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(54) **Combined drying-washing machine with heating pump**

(57) Clothes washing and drying machine, comprising an upper main body (1), a tub (2) possibly containing a rotating drum, a heat pump (10,11), a conduit (22,23) for the ventilation of said tub (2), said conduit comprising an intake conduit (22) for hot and dried air blown into said tub, and a suction conduit (23) for moisture laden air exiting from said tub, wherein it comprises also a lower

basement (3) connected to the lower side of said upper main body (1), in which basement (3) said heat pump (10,11) is lodged.

Said intake conduit (22) is placed between said basement (3) and a first opening (20) on said tub (2), and said suction conduit (23) is placed between said basement (3) and a second opening (21) on said tub (2).

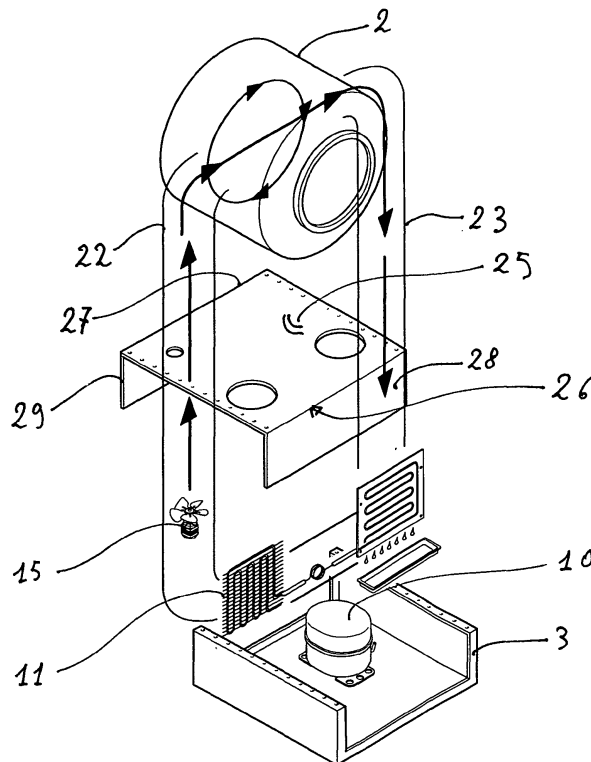


Fig 3

Description

[0001] The present invention refers to an improved kind of combined clothes washing machine, preferably for use in household, provided with devices which make it able to operate also as a drying machine, using an heat pump to heat the air and to condense the humidity therein contained.

[0002] Washing drying machines are largely known in the art to generally operate in various modes, particularly to condense an hot air flow that is blown into the drum and that removes the moisture from the clothes, or in the exhaust mode, in which said flow of moisture-laden hot air is exhausted as such outside the machine.

[0003] These machines are largely known to be substantially implemented by installing a ventilation system, i. e. usually a blower formed by a fan and an electric motor associated thereto, and a heating arrangement, which draw air from the outside and, via appropriate conduit arrangement, heat up such air and blow it into and through the drum holding the clothes to be dried.

[0004] The hot air is then conveyed and blown to condensation means able to condense the moisture collected and contained in said air.

[0005] One of the techniques to heat-up the air and to make its moisture to condense is using a heat pump; as well known, this is used because its energy efficiency with respect to the alternative modes of exploitation of the energy consumption.

[0006] Such examples of the use of a heat pump in a drying machine are exemplary shown in the patents EP 0 467 188 A1, and in EP 1001 07 A1.

[0007] However the use of a heat pump in a drying machine is not without limitations.

[0008] From EP 1 156 149 A3, (ZUG AG), it is divulged the installation of a heat pump in a drying machine; however said solution has the drawback in that the heat pump is placed as a separate module within the body of the same machine, and so it takes a remarkable room that sacrifices the tub volume so greatly limiting the drying capability.

[0009] Furthermore the same encumbrance limitation to which is necessarily subjected the same heat pump restricts its capability of generating a desirable required amount of drying heat and cold for the condensation, and practically reduces the overall drying power, restricting also its better energy efficiency.

[0010] From US 2002/0017117 A1 it is divulged a so called "laundry centre" provided with a number of separate compartments wherein respective devices for the laundry care are lodged; however, even if a drying machine can be provided and associated with said laundry centre, there is no provision for a heat pump associated to it, and obviously the opportunity to lodge a heat pump in one of said compartments is neglected; all that does waste one of the advantages provided with a laundry centre that takes a lot of household room.

[0011] From the patents EP 1 205 129 A1, DE 197

16825 A1, DE 299 14603 U1, DE-GM 81 04 728.2 it is known a pedestal or basement able to keep raised a washing machine, or a generic household appliance, in order to make easier its use; although effective, such basement is not exploited for other advantageous purposes, as for example to use the room available into it.

[0012] It is also known in the prior art and in the market, and it is spread mainly in the USA, to implement a pedestal or basement that is placed under a combined household washing-drying machine; however such basement is provided only with an extractable drawer wherein the laundry to be washed, or other washing accessories, are placed.

[0013] It would therefore be desirable to provide a combined washing-drying machine able to join in a synergical way both the opportunities of an associated heat pump and the features of a basement that is placed under said machine, as well as the advantages of placing said heat pump outside the main body of the machine, therefore avoiding all constraints for the washing and drying capacity of the machine.

[0014] Such aim should be achieved without significantly increasing the machine complexity, and keeping down the production costs with respect to the production costs of a conventional washing machine provided with a fully integrated heat pump.

[0015] According to the present invention, this aim is reached, along with further ones that will be apparent from the following description, in a combined washing-drying machine incorporating a heat pump as recited in the appended claims.

[0016] Anyway the features and advantages of the present invention will be more readily understood from the description that is given below by way of a non limiting example with reference to the accompanying drawings, in which:

- fig. 1 shows a perspective view of a combined washing-drying machine provided with a heat pump assembled according to the invention,
- fig. 2 shows a perspective exploded view of the machine of fig. 1, disassembled in its two main sub-assemblies,
- fig. 3 shows a transparent view of the devices that make up the heat pump, and of the operating connections with the washing tub, in a washing machine according to the invention,
- fig. 4 illustrates symbolically the positioning of the washing tub with respect to the basement, and of the ventilation ducts in a washing machine according to the invention.-

[0017] With reference to fig. 1 and 2 a machine according to the invention comprises a main upper body 1 in which the washing tub 2 is placed, which contains the rotating drum, not shown.

[0018] The main upper body 1 corresponds both in the external size and in the internal structure to a conven-

tional washing machine, so a machine according to the invention may be implemented simply using a fully normal washing machine that has to only slightly be modified as it will be further on described.

[0019] With ref. to fig. 3, said machine comprises, in the lower face, a pedestal or basement 3 able to be laid down on the floor, and that therefore works as the basement of the same machine; inside said basement 3 all devices that normally form a heat pump, i. e. a compressor 10, a condenser 11, an evaporator 12 and other associated devices, needed to its operation, are placed.

[0020] With ref. also to fig. 4, on the upper portion of the surface of the tub 2 two openings 20 and 21 are made, so that the liquor contained in the tub is prevented from flowing out from them.

[0021] From the heat pump placed in said basement two separate air conduits are placed and are oriented upwards, one intake conduit 22 reaching said tub and going into it through a proper mouth on said opening 20, and a suction conduit 23 deriving from said second opening 21 and leading to said lower heat pump.

[0022] The structure and the configuration of the heat pump is such that an hot air flow is produced and emitted from said condenser 11, and that said hot air flow is blown into said intake conduit 22 so that it enters the drum to dry the clothes; correspondently a flow of moisture laden air is sucked from the drum through said suction conduit 23, said flow being conveyed towards said evaporator 12 lodged inside said basement.

[0023] Furthermore in the proper position in the drying air circuit, i. e. from the tub to the heat pump or from the heat pump to the tub, but preferably inside said basement, a fan 15 is arranged to circulate the drying air, as symbolically illustrated in fig. 3.

[0024] It will be now clear that the just described invention allows the use of a heat pump to efficiently dry the clothes contained in a washing machine, as the heat pump is not limited in its size, and furthermore the washing machine maintains its whole operating features as in no way is restricted in its operating means and in its internal architecture, beside of course the installation of said conduits 22 and 23.

[0025] The control means of said heat pump may be easily placed on the upper control board of the same machine, and the related electric connections, not shown, may easily be joined to the various devices of the same heat pump in a safe and simple way, perfectly at the reach to the man skilled in the art.

[0026] Essentially the functional links between the upper washing machine and the lower basement are provided, further to the electric connections, by said two conduits 22 and 23.-

[0027] Advantageously said upper body 1 and said basement 3 are made independently to each other and they can be engaged only in the final assembly, so that the modularity, the transportation and the final installation are favoured.

[0028] To this purpose said upper body 1 and said

basement 3 are provided with means apt to a reciprocal engagement and which are selectively activable/disconnectable; preferably said means comprise two rods or pins 8 which protruding from the front corners of said bodies, are oriented vertically towards the opposite body and engage with corresponding holes or lodgements, not shown, placed in respective corners of said opposite body.

[0029] In fig. 2 said rods 8 are placed on the lower side of said main body 1, and the basement and the upper body are further connected to each other by two brackets 9 arranged on the back side of said basement and said upper body.

[0030] The upper side of said basement is advantageously provided with a separation means 25, in order to protect the basement and the devices there contained from possible water leakage dripping down from the washing machine; such separation means may be realised by a flat, rigid and horizontal surface, whose two opposite edges are continued with respective vertical and opposed portions 28, 29, oriented downwards and so parallel to each other, and sized in such a way to realise two opposite side walls of said basement 3.-

[0031] Therefore the maintenance of said basement 3 and of the heat pump therein contained is improved; in the facts it will be enough with simple operations to separate said two bodies 1 and 3, and to remove said separation means 25 and related walls 28, 29 to access with the highest simplicity and safety to the inner basement both from its top and from its sides.-

Claims

1. Clothes washing and drying machine, comprising:
 - an upper main body (1),
 - a tub (2), possibly containing a rotating drum,
 - a heat pump provided with a compressor (10), a condenser (11) an evaporator (12) a fan (15),
 - a conduit for the ventilation of said tub, into which said fan said evaporator and said condenser are lodged,
 - said conduit comprising an intake conduit (22) for hot and dried air blown into said tub, and a suction conduit (23) for moisture laden air exiting from said tub, **characterised in that** it comprises also a lower basement or pedestal (3) connected to the lower side of said upper main body (1), in which basement said heat pump is lodged.
2. Machine according to claim 1, **characterised in that** said intake conduit (22) is placed between said basement (3) and a first opening (20) on said tub, and said suction conduit (23) is placed between said basement and a second opening (21) on said tub.
3. Machine according to claim 2, **characterised in that**

connecting means are provided which are able to selectively connect/disengage said basement (3) from said upper main body (1), said means comprising at least a rod (8) placed on the front portions and a bracket (9) on the back portions of said main body and said basement. 5

4. Machine according to any previous claim, **characterised in that** said basement is provided with rigid separation means placed between said upper main body (1) and the lower portion of said basement. 10

5. Machine according to claim 4, **characterised in that** said separation means comprises a flat surface (25) having its size basically identical to the horizontal section of said basement, two opposite edge (26, 27) of said flat surface being joined with two respective vertical walls (28, 29) oriented downwards, parallel to each other and apt to close two respective lateral sides of said basement. 15
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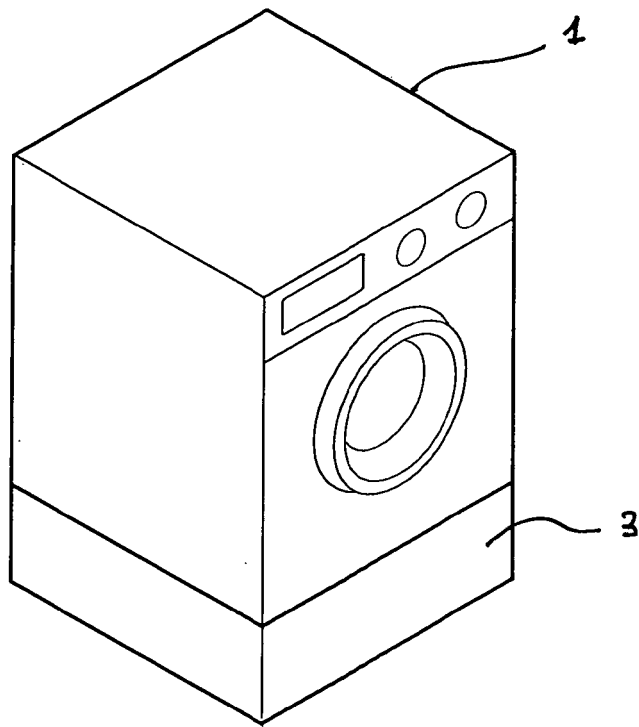


Fig1

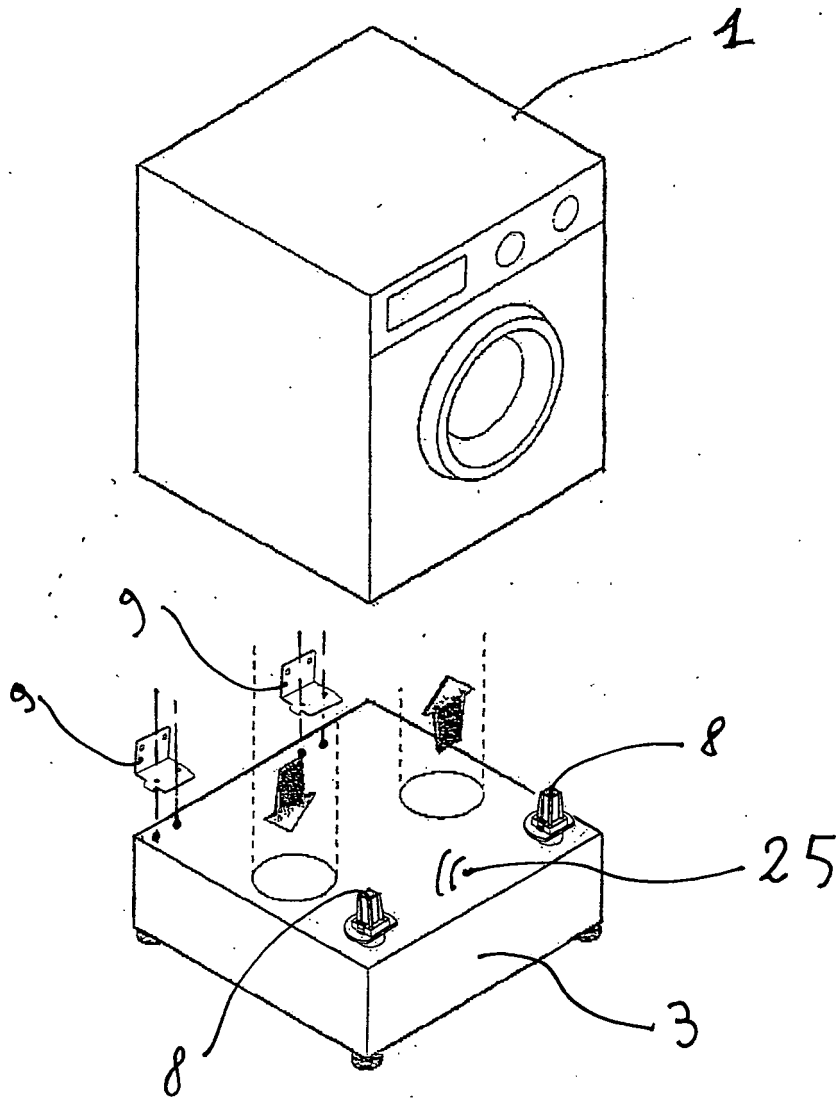


FIG. 2

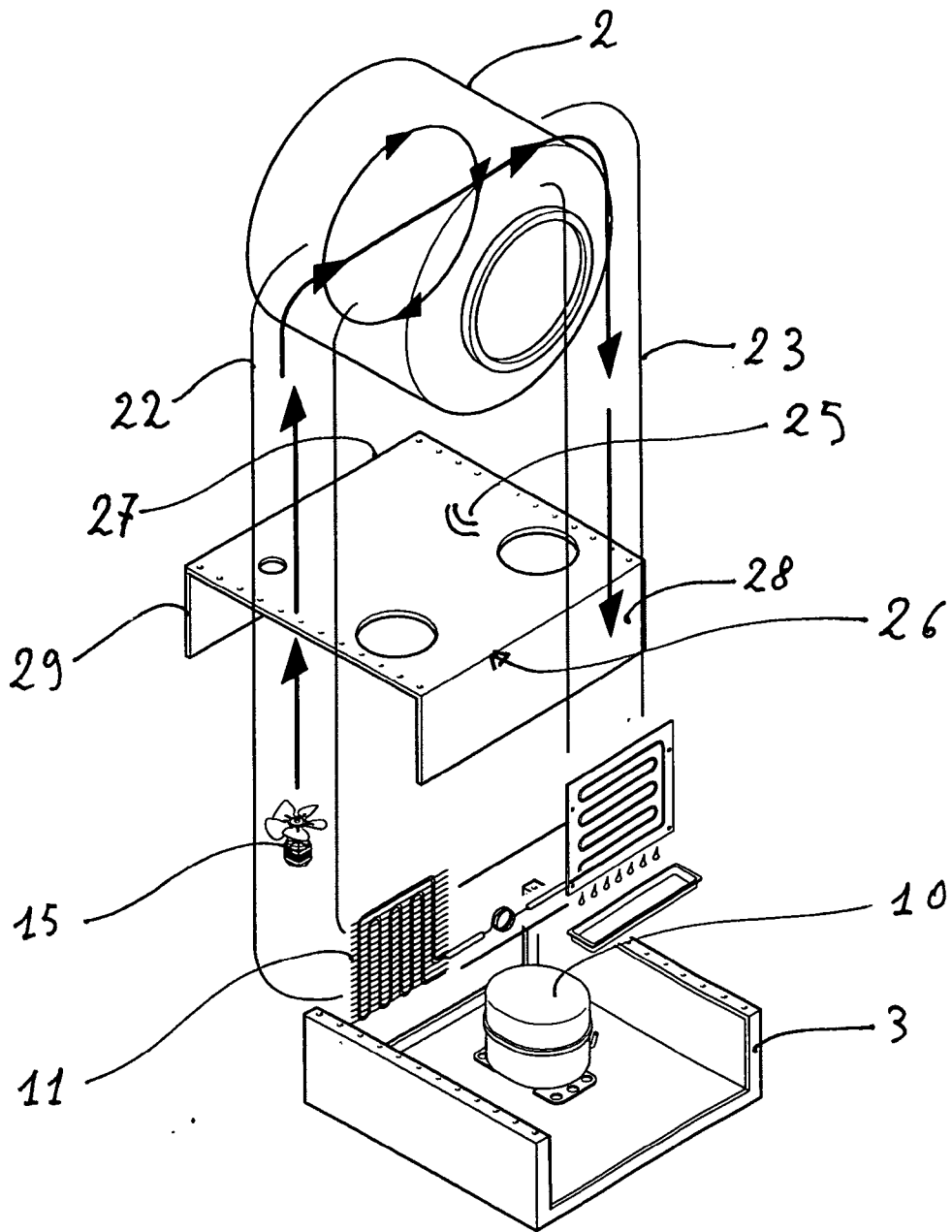


Fig 3

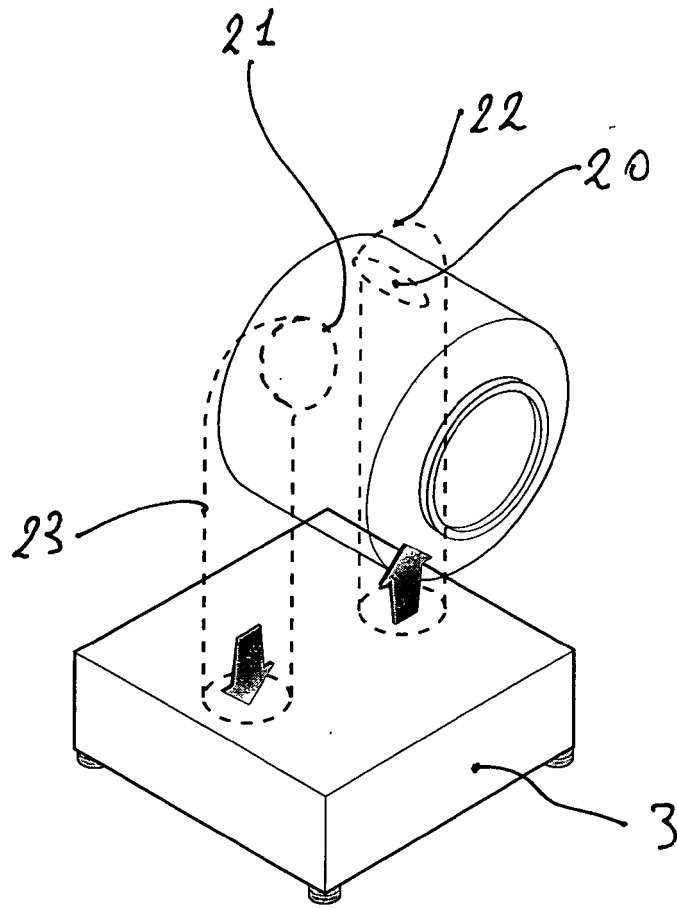


Fig 4



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.7)
X	EP 1 411 163 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD) 21 April 2004 (2004-04-21) * paragraphs [0008] - [0013], [0018] * * paragraphs [0044] - [0050] * * paragraphs [0081] - [0084] * * claims 1,15,18; figures 13,14 * -----	1-5	D06F25/00 D06F58/20
X	PATENT ABSTRACTS OF JAPAN vol. 2003, no. 12, 5 December 2003 (2003-12-05) -& JP 2004 135715 A (MITSUBISHI ELECTRIC CORP; NIPPON KENTETSU CO LTD), 13 May 2004 (2004-05-13) * paragraphs [0050] - [0052] * * abstract; figures 3,11 * -----	1-5	
X	DE 42 12 700 A1 (LICENTIA PATENT-VERWALTUNGS-GMBH, 60596 FRANKFURT, DE) 21 October 1993 (1993-10-21) * column 1, line 5 - column 2, line 26 * * claims 1-7; figures 1,2 * -----	1-5	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	EP 0 434 169 A (OCEAN S.P.A) 26 June 1991 (1991-06-26) * column 1, line 12 - column 2, line 18 * * column 2, line 35 - column 3, line 34 * -----	1-5	D06F
A	DE 32 13 420 A1 (LEPPER,WILHELM,DR.-ING) 13 October 1983 (1983-10-13) * the whole document * -----	1,3,4	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 7 February 2005	Examiner Weinberg, E
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 10 4366

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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