a laundry-drying machine with a panel-type front door and an extractable tank for collecting condensate, which can be removed when the door is open.

The tank is provided, on its upper face, with a filling opening which freely faces, when the door is closed, a pipe for supplying condensation water, without the use of sealing connections or overflow pressure switches.

Any overflow of the tank is collected in the cassette housing of the tank and from this is conveyed by means of appropriate lower discharge means into a condenser reservoir of the machine.

The cassette housing of the tank also constitutes a section of the drying circuit leaving the rotating basket for containing the laundry, which is closed by a perforated protection diaphragm and in which, interposed between diaphragm and collecting tank, there is accom-

modated a filter for catching fluff, which can be removed separately from said tank and cleaned easily.

A first seal arranged all around the loading opening ensures, when the door is closed, the sealing of the drying circuit from the outside.

A second seal, arranged inside the loading opening, mates with the internal diaphragm, isolating the section of the drying circuit leaving the rotating basket from the volume of the basket.

Advantageously, according to a further feature of the invention, the tank is provided with means which reduce to a minimum or eliminate the risk of overflows during handling of the tank.

The characteristics and advantages of the invention will emerge more clearly from the description below of a preferred embodiment and its two variantes, with reference to the attached drawings, in which:

Figure 1 is a view in anteroposterior section of a preferred embodiment of a front-loading laundry-drying machine with a panel-type closing door and a tank for collecting condensation water accommodated in the door, including likewise in diagrammatic form, for clarity and completeness of the description, the drying circuits and the functional machine components known per se;

Figure 2 is a partially exploded perspective view, with the door open, of the laundry-drying machine in Fig. 1;

Figure 3 is a diagrammatic view in anteroposterior section of the collecting tank for the machine in Figs 1 and 2, provided with means of reducing to a minimum the risk of overflow, which consist of an internal tube which limits the filling level of the tank;

Figure 4 is a diagrammatic view in anteroposterior section of a collecting tank for the machine in Figs 1 and 2, provided with means of eliminating completely the risk of overflow, which consist of a siphon which limits the filling and partial emptying level of the tank;

Figure 5 is a diagrammatic view in anteroposterior section of a collecting tank provided with means of eliminating the risk of overflow, with the formation inside the tank of a pressurization volume, which can be depressurized by the removal of the tank, and

Figure 6 is a partial exploded perspective view with the door open of an alternative embodiment of the laundry-drying machine in Figs 1 and 2.

With reference to Fig. 1, the laundry-drying machine comprises essentially a rotating drum or basket 1 which holds the laundry, is set in rotation by a motor 2 and passed through by a flow of air which is introduced into the drum 1 by a centrifugal fan 3 and is subject to heating by heating elements 4.

The laundry contained in the drum 1 releases, by evaporation, the humidity which it contains to the flow of hot air. The hot humid air leaves the drum through a fil-

ter 5 (which retains flying down and fluff) and is conveyed by an appropriate pipe entering a condenser 6 which is cooled by a flow of relatively cold air drawn in from the atmosphere by means of a centrifugal aspirator 7.

In the condenser 6, the vapour contained in the flow of hot air is condensed to liquid by cooling and collects in a condenser reservoir 8 while the dehumidified air leaving the condenser 6 is drawn by the fan 3 and made to recirculate in the drum 1, subject to reheating.

The flow of ambient air used for the condensation is on the other hand dispersed into the atmosphere.

The condensation liquid collected in the reservoir 8 is conveyed, by means of a pump 9, into a collecting tank 10 which is arranged at a higher level relative to that of the condenser.

A level sensor 11, for example of the pressure-switch type, acts if the level of liquid in the reservoir exceeds a predetermined value, stopping the operation of the machine.

The operation of the machine is controlled by a programmer 12 which is actuated by buttons or knobs 13 arranged on a front control panel 14.

All these elements are accommodated in a piece of furniture provided with a front wall 15, in which a loading opening opens, which is closed by a door.

The innovative features of the present invention will now be considered with reference to both Figures 1 and 2.

The loading opening 16 in the front wall is defined by a collar 17 which extends internally from the front wall 15 to be connected, by a labyrinth seal, to a front rim 18 of the rotating drum 1.

In the lower wall of the collar, aspiration openings 19 open, which are connected to an aspiration pipe 20 which conveys the humid air leaving the rotating drum to the condenser 6.

In the upper part of the collar, there opens freely, in other words without any device for valve-type closing or sealed connection to the tank, a nozzle 21 for discharge of the condensation water which the pump 9 draws from the condenser reservoir 8.

The external edge and the internal edge of the collar are expediently provided with a resilient seal 22, 23 respectively.

The door for closing the loading opening, which is hinged on the front wall, is formed by a flat external front panel 24 and by an internal counter-panel 25 which has a flat frame which, when the door is closed, is juxtaposed to the seal 22 bringing about the sealed closing of the loading opening. The counter-panel forms a sleeve 26 which projects internally and is accommodated in the collar of the loading opening and the external wall of which is juxtaposed, when the door is closed, to the seal 23.

Formed inside the sleeve is a housing 27 or containing cassette, which is generally cylindrical but can be prismatic, for a tank 10 for collecting the condensation water, which can be removed from the cassette in

the direction of the housing axis represented by the arrow 28 and inserted by translation in the opposite direction.

On the uppermost edge of the sleeve 26 (or on one side), a perforated cover 29 is hinged, which constitutes a separation diaphragm between the internal volume of the rotating drum 1 and the cylindrical housing 27 to prevent the penetration of the laundry to be dried into the housing 27 during operation of the machine.

Inside the cover 29, which is provided to this end with a containing frame, a filter 5 for catching the down and fluff shed by the laundry is removably engaged.

The filter 5 is expediently provided with a knob 31 or equivalent means for its extraction from the cover 29 in the direction represented by the arrow 32.

Expediently, the knob 31 also serves as a spacer and, by bearing against the wall of the tank 10, ensures the formation, between filter and tank, of an air chamber, through which the hot humid air which passes through the filter can flow towards the aspiration pipe 20, through expedient openings 34 formed in the lower wall of the sleeve.

The sleeve 26 is provided on its upper wall with a funnel-shaped opening 33 which brings the outside of the sleeve into communication with the internal housing 27 and, when the door is closed, faces the nozzle 21 for discharge of the condensation water.

Provided in the lower wall of the sleeve, as already mentioned, are similar openings 34 which, when the door is closed, face the aspiration pipe 20.

The tank 10 is expediently provided with a handle 35 for extraction/insertion and, on its upper face, with a filling mouth 36 which, when the tank is inserted in its housing, is juxtaposed freely, in other words without any device for valve-type closing or sealed connection to a delivery pipe, to the funnel-shaped opening 33.

The filling mouth therefore functions jointly as a filling opening and a vent opening and prevents the tank becoming pressurized during filling.

Expediently, the tank 10 is provided on one side and on the upper wall with a recessed groove 37 which extends from the filling mouth 36 to the lower wall of the tank in such a manner that, when the tank is full, the excess liquid conveyed into the tank can freely overflow from the mouth 36 and flow along the groove 37 to the lower wall of the sleeve 26 where, passing through the openings 34, it is conveyed into the condenser 6 and discharged into the reservoir 8.

The operation of the laundry-drying machine described is very simple: by opening the loading door, the operator can insert the laundry to be dried into the rotating drum, check that the filter 5 is clean and, if necessary, clean it by opening the cover 29 and removing the filter independently of the tank.

It is also possible to check that the tank 10, expediently made to this end of transparent material, is empty and, if necessary, remove it and empty it.

When the tank has been reinserted into its housing, the filter has been reinserted into the cover 29 and the

cover has been reclosed, the door can be reclosed and the operation of the drier can be started.

If, as a result of this, the condensation liquid which is conveyed to the tank exceeds the accumulation volume available, for example as a result of omitting to empty the tank beforehand, the overflow of liquid which is conveyed into the condenser reservoir brings about the action of the pressure-switch protection and stopping of the machine. It is not necessary to provide other safety systems apart from those essential to a conventional laundry-drying machine.

If, by lack of attention, the operator omits to insert the tank in its housing, the condensation liquid leaving the nozzle 21 is discharged into the housing 27 and, conveyed back into the condenser reservoir, brings about the action of the protection, in the same manner, at the very beginning of the drying operation.

The operator, alerted by the action of the protection, can easily recognize, by opening the loading door, the full state of the tank or its absence from the housing.

The structure of the machine is therefore very simple and extremely reliable and at the same time particularly ergonomic and convenient to operate.

The removability of the filter independently of the collecting tank allows it to be handled easily, unaffected by the weight of the tank, for thorough cleaning, if necessary under a jet of water, without risk of damage.

At the same time, the removal of the tank for emptying can be carried out without special precautions, except those which are necessary in order to avoid any overflows if the tank is completely full.

Figures 3, 4 and 5 represent a number of measures which reduce to a minimum or eliminate the risk of any overflows during removal of the tank.

In Fig. 3, the tank 10 is provided internally with an overflow tube 40 which is open on the lower wall of the tank and the top of which ends close to the handle 35 for extracting the tank from its housing. Since the handle is eccentric relative to the barycentric vertical axis of the tank, the tank tends, during its removal from the cassette housing, to rotate slightly to be arranged with its barycentre vertically aligned with the gripping handle.

As a result of this rotation, the upper part of the liquid contained in the tank tends to move away from the upper mouth of the overflow tube 40 so that possible overflows from the overflow tube are avoided.

As illustrated in Fig. 4, the overflow tube 40 can advantageously be replaced by a siphon 41 which comes into action when the level of the liquid in the tank reaches the threshold 42 of the siphon and brings about the partial emptying of the tank to the level of the mouth 43 for feeding the siphon.

Alternatively, as illustrated in Fig. 5, the mouth 36 for filling the tank 10 is provided with a funnel-shaped sleeve 44 which penetrates a convenient depth into the tank.

When the level of the liquid in the tank reaches the lower edge 45 of the funnel-shaped sleeve 44, a volume of air is formed in the upper part of the tank, which is

pressurized by any further liquid supply and prevents complete filling of the tank.

The maximum pressurization which can be exerted is determined in terms of water column, by the difference between the overflow level of the mouth 36 and the filling level of the tank.

By providing a vent opening 46, which is normally closed when the tank 10 is correctly installed in its housing by a resilient plug 47 arranged in the housing, on the first movement of the tank 10 for its removal, the opening 46 is opened, drawing back into the tank the liquid contained in the sleeve 44.

Alternatively, as shown in Fig. 2, the resilient plug 47 can be mounted on the filter 5 and the vent 46 can be provided on the wall of the tank facing the filter in such a manner that opening the cover 29 brings about opening of the vent, still before the tank is removed from its housing.

Fig. 6 represents an alternative embodiment of the laundry-drying machine in Figs 1 and 2, in which, inside the front closing door, the counter-panel 25 forms a cassette 27 or pocket housing for the tank and filter, which is open at the top.

In this case, the perforated diaphragm 47 for closing the cassette is an integral part and steady with the counter-panel itself.

The filter 5, provided with a spacing frame 30 and an upper handle 48, is arranged in the cassette 27 in an interposed position between the perforated diaphragm 47 and the tank 10 which is provided with an upper handle 49 and a filling mouth 36.

The tank is expediently shaped to allow its removal from the cassette by slight rotation and translation upwards, subject to removal of the filter 30, so as to utilize (as in the case of Figs 1 and 2) the volume offered by the thickness of the closing door.

Since the removal of the tank 10 is subject to the removal of the filter, the further advantage is achieved that the filter is inspected upon each operation to remove the tank, avoiding subsequent disadvantages (reduction of the drying efficiency, greater wear of the fan and overheating of the recirculation air).

All the other features of the laundry-drying machine are unchanged and are therefore not discussed. It is clear that all the overflow measures already described can be applied to the tank.

Claims

1. Laundry-drying machine with a front door (24, 25, 26) of the flat-panel (24) type for closing the loading opening (16) and a tank (10) for collecting condensate accommodated in said door (24, 25, 26), said laundry-drying machine being provided with a rotating drum (1) for drying and with a condenser (6) reservoir (8) arranged below the level of said front door, characterized in that it comprises

- a nozzle (21), for supplying condensation

water, which is freely open in said loading opening (16),

- a cassette (27) for housing a collecting tank (10), which cassette is formed in said front door, provided at the bottom with means (34, 20) capable of conveying an overflow of liquid into said condenser reservoir (8) by gravity, and is open at the top in the region of at least said nozzle (21), 5
- a tank (10) for collecting condensation water, which is accommodated in said cassette (27) and can be removed from said cassette only when the door is open, said tank (10) being provided, on its upper face, with a filling mouth (36) which freely faces said supply nozzle (21), 10 when said front door is closed, 15
- a perforated diaphragm (29, 47) mounted on a wall of said cassette (27) to separate the volume of said drum (1) from the volume of said cassette (27), and 20
- a filter (5) for catching fluff, which is accommodated in said cassette (27), interposed between said tank (10) and said diaphragm (29, 47) and can be removed separately from said tank (10). 25

2. Laundry-drying machine according to Claim 1, in which said diaphragm (29) is hinged on a wall (26) of said cassette (27) in order to assume a position for closing said cassette and an opening position, and said filter (5) is mounted removably in said diaphragm (29) and can be removed in said opening position, and in which: 30

said tank (10) can be extracted from said cassette in a direction perpendicular to the flat surface of said panel (24), in said opening position of said diaphragm (29). 35

3. Laundry-drying machine according to Claim 1, in which said cassette housing (27) is open at the top and said filter (5) and said tank (10) can be extracted separately from said cassette by translation upwards. 40 45

4. Laundry-drying machine according to Claim 3, in which said tank (10) can be extracted from said cassette housing (27) only subject to extraction of said filter (5) from said cassette. 50

5. Laundry-drying machine according to Claims 1, 2, 3 or 4, in which said tank (10) is provided internally with an overflow tube (40) which is open at the bottom of said tank (10). 55

6. Laundry-drying machine according to Claims 1, 2, 3 or 4, in which said tank (10) is provided with an internal siphon (41) for overflow and partial emptying, which is open at the bottom of said tank (10).

7. Laundry-drying machine according to Claims 1, 2, 3 or 4, in which said tank (10) is provided with means (44) of pressurization of a volume at the top of said tank, and with means (46) of depressurization of said volume at the top, which can be actuated on removal of said tank (10) from said cassette.

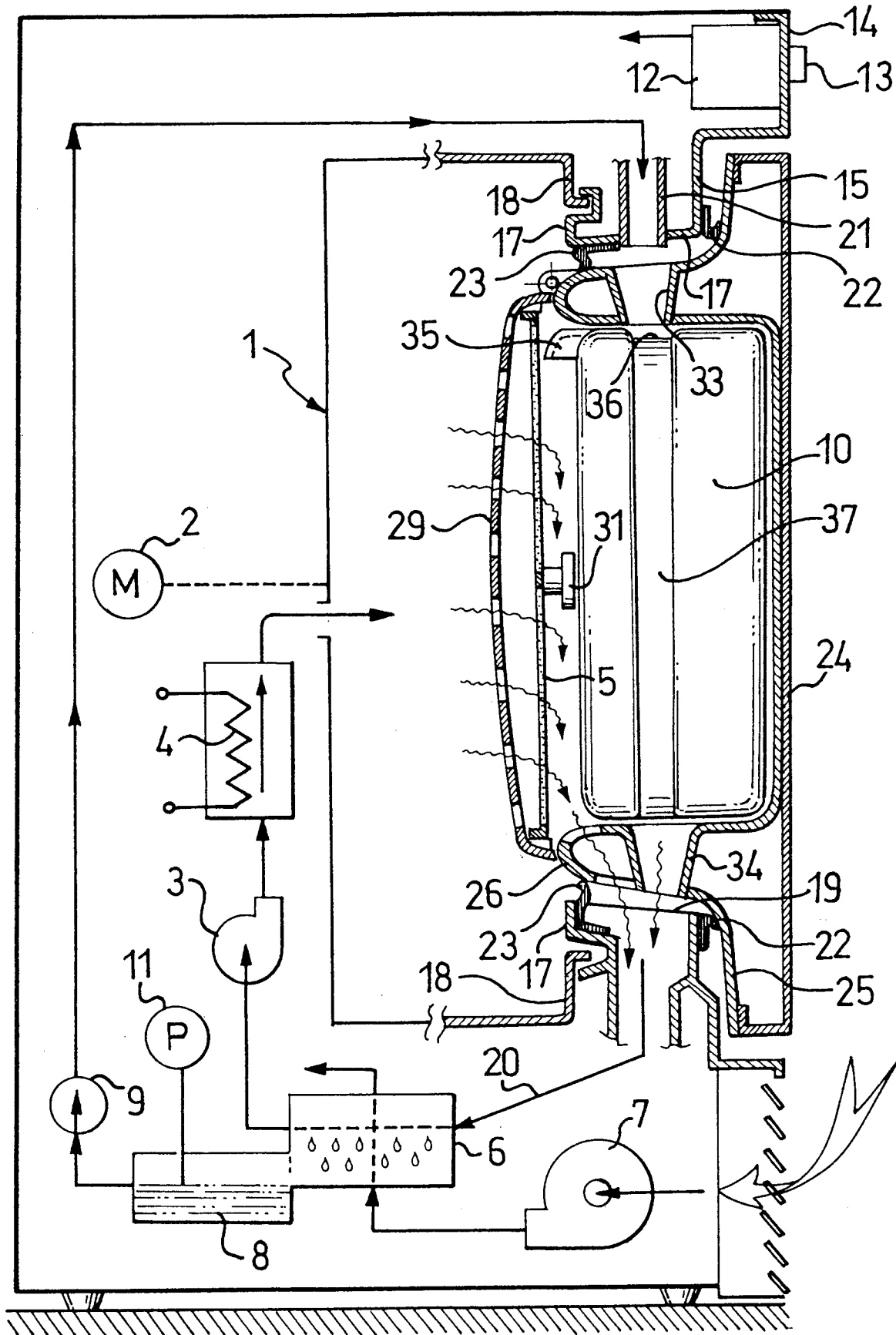


FIG.1

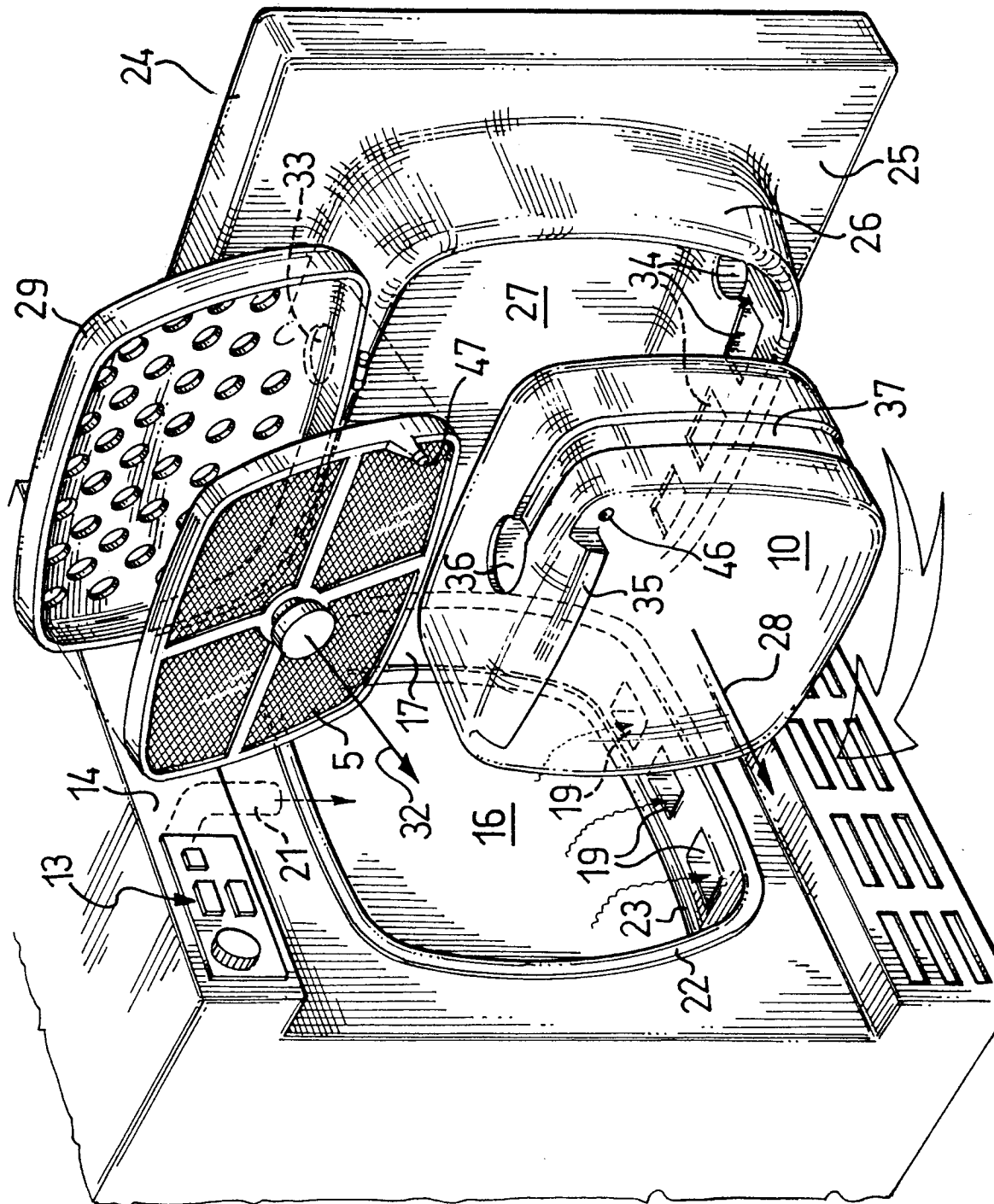


FIG. 2

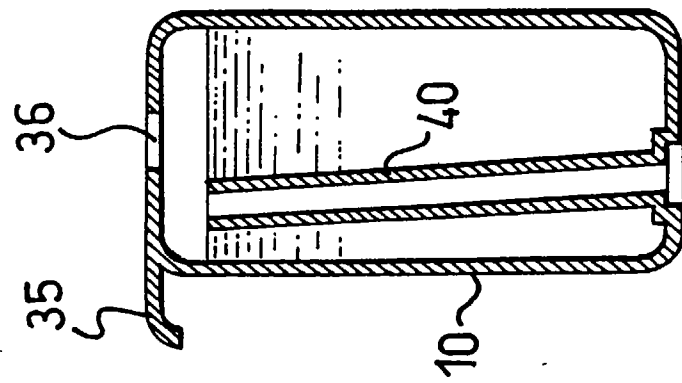


FIG. 3

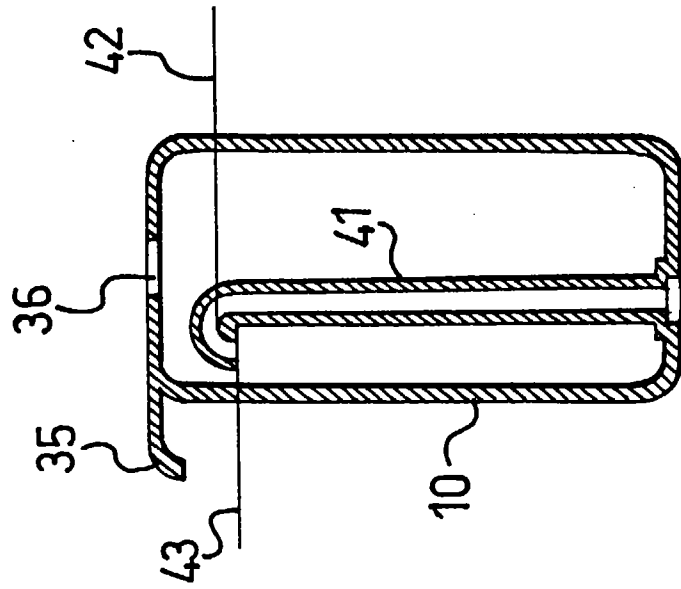


FIG. 4

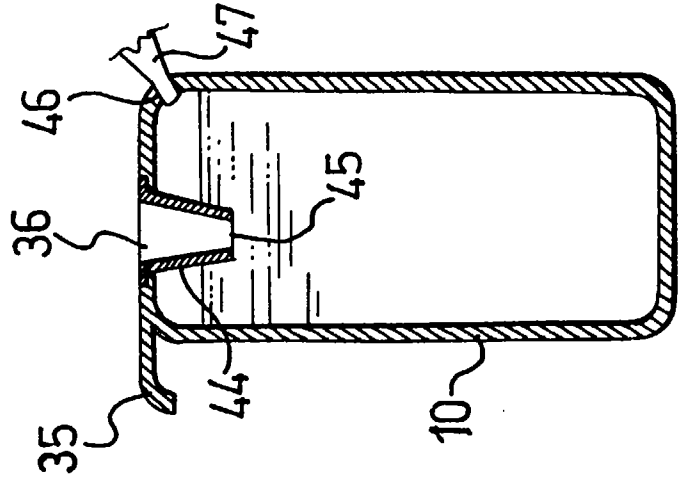


FIG. 5

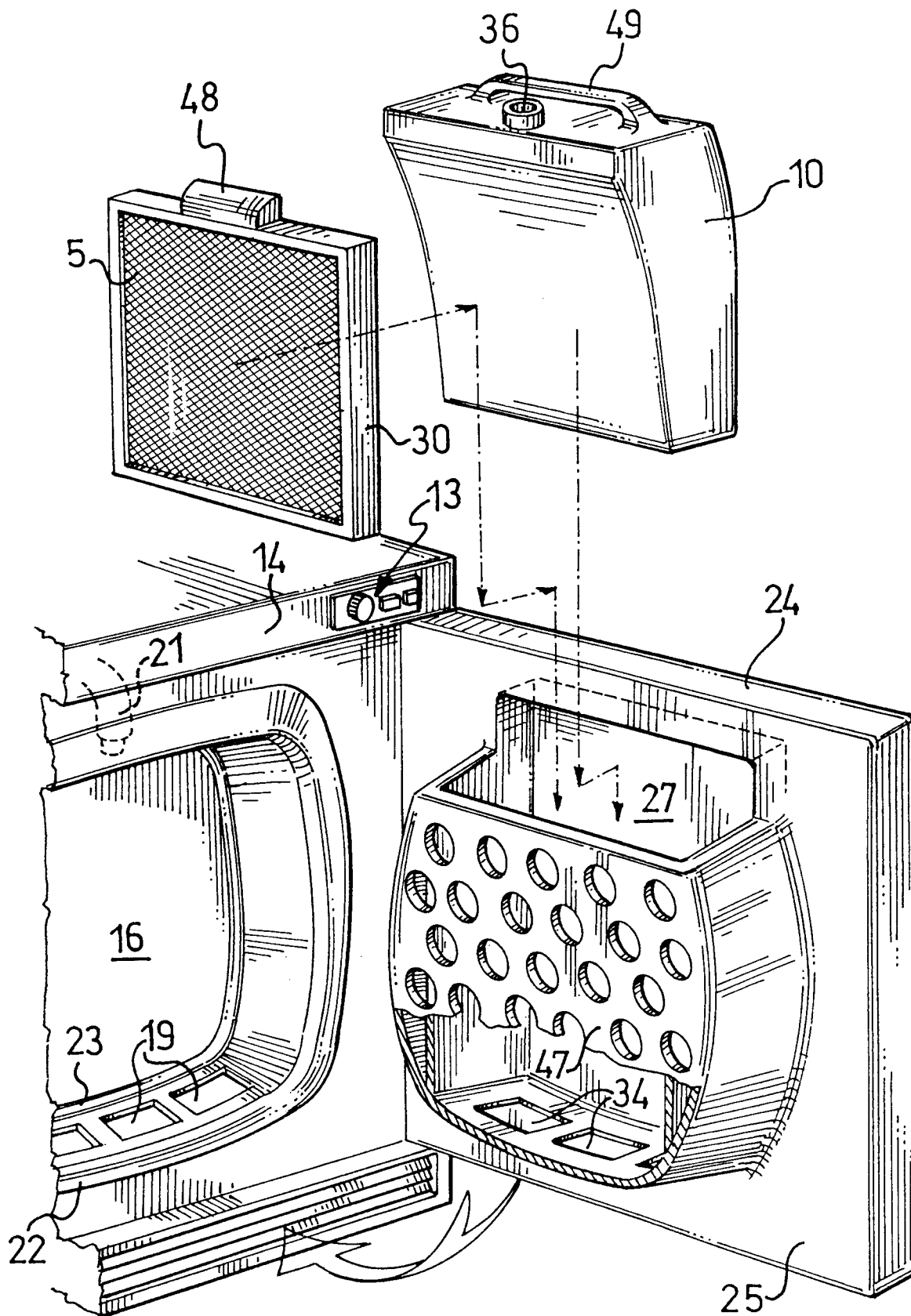


FIG.6



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EUROPEAN SEARCH REPORT

Application Number
EP 96 20 2695

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y A	EP-A-0 555 703 (BAUKNECHT HAUSGERÄTE GMBH) * the whole document * ---	1 2-4	D06F58/24 D06F58/22
Y	GB-A-2 115 127 (BOSCH-SIEMENS HAUSGERÄTE GMBH) * abstract; figure 1 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			D06F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 13 January 1997	Examiner Courrier, G
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