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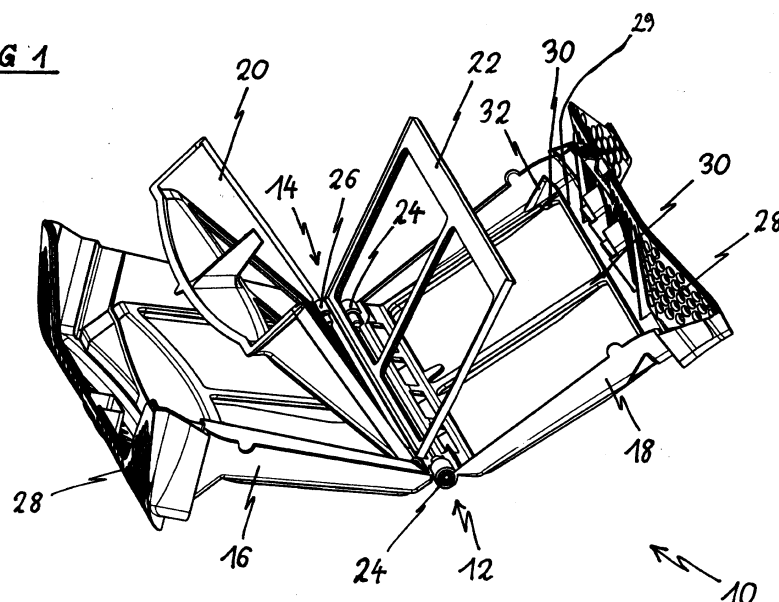
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(54) A drying air filter for a laundry dryer and a laundry dryer

(57) The present invention relates to a drying air filter (10) for a laundry dryer (40). The drying air filter (10) comprises an outer shell (12) and an inner shell (14), wherein the outer shell (12) encloses the inner shell (14) in a closed state of the drying air filter (10). The outer shell (12) includes a first outer part (16) and a second outer part (18). The inner shell (14) includes a first inner part (20) and a second inner part (22). The first outer part (16) and the second outer part (18) are pivoted by an outer hinge (24) in order to open and close the outer shell (12). The first inner part (20) and the second inner part

(22) are pivoted by an inner hinge (26) in order to open and close the inner shell (14). The inner hinge (26) is arranged inside the outer shell. At least one of the first outer part (16) and second outer part (18) includes cam surfaces (30, 32) for interacting with the first inner part (20) and/or the second inner part (22) of the inner shell (14), so that the first inner part (20) and/or the second inner part (22) are guided by the cam surfaces (30, 32), while the outer shell (12) is closed. Further, the present invention relates to a laundry dryer (40) with a drying air filter (10).

FIG 1

Description

[0001] The present invention relates to a drying air filter for a laundry dryer. Further, the present invention relates to a laundry dryer with a drying air filter.

[0002] In a laundry dryer of condense type, one removable drying air filter is placed in the drying air stream duct. In particular, the drying air filter is placed in a section of the drying air stream duct, which faces the rotatable laundry drum. In this position, the drying air stream leaves the laundry drum and proceeds in the duct leading to an air moisture condensing unit.

[0003] The drying air filter is accessible for removal by opening the door. The fluff generated inside the laundry drum by laundry to be dried is collected by the drying air filter. However, due to its geometry, it is possible that the fluff by-passes the drying air filter and goes directly to the air moisture condensing unit. The fluff obstructs the drying air filter during the drying cycles and reduces the overall performances of the laundry dryer.

[0004] DE 84 37 357 U1 discloses a drying air filter having multiple filtering members nested one into the other in order to improve filter efficiency. When the drying air filter with the multiple filtering members nested one into the other is used in a drying air stream duct, the handling of said drying air filter becomes complicated, especially when a user has to clean the drying air filter after the laundry drying process. Often, the inner filtering members, once opened for cleaning, are not appropriately repositioned in a closed configuration. Thereby the outer filtering members are prevented to be repositioned in the right position for allowing the filter to be re-placed into its seat formed in the drying air stream duct. If the drying air filter remains partly open its filtering efficiency is compromised, and the overall performances of the laundry dryer are negatively affected because of fluff deposition on components of the laundry dryer, in particular the air moisture condensing unit.

[0005] Furthermore, the insertion operation of the partly opened drying air filter inside its seat formed on the drying air stream duct may cause damages to the filter. This does not only compromise its filtering efficiency, but also requires a complete substitution of the drying air filter. It would be desirable to have a drying air filter with simplified handling operations, so that the user is not requested to carry out difficult operations for opening and/or closing the drying air filter for cleaning. It would be also desirable to have a drying air filter, whose multiple filtering members can be moved without reciprocal interference, which may cause damages to the filter components.

[0006] It is an object of the present invention to provide a drying air filter for a laundry dryer, which overcomes the problems mentioned above.

[0007] The object of the present invention is achieved by the drying air filter according to claim 1.

[0008] The present invention relates to a drying air filter for a laundry dryer, wherein:

- the drying air filter comprises an outer shell and an inner shell,
- the outer shell encloses the inner shell in a closed state of the drying air filter,
- 5 - the outer shell includes a first outer part and a second outer part,
- the inner shell includes a first inner part and a second inner part,
- 10 - the first outer part and the second outer part are pivoted by an outer hinge in order to open and close the outer shell,
- the first inner part and the second inner part are pivoted by an inner hinge in order to open and close the inner shell,
- 15 - the inner hinge is arranged inside the outer shell, and
- at least one of the first outer part and second outer part includes cam surfaces for interacting with the first inner part and/or the second inner part of the inner shell, so that the first inner part and/or the second inner part are guided by the cam surfaces, while the outer shell is closed.
- 20

[0009] The main feature of the present invention is the arrangement of cam surfaces guiding the first inner part and/or the second inner part, while the outer shell is closed, so that the first inner part and/or the second inner part are positioned in a predetermined way inside the outer shell. This contributes to a sealed drying air filter, so that the fluff in the drying air stream channel of the laundry dryer is reduced.

[0010] Preferably, the drying air filter is formed in a book-like manner. The book-like manner allows an easy handling of the drying air filter.

[0011] In particular, the first outer part, the second outer part, the first inner part and/or second inner part are formed as a frame in each case, wherein the inner portion of said frame is covered or coverable by a filtering net.

[0012] Further, the first outer part and/or the second outer part may include first cam surfaces and second cam surfaces, wherein the first cam surfaces interact with the one of the first inner part and second inner part and the second cam surfaces interact with the other one of the first inner part and second inner part.

[0013] Preferably, the cam surfaces are formed as slanted planes or ramps.

[0014] In particular, the first cam surfaces and the second cam surfaces are dimensioned in such a way, that a sealing between the first inner part, the second inner part and at least one of the one of the first outer part and second outer part is obtained.

[0015] Moreover, the first outer part or the second outer part, respectively, and the cam surfaces are formed as a single-piece part.

[0016] Furthermore, the cam surfaces are arranged at the first outer part and/or second outer part opposite to the outer hinge.

[0017] Additionally, the first outer part and/or second outer part may include a perforated grid arranged oppo-

site to the outer hinge.

[0018] Preferably, the plane of the perforated grid extends perpendicular to the main plane of the drying air filter.

[0019] Further, the drying air filter may include at least one connecting device comprising a connecting embossment and a connecting groove, wherein the connecting embossment and the connecting groove are formed complementary to each other.

[0020] For example, the connecting embossment is formed on one of an outer part of the outer shell or an inner part of the inner shell and the connecting groove is formed on the other one of the inner part of the inner shell or the outer part of the outer shell.

[0021] In particular, the connecting embossment and the connecting groove are arranged opposite to the outer hinge and inner hinge, respectively.

[0022] Moreover, the drying air filter may include at least one rib for covering an element of the outer hinge and/or the inner hinge, respectively. The rib protects the element of the hinge against fluff.

[0023] Further, the present invention relates to a laundry dryer with at least one drying air filter mentioned above.

[0024] Novel and inventive features believed to be the characteristic of the present invention are set forth in the appended claims.

[0025] The invention will be described in further detail with reference to the drawings, in which

FIG 1 illustrates a perspective view of a drying air filter for a laundry dryer according to a first embodiment of the present invention,

FIG 2 illustrates a further perspective view of the drying air filter for the laundry dryer according to the first embodiment of the present invention,

FIG 3 illustrates a sectional side view of the drying air filter in an opened state according to the first embodiment of the present invention,

FIG 4 illustrates a sectional side view of the drying air filter in an intermediate state according to the first embodiment of the present invention,

FIG 5 illustrates a sectional side view of the drying air filter in a closed state according to the first embodiment of the present invention,

FIG 6 illustrates a side view of the drying air filter in the closed state according to the first embodiment of the present invention,

FIG 7 illustrates a partial sectional side view of the drying air filter according to a second embodiment of the present invention,

FIG 8 illustrates a partial perspective view of a first outer part of the drying air filter according to the second embodiment of the present invention,

FIG 9 illustrates a partial perspective view of a first inner part of the drying air filter according to the second embodiment of the present invention,

FIG 10 illustrates a sectional side view of a laundry dryer with the drying air filter according to the present invention,

FIG 11 illustrates a perspective view of a basement portion of the laundry dryer with the drying air filter according to the present invention, and

FIG 12 illustrates a perspective view of the laundry dryer with the drying air filter according to the present invention.

[0026] FIG 1 illustrates a perspective view of a drying air filter 10 for a laundry dryer according to a first embodiment of the present invention. The drying air filter 10 is in an open state.

[0027] The drying air filter 10 comprises an outer shell 12 and an inner shell 14. The outer shell 12 includes a first outer part 16 and a second outer part 18. The inner shell 14 includes a first inner part 20 and a second inner part 22. The inner shell 14 is hinged inside the outer shell 12. Further, the first outer part 16 and the second outer part 18 of the outer shell 12 are hinged to each other. In a similar way, the first inner part 20 and the second inner part 22 of the inner shell 14 are hinged to each other. Moreover, the first inner part 20 and the second inner part 22 are hinged at the first outer part 16. The outer shell 12 and the inner shell 14 are separately openable. The inner shell 14 is removable from the outer shell 12.

[0028] The drying air filter 10 is formed in a book-like manner. The first outer part 16 and the second outer part 18 of the outer shell 12 are ideally comparable with a book cover. The first inner part 20 and the second inner part 22 of the inner shell 14 are ideally comparable with book pages.

[0029] The first outer part 16, the second outer part 18, the first inner part 20 and the second inner part 22 are formed as frames. The inner portions of said frames are covered or coverable by a filtering net in each case. The filtering nets are not explicitly shown in FIG 1. Each of the filtering nets extends within one plane.

[0030] The first outer part 16 and the second outer part 18 of the outer shell 12 are connected by an outer hinge 24. The first inner part 20 and the second inner part 22 of the inner shell 14 are connected by an inner hinge 26, wherein said inner hinge 26 is arranged at the first outer part 16 and besides the outer hinge 24.

[0031] The drying air filter 10 includes a perforated grid

28. In this example, said perforated grid 28 includes two fragments. The one fragment of the perforated grid 28 is an integrated part of the first outer part 16, while the other fragment of the perforated grid 28 is an integrated part of the second outer part 18. The fragments of the perforated grid 28 are arranged at the first and second outer parts 16 and 18, respectively, opposite to the outer hinge 24. In a closed state of the drying air filter 10, the plane of the perforated grid 28 extends perpendicular to the main plane of the drying air filter 10. The drying air filter 10 is closable in the book-like manner.

[0032] The second outer part 18 includes first cam surfaces 30 and second cam surfaces 32. In this example, the second outer part 18 includes three first cam surfaces 30 and two second cam surfaces 32. The first cam surfaces 30 and the second cam surfaces 32 are formed as slanted planes. The cam surfaces 30 and 32 are arranged at the second outer part 18 opposite to the outer hinge 28. Further, two of the first cam surfaces 30 and both second cam surfaces 32 are arranged in frame corners of the second outer part 18. The third of the first cam surfaces 30 is arranged at a T-piece besides a central sash bar of the second outer part 18. The second cam surfaces 32 are thicker slanted planes than the first cam surfaces 30.

[0033] When a user closes the outer shell 12, then the first inner part 20 and the second inner part 22 of the inner shell 14 follow the movement independently of their actual positions. The first cam surfaces 30 guide the second inner part 22 of the inner shell 14, so that the second inner part 22 is raised by said first cam surfaces 30. Then, the second inner part 22 is released over a sealing edge 29 formed on an inner surface of the second outer part 18. By this way, a good sealing between the second inner part 22 and the second outer part 18 is obtained.

[0034] The first inner part 20 of the inner shell 14 is guided by the second cam surfaces 32. The first inner part 20 is raised by the second cam surfaces 32 and then released over the sealing edge 29 formed on the inner surface of the second outer part 18. This allows a sufficient sealing between the first inner part 20 and the second outer part 18.

[0035] FIG 2 illustrates a further perspective view of the drying air filter 10 for the laundry dryer according to the first embodiment of the present invention. The drying air filter 10 is in the open state. FIG 2 clarifies the connections between the first outer part 16, the second outer part 18, the first inner part 20 and the second inner part 22.

[0036] The first outer part 16 and the second outer part 18 of the outer shell 12 are connected by the outer hinge 24. The first inner part 20 and the second inner part 22 of the inner shell 14 are connected by the inner hinge 26. The inner hinge 26 is arranged at the first outer part 16 and besides the outer hinge 24.

[0037] Further, the outer hinge 24 comprises a rib 34 for each hinge element of said outer hinge 24. The rib 34 is arranged at the inner surface of the second outer part

18 of the outer shell 12. The rib 34 covers a gap at the hinge elements of the outer hinge 24, when the outer shell 12 is in a closed state. Said gap is not covered by the filtering net.

[0038] FIG 3 illustrates a sectional side view of the drying air filter 10 in an opened state according to the first embodiment of the present invention. A detailed sectional side view A shows an enlarged portion of FIG 3 including the outer hinge 24 and the inner hinge 26.

[0039] The first outer part 16 and the second outer part 18 of the outer shell 12 are connected by the outer hinge 24. The first inner part 20 and the second inner part 22 of the inner shell 14 as well as the first outer part 16 of the outer shell 12 are connected by the inner hinge 26. The inner hinge 26 is arranged at the first outer part 16 and besides the outer hinge 24.

[0040] FIG 4 illustrates a sectional side view of the drying air filter 10 in an intermediate state according to the first embodiment of the present invention. A detailed sectional side view B shows an enlarged portion of FIG 4 with the outer hinge 24 and the inner hinge 26. A further detailed sectional side view C shows another enlarged portion of FIG 4 with the first cam surfaces 30 and the second cam surfaces 32.

[0041] In the intermediate state of FIG 4 the second inner part 22 of the inner shell 14 rests against the first cam surfaces 30. Subsequently, when the first outer part 16 and the second outer part 18 of the outer shell 12 are put together by the user, the first inner part 20 and the second inner part 22 of the inner shell 14 are also folded together. The second cam surfaces 32 acts on the first inner part 20 of the inner shell 14, so that the first inner part 20 is raised by the second cam surfaces 32 and then released over the sealing edge 29 on the inner surface of the second outer part 18. This allows a sufficient sealing between the first inner part 20 and the second outer part 18.

[0042] FIG 5 illustrates a sectional side view of the drying air filter 10 in a closed state according to the first embodiment of the present invention. A detailed sectional side view D shows an enlarged portion of FIG 5 comprising the outer hinge 24 and the inner hinge 26.

[0043] The first outer part 16 and the second outer part 18 of the outer shell 12 have been folded together by the user. The sealing edge 29 on the inner surface of the second outer part 18 includes slanted planes, so that the sealing edge 29 is complementary to the first cam surfaces 30 and/or the second cam surfaces 32.

[0044] Further, a labyrinth coupling may be provided between the first inner part 20 and the second inner part 22 of the inner shell 14. Said labyrinth coupling avoids that drying air with fluff by-passes the drying air filter 10.

[0045] FIG 6 illustrates a side view of the drying air filter 10 in the closed state according to the first embodiment of the present invention. In this state the drying air filter 10 is prepared to be inserted into the laundry dryer.

[0046] FIG 7 illustrates a partial sectional side view of the drying air filter 10 according to a second embodiment

of the present invention. The second embodiment differs from the first embodiment in an additional connecting device. A detailed sectional side view E shows an enlarged portion of FIG 7 with said connecting device.

[0047] The connecting device comprises a connecting embossment 36 and a connecting groove 38. The connecting embossment 36 is formed on the first outer part 16 of the outer shell 12. The connecting groove 38 is formed in the first inner part 20 of the inner shell 14. The connecting embossment 36 on the first outer part 16 and the connecting groove 38 in the first inner part 20 are complementary to each other, so that the connecting embossment 36 engages with the connecting groove 38. Thus, the connecting embossment 36 and the connecting groove 38 form a snap-in mechanism.

[0048] The connecting device allows an improved closing of the drying air filter 10 by the user. Alternatively, the positions of the connecting embossment 36 and connecting groove 38 may be reversed.

[0049] FIG 8 illustrates a partial perspective view of a first outer part of the drying air filter 10 according to the second embodiment of the present invention. A detailed sectional side view F shows an enlarged portion of FIG 7 with the connecting embossment 36.

[0050] The connecting embossment 36 is formed on the first outer part 16 of the outer shell 12. In this example, the connecting embossment 36 is arranged in the centre of the first outer part 16.

[0051] FIG 9 illustrates a partial perspective view of a first inner part of the drying air filter 10 according to the second embodiment of the present invention. A detailed sectional side view G shows an enlarged portion of FIG 9 with the connecting groove 38. The connecting groove 38 is formed in the first inner part 20 of the inner shell 14. The connecting groove 38 and the connecting embossment 36 are complementary to each other and form a snap-in mechanism.

[0052] FIG 10 illustrates a sectional side view of a laundry dryer 40 with the drying air filter 10 according to the present invention. The laundry dryer 40 includes a basement portion 42, a laundry drum 44, a first heat exchanger 46, a second heat exchanger 48, a front door 50 and the drying air filter 10.

[0053] The laundry drum 44 is arranged above the basement portion 42. The first heat exchanger 46 and the second heat exchanger 48 are arranged in the basement portion 42. The front door 50 is arranged in front of the laundry drum 44. The drying air filter 10 is positioned in a lower portion of an intermediate space between the front door 50 and the laundry drum 44. The drying air filter 10 is arranged inside a drying air stream channel between the laundry drum 44 and the heat exchangers 46 and 48.

[0054] In this example, the laundry dryer 40 includes a heat pump system. However, the drying air filter 10 is also suitable for a laundry dryer of the condense type having an air-air type heat exchanger for removing moisture from drying air and an electric heater for increasing

temperature of the drying air.

[0055] FIG 11 illustrates a perspective view of the basement portion 42 of the laundry dryer 10 with the drying air filter 10 according to the present invention. A compressor 52 of the heat pump system is arranged in the basement portion 42. The drying air filter 10 is arranged in the lower portion of the intermediate space between the front door 50 and the laundry drum 44, but it is not explicitly shown in FIG 11.

[0056] FIG 12 illustrates a perspective view of the laundry dryer 10 with the drying air filter 10 according to the present invention. FIG 12 shows the complete laundry dryer 10 of FIG 10 and FIG 11.

[0057] Although illustrative embodiments of the present invention have been described herein with reference to the accompanying drawings, it is to be understood that the present invention is not limited to those precise embodiments, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope of the invention as claimed. All such changes and modifications are intended to be included within the scope of the invention as defined by the appended claims.

25 List of reference numerals

[0058]

10	drying air filter
12	outer shell
14	inner shell
16	first outer part
18	second outer part
20	first inner part
22	second inner part
24	outer hinge
26	inner hinge
28	perforated grid
29	sealing edge
30	first cam surface
32	second cam surface
34	rib
36	connecting embossment
38	connecting groove
40	laundry dryer
42	basement portion
44	laundry drum
46	first heat exchanger
48	second heat exchanger
50	front door
52	compressor

Claims

1. A drying air filter (10) for a laundry dryer (40), wherein:

- the drying air filter (10) comprises an outer shell (12) and an inner shell (14),
 - the outer shell (12) encloses the inner shell (14) in a closed state of the drying air filter (10),
 - the outer shell (12) includes a first outer part (16) and a second outer part (18),
 - the inner shell (14) includes a first inner part (20) and a second inner part (22),
 - the first outer part (16) and the second outer part (18) are pivoted by an outer hinge (24) in order to open and close the outer shell (12),
 - the first inner part (20) and the second inner part (22) are pivoted by an inner hinge (26) in order to open and close the inner shell (12),
 - the inner hinge (26) is arranged inside the outer shell (12), and
 - at least one of the first outer part (16) and second outer part (18) includes cam surfaces (30, 32) for interacting with the first inner part (20) and/or the second inner part (22) of the inner shell (14), so that the first inner part (20) and/or the second inner part (22) are guided by the cam surfaces (30, 32), while the outer shell (12) is closed.
2. The drying air filter according to claim 1,
characterized in that
the drying air filter (10) is formed in a book-like manner.
 3. The drying air filter according to claim 1 or 2,
characterized in that
the first outer part (16), the second outer part (18), the first inner part (20) and/or second inner part (22) are formed as a frame in each case, wherein the inner portion of said frame is covered or coverable by a filtering net.
 4. The drying air filter according to any one of the preceding claims,
characterized in that
the first outer part (16) and/or the second outer part (18) includes first cam surfaces (30) and second cam surfaces (32), wherein the first cam surfaces (30) interact with the one of the first inner part (20) and second inner part (22) and the second cam surfaces (32) interact with the other one of the first inner part (20) and second inner part (22).
 5. The drying air filter according to any one of the preceding claims,
characterized in that
the cam surfaces (30, 32) are formed as slanted planes or ramps.
 6. The drying air filter according to any one of the preceding claims,
characterized in that
the first cam surfaces (30) and the second cam surfaces (32) are dimensioned in such a way, that a sealing between the first inner part (20), the second inner part (22) and at least one of the one of the first outer part (16) and second outer part (18) is obtained.
 7. The drying air filter according to any one of the preceding claims,
characterized in that
the first outer part (16) or the second outer part (18), respectively, and the cam surfaces (30, 32) are formed as a single-piece part.
 8. The drying air filter according to any one of the preceding claims,
characterized in that
the cam surfaces (30, 32) are arranged at the first outer part (16) and/or second outer part (18) opposite to the outer hinge (28).
 9. The drying air filter according to any one of the preceding claims,
characterized in that
the first outer part (16) and/or second outer part (18) include a perforated grid (28) arranged opposite to the outer hinge (28).
 10. The drying air filter according to claim 9,
characterized in that
the plane of the perforated grid (28) extends perpendicular to the main plane of the drying air filter (10).
 11. The drying air filter according to any one of the preceding claims,
characterized in that
the drying air filter (10) includes at least one connecting device comprising a connecting embossment (36) and a connecting groove (38), wherein the connecting embossment (36) and the connecting groove (38) are formed complementary to each other.
 12. The drying air filter according to claim 11,
characterized in that
the connecting embossment (36) is formed on one of an outer part (16, 18) of the outer shell (12) or an inner part (20, 22) of the inner shell (14) and the connecting groove (38) is formed on the other one of the inner part (20, 22) of the inner shell (14) or the outer part (16, 18) of the outer shell (12).
 13. The drying air filter according to claim 11 or 12,
characterized in that
the connecting embossment (36) and the connecting groove (38) are arranged opposite to the outer hinge (24) and inner hinge (26), respectively.
 14. The drying air filter according to any one of the pre-

ceding claims,

characterized in that

the drying air filter (10) includes at least one rib (34)
for covering an element of the outer hinge (24) and/or
the inner hinge (26), respectively.

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- 15.** A laundry dryer (40) comprising at least one drying
air filter (10) according to any one of the claims 1 to
14.

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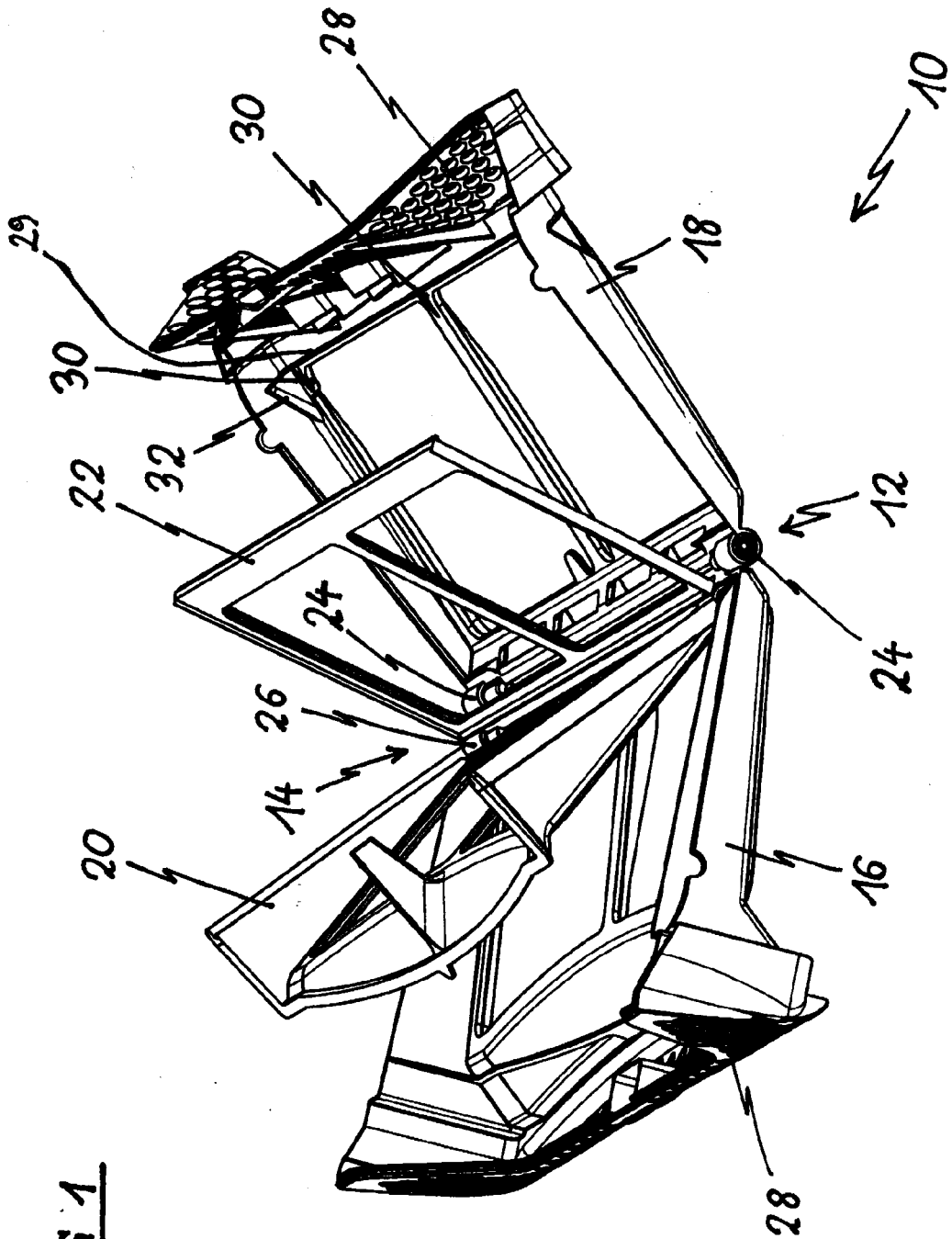


FIG 1

FIG 2

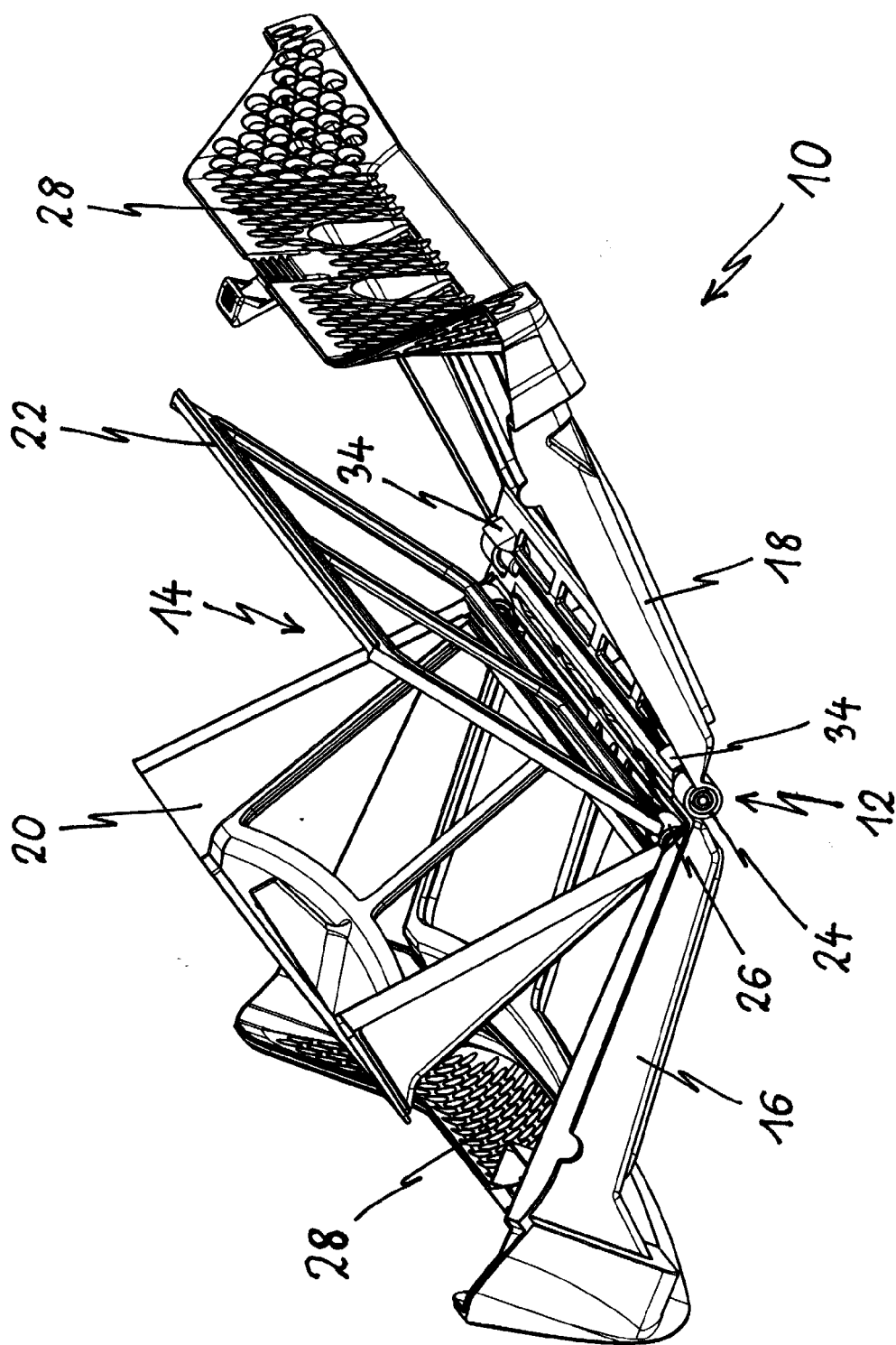


FIG 3

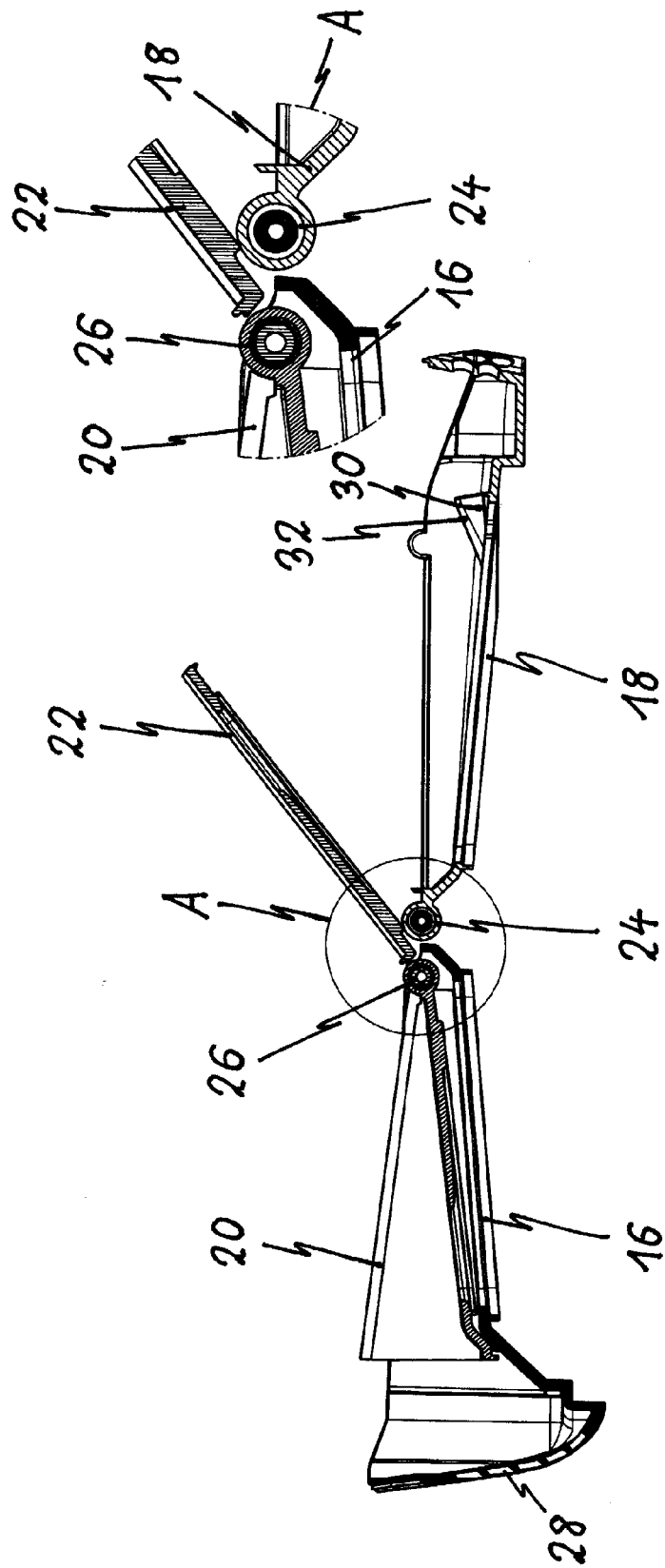


FIG 4

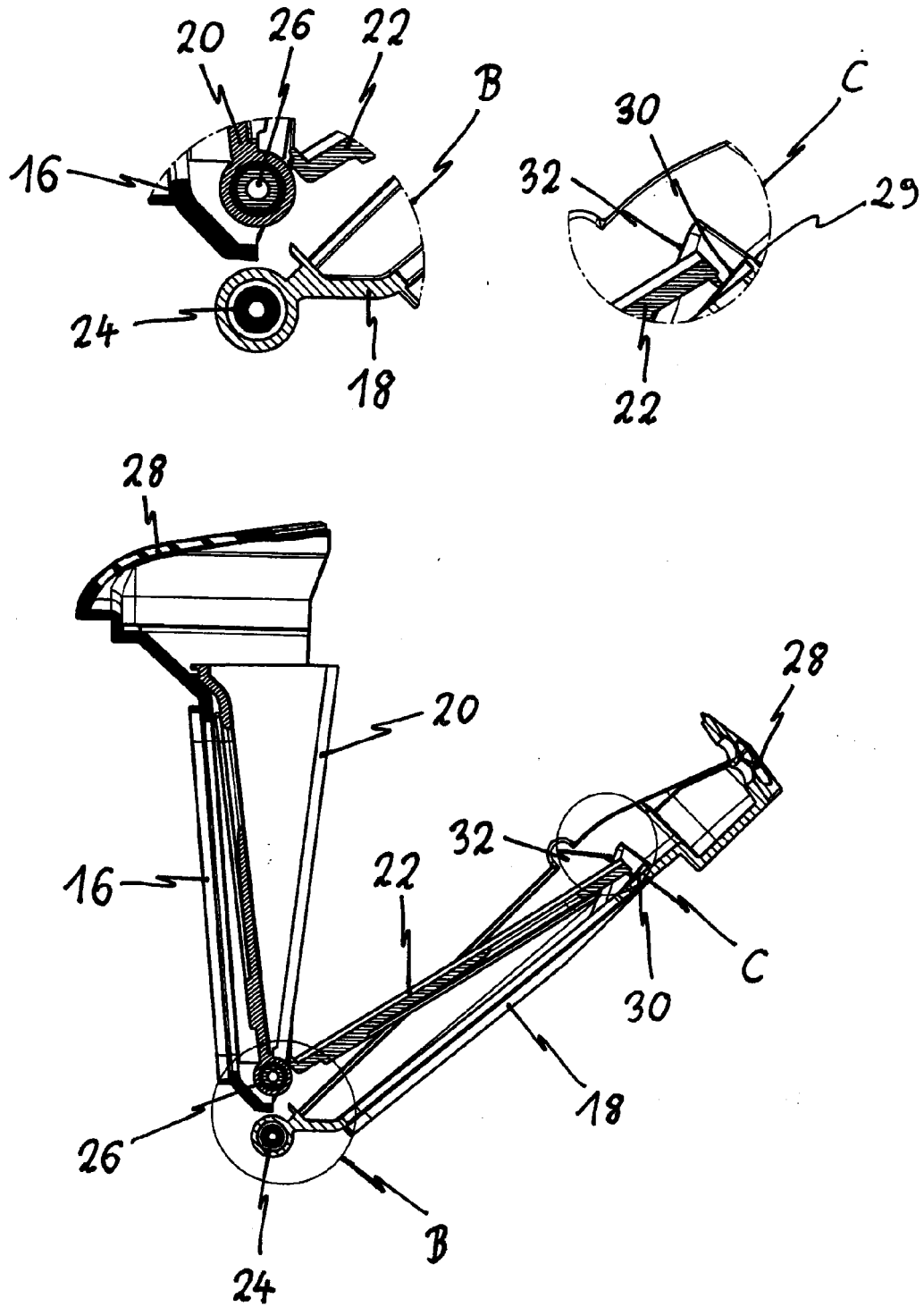


FIG 6

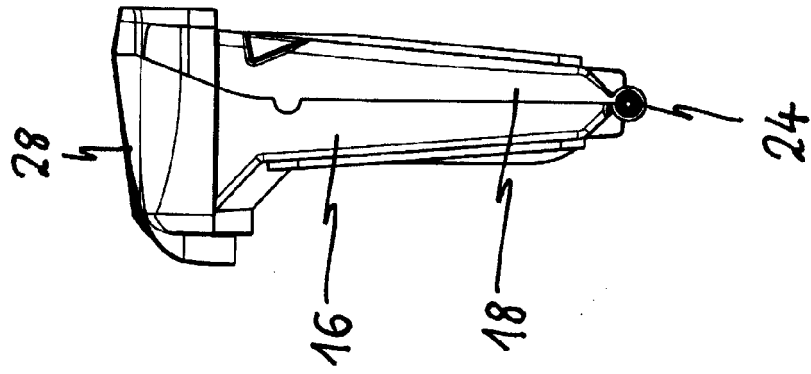


FIG 5

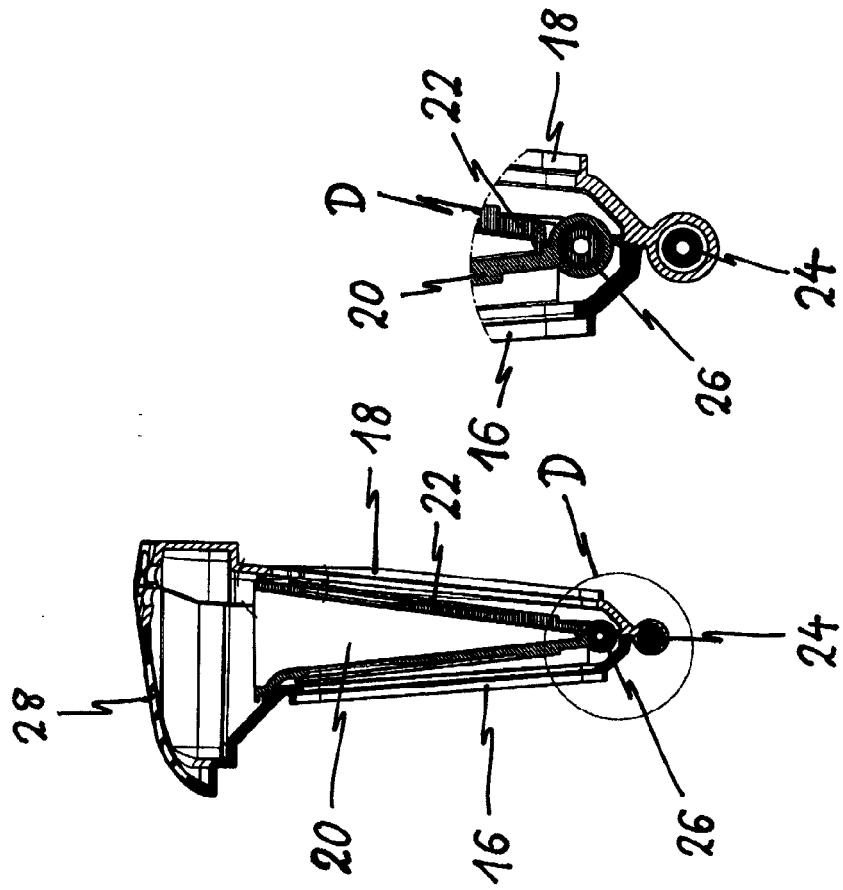


FIG 7

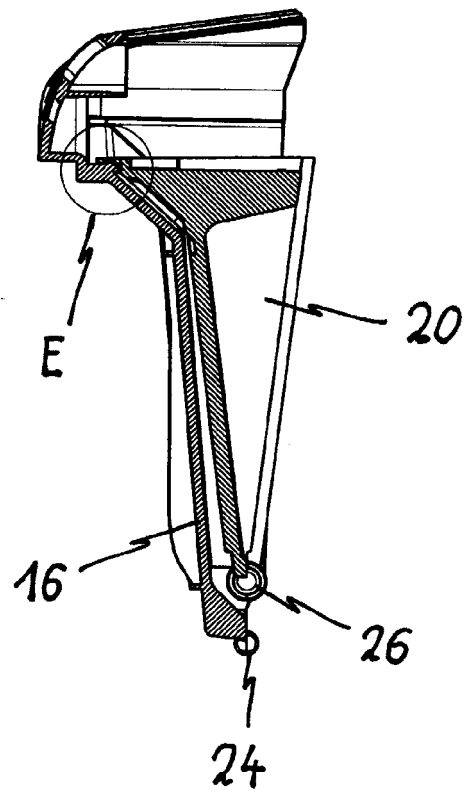
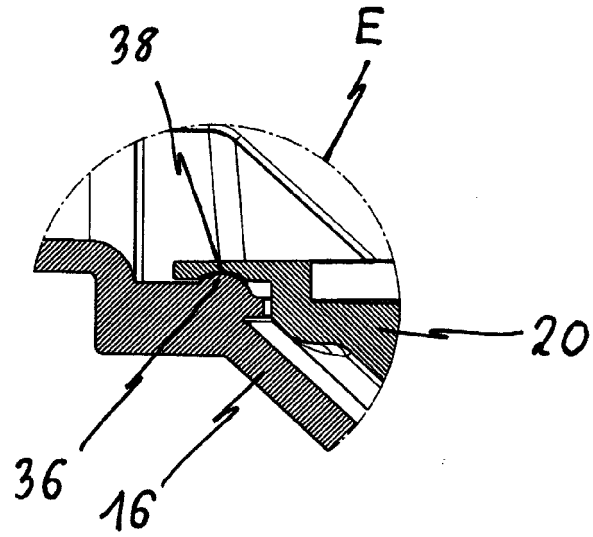


FIG 8

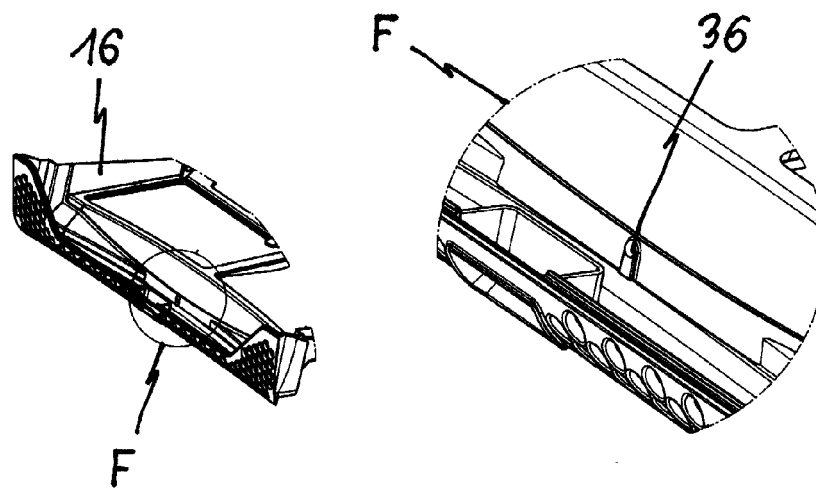


FIG 9

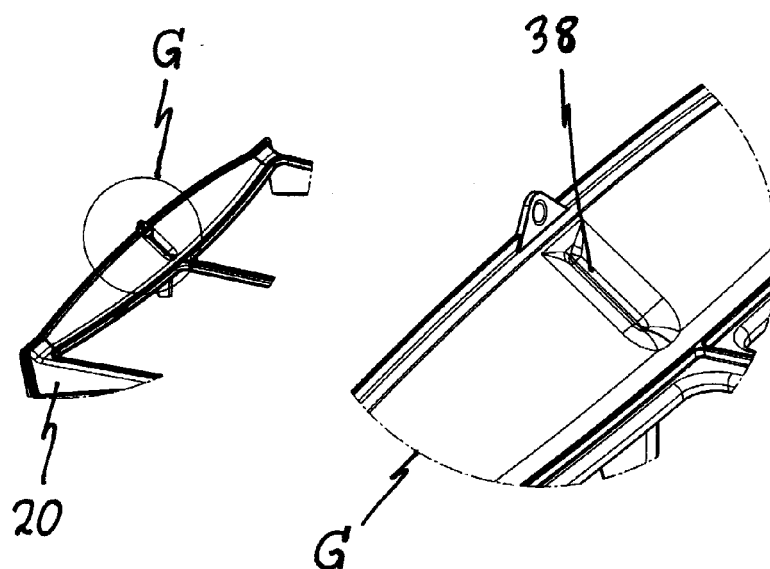


FIG 10

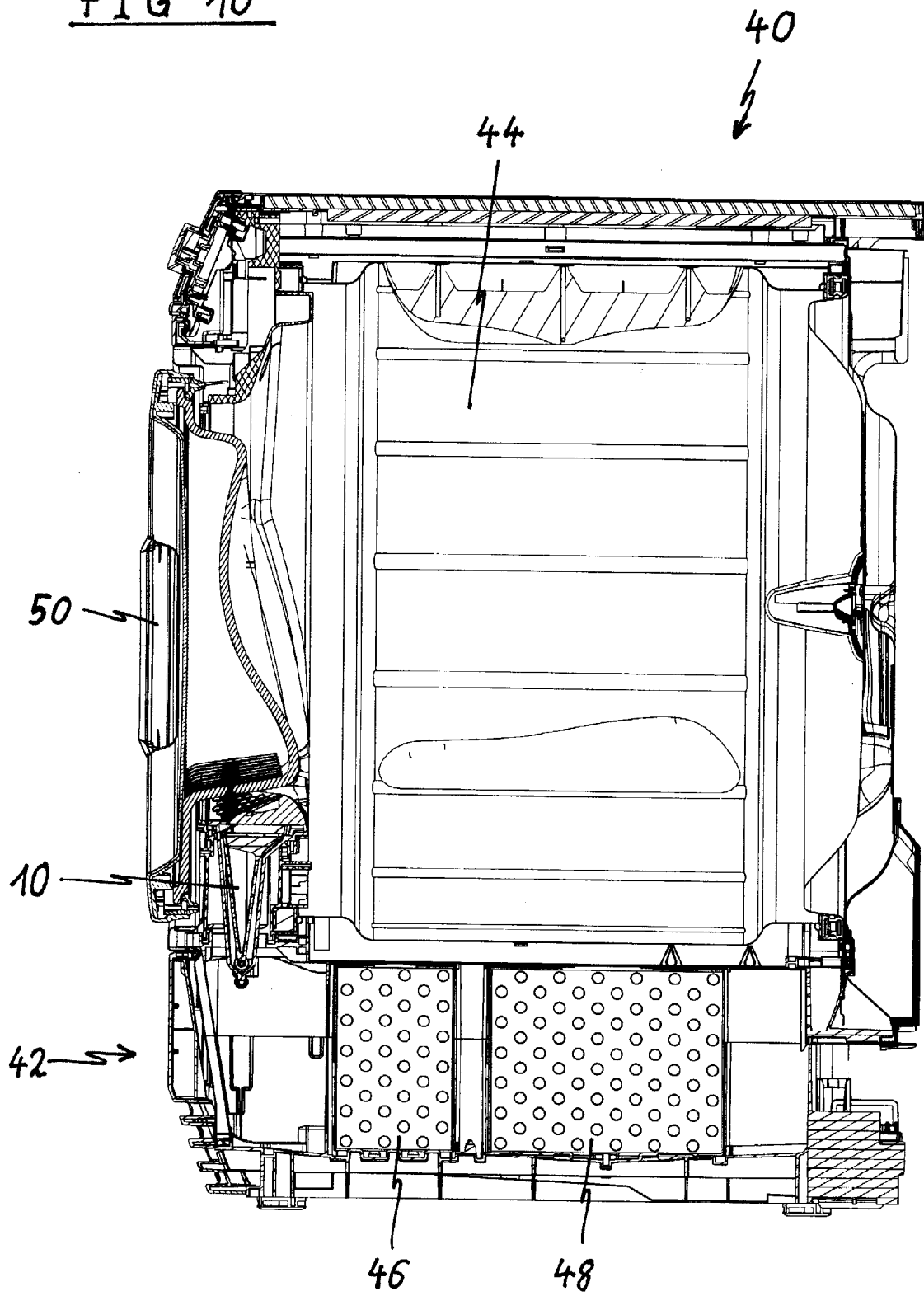


FIG 11

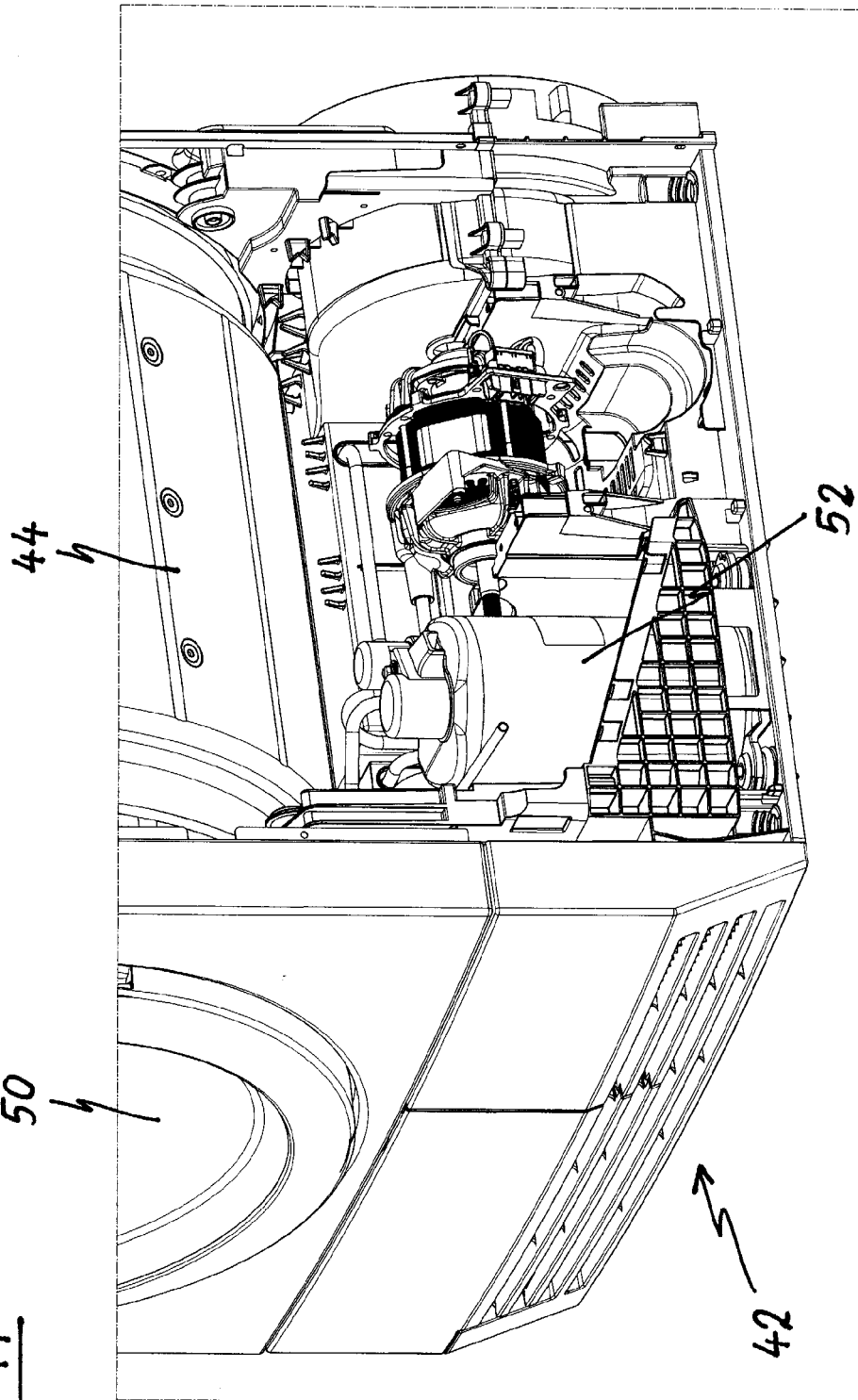
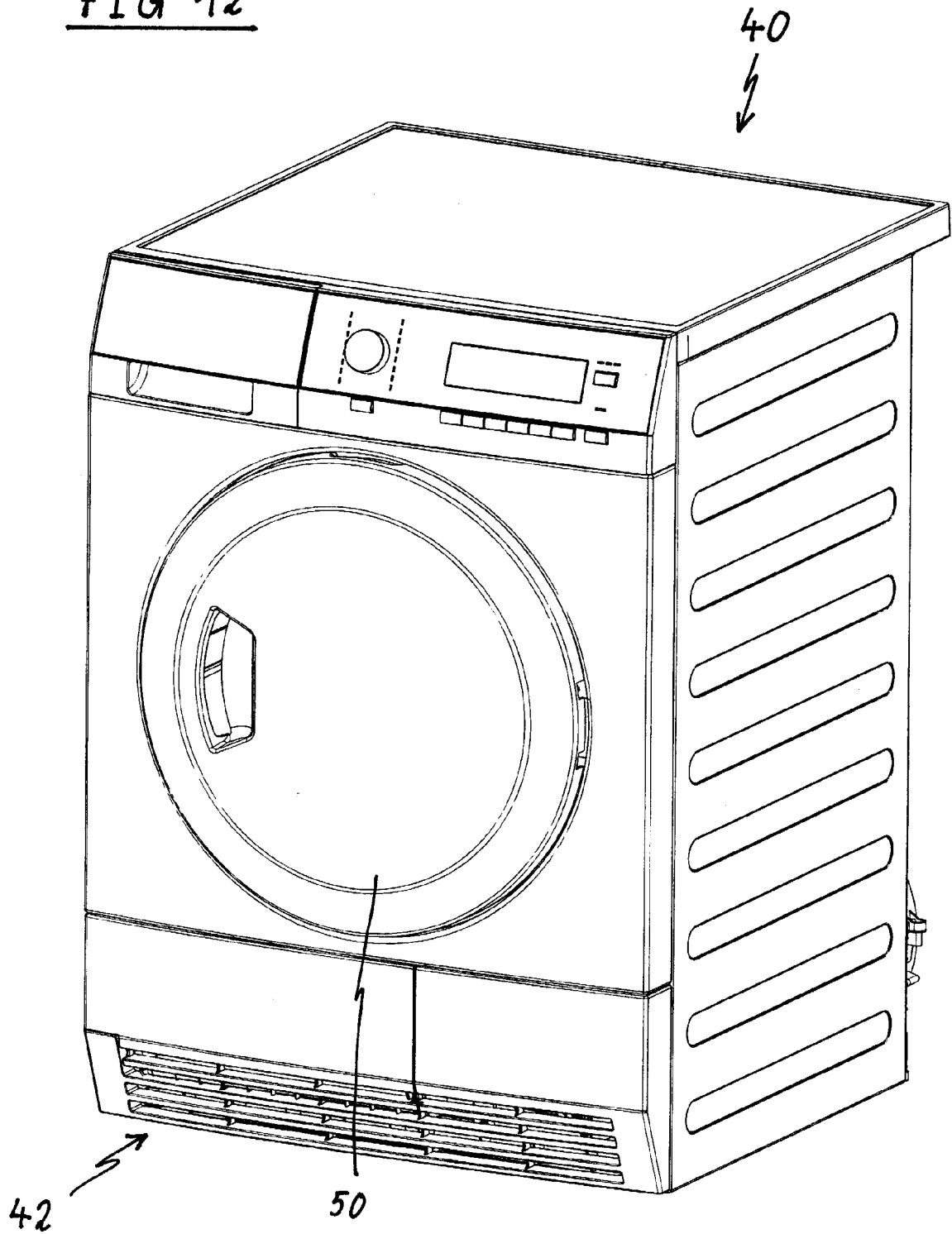


FIG 12





EUROPEAN SEARCH REPORT

 Application Number
 EP 13 18 1963

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			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		9 April 2014	Kising, Axel
CATEGORY OF CITED DOCUMENTS			
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