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(54) **Laundry drier**

Wäschetrockner

Sèche-linge

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**EP-A- 1 634 984**
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## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to a laundry drier, preferably for home use.

### BACKGROUND ART

**[0002]** Known laundry driers operate in various ways, and in particular may condense a stream of hot air blown into a drying drum to remove moisture from the laundry, or may exhaust the stream of moisture-laden hot air directly from the drier. Known laundry driers comprise a ventilation system (i. e. usually a blower comprising a fan and an electric fan motor) and a heating arrangement, which draw air from outside, and heat and blow the air into and through the laundry drum; and the hot drying air is then either exhausted directly from the drier or fed to condensing means to condense the moisture collected in the hot air.

**[0003]** A known condensation laundry drier comprises a laundry drum; an air intake conduit for feeding the hot drying air into the drum through an inflow opening; and an air outlet or exhaust conduit for exhausting the hot drying air from inside the drum through a corresponding outflow opening. The air conduits are connected to each other by a condenser for condensing the moisture in the hot drying air flowing through it.

**[0004]** In a standard laundry drier, the hot drying air, which evaporates the water in the laundry, flows axially into the drum from the rear of the drum (i.e. in a direction parallel to the central rotation axis of the drum), and axially out of the drum from the front. In other words, the hot drying air flows in and out of the drum along an axial path, i.e. in a rear-to-front direction from the rear drum flange to the front drum outlet, so that the heating element for heating the drying air is located at the rear of the drier, close to the rear of the drum.

**[0005]** One example of a standard laundry drier is described in EP1666657A1, which describes a front-loading laundry drier comprising a laundry drum; a delivery conduit for feeding drying air into the drum; and an outflow conduit for removing the drying air from inside the drum.

**[0006]** In standard laundry driers of the above type, however, the hot drying air tends to be concentrated in the centre of the drum, around the central rotation axis of the drum, as opposed to being distributed evenly inside the drum.

**[0007]** EP1634984A1 describes a combination washing machine-drier comprising a top main body; a tub housing a revolving drum; a heat pump; a tub ventilation conduit comprising an intake conduit for hot, dry air blown into the tub; a suction conduit for moisture-laden air from the tub; and a base connected to the bottom of the top main body and housing the heat pump. The intake conduit is located between the base and a first opening in the tub, and the suction conduit is located between the base and a second opening in the tub.

**[0008]** In the combination washing machine-drier in EP1634984Al, however, the hot drying air flows radially into and out of the drum (i.e. in a direction perpendicular to the central rotation axis of the drum), and so tends to be concentrated in a portion of the drum close to the inflow and outflow openings, as opposed to being distributed evenly inside the drum.

**[0009]** German patent n. DE 88054 and Swiss patent n. CH 307608 disclose a laundry drier comprising a rotating drum, on which lateral surface a nozzle is provided, adapted for admitting a flow of hot air into the drum in a direction tangent to the lateral surface of the latter; inside the drum the flow of hot air divides in two parts which, after traversing the clothes contained in the drum, comes out axially from the latter, respectively via two openings present at the two longitudinal ends of the drum. Also this solution, however, doesn't guarantee an even distribution of the hot air flow inside the drum.

**[0010]** European patent application n, EP 1 600 548 A2 discloses a clothes dryer including a drum rotatably installed in a cabinet, a plurality of vent holes being formed on the circumferential surface of the drum, first and second ducts coupled to the drum, respectively, for sucking and exhausting air to/from the drum, and a fan motor for forcibly sending air through the first and second ducts. Here, at least one of the first and second ducts is linked to the plurality of vent holes. The clothes dryer can increase a capacity of the drum without increasing a size of the cabinet.

### DISCLOSURE OF INVENTION

**[0011]** It is an object of the present invention to provide a laundry drier designed to eliminate the aforementioned drawbacks, and which is cheap and easy to implement.

**[0012]** According to the present invention, there is provided a laundry drier as claimed in the accompanying Claims.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0013]** Non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic side view of a laundry drier in accordance with the present invention;
Figure 2 shows a schematic view in perspective of a drum of the Figure 1 laundry drier;
Figure 3 shows a schematic, exploded view in perspective of the Figure 2 drum; and
Figure 4 shows a schematic side view of an alternative embodiment of a laundry drier in accordance with the present invention.

PREFERRED EMBODIMENTS OF THE INVENTION

**[0014]** Number 1 in Figure 1 indicates as a whole a laundry drier comprising a casing 2 resting on a floor 3 on a number of feet 4. Casing 2 supports a revolving laundry drum 5, which rotates about a horizontal rotation axis 6 (in alternative embodiments not shown, rotation axis 6 may be tilted or vertical), and front access to which is closed by a hinged door (not shown).

**[0015]** Laundry drier 1 also comprises a ventilation system 7, which draws air from the outside, and heats and blows the air into and through laundry drum 5. The hot drying air is then conducted out of drum 5 and blown to a condenser 8 to condense the moisture collected in the hot air; and, downstream from condenser 8, the dry hot air is blown back into and through drum 5. In a preferred embodiment, condenser 8 is also fed through with a stream of "cold" air, i.e. air drawn in from the outside and fed to condenser 8 by a corresponding cooling conduit (not shown).

**[0016]** Ventilation system 7 comprises an air intake conduit 9 for feeding the hot drying air into drum 5 through an inflow opening 10; and an air exhaust conduit 11 for exhausting the hot drying air from inside the drum through a corresponding outflow opening 13. Air conduits 9 and 11 are connected to each other by condenser 8, which condenses the moisture in the hot drying air flowing through it. Ventilation system 7 also comprises a heating device 13 (e.g. an electric resistor) located along air intake conduit 9 to heat the drying air; and a fan 14 located along air intake conduit 9, upstream from condenser 8 (as shown in Figure 1) or downstream from condenser 8 (as in an alternative embodiment not shown).

**[0017]** Outflow opening 13 is located at a front access opening of drum 5 and close to rotation axis 6, so that the hot drying air flows axially out of drum 5 from the front (i.e. in a direction parallel to central rotation axis 6 of drum 5). As shown more clearly in Figure 3, inflow opening 10 comprises a number of through holes 15 formed through a lateral surface 16 of drum 5 to define a circular perforated strip 17 on lateral surface 16 of drum 5. In other words, lateral surface 16 of drum 5 only has through holes 15 in perforated strip 17, while the rest of lateral surface 16 has no perforation.

**[0018]** Intake conduit 9 terminates with an annular chamber 18 defined inside a hollow ring 19 surrounding drum 5 to completely cover perforated strip 17, so that the hot drying air fed along intake conduit 9 reaches annular chamber 18 and flows into drum 5 through holes 15 in perforated strip 17. The hot drying air therefore flows radially into drum 5 (i.e. in a direction perpendicular to central rotation axis 6 of drum 5). In a preferred embodiment, perforated strip 17 and, therefore, annular chamber 18 are located close to a rear wall 20 of drum 5, so that the hot drying air flows radially into and axially out of drum 5 along a rear-to-front direction path from rear wall 20 to the front access opening of drum 5. Moreover, with a radial inlet and an axial outlet, the hot drying air flows radially into and axially out of drum 5 along a periphery-to-centre direction path.

**[0019]** In a preferred embodiment, between lateral surface 16 of drum 5 and lateral walls 21 and 21' of annular chamber 18, respective sliding seals 22 are interposed to seal and prevent hot drying air leakage from annular chamber 18. Sliding seals 22 may be fixed to lateral walls 21 and 21' of annular chamber 18 and slide along lateral surface 16 of drum 5, or may be fixed to lateral surface 16 of drum 5 and slide along lateral walls 21 and 21' of annular chamber 18.

**[0020]** In figure 4, a rear lateral wall 21 of annular chamber 18 is larger than a front lateral wall 21', and partly overlaps rear wall 20 of drum 5, so that the sliding seal 22 of rear lateral wall 21 is interposed between rear lateral wall 21 of annular chamber 18 and rear wall 20 of drum 5, and is easier to implement than sliding seal 22 of front lateral wall 21'.

**[0021]** In a preferred embodiment, condenser 8, heating device 13, and fan 14 are located at the bottom (in the base) of casing 2, and therefore beneath drum 5, so that air intake conduit 9 and air exhaust conduit 11 are both substantially vertical. When heating device 13 is housed in the base of casing 2, the protective metal parts normally surrounding heating device 13 may be reduced, thus reducing cost.

**[0022]** It should be pointed out that condenser 8 and the relative cooling conduit are referred to here purely by way of example in connection with one embodiment and a particularly advantageous application of the present invention, and may be omitted in the case of an exhaust-type laundry drier 1 (i.e. in which the hot drying air from drum 5 is exhausted directly from laundry drier 1).

**[0023]** Laundry drier 1 as described above has numerous advantages, by being cheap and easy to implement, and by providing for extremely even distribution of the hot drying air inside drum 5.

**[0024]** More specifically, extremely even distribution of the hot drying air inside drum 5 is achieved by providing a radial inlet close to rear wall 20 of drum 5, and an axial outlet from the front access opening of drum 5, so that the hot drying air flows radially into and axially out of drum 5 along a path in a rear-to-front direction and in a periphery-to-centre direction from rear wall 20 to the front access opening of drum 5. It is important to point out that inflow opening 10, being defined by all the holes 15 in perforated strip 17, has a large area, and is also perfectly symmetrical with respect to drum 5, thus enabling extremely even distribution of the hot drying air inside drum 5.

**Claims**

**1.** A laundry drier (1) comprising:

a revolving laundry drum (5) having a front access opening; and

a ventilation system (7), which blows drying air into and through the drum (5), and comprises an air intake conduit (9) for feeding the drying air into the drum (5) through an inflow opening (10), and an air exhaust conduit (11) for exhausting the drying air from inside the drum through an outflow opening (12);
the inflow opening (10) being located at a lateral surface (16) of the drum (5), and the outflow opening (12) being located at the front access opening of the drum (5), so that the drying air flows radially into the drum (5) and axially out of the drum (5) in a rear-to-front direction and a periphery-to-centre direction, the intake conduit (9) terminating with an annular chamber (18) surrounding the drum (5) to completely cover said inflow opening (10), the front lateral wall (21') of said annular chamber (18) being rotatably associated to the lateral surface (16) of said drum (5), **characterized in that** a rear lateral wall (21) of said annular chamber (18) is larger than said front lateral wall (21'), and partly overlaps a rear wall (20) of the drum (5).

**2.** A laundry drier (1) as claimed in Claim 1, wherein the inflow opening (10) comprises a number of through holes (15) formed through the lateral surface (16) of the drum (5) to define a circular perforated strip (17) on the lateral surface (16) of the drum (5); and the rest of the lateral surface (16) has no perforation.

**3.** A laundry drier (1) as claimed in Claim 1 or 2, wherein, between the lateral surface (16) of the drum (5) and front lateral wall (21') of the annular chamber (18), a sliding seal (22) is interposed to seal the annular chamber (18) and prevent hot drying air leakage from the annular chamber (18).

**4.** A laundry drier (1) as claimed in Claim 3, wherein a sliding seal (22) is fixed to the front lateral wall (21') of the annular chamber (18).

**5.** A laundry drier (1) as claimed in Claim 3, wherein a sliding seal (22) is fixed to the lateral surface (16) of the drum (5).

**6.** A laundry drier (1) as claimed in one or more of the previous claims, wherein, between the rear wall (20) of the drum (5) and the rear lateral wall (21) of the annular chamber (18), a sliding seal (22) is interposed to seal the annular chamber (18) and prevent hot drying air leakage from the annular chamber (18).

**7.** A laundry drier (1) as claimed in Claim 6, wherein said sliding seals (22) is fixed to the rear lateral wall (21) of the annular chamber (18).

**8.** A laundry drier (1) as claimed in Claim 6, wherein said sliding seal (22) is fixed to the real wall (20) of the drum (5).

**9.** A laundry drier (1) as claimed in any of Claims 1 to 8, wherein the ventilation system (7) comprises a condenser (8) to condense the moisture collected in the drying air from the drum (5).

**10.** A laundry drier (1) as claimed in any of Claims 1 to 9, wherein the ventilation system (7) comprises a heating device (13) for heating the drying air; and a fan (14).

**11.** A laundry drier (1) as claimed in Claim 10, wherein the heating device (13) and the fan (14) are housed in a bottom portion of a casing (2) and located beneath the drum (5).

**Patentansprüche**

**1.** Wäschetrockner (1), Folgendes umfassend:

eine sich drehende Wäschetrommel (5) mit einer vorderen Zugangsöffnung; und
ein Belüftungssystem (7), das Trocknungsluft in die und durch die Trommel (5) bläst und eine Luftaufnahmeleitung (9) zur Zuführung der Trocknungsluft in die Trommel (5) durch eine Zustromöffnung (10) sowie eine Luftabzugleitung (11) für den Abzug der Trocknungsluft vom Inneren der Trommel durch eine Abgangsöffnung (12) umfasst;

wobei die Zustromöffnung (10) an einer Seitenfläche (16) der Trommel (5) und die Abgangsöffnung (12) an der vorderen Zugangsöffnung der Trommel (5) angeordnet ist, so dass die Trocknungsluft von hinten nach vorne und vom Rand zur Mitte radial in die Trommel (5) strömt und axial aus der Trommel (5) heraus strömt, wobei die Aufnahmeleitung (9) in einer ringförmigen Kammer (18) endet, welche die Trommel (5) umschließt, um die Zustromöffnung (10) vollständig abzudecken,
wobei die vordere Seitenwand (21') der ringförmigen Kammer (18) auf drehbare Weise mit der Seitenfläche (16) der Trommel (5) verbunden ist, **dadurch gekennzeichnet, dass** eine hintere Seitenwand (21) der ringförmigen Kammer (18) größer ist als die vordere Seitenwand (21') und eine Rückwand (20) der Trommel (5) teilweise überlappt.

**2.** Wäschetrockner (1) gemäß Anspruch 1, wobei die Zustromöffnung (10) eine Anzahl von durchgehenden Löchern (15) aufweist, die durch die Seitenfläche (16) der Trommel (5) gebildet sind, um einen kreisförmigen perforierten Streifen (17) auf der Sei-

tenfläche (16) der Trommel (5) zu begrenzen, und der Rest der Seitenfläche (16) keine Perforation aufweist.

**3.** Wäschetrockner (1) gemäß Anspruch 1 oder 2, wobei zwischen der Seitenfläche (16) der Trommel (5) und der vorderen Seitenwand (21') der ringförmigen Kammer (18) eine Schiebedichtung (22) eingesetzt ist, um die ringförmige Kammer (18) abzudichten und ein Austreten heißer Trocknungsluft aus der ringförmigen Kammer (18) zu verhindern.

**4.** Wäschetrockner (1) gemäß Anspruch 3, wobei an der vorderen Seitenwand (21') der ringförmigen Kammer (18) eine Schiebedichtung (22) befestigt ist.

**5.** Wäschetrockner (1) gemäß Anspruch 3, wobei an der Seitenfläche (16) der Trommel (5) eine Schiebedichtung (22) befestigt ist.

**6.** Wäschetrockner (1) gemäß einem oder mehreren der vorangehenden Ansprüche,
wobei zwischen der Rückwand (20) der Trommel (5) und der hinteren Seitenwand (21) der ringförmigen Kammer (18) eine Schiebedichtung (22) eingesetzt ist, um die ringförmige Kammer (18) abzudichten und ein Austreten heißer Trocknungsluft aus der ringförmigen Kammer (18) zu verhindern.

**7.** Wäschetrockner (1) gemäß Anspruch 6, wobei die Schiebedichtung (22) an der hinteren Seitenwand (21) der ringförmigen Kammer (18) befestigt ist.

**8.** Wäschetrockner (1) gemäß Anspruch 6, wobei die Schiebedichtung (22) an der Rückwand (20) der Trommel (5) befestigt ist.

**9.** Wäschetrockner (1) gemäß einem der Ansprüche 1 bis 8, wobei das Belüftungssystem (7) einen Kondensator (8) zur Kondensation der in der Trocknungsluft von der Trommel (5) enthaltenen Feuchtigkeit umfasst.

**10.** Wäschetrockner (1) gemäß einem der Ansprüche 1 bis 9, wobei das Belüftungssystem (7) eine Heizvorrichtung (13) zum Erhitzen der Trocknungsluft sowie einen Ventilator (14) umfasst.

**11.** Wäschetrockner (1) gemäß Anspruch 10, wobei die Heizvorrichtung (13) und der Ventilator (14) in einem unteren Abschnitt eines Gehäuses (2) untergebracht und unterhalb der Trommel (5) angeordnet sind.

**Revendications**

**1.** Sèche-linge (1) comprenant :
un tambour de linge rotatif (5) ayant une ouverture d'accès avant ; et
un système de ventilation (7) qui souffle de l'air de séchage dans et à travers le tambour (5), et comprend un conduit d'admission d'air (9) pour alimenter l'air de séchage dans le tambour (5) par une ouverture d'entrée (10), et un conduit d'échappement d'air (11) pour évacuer l'air de séchage de l'intérieur du tambour par une ouverture de sortie (12) ;
l'ouverture d'entrée (10) étant positionnée dans une surface latérale (16) du tambour (5), et l'ouverture de sortie (12) étant positionnée dans l'ouverture d'accès avant du tambour (5), de sorte que l'air de séchage s'écoule de manière radiale dans le tambour (5) et sort de manière axiale du tambour (5) dans une direction allant de l'arrière vers l'avant et une direction allant de la périphérie vers le centre, le conduit d'admission (9) se terminant par une chambre annulaire (18) entourant le tambour (5) pour couvrir complètement ladite ouverture d'entrée (10), la paroi latérale avant (21') de ladite chambre annulaire (18) étant associée de manière rotative à la surface latérale (16) dudit tambour (5), **caractérisé en ce qu'**une paroi latérale arrière (21) de ladite chambre annulaire (18) est plus grande que ladite paroi latérale avant (21') et chevauche partiellement une paroi arrière (20) du tambour (5).

**2.** Sèche-linge (1) selon la revendication 1, dans lequel l'ouverture d'entrée (10) comprend un certain nombre de trous traversants (15) formés à travers la surface latérale (16) du tambour (5) afin de définir une bande circulaire perforée (17) sur la surface latérale (16) du tambour (5) ; et
le reste de la surface latérale (16) n'a pas de perforation.

**3.** Sèche-linge (1) selon la revendication 1 ou 2, dans lequel, entre la surface latérale (16) du tambour (5) et la paroi latérale avant (21') de la chambre annulaire (18), un joint d'étanchéité coulissant (22) est interposé afin de réaliser l'étanchéité de la chambre annulaire (18) et d'empêcher la fuite de l'air de séchage chaud de la chambre annulaire (18).

**4.** Sèche-linge (1) selon la revendication 3, dans lequel un joint d'étanchéité coulissant (22) est fixé sur la paroi latérale avant (21') de la chambre annulaire (18).

**5.** Sèche-linge (1) selon la revendication 3, dans lequel un joint d'étanchéité coulissant (22) est fixé sur la surface latérale (16) du tambour (5).

**6.** Sèche-linge (1) selon une ou plusieurs des revendications précédentes, dans lequel, entre la paroi ar-

rière (20) du tambour (5) et la paroi latérale arrière (21) de la chambre annulaire (18), un joint d'étanchéité coulissant (22) est interposé pour réaliser l'étanchéité de la chambre annulaire (18) et empêcher la fuite de l'air de séchage chaud de la chambre annulaire (18).

**7.** Sèche-linge (1) selon la revendication 6, dans lequel ledit joint d'étanchéité coulissant (22) est fixé sur la paroi latérale arrière (21) de la chambre annulaire (18).

**8.** Sèche-linge (1) selon la revendication 6, dans lequel ledit joint d'étanchéité coulissant (22) est fixé sur la paroi arrière (20) du tambour (5).

**9.** Sèche-linge (1) selon l'une quelconque des revendications 1 à 8, dans lequel le système de ventilation (7) comprend un condenseur (8) pour condenser l'humidité collectée dans l'air de séchage provenant du tambour (5).

**10.** Sèche-linge (1) selon l'une quelconque des revendications 1 à 9, dans lequel le système de ventilation (7) comprend un dispositif de chauffage (13) pour chauffer l'air de séchage ; et un ventilateur (14).

**11.** Sèche-linge (1) selon la revendication 10, dans lequel le dispositif de chauffage (13) et le ventilateur (14) sont logés dans une partie inférieure d'un boîtier (2) et positionnés au-dessous du tambour (5).

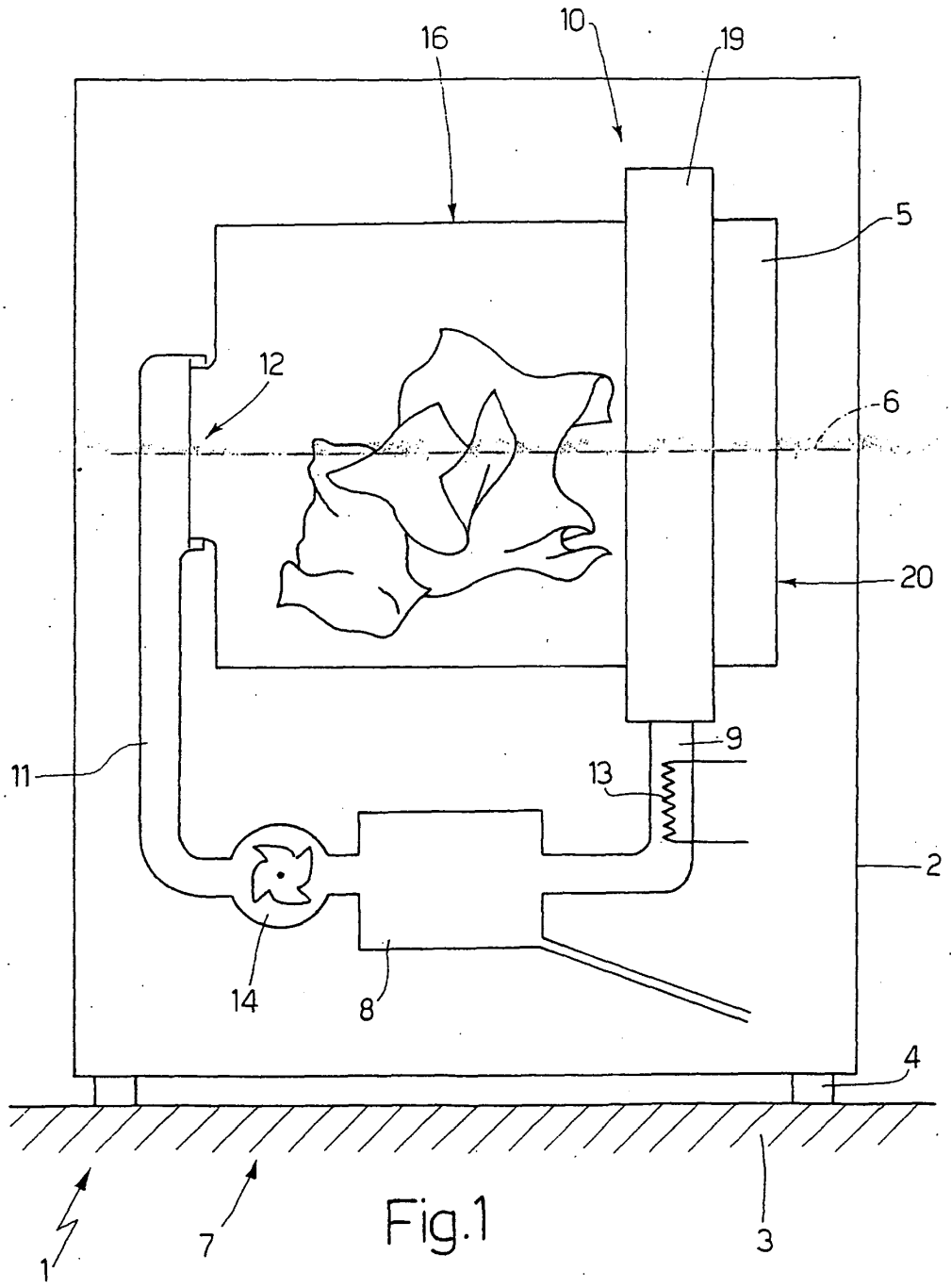



Fig.1

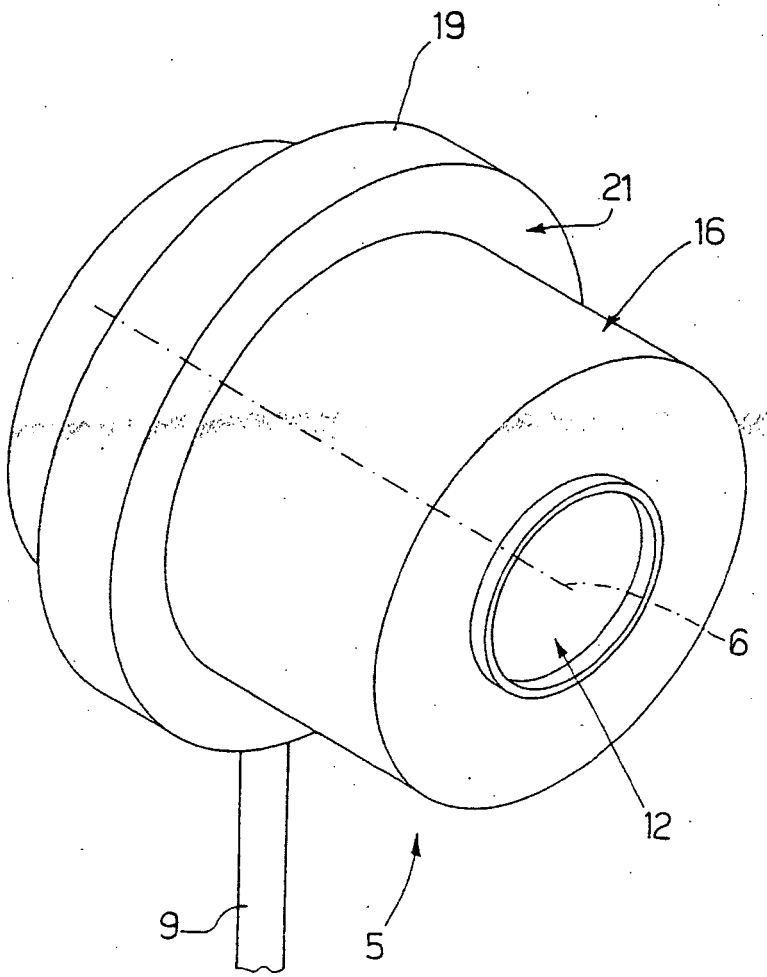



Fig.2

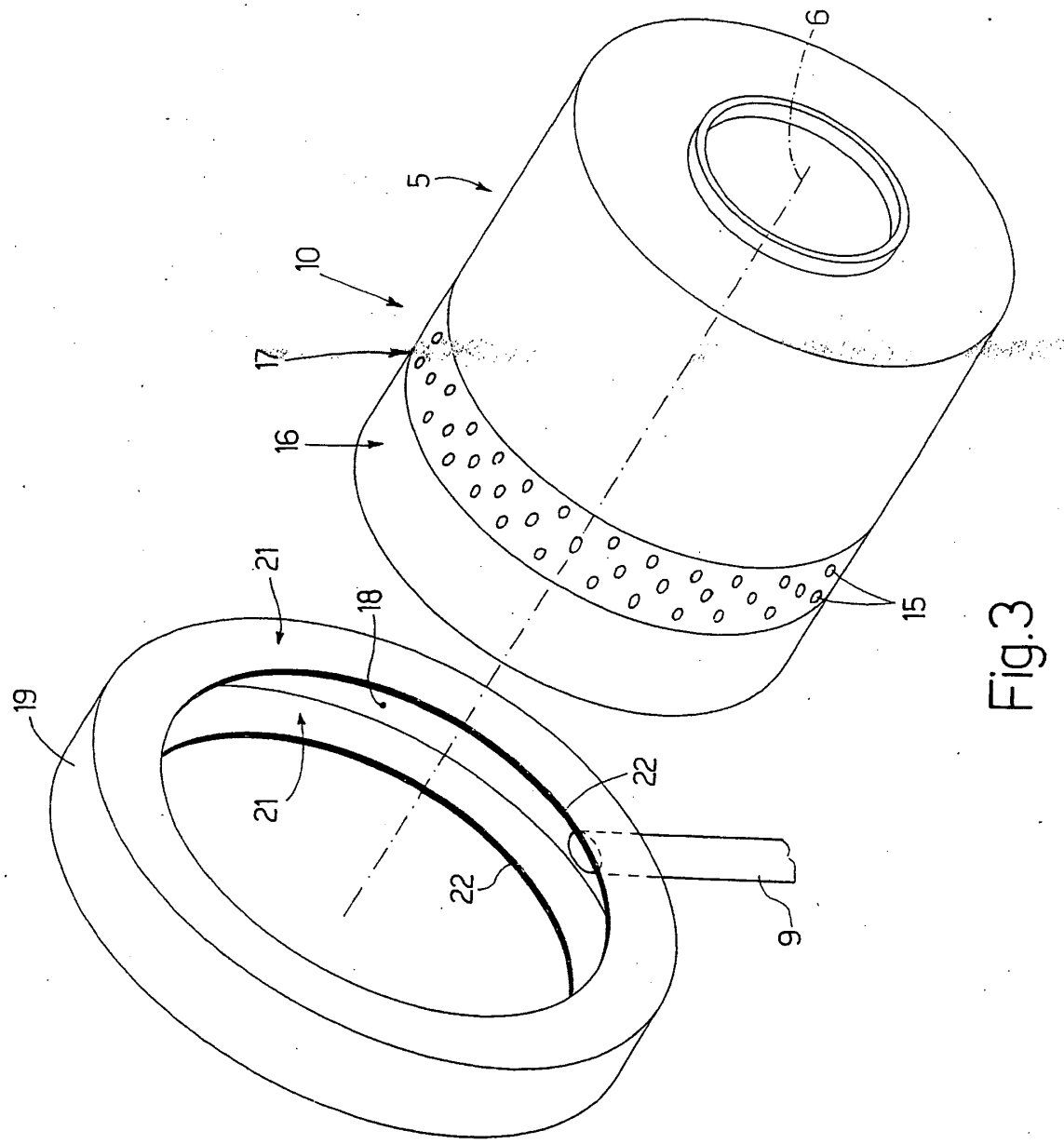



Fig.3

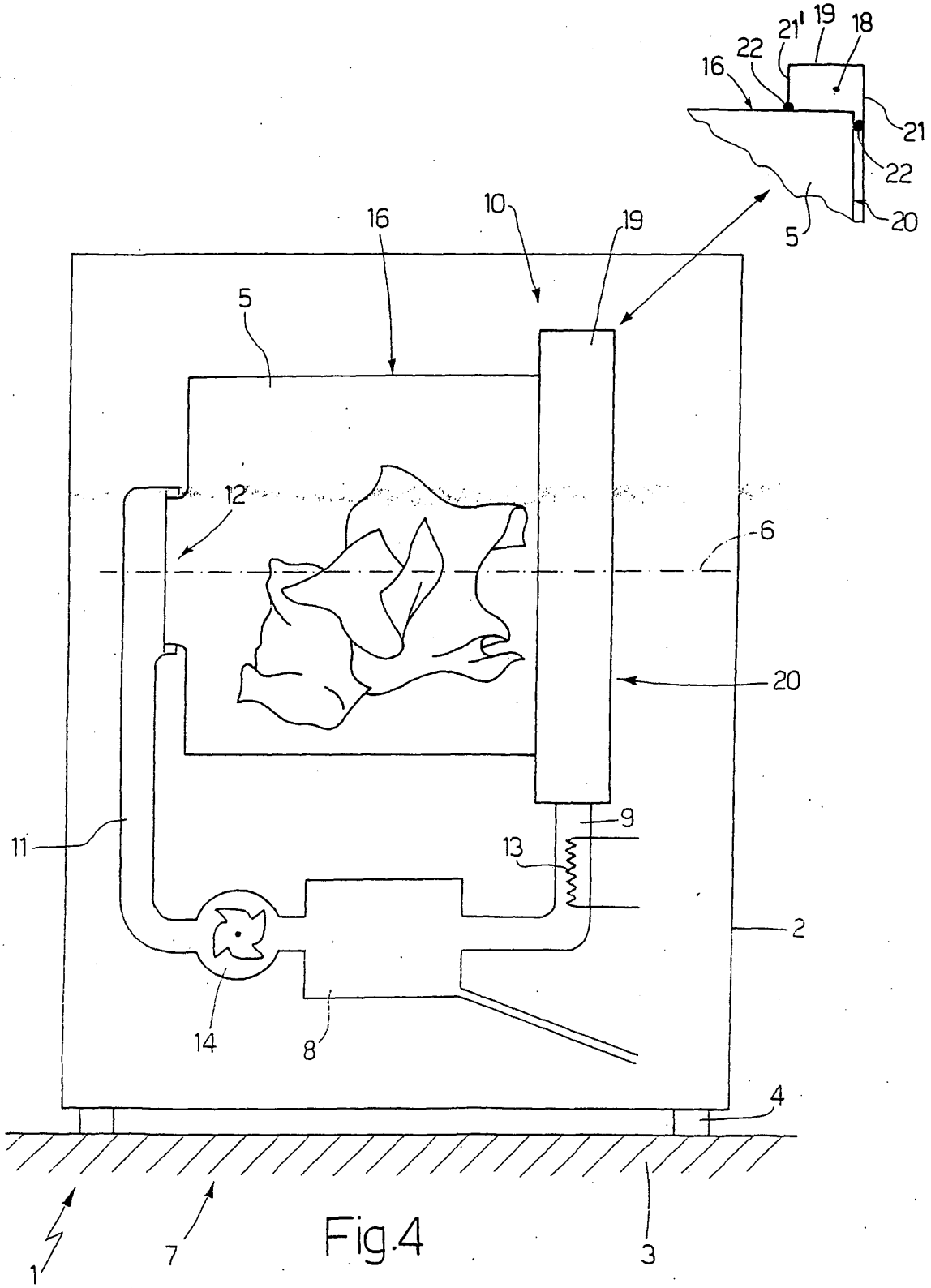



Fig.4

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


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