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(54) Method and installation for the condensation of humidity in laundry washers.

(57) A laundry drier, preferably of the domestic type, operating according to the technique of expulsion to the exterior of the warm and humid air used for drying the fabrics, and provided moreover with an additional cold water container for the condensation and recovery of the humidity.

The machine is characterized by the fact that the mentioned container is connected to a household laundry washer associated to the laundry drier, and is in particular disposed, in the case of a machine of the front-loading type, between the rear wall of the laundering tub and the rear wall of the housing, and in the case of a machine of the top-loading type, between any of the walls of the laundering tub and the corresponding wall of the housing.

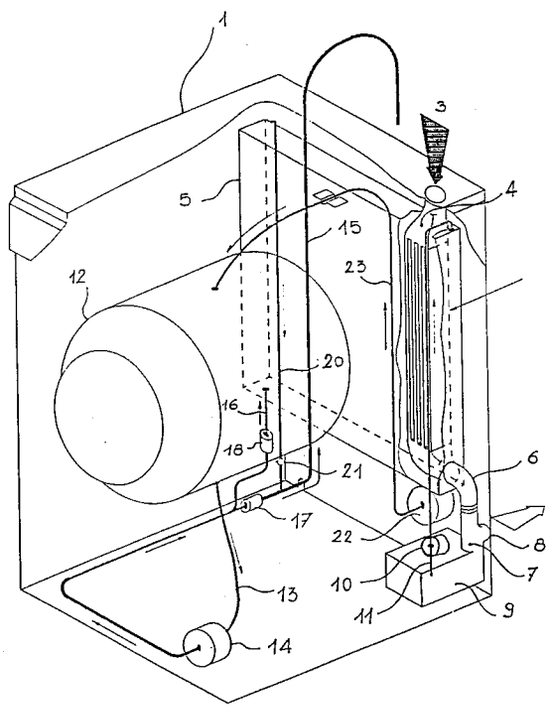

FIG. 2

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The invention relates to a method for the dehumidification of air in laundry washers, particularly of the domestic type, to be associated to laundry driers emitting to the exterior the warm and humid air used in the drying process.

A steadily growing tendency in the market is the use of household laundry driers of increasingly prefectioned performance, including the consideration of the domestic environment in general.

These tendencies have stimulated the marketing of so-called "condensation" drying systems, in which the humidity extracted from the fabrics is condensated by any suitable means internally of the laundry drier, and subsequently discharged by manual operation or any suitable automatic process.

This permits the thus dehumidified air to be discharged towards the domestic environment without causing the usual problems well known to those skilled in the art, and of course to the user himself.

Although these types of laundry driers are satisfactory and reliable in operation, they still suffer from certain short-comings as regards their operation, in view of the fact that the condensed water has to be manually discharged rather frequently, and that their operation involves a considerable consumption of mains water as the cooling medium in the condensation process.

Due to their considerably more complex design, machines of this type are moreover more costly than laundry driers with direct discharge of the warm air to the environment.

In an endeavour to reduce the water consumption while at least partially solving the problem of the release of humidity in the domestic environment, proposals have been made, for instance in DE-OS 2451339, to employ combined installations composed of a laundry washer, a laundry drier and a receptacle for the recovery of water discharged from the laundry washer, the receptacle being designed to feed cold water to a special type of condenser installed in the laundry drier.

This solution requires the installation of a third element, namely, the receptacle, and of associated piping, and is therefore inacceptable for domestic use due to increased space requirements and for economic reasons.

It would therefore be desirable to dispose of an installation which combines the operative advantages of a condensation-type laundry drier with the economic advantages of a laundry drier with direct discharge of the warm and humid air.

The present invention attains this object of removing the humidity from the drying air by directing the air through suitable conduit means into a rinsing water recovery receptacle installed in the laundry washer, and condensing the humidity contained in this air by making use of the temperature difference between the drying air and the recovered rinsing water.

The characteristics of the invention will become more clearly evident from the following description, given by way of example with reference to the accompanying drawings, wherein:

- fig. 1 shows a diagrammatic illustration of a typical installation of a laundry drier supported on top of a laundry washer,
- fig. 2 shows the internal construction of a laundry washer as modified in accordance with the invention, and
- fig. 3 shows the internal construction of a further improved embodiment of the laundry washer shown in fig. 2.

The characteristics of the invention are specified in the attached claims.

For better understanding of the present invention, reference shall be made to an example in which the laundry washer is of the front-loading type, without, however, restricting the claimed protection to this configuration, inasmuch as one skilled in the art could readily apply the teaching of the invention to different installations and arrangements.

At least from Italian Patent Application no. 45716 A/90 it is known to install within a laundry washer, particularly of the domestic type, one or several receptacles for the recovery of laundering liquids, particularly of the liquid used in the last ones of a number of rinsing cycles, the thus recovered liquid being then used in the course of subsequent laundering programs.

It is also known that ever more widespread use is made of two appliances, namely, a laundry washer and a laundry drier, the two appliances being usually installed close to one another, particularly with the laundry drier being supported on top of the laundry washer.

With this arrangement of the two appliances it would therefore be desirable and possible to make use of their complementarity as regards both their use and their technical functions for obtaining a novel drying performance offering particular advantages in the sense pointed out above.

Fig. 2 illustrates an example of a piping system of a laundry washer provided with a receptacle for the recovery of the washing liquid (or rinsing water): the liquid drained from the bottom of a tub 12 is directed through a conduit 13 and a pump 14 to two separate conduits 15 and 16 controlled by respective shut-off valves 17 and 18.

Conduit 15 leads to the exterior and acts as the conventional discharge conduit, while conduit 16 opens into the receptacle 5.

The two shut-off valves 17 and 18 are controlled by a conventional program control unit not

shown in the figure.

During the normal discharge operation, pump 14 acts to draw the liquid from tub 12 and to deliver it through conduit 13. At this stage shut-off valve 17 is open and valve 18 closed. The liquid is therefore directed from conduit 13 to conduit 15 for discharge to the exterior.

In the course of another phase, when it is desired to recover the discharged liquid, valve 17 is closed and valve 18 opened. As a result, the liquid is deviated from conduit 13 to conduit 16 to flow into receptacle 5.

For avoiding pressurization of receptacle 5 when the liquid supplied thereto exceeds its capacity, another conduit 20 is provided to connect the top portion of receptacle 5 to discharge conduit 15, this additional conduit 20 being equipped with a non-return valve 21 to prevent the liquid from flowing back into receptacle 5 during a normal discharge phase.

Since the water used for the rinsing operation is not hated, it remains at a relatively low temperature, particularly at the time of the last rinsing operation.

When this liquid is collected in receptacle 5, and laundry drier 2 is subsequently activated, there will be a considerable temperature difference between the walls of the condenser 4 immersed in this liquid and the humid air discharged from the laundry drier.

With reference to fig. 1, there are shown the laundry washer 1, the laundry drier 2, and a hot air conduit 3 extending between the two appliances.

This air conduit 3 directs the humid air into a condenser 4 disposed within receptacle 5 itself mounted in laundry washer 1.

The outer wall surfaces of condenser 4 are thus in direct contact with the liquid contained in receptacle 5, and preferably provided with cooling ribs for improving the heat exchange effect.

On the generally known "cold wall" principle, the described arangement results in the condensation of the humidity contained in the drying air and thus, as intended, in the final discharge to the exterior of relatively dry air.

The air leaving condenser 4 is finally discharged to the exterior through a discharge conduit 6 and an outlet port 8.

The liquid condensed on the walls of condenser 4 collects at the bottom and exits also through conduit 6, the latter being provided with a downwards directed branch 7 disposed at a level below that of outlet port 8 and opening into a condensate collecting receptacle 9.

The water thus collected in receptacle 9 may then be emptied manually in the conventional manner, or more advantageously still, a pump 10 may be provided for directing the collected water through a conduit 11 into receptacle 5.

This transfer of the collected liquid may advantageously be completely automatized by the provision of suitable control circuitry for pump 10 which may operate for instance under the direct control of the program control unit, or autonomously by the automatic detection of the liquid level in receptacle 9.

At this point the present invention will be recognized to offer a still further advantage: in view of the fact that the air discharged from a laundry drier of the condensation type is never completely dehumidified, the invention is also usefully applicable to the combination of a laundry washer and a laundry drier of the condensation type.

A still further improvement and simplification of the described piping system can be obtained in the following manner: by the creation of a partial vacuum within receptacle 5, the condensate collected in receptacle 9 can be automatically transferred from the latter to the former.

A partial vacuum of a desired magnitude can be created in a simple manner by the operation of a pump 22 acting to transfer a determined amount of liquid from receptacle 5 into tub 12 through a connecting pipe 23.

As shown in fig. 3, a further improvement of the described piping system may be achieved by the provision of another connecting pipe 24 connecting condensate receptacle 9 to a top portion of tub 12 in place of pipe 11 discharging into receptacle 5.

In this manner it is possible to avoid that an excess amount of rinsing water supplied to receptacle 5 overflows by way of pipe 11 and centrifugal pump 10 into condensate receptacle 9, and escapes to the exterior from there through outlet port 8.

Claims

1. A method for the condensation of humidity contained in the discharge air of a laundry drier, particularly of the domestic type, comprising a phase in which said air is caused to sweep a cold wall, and a phase in which the humidity condensed on said cold wall is removed, characterized in that said cold wall (4) is located within a laundry washer (1) associated to said laundry drier (2).

2. A method acording to claim 1, characterized in that said cold wall (4) is located in a receptacle (5) for the recovery of laundering liquid, or preferably rinsing liquid, in said laundry washer (1).

3. A method according to any of the preceding

claims, characterized in that the obtained condensate is collected by gravity in a receptacle (9) which is periodically emptied.

4. A method according to claim 3, characterized in that said receptacle (9) is emptied by the transfer of the liquid contained therein into said recovery receptacle (5).

5. A method according to claim 4, characterized in that said transfer is carried out by creating a partial vacuum in said recovery receptacle (5), preferably by emptying it, and by the aspiration of the condensed liquid contained in said receptacle (9) by means of a conduit (23).

6. A method according to any of claims 1 to 3, characterized in that said receptacle (9) is emptied by the transfer of the liquid contained therein through a conduit (24) opening into a top portion of the laundering tub (12).

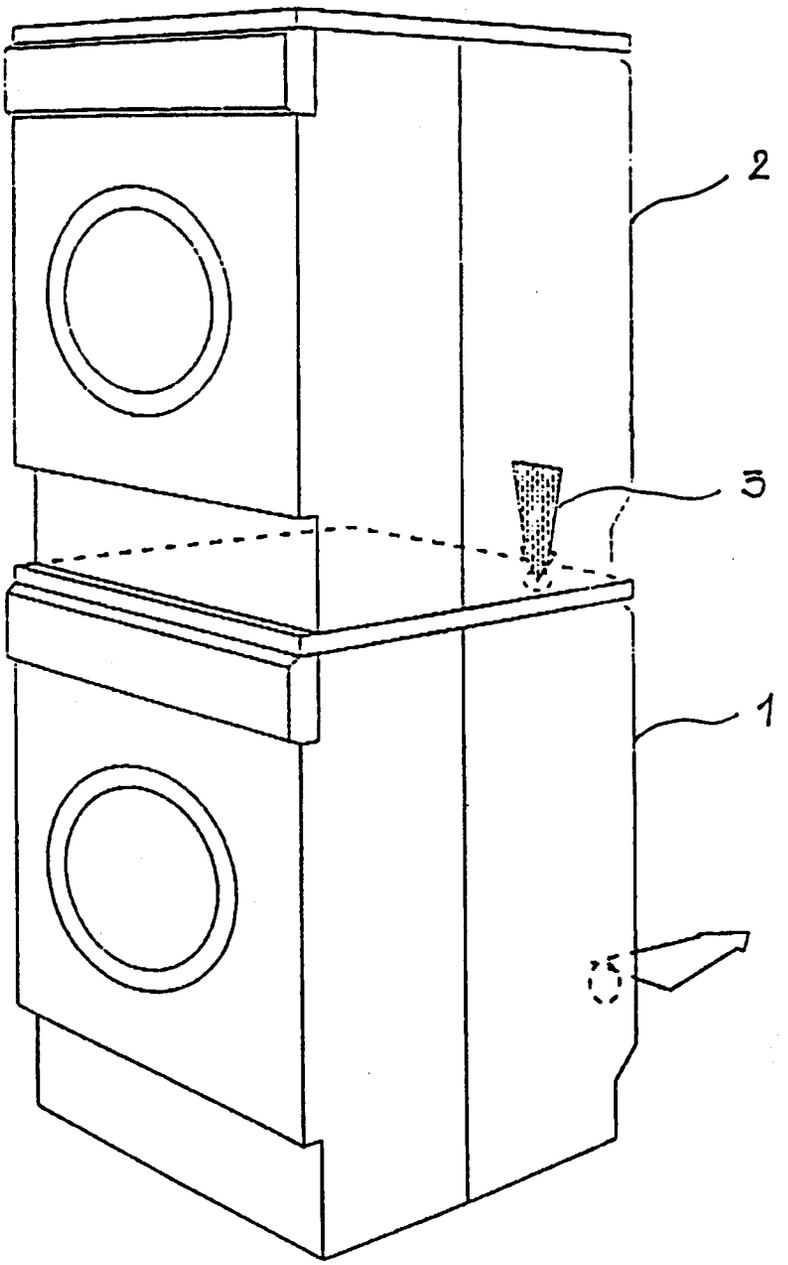

FIG. 1

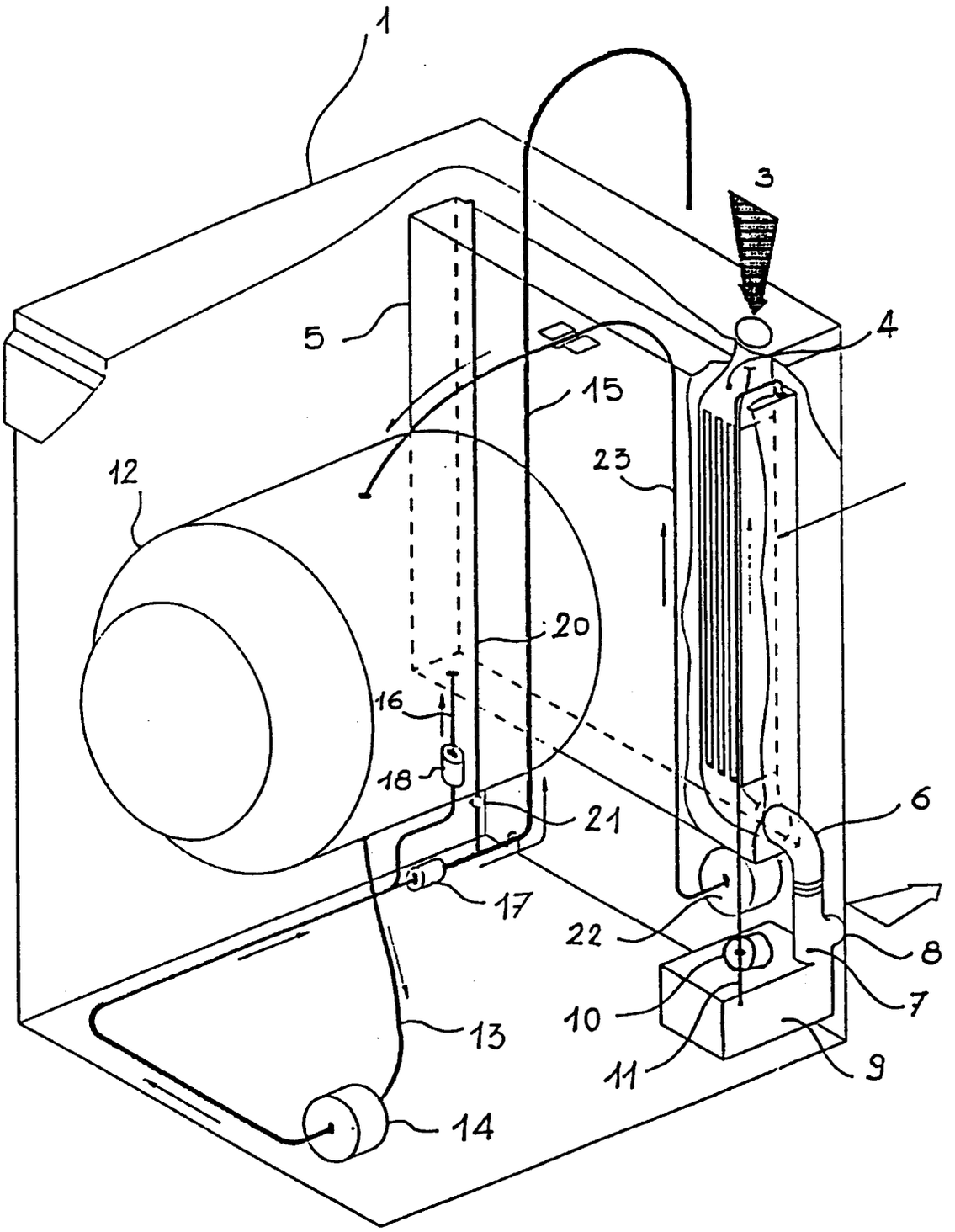

FIG. 2

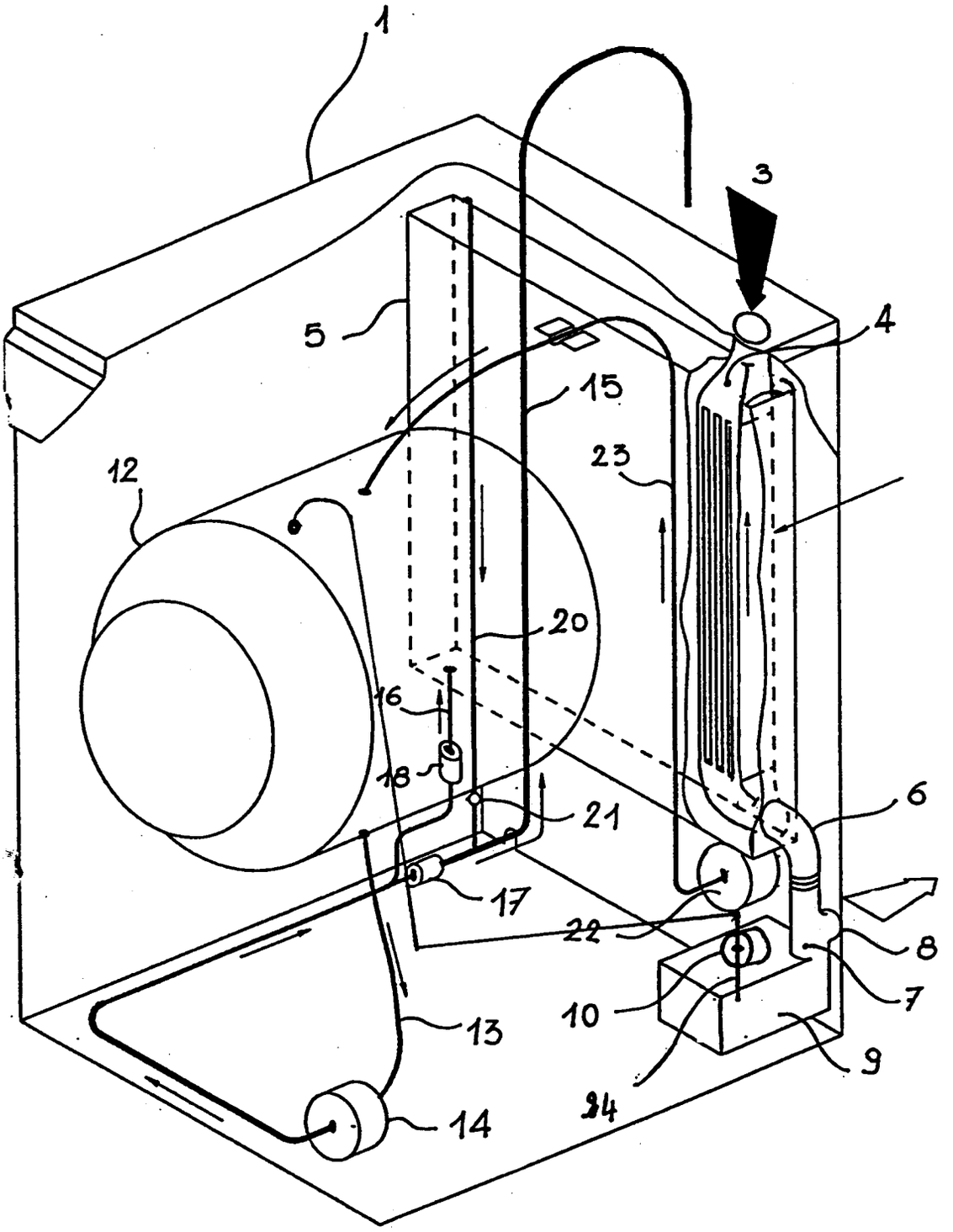

FIG. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 11 0191

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.5)
X	FR-A-2 249 206 (N.V.PHILIPS GLOEILAMPEN-FABRIEKEN)	1	D 06 F 58/24 D 06 F 29/00 D 06 F 39/00
A	FR-A-2 249 206 (* claims; figures *)	3	
X	DE-A-2 556 629 (AUGUST LEPPER MASCHINEN-U.APPARATEBAU GMBH)	1	
A	DE-A-2 556 629 (* claims; figure *)	2	
X	US-A-2 834 121 (WHIRLPOOL CORPORATION) * column 5, line 43 - line 49; figures * *	1	
A,D	DE-A-2 451 339 (BOSCH-SIEMENS HAUSGERÄTE GMBH) * claims; figures * *	1-3	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
D 06 F

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	09 October 91	COURRIER,G.L.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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