(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 936 022 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.06.2008 Bulletin 2008/26

(51) Int Cl.:
D06F 58/22 *(2006.01)*

(21) Application number: **06126975.9**

(22) Date of filing: **22.12.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

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(54) Clothes tumble dryer

(57) Clothes tumble dryer comprising a closed-loop drying-air circuit adapted to circulate heated drying air through a rotating drum, an air-cooled condenser (2) adapted to remove moisture from the hot moisture-laden drying air exiting the drum, an open-loop cooling-air circuit adapted to circulate through the air-cooled condenser (2) a stream of cooling air taken in from the outside ambient to cool said condenser, and to let out the stream of cooling air again into the outside ambient, lint retaining and collecting arrangements being provided to remove the fluff from the flow of drying air, wherein the closed-loop drying-air circuit includes an air passage (4) provided with an inflow aperture (5) fluidly connected to the drum, an outflow aperture (6) fluidly connected to the air-cooled condenser (2), and an airflow deflecting surface (7) adapted to deflect and convey the air entering through the inflow aperture (5) towards the outflow aperture (6); the lint retaining and collecting arrangements comprise water delivery means (8) adapted to provide water at an upper portion of the airflow deflecting surface (7) for causing a water film or curtain (9) to flow down along the airflow deflecting surface (7), so that the flow of drying air is adapted to impinge against and move along with the water curtain (9) and the latter is adapted to trap and retain the fluff, and further comprise drain means (10) adapted to collect the fluff-laden water at a lower portion of the airflow deflecting surface (7).

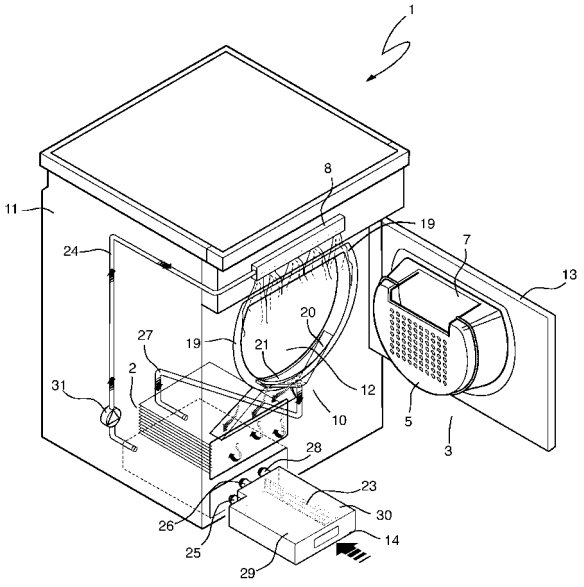

FIG. 2

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Description

[0001] The present invention refers to a clothes tumble dryer.

[0002] Condenser-type tumble dryers are known in the art to comprise a closed-loop drying air circuit adapted to cause heated drying air to circulate through a rotating drum, an air-cooled condenser, i.e. an air/air heat exchanger, adapted to remove moisture from the hot moisture-laden drying air exiting said drum, and an open-loop cooling air circuit adapted to circulate through the air-cooled condenser a stream of cooling air taken in from the outside ambient to cool said condenser, and to let out said stream of cooling air again into the outside ambient.

[0003] An example of a clothes drying machine of the above-indicated kind is shown schematically in Figure 1.

[0004] Through the closed-loop drying air circuit, the hot and moisture-laden drying air is caused to leave the rotating drum and is conveyed towards the air-cooled condenser; then, the dehydrated drying air exiting the condenser is sent back into the drum, upon having been duly heated up again, so as to remove additional moisture from the clothes being tumbled in the drum.

[0005] Heating means are provided downstream from the air-cooled condenser to heat up the dehydrated drying air due to be sent again into the drum.

[0006] The air-cooled condenser comprises a plurality of fluid passageways, along which the drying air is able to flow in view of having the moisture condensed and removed therefrom, and these fluid passageways are capable of being invested by, i.e. are exposed to the flow of cooling air flowing through the open-loop cooling air circuit.

[0007] The closed-loop drying air circuit usually includes lint filtering and collecting arrangements for removing the fluff from the drying air. Such filtering means are required in order to prevent fluff, or lint, from being able to settle and build up on the heat-exchange surfaces of the air-cooled condenser, thereby affecting the performance and the efficiency thereof. In addition, these filtering means prevent fluff from dangerously piling up on the heating means, so as to ward off any fire risk.

[0008] The filtering means, however, have a major drawback in that they tend to most easily become clogged in the course of the drying operation, thereby involving substantial pressure losses in the drying circuit and hence, a corresponding increase in the power required to ensure a predetermined, satisfactory flow rate through the same drying circuit, along with a substantial variation in the flow rate in the course of the drying operation and a reduction in efficiency.

[0009] Another drawback derives from the fact that, for the tumble dryer to be able to perform at the highest possible performance level it is capable of ensuring, the need arises for the user, after each drying cycle is ended, to submit the filtering means to due maintenance and cleaning.

[0010] However, users tend to dislike such maintenance and cleaning chore, since this requires them to directly handle, i.e. come into contact with fluff and lint; furthermore, it is generally felt as representing itself a waste of time. It should also be stressed that the full efficiency and performance capability of the tumble dryer come to depend on the kind of maintenance ensured by the user, actually. The consequences of a poor maintenance, or a maintenance that is not carried out as frequently as necessary, are therefore fully obvious.

[0011] However, fluff is anyway and unavoidably retained by the filtering means during a drying process and such fluff unavoidably builds up a resistance to the flow of the drying air therethrough, with the result that the flow rate of the operative process air is anyway reduced and the drying time needed to complete the ongoing drying cycle is increased accordingly.

[0012] It is therefore an object of the present invention to solve the above-noted problems, thereby doing away with the drawbacks of the cited prior art.

[0013] According to the present invention, this aim, along with further ones that will become apparent from the following disclosure, is reached in a clothes tumble dryer incorporating the features as defined and recited in the claims appended hereto.

[0014] Features and advantages of the present invention will anyway be more readily understood from the description that is given below by way of nonlimiting example with reference to the accompanying drawings, in which:

- Figure 1 is a schematic view of a clothes tumble dryer according to the prior art;
- Figure 2 is a schematic perspective view of a clothes tumble dryer according to the present invention;
- Figure 3 is a side elevational, cross-sectional view of the air passage with the airflow deflecting surface;
- Figure 4 is a schematic perspective view of a clothes tumble dryer according to another embodiment of the present invention;
- Figure 5 is a schematic perspective view of a clothes tumble dryer according to a further embodiment of the present invention;
- Figure 6 is a schematic perspective view of a clothes tumble dryer according to yet a further embodiment of the present invention.

[0015] With reference to the above-cited Figures, the clothes tumble dryer according to the present invention, as generally indicated with the reference numeral 1, comprises a closed-loop drying-air circuit adapted to circulate heated drying air through a rotating drum holding a load of clothes to be dried, an air-cooled condenser 2 adapted

to remove moisture from the hot moisture-laden drying air exiting said drum, an open-loop cooling-air circuit adapted to circulate over and through the condenser 2 a stream of cooling air taken in from the outside ambient to cool said condenser, and to let out said stream of cooling air again into the outside ambient, lint retaining and collecting arrangements for removing the fluff from the stream of drying air.

[0016] The closed-loop drying-air circuit includes an air passage 4 provided with an inflow aperture 5 fluidly connected to the drum, an outflow aperture 6 fluidly connected to the air-cooled condenser 2 and an airflow deflecting surface 7 adapted to deflect and convey the air entering the inflow aperture 5 towards the outflow aperture 7.

[0017] The lint retaining and collecting arrangements comprise water delivery means 8 adapted to provide water to an upper portion of the airflow deflecting surface 7 so as to cause a water film 9 to flow down along the airflow deflecting surface 7, so that the stream of drying air will impinge against and flow along the water film 9, the latter being adapted to trap the fluff contained therein.

[0018] In addition, the lint retaining and collecting arrangements comprise drain means adapted to collect the fluff-laden water at a lower portion of the airflow deflecting surface 7.

[0019] Preferably, the dryer is provided with a head member 3 adapted to close an open end of the rotating drum, and such head member 3 defines the air passage 4 of the closed-loop drying-air circuit.

[0020] In other words, the air passage 4 of the closed-loop drying-air circuit is formed in a head member 3 that substantially closes an open end of the rotating drum.

[0021] The tumble dryer comprises an outer cabinet 11, i.e. an outer casing, enclosing the component parts of the machine. Such outer cabinet 11 comprises a clothes loading/unloading port 12, provided with a cabinet door assembly 13, for the clothes to be able to be introduced in and removed from the interior of the drum. The drum is mounted inside the cabinet 11 for rotation about its central axis, as driven by a motor arranged to drive the drum.

[0022] Through the closed-loop drying-air circuit, the hot and moisture-laden drying air is caused to leave the rotating drum and is conveyed towards the air-cooled condenser 2; then, the dehydrated drying air exiting the condenser 2 is sent back into the drum, upon having been duly heated up again, so as to remove additional moisture from the clothes being tumbled in the drum. The tumble dryer comprises appropriate blower means adapted to cause the drying air to circulate inside and through the closed-loop drying-air circuit. Heating means are provided downstream from the air-cooled condenser to heat up the dehydrated drying air due to be sent again into the drum.

[0023] The open-loop cooling-air circuit comprises blower means adapted to cause the cooling air to circulate through the air-cooled condenser, an air intake aperture and an air exhaust aperture fluidly connected with the air-cooled condenser 2, wherein the cooling air is taken in from the outside ambient, conveyed to and through the air-cooled condenser, and eventually blown back into the outside ambient again.

[0024] The air-cooled condenser 2, which is, preferably, an air-to-air heat exchanger, comprises a plurality of fluid passageways, along which the drying air is able to flow in view of having the moisture condensed and removed therefrom, and these fluid passageways are capable of being invested by, i.e. are exposed to the stream of cooling air flowing through the open-loop cooling-air circuit.

[0025] For example, the condenser 2 may comprise a first array of spaced-apart fluid passageways for the drying air and a second array of spaced-apart fluid passageways for the cooling air, which are arranged in an alternating relationship relative to said first array of fluid passageways, so that between two such adjacent fluid passageways for the drying air there is provided a fluid passageway for the cooling air.

[0026] The cooling air that flows along the second array of fluid passageways is adapted to brush, i.e. move in contact with the fluid passageways of the drying air, thereby cooling it down by convection so as to cause water vapour in the hot moisture-laden drying air to precipitate by condensation.

[0027] The dryer comprises collecting means 14,15,16,17,18 for collecting, from the air-cooled condenser 2, the condensate water forming during the operation of the dryer.

[0028] The afore-cited head member 3 is adapted to substantially close an open end of the drum and provide an air passage 4 that is an integral portion of the closed-loop drying-air circuit and is adapted to receive and convey the hot moisture-laden drying air exiting the drum. The air passage 4 is provided with an inflow aperture 5 fluidly connected to the drum, an outflow aperture 6 fluidly connected to the air-cooled condenser 2, and an airflow deflecting surface 7 adapted to deflect the air entering the inflow aperture 5 and convey towards the outflow aperture 6, from which the air ultimately reaches the air-cooled condenser 2.

[0029] The drum can be made as a single-piece unitary construction comprising a cylindrical wall, a front flange with an access opening for reaching into the drum, and a rear flange mechanically connected to a shaft about which the drum is adapted to rotate. In this case, the head member 3 is associated to or incorporated in the cabinet door assembly 13 for it to be able to close the access opening of the drum when the cabinet door assembly itself is closed. In practice, the head member 3 protrudes from an inner side of the cabinet door assembly 13 towards the drum, and it is provided and arranged in such manner that the inflow aperture 5 of the air passage 4 comes to lie in a position close to the access opening of the drum or to be received into said opening when the cabinet door assembly 13 is closed.

[0030] It can however be most readily appreciated that the head member 3 forming the air passage 4 can alternatively be provided in correspondence to the rear flange of the drum.

[0031] In a further embodiment, the drum can be comprised of a cylindrical side wall that is open at the front and rear ends thereof. The cylindrical side wall is rotatably fitted to a front support and a rear support to close the respective ends of the drum, while allowing the cylindrical side wall to rotate relative to the front and rear head members, which are stationary relative to the outer cabinet 11.

[0032] One of said front and rear supports forms the head member 3 that - possibly in cooperation with a cabinet door when the latter is in its closed position - defines the air passage 4.

[0033] The afore-mentioned water delivery means 8 may for instance comprise shower means, such as for instance a spout, sprinkler or the like, which - as preferably provided with a plurality of delivery ports - are adapted to issue a water flow in proximity of an upper portion of the airflow deflecting surface 7 to in this way originate a water film or curtain 9 flowing down along the airflow deflecting surface 7. The drying air passing through the air passage 4 defined by the head member 3 during the operation of the tumble dryer, is due to impinge against such water film 9 so as to be deflected and move along with the same water film 9. Thus, by in this way coming into contact with the drying air and the matters carried along with it, the water is able to catch and retain fluff and lint carried by the flow of drying air, which is thereby cleared from such matters as it then leaves the air passage 4 to be conveyed, i.e. to move towards the air-cooled condenser.

[0034] The afore-cited drain means 10 may for instance include a collecting arrangement adapted to collect the fluff-laden water at a lower portion of the airflow deflecting surface 7.

[0035] In practice, the drying air flows into the air passage 4 through the inflow aperture 5 to impinge against the water film or curtain 9 flowing down along the airflow deflecting surface 7. Such water curtain acts as a deflecting wall, which the drying air is due to impinge against in view of being diverted to then move on in contact with the same water curtain. The water traps and retains such matters as fluff and lint usually carried along with the drying air, while the drain means 10 collect the fluff-laden water in proximity to a lower portion of the airflow deflecting surface. Upon having in this way been cleared from the fluff it was carrying along, the drying air finally flows out of the air passage 4 through the outflow aperture 6 to be eventually conveyed towards the air-cooled condenser 2.

[0036] In an embodiment of the present invention, the head member 3 comprises the water delivery means 8 and the drain means 10, wherein the drain means 10 are in particular situated close to the airflow deflecting surface. Such embodiment is found to be particularly advantageous in the case in which the open end of the cylindrical side wall of the drum is rotatably fitted to the head member 3.

[0037] In a further embodiment of the present invention, as illustrated in Figures 2 to 6, in which it can be noticed that the cabinet door assembly 13 includes the head member 3 forming the air passage 4, the water delivery means 8 and the drain means 10 are provided in correspondence to, i.e. close to the frame 19 delimiting the clothes loading/unloading port 12 of the outer cabinet 11, so that, when the cabinet door assembly 13 is closed, the water delivery means 8 come to lie in proximity of the upper portion of the airflow deflecting surface 7, while the drain means 10 come to lie in proximity of the lower portion of the airflow deflecting surface 7.

[0038] In particular, a top portion of the frame 19 houses the water delivery means 8, while a bottom portion of the same frame 19 integrally forms a conveying or collecting arrangement 20 of the drain means 10.

[0039] In correspondence to the frame 19 there is further provided an opening 21, through which the fluff-cleared drying air exiting the air passage 4 through the outflow aperture 6 is adapted to flow to directly reach the air-cooled condenser 2, as this is shown in Figures 2, 4 and 5, or to be conveyed to the air-cooled condenser 2 via blower means 22.

[0040] Of course, the above-cited collecting arrangement 20 and opening 21 are provided and configured in such appropriate manner as to prevent fluff-laden water from being accidentally carried over by the drying air to the air-cooled condenser 2.

[0041] In an advantageous manner, the water delivery means 8 are fluidly connected to the collecting means 14,15,16,17,18, so that the water delivery means 8 are supplied with the condensate water collecting into said collecting means 14,15,16,17,18.

[0042] In addition, even the drain means 10 are fluidly connected to said collecting means 14,15,16,17,18, so that the fluff-laden water is able to be conveyed to collect into said collecting means 14,15,16,17,18.

[0043] Preferably, the water delivery means 8, the drain means 10 and the collecting means 14,15,16,17,18 form a closed-loop water circuit, so that the water flowing in from the drain means 10 is able to be recovered and supplied again to the water delivery means 8.

[0044] The closed-loop water circuit may include filtering means 23 adapted to filter the fluff-laden water flowing from the drain means 10, so that the water delivery means 8 can be supplied with filtered, fluff-cleared water.

[0045] Preferably, the collecting means 14,15,16,17,18 are provided with such filtering means 23.

[0046] The collecting means 14,15,16,17,18 may include either removable reservoirs, i.e. capable of being taken out of the outer cabinet 11, in which there are provided such filtering means 23, or fixedly installed reservoirs, in which the filtering means 23 are provided in a removable manner for them to be taken out for cleaning.

[0047] In the embodiment illustrated in Figures 2 and

3, the water delivery means 8 are connected, via a supply conduit 24, to the collecting means 14, which include a removable reservoir in which there are provided the filtering means 23. A first fit-in valve 25, which the collecting means 14 are provided with, enables the collecting means 14 to be removably connected with the supply conduit 24, whereas a second fit-in valve 26 enables the condensate water to flow from the air-cooled condenser 2 into the collecting means 14. A recovery conduit 27 connects the drain means 20 with the collecting means 14 via a third fit-in valve 28 provided on the same collecting means 14.

[0048] The filtering means 23 subdivide the collecting means 14 into a first compartment 29, which is adapted to collect the condensate water flowing in from the air-cooled condenser 2, and a second compartment 30, which is adapted to collect the fluff-laden water flowing in from the drain means 10. Since it is the first compartment 29 that is connected to the supply conduit 24 of the water delivery means 8, the water in the second compartment 30 is therefore due to flow through the filtering means 23 - which retain the fluff contained therein - to eventually reach into the first compartment 29 and, from here, the water delivery means 8 via the supply conduit 24.

[0049] Pump means 31 are provided to circulate the water through the closed-loop water circuit formed by the water delivery means 8, the drain means 10 and the collecting means 14,15,16,17,18.

[0050] The fluff building up on the filtering means 23 can be removed therefrom by simply having the reservoirs 14 emptied through an aperture provided on the second compartment 30. In this manner, the water to be discharged, by flowing from the first compartment 29 to the second compartment 30, is adapted to remove and collect the fluff settled on the filtering means 23 during the operation of the dryer.

[0051] Figure 4 illustrates a further embodiment of the present invention, in which similar or identical parts and details are indicated with the same reference numerals.

[0052] In this particular case, the collecting means include a fixedly mounted reservoir 15, which cannot therefore be removed from the outer cabinet 11, and which is provided with the filtering means 23, wherein said reservoir is fluidly connected with the delivery means 8, the drain means 10 and the air-cooled condenser 2 in a similar manner as described hereinbefore.

[0053] The collecting means further include a canister 16, which is removably provided in the upper portion of the outer cabinet 11 and is itself connected to the supply conduit 24.

[0054] Valve means 32 are provided to selectively deliver the water flowing through the supply conduit 24 to the water delivery means 8 and/or into the removable canister 16 as required.

[0055] Advantageously, in the fixedly installed reservoirs 15 the filtering means 23 can be provided in a removable manner so as to enable them to be taken out for cleaning.

[0056] Figure 5 illustrates a further embodiment of the present invention, in which similar or identical parts and details are indicated with the same reference numerals.

[0057] In this case, the collecting means include a fixedly mounted reservoir 17, which cannot therefore be removed from the outer cabinet 11, and which is fluidly connected with the delivery means 8, the drain means 10 and the air-cooled condenser 2 in a similar manner as described hereinbefore, so as to be able to receive both the condensate water flowing in from the air-cooled condenser 2 and fluff-laden water flowing in from the drain means 10.

[0058] The collecting means further include a canister 18, which is removably provided in the upper portion of the outer cabinet 11, and which is connected to the reservoir 17, via a connection conduit 33, and to the water delivery means 8 via the supply conduit 24. The canister 18 includes the filtering means 23 adapted to filter the water flowing therethrough and due to be supplied to the delivery means 8, wherein said filtering means 23 are so arranged in the canister 18 as to substantially define a first compartment 34, which is adapted to receive the water flowing in from the reservoir 17, and a second compartment 35, in which the filtered water collecting therein is adapted to be conveyed to the water delivery means via the supply conduit 24.

[0059] The fluff building up on the filtering means 23 can be removed therefrom by simply having the canister 18 emptied through an aperture provided on the first compartment 34. In this manner, the water to be discharged, by flowing from the second compartment 35 to the first compartment 34, is adapted to remove and collect the fluff settled on the filtering means 23 during the operation of the dryer.

[0060] Figure 6 illustrates a further embodiment of the present invention, which is substantially similar to the one shown in Figures 2 and 3, the only difference lying in the fact that the fluff-cleared drying air exiting the air passage 4 is first led to blower means 22 for them to then send and appropriately convey it to the air-cooled condenser 2.

[0061] As far as the embodiment according to Figures 2 and 3 is concerned, the operation of the tumble dryer according to the present invention calls for the pump means 31 to draw in the water contained in the reservoir 14 - via the first valve 25 - in view of forcing it out it to the water delivery means 8 along the supply conduit 24. By flowing down along the airflow deflecting surface 7, the resulting water curtain 9 catches and retains the fluff being carried by the flow of drying air, thereby removing it therefrom. The fluff-laden water collects into the collecting arrangement 20 of the drain means 10 and - via the recovery conduit 27 - is filled into the reservoir 14. Via the third valve 28, the fluff-laden water enters the second compartment 30 of the reservoir 14 to then flow, by passing through the filtering means 23, into the first compartment 29 of the reservoir 14, from which it is drawn in by the pump means 31 via the first valve 25.

[0062] The water condensing in the air-cooled condenser 2 is in turn allowed to fill - via the second valve 26 - into the first compartment 29, from which it is drawn in by the pump means 31 via the first valve 25.

[0063] The water curtain or film may be provided so as to be available, i.e. running throughout the drying cycle performed by the tumble dryer; in this case, all it takes is to ensure that the reservoir 14 is never totally emptied and, to this purpose, a pre-established amount of water is anyway allowed to remain in the reservoir 14. In alternative thereto, since fluff starts being produced when the clothes in the drying load have first been dried to a certain extent, there is no need for the water curtain to be activated from the very beginning of the drying cycle, actually, so that it is sufficient if the water curtain is activated starting from a certain period of time from the beginning of the drying cycle. This has the advantage that the water curtain itself may then be produced by using the condensate water that has in the meantime been able to collect in the reservoir 14.

[0064] The operation mode of the tumble dryer in the embodiment described with reference to Figure 4 is substantially similar to the one described in connection with the embodiment discussed above, the only difference being that the water drawn in by the pump means 31 from the fixedly mounted reservoir 15 may be selectively sent - via the appropriate valve means 32 - to the water delivery means 8 and/or the removable canister 16.

[0065] The operation of the tumble dryer in the embodiment described with reference to Figure 5 calls for the fixedly mounted reservoir 17 to collect both the condensate water flowing in from the air-cooled condenser 2 and the fluff-laden water flowing in from the recovery conduit 27 of the drain means 10. The pump means 31 operate to draw in the water from the reservoir 17 and send it - via the connecting conduit 33 - into the first compartment 34 of the removable canister 18. Then, by passing through the filtering means 23 acting as a partition, the water flows into the second compartment 35 of the canister 18 and, from said second compartment, it reaches the water delivery means 8 via the supply conduit 24.

[0066] It can at this point be fully appreciated that the present invention provides lint retaining and collecting arrangements that are effective in ensuring that the tumble dryer is able to perform unvaryingly throughout the drying cycle, i.e. the performance level of the tumble dryer remains unaltered throughout the drying cycle, since they prevent obstructions from forming that would offer resistance to the flow of the process air through the closed-loop drying air circuit.

[0067] In addition, the lint retaining and collecting arrangements according to the present invention do not require any special maintenance to be carried out by the user.

[0068] It should in fact be specially stressed that the sole reason why filtering means 23 are used to filter the fluff-laden water is to enhance the capability of the water curtain 9 to trap and retain fluff on the whole and to totally minimize the risk that the closed-loop water circuit becomes clogged in the course of the drying process. However, the use of such filtering means is not to be seen as being necessary.

[0069] In addition, in the case that such filtering means 23 are provided in the removable canisters 14, 18, it just takes for the same canisters to be simply emptied - as this must anyway be done - to ensure cleaning of the filtering means 23.

Claims

1. Clothes tumble dryer comprising a closed-loop drying-air circuit adapted to circulate heated drying air through a rotating drum, an air-cooled condenser (2) adapted to remove moisture from the hot moisture-laden drying air exiting said drum, an open-loop cooling-air circuit adapted to circulate through the air-cooled condenser (2) a stream of cooling air taken in from the outside ambient to cool said condenser, and to let out said stream of cooling air again into the outside ambient, lint retaining and collecting arrangements being provided to remove the fluff from the flow of drying air, wherein the closed-loop drying-air circuit includes an air passage (4) provided with an inflow aperture (5) fluidly connected to the drum, an outflow aperture (6) fluidly connected to the air-cooled condenser (2), and an airflow deflecting surface (7) adapted to deflect and convey the air entering through the inflow aperture (5) towards the outflow aperture (6), **characterized in that** said lint retaining and collecting arrangements comprise water delivery means (8) adapted to provide water at an upper portion of the airflow deflecting surface (7) for causing a water film or curtain (9) to flow down along the airflow deflecting surface (7), so that the flow of drying air is adapted to impinge against and move along with the water curtain (9) and the latter is adapted to trap and retain the fluff, and further comprise drain means (10) adapted to collect the fluff-laden water at a lower portion of the airflow deflecting surface (7).

2. Tumble dryer according to claim 1, comprising collecting means (14,15,16,17,18) for collecting from the air-cooled condenser (2) the condensate water forming during dryer operation, wherein said water delivery means (8) are fluidly connected to the collecting means (14,15,16,17,18) so that the water delivery means (8) are adapted to be supplied with said condensate water.

3. Tumble dryer according to claim 2, wherein said drain means (10) are fluidly connected to the collecting means (14,15,16,17,18) so that the fluff-laden water is adapted to be conveyed into and collected in said collecting means (14,15,16,17,18).

4. Tumble dryer according to claim 3, wherein said water delivery means (8), said drain means (10) and said collecting means (14,15,16,17,18) form a closed-loop water circuit, so that the water flowing in from the drain means (10) is adapted to be recovered to be sent again to the water delivery means (8).

5. Tumble dryer according to claim 4, wherein said closed-loop water circuit includes filtering means (23) adapted to filter the fluff-laden water flowing in from the drain means (10), so that filtered, fluff-cleared water is adapted to be sent to the water delivery means (8).

6. Tumble dryer according to claim 5, wherein the collecting means (14,15,16,17,18) are provided with said filtering means (23).

7. Tumble dryer according to claim 6, wherein said collecting means (14,15,16,17,18) include at least a canister capable of being removed from the outer cabinet (11), or at least a reservoir fixedly mounted in the outer cabinet (11), in which said filtering means (23) are provided.

8. Tumble dryer according to any of the preceding claims, wherein said air passage (4) of the closed-loop drying-air circuit is provided on a head member (3) adapted to close an open end of the rotating drum.

9. Tumble dryer according to claim 8, comprising an outer cabinet (11) having a clothes loading/unloading port (12) provided with a cabinet door assembly (13) for the clothes to be able to be introduced in and removed from the interior of the drum, wherein said head member (3) including the air passage (4) is associated to or incorporated in the cabinet door assembly (13) in such manner that the inflow aperture (5) of the air passage (4) comes to lie in a position close to the access opening of the drum or is received into said opening when the cabinet door assembly (13) is closed.

10. Tumble dryer according to claim 8, including a drum comprised of a cylindrical side wall that is open at the front and rear ends thereof, said cylindrical side wall being rotatably fitted on to a front support and a rear support to close the front and rear ends of the drum, respectively, while allowing the cylindrical side wall itself to rotate relative to said front and rear supports, which are stationary relative to the outer cabinet (11), wherein the front support or the rear support forms the head member (3) including said air passage (4).

11. Tumble dryer according to claim 9, wherein the cabinet door assembly (13) comprises the head member (3) including the air passage (4), said water delivery means (8) and said drain means (10) being provided in correspondence to a frame (19) delimiting the clothes loading/unloading port (12) of the outer cabinet (11), so that, when the cabinet door assembly (13) is closed, the water delivery means (8) come to be located close to the upper portion of the airflow deflecting surface (7) and the drain means (10) come in turn to be located close to the lower portion of the airflow deflecting surface (7).

12. Tumble dryer according to claim 11, wherein a top portion of the frame (19) houses the delivery means (8), whereas a bottom portion of the frame (19) integrally forms a collecting arrangement (20) of the drain means (10).

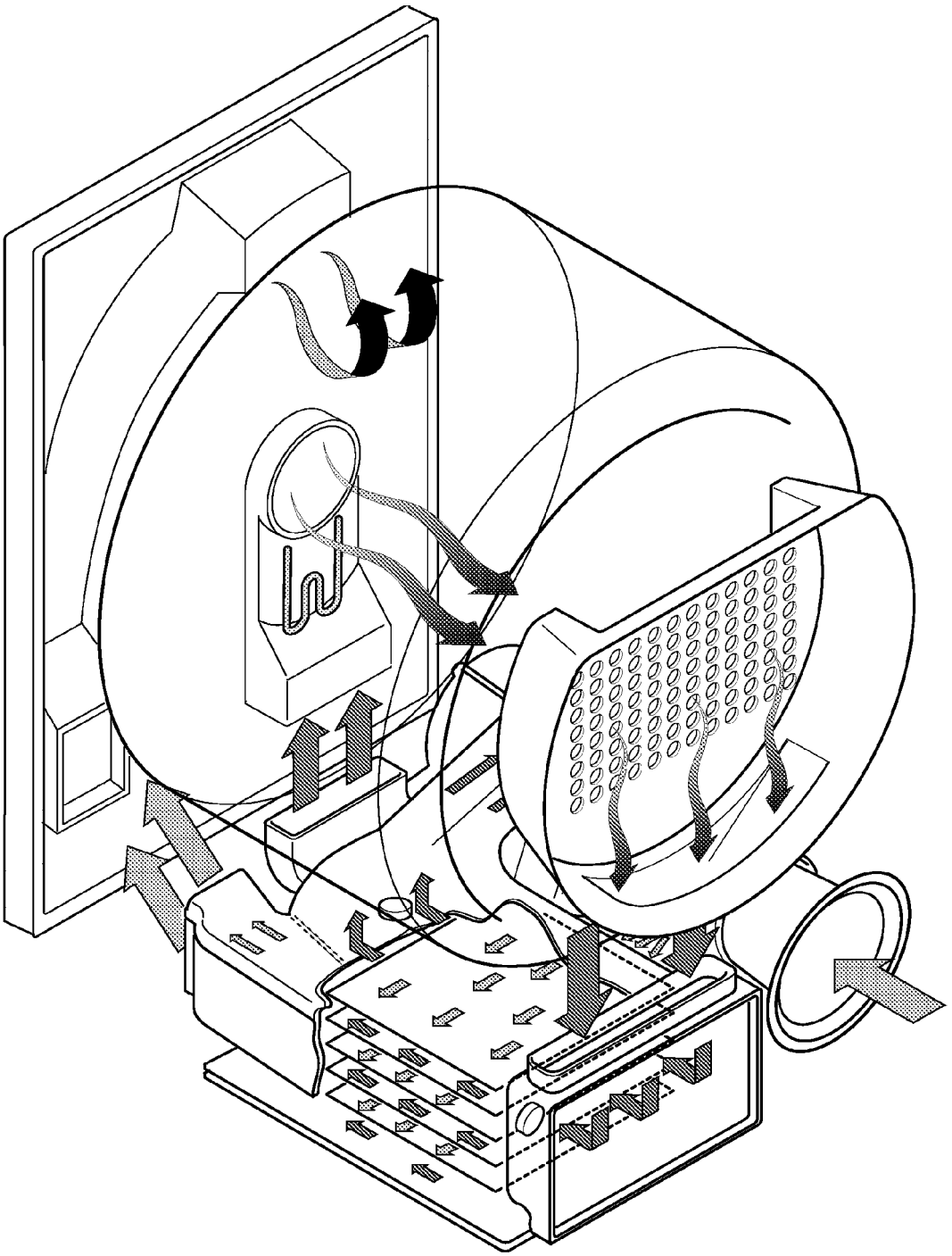

FIG.1

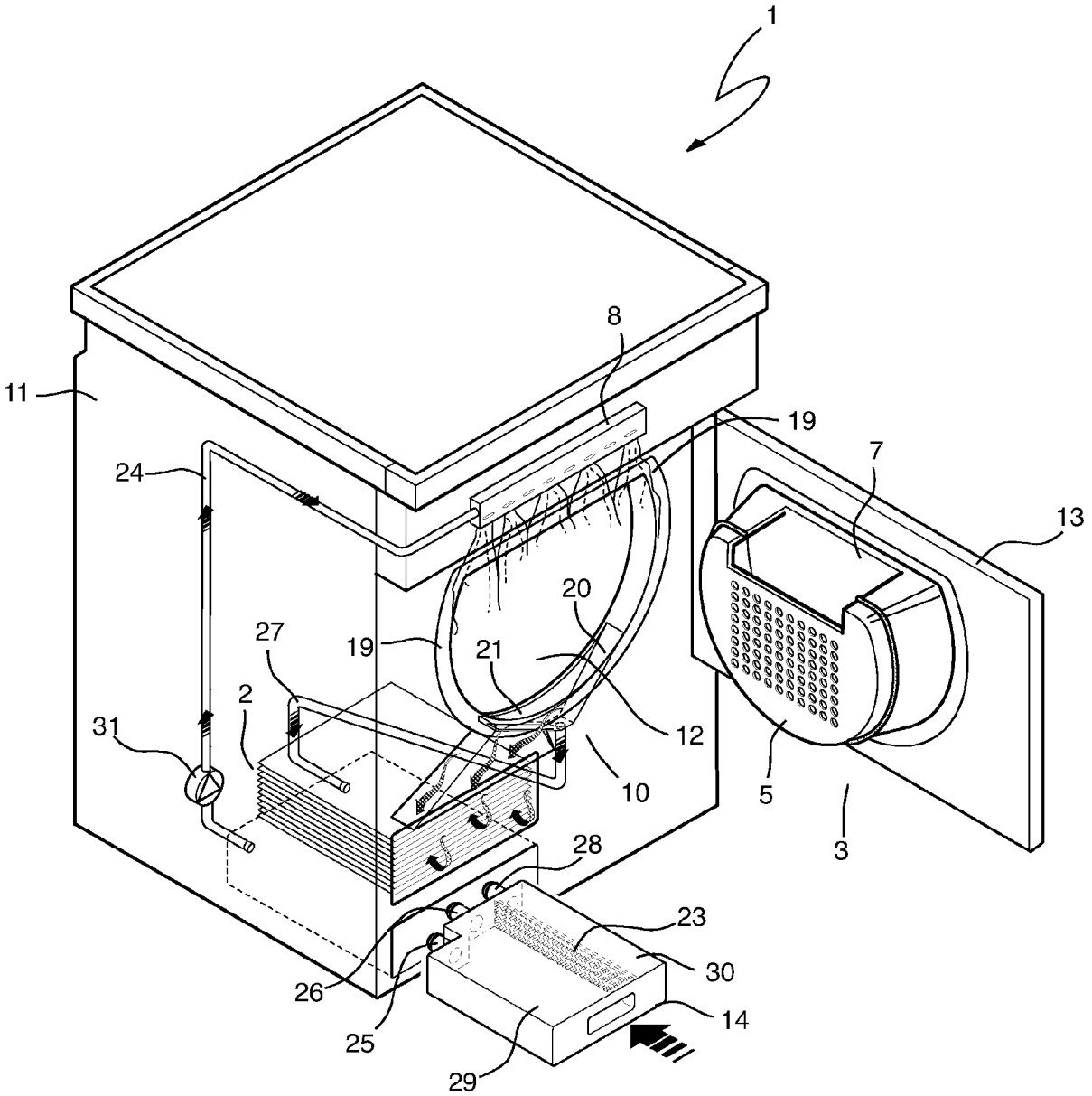

FIG. 2

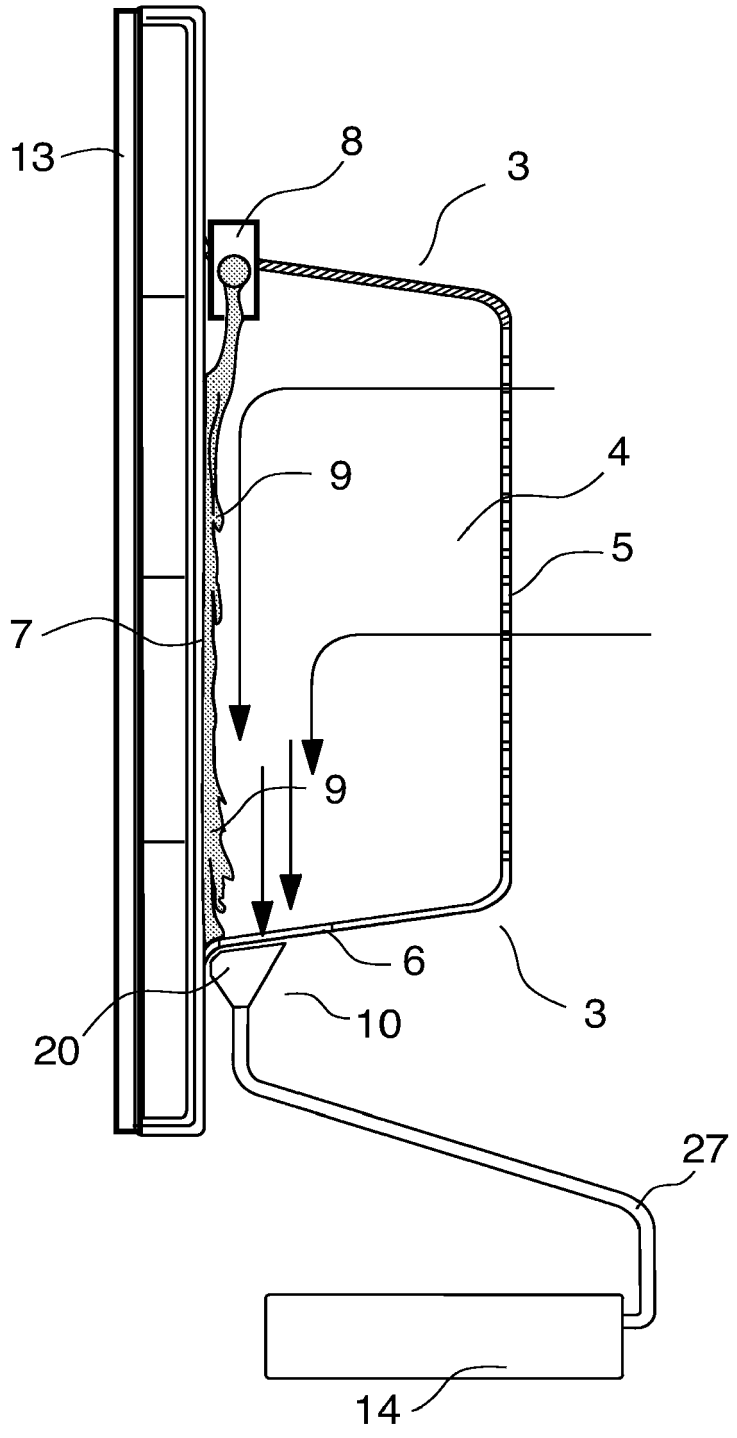

FIG.3

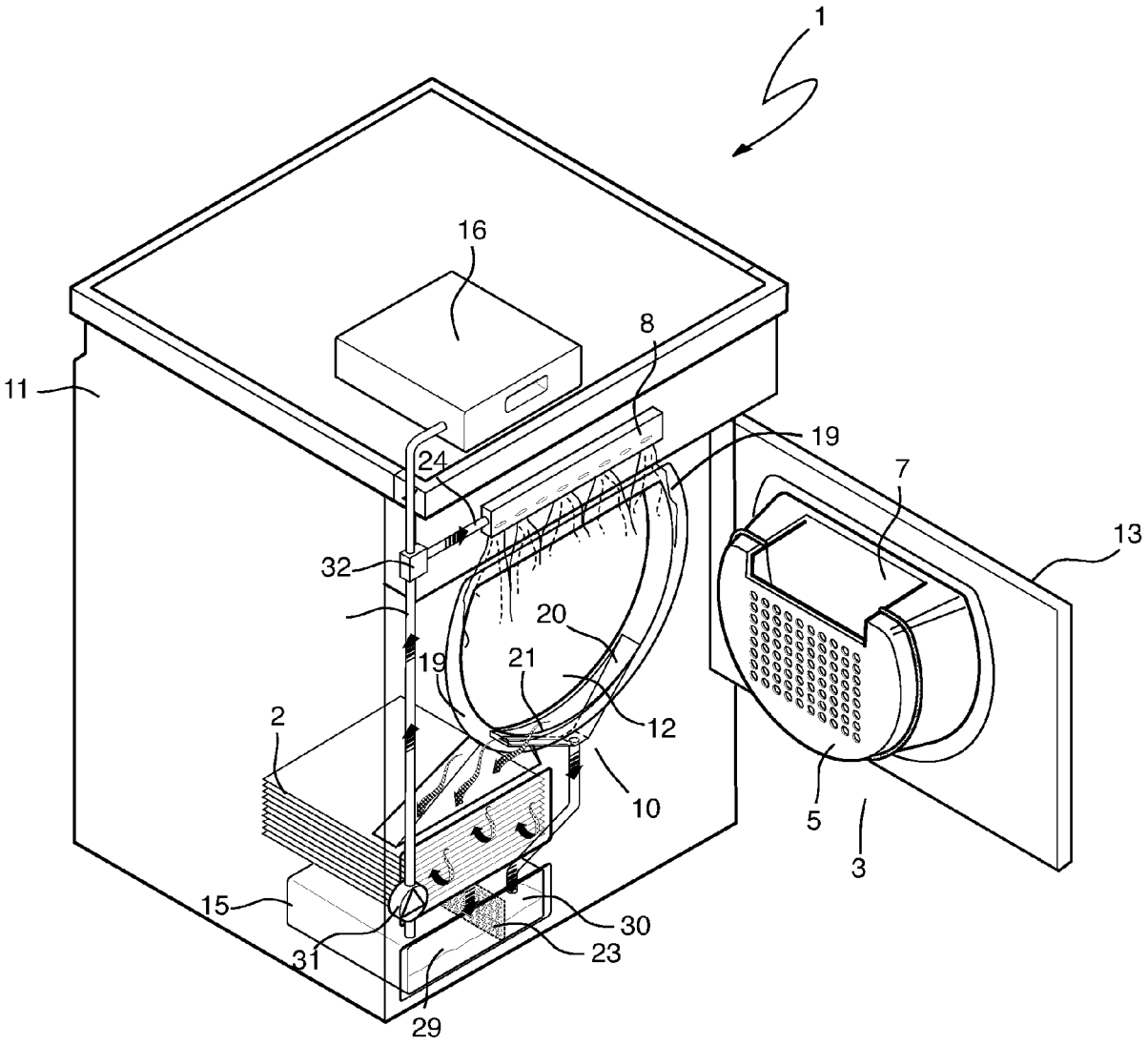

FIG.4

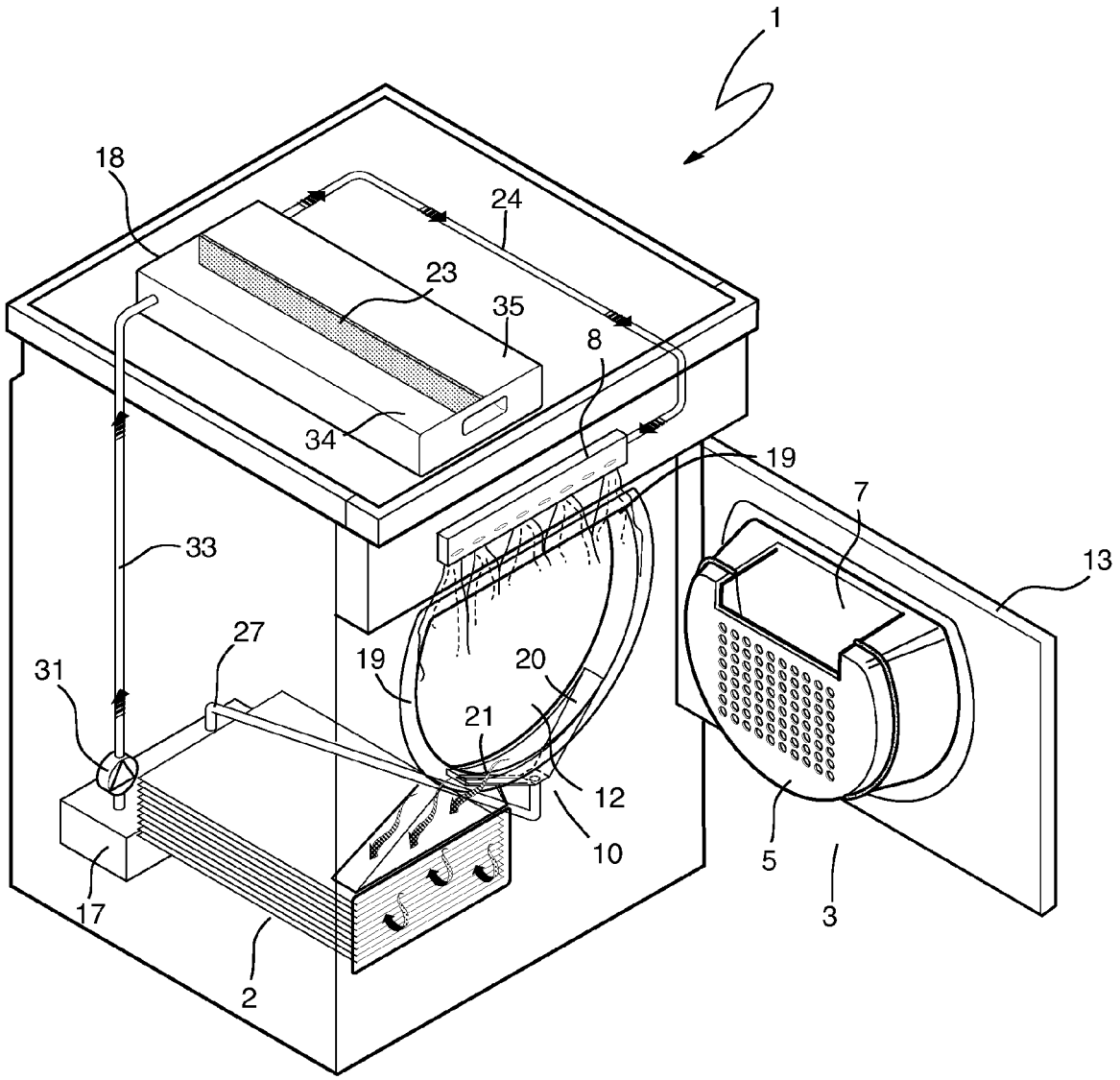

FIG.5

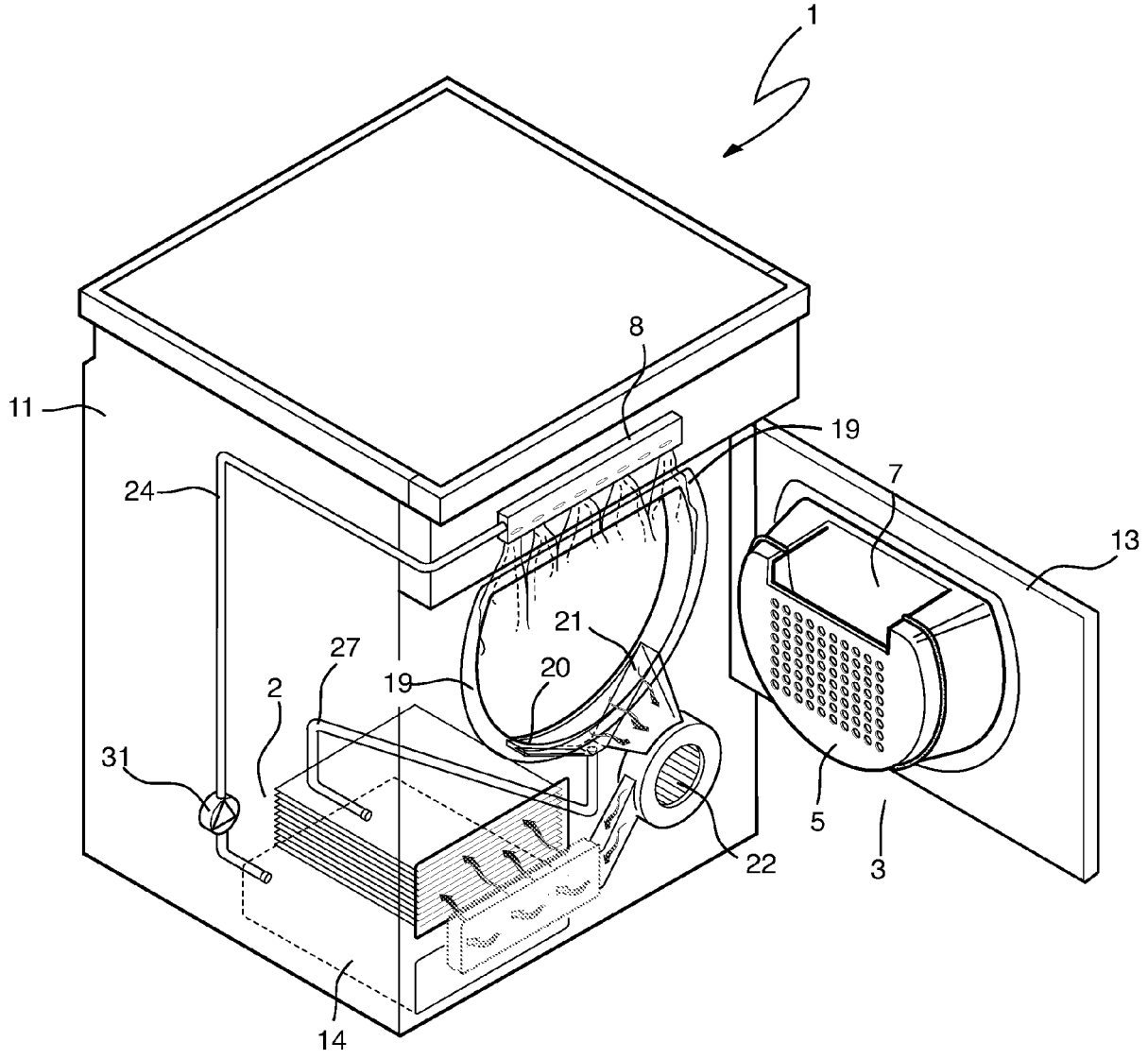

FIG.6

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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 0 789 105 A1 (CANDY SPA [IT]) 13 August 1997 (1997-08-13)	1-10	INV. D06F58/22
A	column 2, line 51 - column 3, line 16; column 4, lines 4-48; abstract; figures 1,2	11,12	
Y	EP 0 548 386 A1 (ZANKER GMBH [DE]) 30 June 1993 (1993-06-30)	1-10	
A	page 3, lines 1-3; page 5, lines 22-58; page 6, lines 35-55; abstract; figures	11,12	
A	EP 1 669 487 A (LG ELECTRONICS INC [KR]) 14 June 2006 (2006-06-14) paragraphs 31-37, 48-50, 59; figures	1-12	
A	DE 37 38 031 A1 (BOSCH SIEMENS HAUSGERAETE [DE]) 18 May 1989 (1989-05-18) column2, lines 26-65; figures	1-12	

TECHNICAL FIELDS SEARCHED (IPC)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 June 2007	Clivio, Eugenio

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18-06-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0789105 A1	13-08-1997	IT MI960095 U1	06-08-1997
EP 0548386 A1	30-06-1993	AT 150812 T	15-04-1997
		DE 9117222 U1	10-07-1997
		DE 59108640 D1	30-04-1997
		ES 2099123 T3	16-05-1997
EP 1669487 A	14-06-2006	AU 2005203176 A1	29-06-2006
		CN 1786328 A	14-06-2006
		KR 20060065266 A	14-06-2006
		US 2006123854 A1	15-06-2006
DE 3738031 A1	18-05-1989	NONE	

EPO FORM P0459

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