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(54) **Household laundry dryer with improved drum**

(57) Laundry drying machine comprising a drum (1), a deadening band (6) placed into contact on the internal surface of said drum, a plurality of baffles (2A, 3A, 4A, 5A) inside said drum, means to detect the electric insulation between suitable points inside said drum, wherein a plurality of insulating supports (2, 3, 4, 5) placed against said deadening band are provided, said supports being able to carry a respective said baffle; said

means comprise at least two baffles (2A, 3A) to which respective connections (7A, 8A) are associated, able to electrically connect said baffles to respective and reciprocally insulated portions placed on the outer surface of said drum.

Preferably on said deadening band, but under said supports, a further metallic band into contact with said deadening band, is placed.

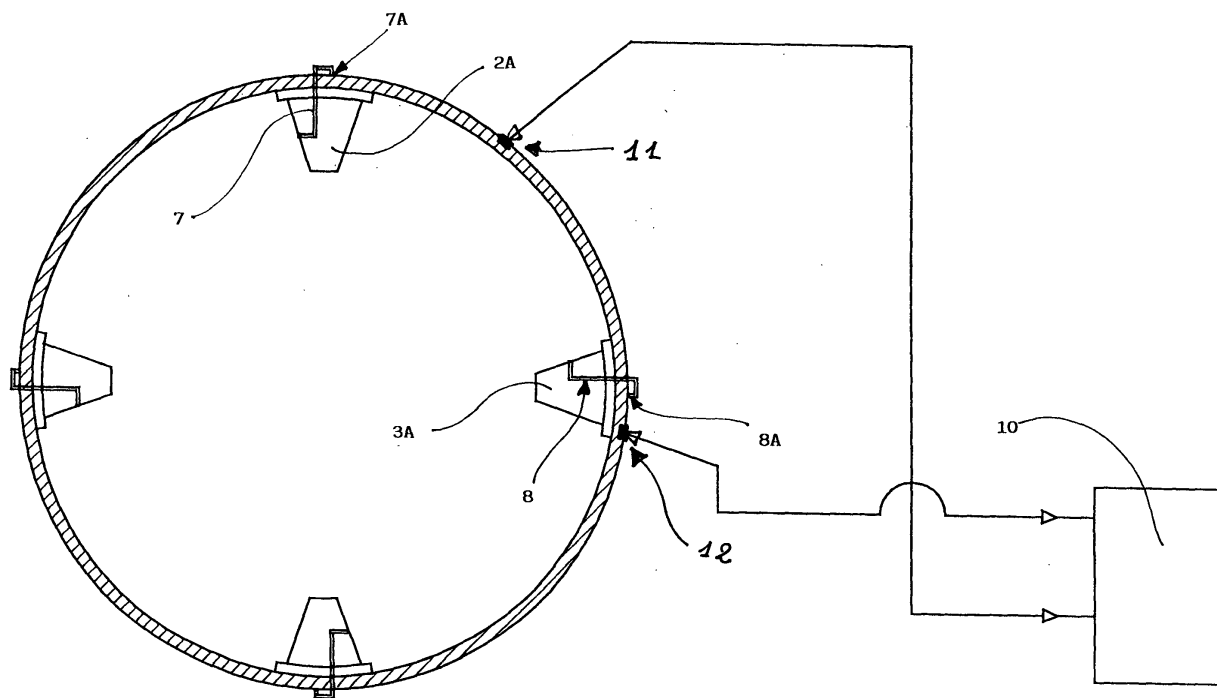


Fig. 3

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Description

[0001] The instant invention refers to a kind of condenser drying machine, preferably of a household type, showing a particularly silent working during all times of drum operation.

[0002] Largely known in the art is the general requirement of reducing as much as possible the noise generated by household appliances in their operation; such facts has been extensively described in the European Patent Application n. 04 100 491.2, filed by the same Applicant.

[0003] During a drying cycle the laundry contained in the drum is continuously lifted to the inner top side of said drum due to the lifters rotation, and if the drum rotation speed is low enough the same laundry will fall down on the drum bottom, and then is again lifted with a repeating and uninterrupted motion.

[0004] Also largely known in the art is the fact that the typical rumble of the laundry continuously falling down on the drum bottom is perceived as being particularly high, especially in the night time, since it is aggravated by the additional noise generated by the fans used to circulate the drying air, and possibly also by the condensing air passing through the condenser in such type of drying machines.

[0005] This problem is particularly annoying when the drying machine operates at a slowed-down speed in order to reduce the noise generated by said air flows; as a matter of fact, during a slowed rotation and after having been lifted to the top, the laundry easier falls-down on the drum bottom, as the centrifugal force in the drum rotating at a lowered speed is no more enough to compensate the gravity force.

[0006] In order to try to reduce such problem, from JP Application No. 06100806 it is known to fix a silencing sheet, made of insulating material, in contact with the internal circumferential metallic surface of the side plate of the rotary drum, and connecting the sheet to the side plate.

[0007] However a further problem arises, when the laundry humidity is detected by electronic means that are able to measure the laundry insulating resistance between the drum and the baffles placed on the internal surface of the drum.

[0008] In the fact the electric insulation generated by said sheet will prevent using the drum metallic surface as an electric contact, differently from the prior art drying machines where the laundry insulating resistance, depending on the relevant humidity, can be detected and measured.

[0009] It would therefore be desirable, and is actually a main purpose of the present invention, to provide a clothes drying machine that will eliminate, or at least reduce the drawback of the noise produced by the laundry falling down on the drum bottom, without missing the possibility of using the drum as an electric contact area of insulation detection.

[0010] According to another purpose of the present invention, this must be applicable also to drying machines whose drum is made of two electrically separated and cylindrical half-drums, according to a well known technique.

[0011] According to a further purpose of the present invention this clothes drying machine shall be able to be easily manufactured using existing, ready available materials and techniques, and be competitive in its construction without suffering any alteration or reduction in the performance and reliability thereof.

[0012] According to the present invention, these aims are reached in a drying machine incorporating the characteristics as recited in the appended claims and including such operating means as described below by mere way of non-limiting example with reference to the accompanying drawings, in which:

- Fig. 1 is a simplified sectional view of the drum of a dryer machine, seen from a section passing on the drum axis, according to the invention,
- Fig. 2 is a simplified sectional view of the corresponding drum, taken from section A - A of fig. 1,
- Fig. 3 is a schematic view of a drum showing an improvement of the invention, referred to the drum showed in fig. 2,
- Fig. 4 is a simplified sectional view of the drum of a dryer machine, seen from a section passing on the drum axis, according to a preferred embodiment of a different improvement of the invention,
- Fig. 5 is a simplified sectional view of the corresponding drum, taken from section B - B of fig. 4,
- Fig. 6 is a simplified sectional view of a drum according to a further improvement of the invention,
- Fig. 7 is a schematic and a symbolic view of a section of the drum according to fig. 6, taken from a section plane orthogonal to the drum axis.

[0013] A laundry drying machine according to the prior art comprises:

- a rotating drum 1,
- a plurality of baffles 2A, 3A, 4A, 5A placed inside said rotating drum and solidly engaged to it,
- means able to detect and measure the electric insulation resistance between said drum and said baffles connected among them.

[0014] Furthermore said drying machine is also provided with a deadening band 6, that covers the internal cylindrical surface of the drum and is interposed between it and the baffles, as showed in figures 1 and 2.

[0015] According to the invention, a plurality of insulating supports 2, 3, 4, 5, made preferably of plastic material, are mounted into contact with said internal surface of the drum, and said baffles 2A, 3A, 4A, 5A are engaged on respective said supports.

[0016] Furthermore two adjacent baffles 2A and 3A

are provided with means, able to detect the insulating resistance inside the drum, mainly consisting of respective contacts 7, 8 which connect said baffles, made of metal and therefore electrically conductive, to respective electric connections 7A and 8A.

[0017] These connections electrically link said baffles to respective and electrically separated portions A and B (here represented on the opposites bases of said drum).

[0018] To these portions are then connected two sliding electrical contacts 11, 12 able to connect said drum portions to a detecting and measuring means 10, represented only symbolically as well known in the art.

[0019] A typical solution is to connect a drum base "A" to the perimetral deadening band 6, and to use said sub-assembly constituted by said base and said band 6 as a first point where to measure the insulation current, and to use the remaining base "B" as a second measuring point.

[0020] As clearly showed in fig. 3, said two connections 7A and 8A, connecting the respective baffles 2A and 3A, do pass both through the drum wall 1, and through said deadening band 6, and also through the respective supports 2, 3.

[0021] Of course said connections are insulated with respect to the outside, and especially with respect to the drum, in order to avoid the risk of shorting the baffles between which the insulating resistance has to be measured.

[0022] In order to improve the precision and the stability of the measured insulation, it is also desirable that the baffles used for the insulation measure are as closest as possible, and therefore two adjacent baffles will be preferably selected, as symbolically showed in fig. 3.

[0023] It will also easily understood that, in order to obtain the best measure precision and stability, all baffles are so construed and arranged to give a valid contribution to said measure and therefore they are split into two distinct groups, wherein the baffles of a first group are electrically connected among them, and the same thing for the baffles of the second group.

[0024] It will be then apparent that the measure of the insulation resistance must be carried out between the two separate sliding connections 11, 12, each of which is linked to a respective group of baffles, connected as just described.

[0025] Moreover it has to be remarked, as practically experienced, that if said baffles are grouped in a way that to a same group belong only baffles alternated each other on the inner surface of the drum, then the measure becomes more precise and stable as there is a greater probability that a part of the laundry is in the same time into contact with two adjacent baffles, that therefore have to belong to the two different groups, whereon the insulating resistance measure is taken out.

[0026] However the proposed solution, although effective from the point of view of the requested result of a noise reduction, shows the "user unfriendly" drawback

that the drum inner wall does not appear anymore shining and reflecting, as in the conventional drums made of stainless steel, but unavoidably shows the dull appearance of the deadening band.

[0027] In order to avoid such problem, an advantageous improvement is here proposed; it consists in that on said deadening band a further metallic band 14 is overlapped, made for instance even in stainless steel, coated with copper or nickel etc., as exemplified in fig. 4, showing a front section of the drum wall orthogonal to the "X" drum axis, and in the fig. 5 showing the corresponding view of the drum as per the section B - B of fig. 4.

[0028] Such further band 14 must then be wholly placed in close contact with said deadening band 6, but also under said insulating supports 2, 3, 4, 5 bearing the respective baffles, so as the previously existing situation, relevant to the electrical connections before described, will not be modified.

[0029] With reference to the possible question of a consequent cost increase, it must be remarked that, as said metallic band 14 is given only for aesthetic reasons, and not for mechanical and structural reasons, it can be made with a very thin thickness, so avoiding useless additional costs.

[0030] Furthermore in this case the drum is no more visible from an user looking into the drum from outside the machine; therefore the drum can be made with a normal dull metal sheet, quite cheaper of the stainless steel sheet normally used.

[0031] As a conclusion the cost increase with the suggested solutions does result basically negligible.

[0032] The possibility of using a metallic wall with sound damping properties is, in itself, known in the art; for instance the Company Thyssen-Stahl has developed a sandwich sheet, commercially known as TRITEC, that is a material comprising two metal outer "skins" and a viscoelastic plastic core layer.

[0033] The just described solution allows a further advantageous improvement and an use broadening; indeed it has to be considered, as known in the art, that the electric signal derived from the baffles, and finally measured, is as much stable and representative of the real laundry humidity as much the contacts of the measured signal are close to each other.

[0034] In the just described solutions the measurement contacts are the adjacent baffles, and their distance is obviously remarkable.

[0035] More over it is known that presently it is preferred to use metallic drums made with two corresponding and semicircular semi-drums 1A, 1B, suitably coupled to each other through a ring-shaped and fitting element 15; each of said semi-drums 1A, 1B is connected to a corresponding base of the drum, respectively 1AA and 1BB, as shown in fig.6. Such constructive arrangement is employed when it is desired to take the signal not from the drum external cylindrical band, but from their two bases, or in any case outside from said drum

band.

[0036] Such a solution is preferred for well known reasons that therefore will not be repeated.

[0037] Do to the above, it was observed that when the described solution is used, that is the metallic plate 14 is overlapped by the deadening band 6, then the distance "d" between said plate and the baffles is due only to the thickness of said supports, of about 0,5 mm., that is a very smaller distance to the distance between adjacent baffles (see fig. 5).

[0038] The instant improvement therefore takes advantage of such a very little distance "d" to turn the baffles on one side, and the metallic band 14 on the other side, into respective contacts of the measurement circuit of the insulation resistance inside the drum; to this purpose, and with reference to fig. 6, the instant improvement uses that metallic band 14 as one of the measure contact, and the baffles, one or more of them, and preferably all of them for obvious reasons, and connected among them, as the other measure contact.

[0039] To implement such purpose, each of the baffles 20, 21, 22 and 23, that are selected as one common contact are linked with respective connections 20A, 20B, 20C, 20D able to electrically connect them to the first semi-drum 1A; the second contact is obtained by connecting the second semi-drum 1B to said metallic band 14 through a respective passing-through electric connection 30 (Fig. 7).

[0040] Said connections 20A-20D are obviously insulated with respect to the surrounding elements, and preferably they can ordinarily cross the respective said supports 2-5 said metallic band 14 and said deadening band 6, and at last go into contact with said first semi-drum 1A; to its turn the connection 30 crosses said deadening band 6 and said metallic plate 14, and then connects to the respective semi-drum 1B.

[0041] Fig. 7 symbolically illustrates such solution; said figure is a representation of the projection on a plane orthogonal to the drum axis "X" both of a portion of the semi-drum 1A, to which said connections 20A, 20B, 20C, 20D are terminated, and of a portion of the semi-drum 1B, (represented by the part contained in the curved lines "K") associated with said connection 30 linking it to said metallic band 14.

[0042] From said electrically insulated semi-drums 1A and 1B the respective signals are then taken through suitable sliding contacts 35, 36, and at last processed by known means.

Claims

1. Laundry drying machine comprising:

- a rotating drum (1),
- a deadening band (6) placed into contact on the cylindrical internal surface of said drum,
- a plurality of baffles (2A, 3A, 4A, 5A) placed in-

side said drum and near it,

- means able to detect the electric insulation between suitable points inside said drum,

characterised in that

a plurality of insulating supports (2, 3, 4, 5) placed against said deadening band is provided, said supports being able to carry respective said baffles (2A, 3A, 4A, 5A).

2. Machine according to claim 1, **characterised in that** said means are also comprising at least two baffles (2A, 3A) to which respective connections (7A, 8A) are associated, able to electrically connect said baffles to respective and reciprocally insulated two portions (A, B) placed on the outer surface of said drum.

3. Machine according to claim 2, **characterised in that** the baffles linked to a first portion (A) of the drum are alternated to the baffles linked to the second drum portions (B).

4. Machine according to any of the claims 2 or 3, **characterised in that** a further metallic band (14) is placed on said deadening band (6).

5. Machine according to claim 4, **characterised in that** said supports (2, 3, 4, 5) are mounted on said metallic band (14).

6. Laundry drying machine comprising:

- a rotating drum (1) made of a first and of a second cylindrical and electrically insulated semi-drums (1A, 1B)
- a deadening band (6) placed into contact on the cylindrical internal surface of said drum,
- a plurality of baffles (2A, 3A, 4A, 5A) placed inside said drum and near it,
- means able to detect the electric insulation between suitable points inside said drum,

characterised in that

- a plurality of insulating supports (2, 3, 4, 5) placed against said deadening band is provided, said supports being able to carry a respective said baffle (2A, 3A, 4A, 5A),
- a further metallic band (14) is placed on said deadening band (6), said supports being mounted on and in contact with said metallic band (14).

7. Machine according to claim 6, **characterised in that:**

- a plurality of electrical connections (20A, 20B,

20C, 20D) are provided between each or some of these baffles (2A, 3A, 4A, 5A) and a first semi-drum (1A),

- a separate connection (30) is provided between said further metallic band (14) and said second semi-drum (1B).

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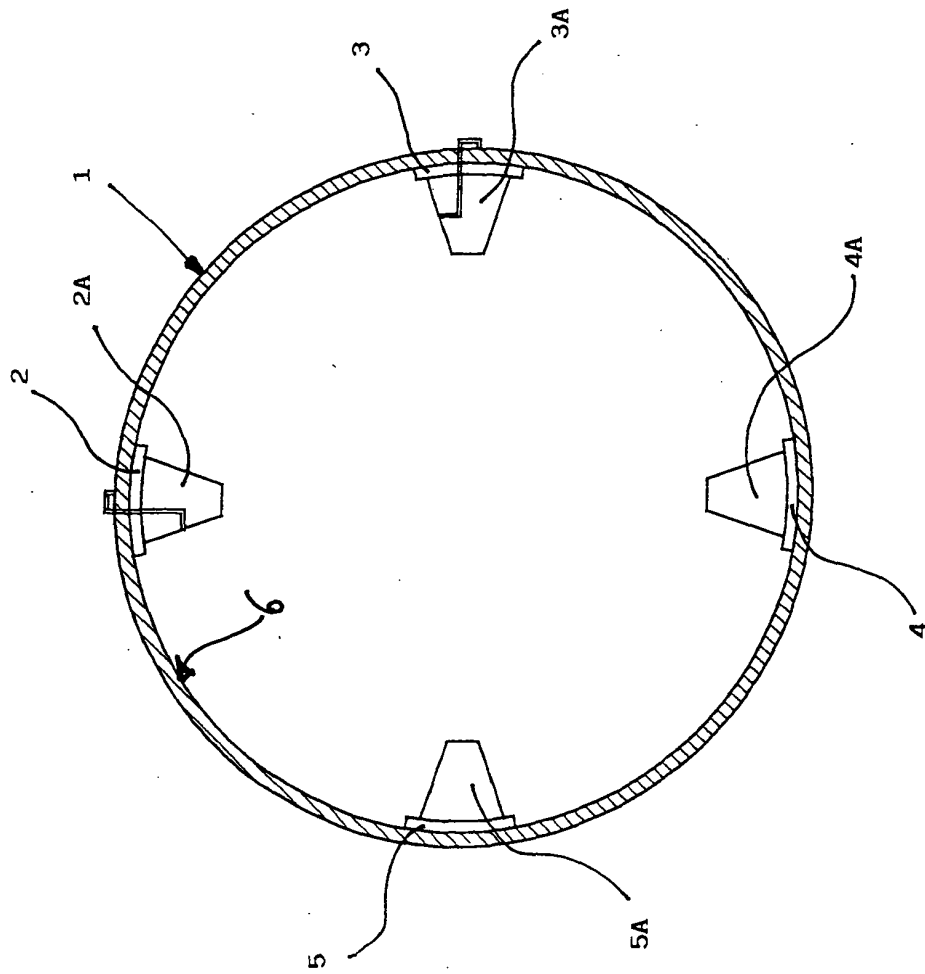


Fig. 2

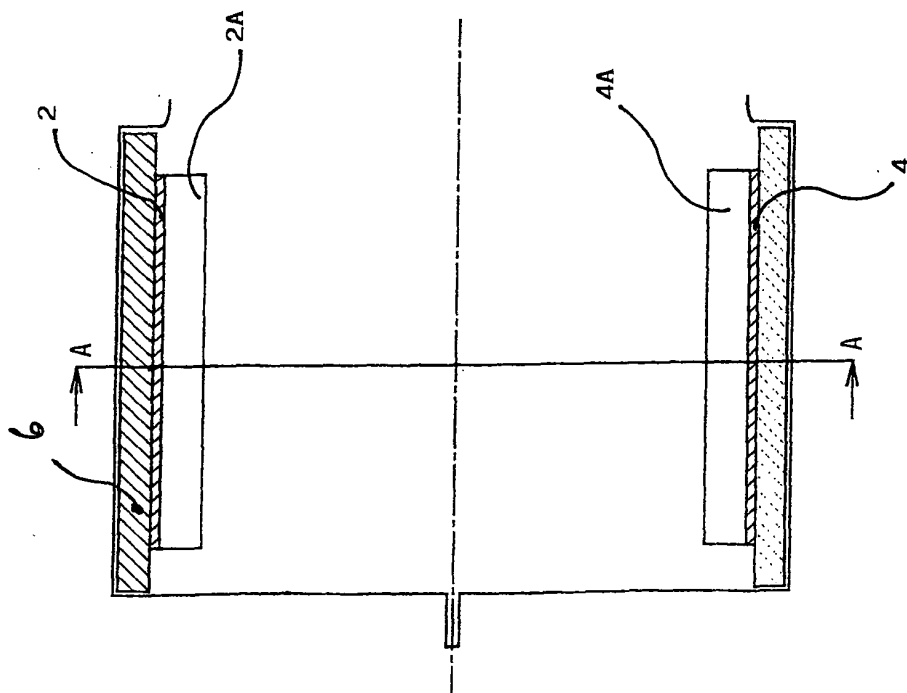


Fig. 1

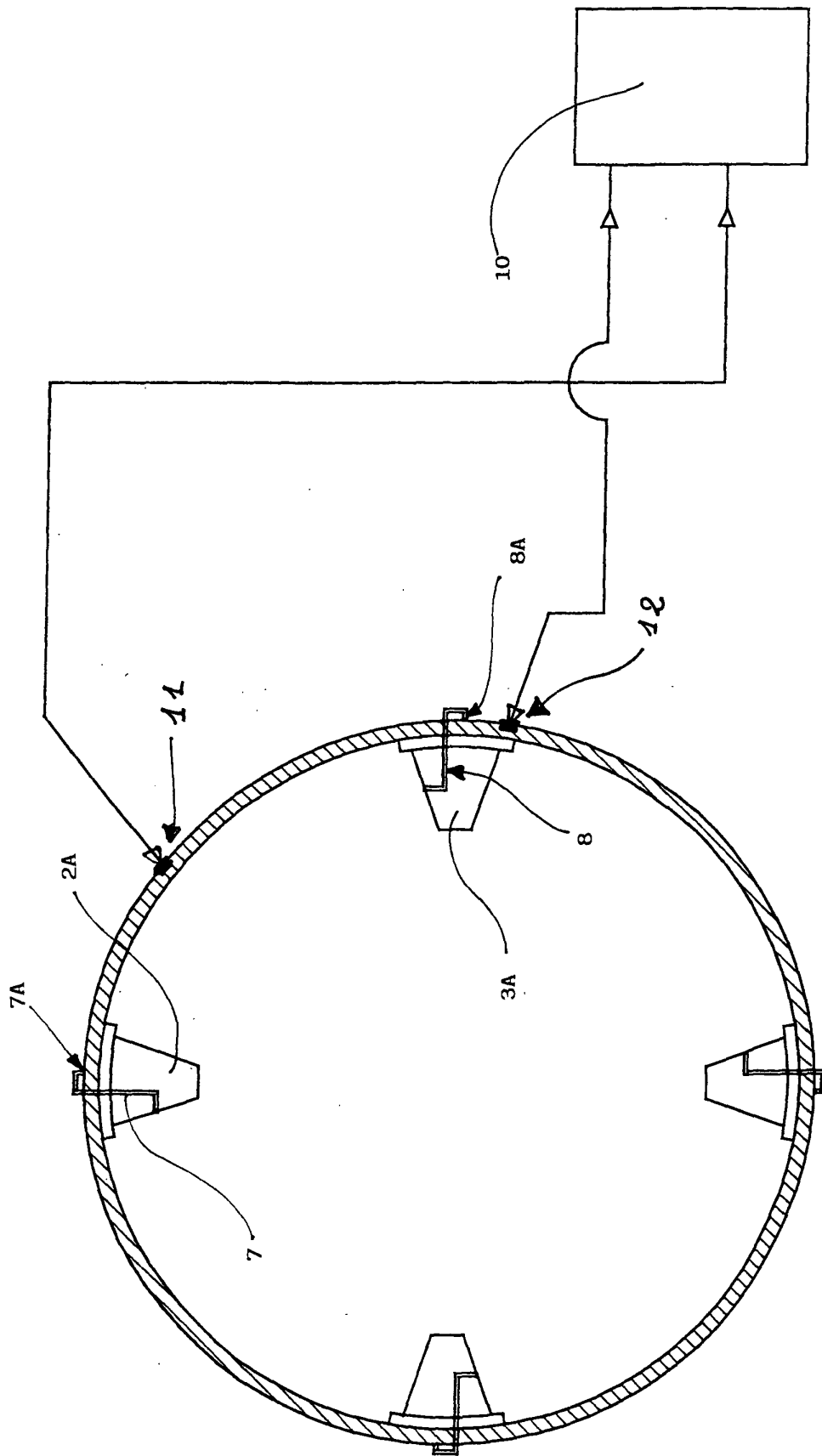
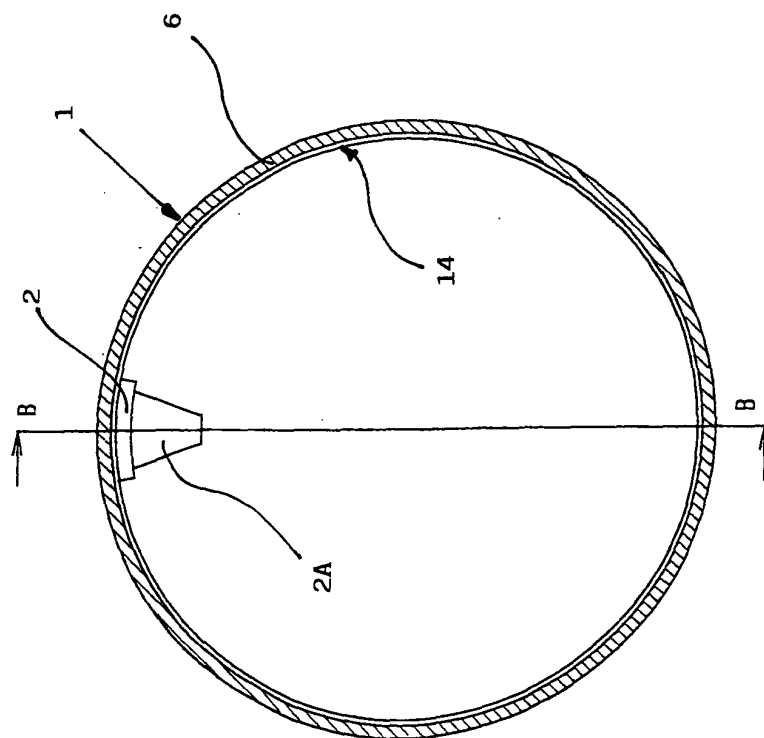
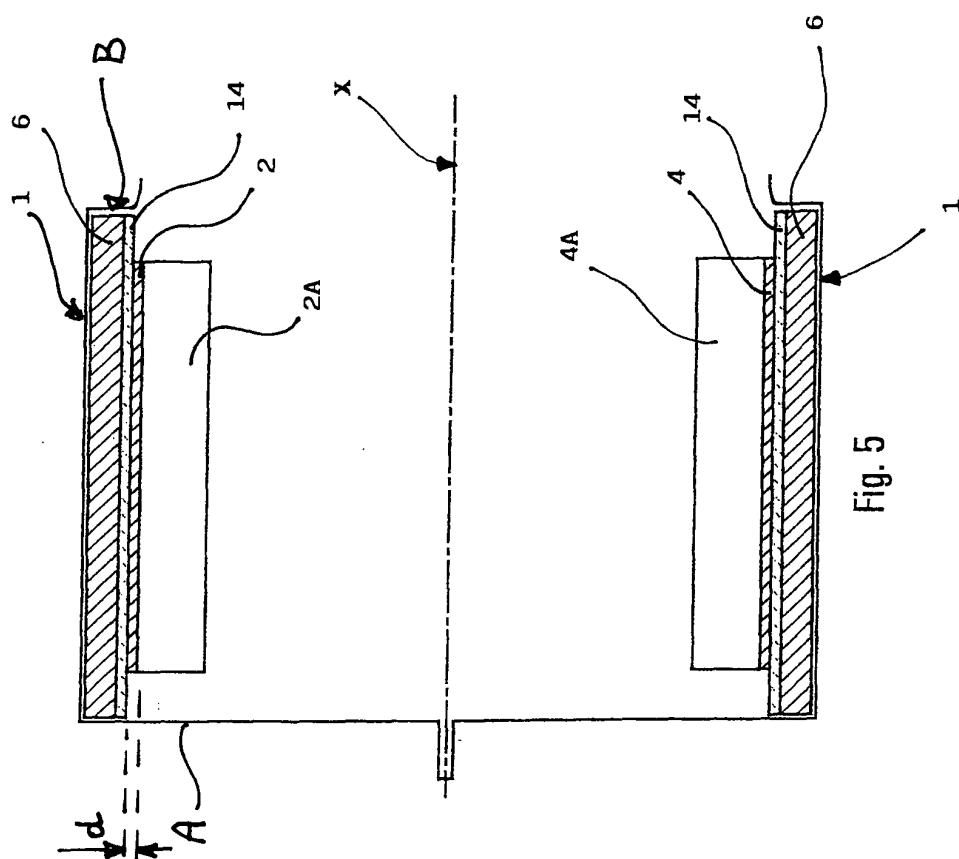
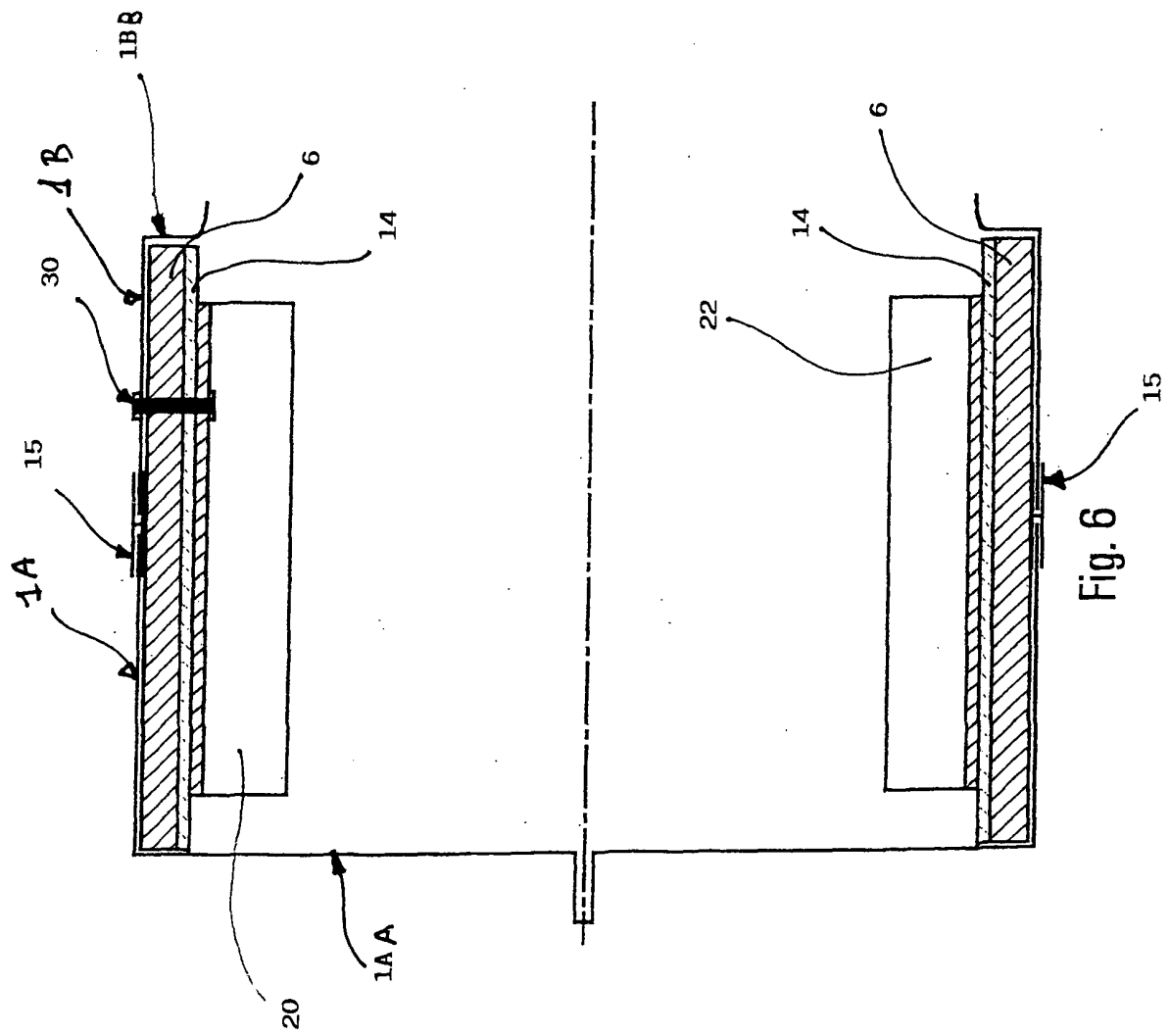


Fig. 3





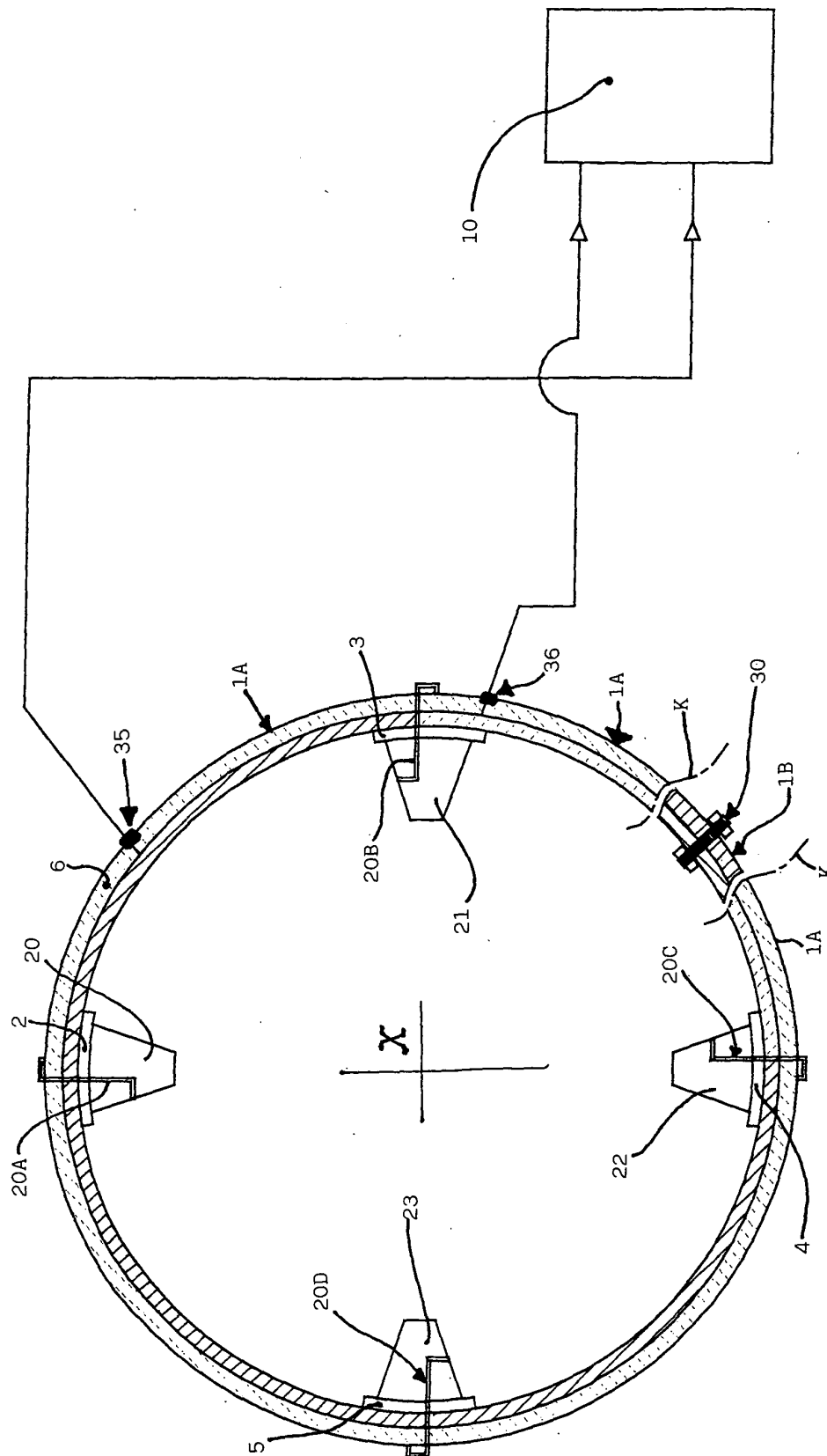


Fig 7



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 04 10 1157

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Place of search Munich		Date of completion of the search 2 August 2004	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			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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