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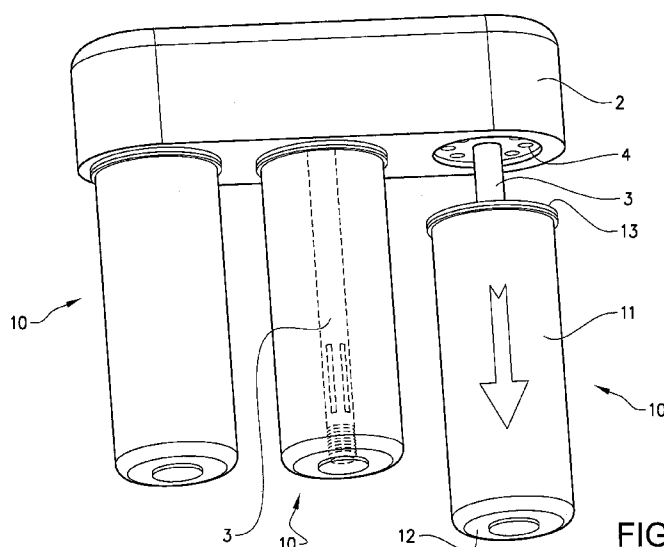


FIG. 2

(57) Abstract: The invention concerns a filter unit (10) for an internal combustion engine (1), wherein the filter unit (10) comprises a filter housing (11) having a cylindrical shape with a closed lower end (12) and means for transfer of a fluid (14, 15) between the filter unit (10) and the engine (1) at an upper end (13) of the filter housing (11), wherein the filter unit (10) comprises mounting means (16) for fastening the filter unit (10) to an engine structure (2) comprising a mounting rod (3), wherein the filter mounting means (16) is configured to engage with corresponding mounting means (5) arranged on the mounting rod (3). The invention is characterized in that the filter unit (10) comprises guiding means (20) configured to axially align the filter unit (10) with the mounting rod (3) before the filter unit (10) is fastened in its intended operative position in relation to the engine structure (2) via the mounting means (16). The invention also concerns an internal combustion engine (1) comprising a filter unit (10) of the above type.

Filter unit**TECHNICAL FIELD**

5 This invention relates to a filter unit for an internal combustion engine according to the preamble of claim 1. In particular, the invention relates to an oil filter for such an engine. The invention also relates to an internal combustion engine comprising such a filter unit.

BACKGROUND OF THE INVENTION

10 A common type of oil filters for internal combustion engines, a so-called spin-on filter design, consists of a housing/canister with a filter element placed inside. The housing has oil inlet and outlet arranged so that oil that flows from inlet to outlet is forced to pass through the filter element. In a common variant, the inlet and outlet are placed together with each other in one end of
15 the housing with a central opening (usually outlet) surrounded by a number of smaller openings (usually inlets). In such a case the filter element normally has the general shape of a hollow cylinder through which the oil flows in a radial direction.

20 The housing is mounted either directly on the engine or remotely with supply and return pipes connecting it to the engine. Conventionally, the central opening is provided with threads for connection to a correspondingly threaded end of a pipe that works both as a mounting rod and an oil conduit for leading filtered oil towards the engine. When changing such an oil filter,
25 the housing is unscrewed from its mount, discarded, and replaced with a new one.

When changing such filters it is important that the new filter is correctly connected to avoid oil leakage and even loss of the entire filter during
30 operation of the engine. At the same time it is important to keep the engine service time at a minimum to increase the up-time for a commercial vehicle or working machine, such as a truck, a wheel loader or a marine engine.

To ensure a secure connection of a conventional spin-on oil filter, the mechanic performing the engine service needs to spend a relatively long time on properly connecting the filter.

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There is thus a need for improved filters or filter connections that reduces the time for changing filter but that still provides for a proper and secure connection of the filter to the engine.

10 SUMMARY OF THE INVENTION

The invention concerns a filter unit for an internal combustion engine, wherein the filter unit comprises a filter housing having a cylindrical shape with a closed lower end and means for transfer of a fluid between the filter unit and the engine at an upper end of the filter housing, wherein the filter unit comprises mounting means for fastening the filter unit to an engine structure comprising a mounting rod, and wherein the filter mounting means is configured to engage with corresponding mounting means arranged on the mounting rod.

20 The invention is characterized in that the filter unit comprises guiding means configured to axially align the filter unit with the mounting rod before the filter unit is fastened in its intended operative position in relation to the engine structure via the mounting means.

25 The inventive filter unit is thus guided into place when fitting the filter onto the engine structure. This way a new filter unit can be positioned and aligned at the engine structure in a quick, easy and correct manner before fastening the filter to the structure. A proper axial alignment is often a prerequisite for acquiring a proper sealing after fastening, and it is an advantage for most mounting means, such as threads or a twist-lock structure (bayonet mount),
30 that the filter is properly aligned already before engaging the mounting means.

The invention is particularly useful when the filter unit mounting means includes threads intended to engage with corresponding threads arranged onto the mounting rod. When fastening such a filter unit it is important that the threads of the filter are properly aligned axially with the threads of the engine structure before the filter is screwed on (fastened). If the filter is mounted by means of a fast and strong mounting power tool or robot or even by strong hands and the threads are not axially aligned, the threads might be damaged during the fastening process. Weakened/damaged threads might result in oil leakage or even in that the filter falls off, in particular during operation of the engine when the filter is filled with oil and the engine vibrates. The inventive filter provides for a quick alignment of the threads and a safe connection.

In an embodiment of the invention the filter housing is adapted to receive the mounting rod via an opening in the upper end. Preferably, the guiding means is arranged inside the filter housing.

In an embodiment of the invention the filter mounting means is positioned inside the filter housing at an axial distance from the upper end. This means that the filter mounting means is separated from the opening at the upper end where the threads are located in conventional spin-on filters. This also means that the opening in the upper end can form part of the guiding means. The axial distance, i.e. the minimum distance between the upper end of the filter and the filter mounting means in the longitudinal direction of the filter unit, can be considered to be at least as long as the diameter of the opening in the upper end.

According to an embodiment, the filter mounting means is located in a position closer to the lower end of the filter housing than the upper end of the filter housing. This creates conditions for a relatively long guiding distance

and/or a sufficient number of guiding means between an entry for the mounting rod and the position of the filter mounting means.

5 The filter mounting means are thereby adapted to be engaged with corresponding mounting means on a mounting rod inserted into the filter housing. The filter mounting means can be placed close to the lower end of the filter (so that the lower end can support the filter mounting means) or closer to the upper end of the filter (but still at a distance from the opening in the upper end of the filter). In these cases the corresponding mounting
10 means can be placed at the end part of the mounting rod.

Alternatively, the filter mounting means can be arranged in the opening at the upper end of the filter, in line with conventional spin-on filters. In such a case the corresponding mounting means on the mounting rod should not be
15 placed at the end part thereof but at a distance from the end so that a part of the rod below its mounting means extends into the filter housing and interacts with the guiding means (during insertion of the rod) before the two mounting means connect and become engaged at the opening.

20 In an embodiment of the invention the guiding means are arranged between, in an axial direction of the filter housing, the filter mounting means and the upper end of the filter housing. Preferably, the filter housing has an internal cavity that extends in an axial direction from the opening in the upper end, wherein the cavity is adapted to receive and enclose at least a portion of the
25 mounting rod so that an end portion of the mounting rod is allowed to be positioned inside the filter housing in an end position at an axial distance from the upper end thereof when the filter unit is fastened in its intended operative position, and wherein the guiding means is arranged in said cavity.

30 The guiding means thus acts directly onto the mounting rod and aligns the filter axially in relation to the rod when the rod is introduced into the filter housing towards its end position. In conventional filter units the rod's end

position is at the upper end of the filter housing with no guiding before the threads engage. Preferably, the opening and the cavity are provided centrally on the upper side of the filter so as to make the filter unit rotationally symmetric and thereby easy to rotate in place in an axially aligned manner.

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In an embodiment of the invention the filter mounting means comprises threads.

10 In an embodiment of the invention the guiding means comprises at least two axially displaced guiding elements that, at least in cooperation with each other, define an axially directed passage adapted to the cross-section of the intended mounting rod.

15 The guiding elements can be separate guiding elements, such as two axially displaced rings or inwardly directed flanges (or parts thereof), or form axially displaced sections of a single elongated guiding means, such as a cylinder. The guiding means can be structured in various ways. The guiding surface of the guiding means may be inclined (e.g. funnel-shaped) to facilitate guiding.

20 In an embodiment of the invention the means for transfer of a fluid between the filter unit and the engine at the upper end of the filter housing comprises a set of openings. Preferably, the opening for receiving the mounting rod forms part of the set of openings for transfer of a fluid.

25 Preferably the mounting rod is hollow in this case so as to form a pipe-shaped fluid conduit which is introduced through the opening. Besides allowing oil or other fluid to enter or exit the filter (via the inside of the mounting rod), such a filter-mounting rod design makes it possible to use the mounting rod/pipe for sucking or pressing out used oil from the filter before
30 disconnecting the used filter from the engine structure. The purpose of this is to lower the oil level in the filter before disconnection and avoid spilling of used oil which otherwise is difficult to avoid as the filter is likely to be

completely full of dirty oil at the time of filter change. Suction or pumping out oil from the filter can be accomplished e.g. by applying pressurized air via a valve in the engine structure. Various arrangements for sucking/pumping out the oil is possible depending on the particular engine structure design.

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In an embodiment of the invention the filter housing encloses a filter chamber wherein the filter unit is arranged so as to lead the fluid to and from the filter unit via the filter chamber.

- 10 In an embodiment of the invention the filter unit is configured for filtering an engine oil.

The invention also concerns an internal combustion engine comprising a filter unit of the above type. Preferably, the engine structure comprises a mounting
15 rod configured to be introduced through an opening in the upper side of the filter housing. Preferably, the mounting rod is provided with mounting means configured to engage with corresponding mounting means on the filter unit. Preferably, the mounting rod is hollow and provided with one or several openings in the end part and/or in the sides thereof to allow oil to flow
20 between an inside of the filter unit and an inside of the mounting rod when the filter unit is mounted to the mounting rod.

BRIEF DESCRIPTION OF DRAWINGS

25 In the description of the invention given below reference is made to the following figure, in which:

- Figure 1 shows an overview of an engine provided with three filter units according to an embodiment of the invention,
Figure 2 shows a part of the engine of figure 1 with one of the filter units partly removed,
30 Figs. 3a-3c show a sectional view of one of the filter units of figures 1-2 and the steps of aligning and fastening the filter unit to a mounting rod of the engine,

Figure 4 shows the parts and the assembling of the filter unit of figure 3,
Figure 5 shows a sectional view of the assembled filter unit of figure 4.

DESCRIPTION OF EXAMPLE EMBODIMENTS OF THE INVENTION

5 Figure 1 shows an internal combustion engine 1 having an engine part 2 provided with three oil filter units 10 (which in this example are identical).

Figure 2 shows the engine part 2 with the filter unit 10 to the right partly removed, The engine part 2 is provided with three mounting rods 3, one for
10 each filter unit 10 (indicated with dashed lines for the filter unit 10 in the middle). The mounting rods 3 are hollow and form pipes/conduits for leading oil out from the filter units 10 (see below).

Each filter unit 10 comprises a filter housing 11 having a cylindrical shape
15 with a closed lower end 12 and a set of openings 14, 15 (see figures 3-5) for transfer of engine oil between the filter unit 10 and the engine 1 at an upper end 13 (see figures 3-5) of the filter housing 11. The upper end 13 is formed by a wall extending in a transverse direction of the filter.

20 Oil flows in this case from the engine 1, out through openings 4 in the engine structure 2, into the filter unit 10 via the smaller openings 14 at the upper end 13 of the filter housing 11, and back to the engine 1 via the mounting rod 3, which is inserted into the filter housing 11 through the central, larger opening
25 15 at the upper end of the filter housing 11. As shown in e.g. figure 3a, the mounting rod 3 is provided with openings 6 at a side thereof for allowing filtered oil (i.e. oil that has passed a filter element 17, see e.g. figure 4) in the filter unit 10 to enter the inside of the mounting rod 3 for transfer towards the engine 1.

30 Each filter unit 10 further comprises mounting means in the form of threads 16 (see figures 3-5) for fastening the filter unit 10 to the mounting rod 3 that is provided with corresponding threads 5. (see figures 3-5).

Each filter unit 10 further comprises guiding means 20 configured to axially align the filter unit 10 with the mounting rod 3 before the filter unit 10 is fastened in its intended operative position in relation to the engine structure 2 via the mounting means 16.

The filter housing 11 is adapted to receive the mounting rod 3 via the central opening 15 in the upper end of the housing 15, and the guiding means 20 is arranged inside the filter housing 15. Also the filter mounting means 16 is positioned inside the filter housing, close to the lower end 12 of the housing 11 at an axial distance from the upper end 13. In relation to an axial direction of the filter housing 11, the guiding means 20 are arranged between the filter mounting means 16 and the upper end 13 of the filter housing 11.

The filter housing 11 has an internal cavity, inside of the filter element 17, that extends in an axial direction from the opening 15 in the upper end 13 towards the lower end 12. This cavity is adapted, in this case facilitated by a cylindrical element 21 supporting the guiding means 20 (see figures 4-5), to receive and enclose at least a portion of the mounting rod 3 so that an end portion of the mounting rod 3 is allowed to be positioned inside the filter housing 11 in an end position at the filter mounting means 16 when the filter unit 10 is fastened in its intended operative position (see figure 3c). The guiding means 20 is thus arranged in this internal cavity.

In this example, the guiding means comprises four axially spaced guiding elements 20 supported by the cylindrical element 21, which is arranged in the internal cavity inside of the filtering element 17 in the filter housing 11. These guiding elements 20 define an axially directed passage adapted to the circular cross-section of the mounting rod 3. Also the opening 15 works in this case as a guiding element.

Openings are arranged in the side of the cylindrical element 21 to allow oil to pass radially inwards towards and into the mounting rod 3 via its openings 6.

5 Figs. 3a-3c show a sectional view of one of the filter units 10 of figures 1-2 and the steps of aligning and fastening the filter unit 10 to the mounting rod 3.

In figure 3a a new, fresh filter unit 10 is moved upwards towards the mounting rod 3.

10 In figure 3b the end of the mounting rod 3 has been inserted half-way into the housing 11 via the opening 15. During insertion, i.e. when the filter unit 10 is moved towards the mounting rod 3, the guiding elements 20 acts onto the mounting rod 3 and aligns the filter unit 10 axially in relation to the mounting rod 3. As the threads 5 at the end of the mounting rod 3 reaches the
15 corresponding threads 16 of the filter unit 10 inside the housing 11, the threads 5, 16 are aligned and engaging the threads becomes easy and safe.

In figure 3c the threads 5, 16 have been engaged and the filter unit 10 has thus been fastened in its intended operative position in relation to the engine
20 structure via the mounting means (threads 16)..

Figure 4 shows the parts and the assembling of the filter unit 10 of figure 3, In this case the parts are the upper end 13 with its openings 14 and 15, the cylindrical element 21 carrying the guiding elements 20, the filter element 17,
25 and the filter housing 11 with its closed end 12.

Figure 5 shows a sectional view of the assembled filter unit 10 of figure 4.

30 The exemplified embodiment of the inventive filter unit 10 can also be used to avoid spilling of oil when switching filter by emptying a used filter unit 10 before disconnection by pumping or sucking out used oil from the inside of the filter housing 11 via the mounting rod/oil pipe 3. This can be

accomplished by applying for instance pressurized air via a small valve in the engine structure 2. Vacuum or overpressure can be used for removing oil from the oil filled filter (using pumps or pressurized air ,with ejector principle for creating under pressure via pressurized air). This way the level of oil can
5 be decreased in the filter unit 10 before de-mounting.

The invention is not limited by the embodiments described above but can be modified in various ways within the scope of the claims.

10 For instance, in a variant of the invention the diameter of the cylindrical element 21 can be adapted to that of the mounting rod 3 so that the individual guiding elements 20 are dispensed with and so that instead the entire cylindrical element 21 works as an elongated guiding means.

15 The filter mounting means 16 does not necessarily have to be arranged at the lower end 12 but can be positioned closer to the upper end 13. In such a case the end of the mounting rod 3 is preferably open and the filter unit 10 preferably arranged in such a way that oil can flow into the mounting rod/oil pipe 3 through this open end (as a complement or alternative to the side
20 openings 6 described above).

The guiding elements 20, including the sides of the opening 15, may be conical with a larger entrance opening (upwards) than exit opening (downwards) so as to facilitate insertion of the mounting rod 3 when
25 connecting the filter unit 10 to the engine structure 2.

According to an alternative, the mounting means may be formed by a twist-lock structure (bayonet mount). According to one example, the twist-lock structure is realized in that the mounting rod is provided with at least one,
30 and preferably a plurality of circumferentially spaced receptions/slots, each configured for receipt of a correspondingly shaped projection of the filter mounting means. Each reception/slot would have a first section extending

primarily in an axial direction of the mounting rod and a second section extending primarily in a transverse direction, preferably in the radial direction, of the mounting rod. Further, the first section of each reception/slot would preferably be open to a free end of the mounting rod. The second section

5 may further be provided with a recessed portion for reception of the projection in an operative position of the filter relative to the filter housing. The mounting means in the filter would comprise at least one, and preferably a plurality of circumferentially spaced projections, for example in the form of pins, for being received in the slots. Preferably, the filter mounting means

10 would comprise a tubular portion, wherein the projection(s) extend radially inwards from an inner side of the tubular portion. The tubular portion would preferably extend in the axial direction of the filter. The tubular portion may have a circular-cylindrical shape. Further, preferably, the filter is provided with an axial seal of an axially resilient character at its upper end wall. To

15 install the filter, the mounting rod is received in the tubular portion of the filter and the projection is received in the corresponding first section of the reception/slot during an axial upwards movement of the filter, wherein the seal is compressed at the last part of the movement. Thereafter, the filter is turned, wherein the projection is received in the second section and ends up

20 in the recessed portion due to the resilient character of the seal when the filter is released.

The invention has been described above for an oil filter. However, the invention should not be considered to be limited to oil filters, but may be

25 applied to other types of filters, such as fuel filters.

CLAIMS

1. A filter unit (10) for an internal combustion engine (1), wherein the filter unit
5 (10) comprises a filter housing (11) having a cylindrical shape with a closed lower end (12) and means for transfer of a fluid (14, 15) between the filter unit (10) and the engine (1) at an upper end (13) of the filter housing (11), wherein the filter unit (10) comprises mounting means (16) for fastening the filter unit (10) to an engine structure (2) comprising a mounting rod (3),
10 wherein the filter mounting means (16) is configured to engage with corresponding mounting means (5) arranged on the mounting rod (3),
c h a r a c t e r i z e d i n
that the filter unit (10) comprises guiding means (20) configured to axially align the filter unit (10) with the mounting rod (3) before the filter unit (10) is
15 fastened in its intended operative position in relation to the engine structure (2) via the mounting means (16).
2. A filter unit (10) according to claim 1, wherein the filter housing (11) is adapted to receive the mounting rod (3) via an opening (15) in the upper end
20 (13).
3. A filter unit (10) according to claim 2, wherein the guiding means (20) is arranged inside the filter housing (11).
- 25 4. A filter unit (10) according to claim 2 or 3, wherein the filter mounting means (16) is positioned inside the filter housing (11) at an axial distance from the upper end (13).
- 30 5. A filter unit (10) according to claims 3 and 4, wherein the guiding means (20) are arranged between, in an axial direction of the filter housing (11), the filter mounting means (16) and the upper end (13) of the filter housing (11).

6. A filter unit (10) according to claim 2 or 3, wherein the filter housing (11) has an internal cavity that extends in an axial direction from the opening (15) in the upper end (13), wherein the cavity is adapted to receive and enclose at least a portion of the mounting rod (3) so that an end portion of the mounting rod (3) is allowed to be positioned inside the filter housing (11) in an end position at an axial distance from the upper end (13) thereof when the filter unit (10) is fastened in its intended operative position, and wherein the guiding means (20) is arranged in said cavity.
7. A filter unit (10) according to claim 4, where the axial distance between the filter mounting means (16) and the upper end (13) is at least as long as the diameter of the opening (15) in the upper end (13).
8. A filter unit (10) according to claim 7, wherein the filter mounting means (16) is located in association with the lower end (12) of the filter housing (11).
9. A filter unit (10) according to any of the above claims, wherein the filter mounting means (16) comprises threads.
10. A filter unit (10) according to any of the above claims, wherein the guiding means comprises at least two axially displaced guiding elements (20) that, at least in cooperation with each other, define an axially directed passage adapted to the cross-section of the intended mounting rod (3).
11. A filter unit (10) according to any of the above claims, wherein the means for transfer of a fluid between the filter unit (10) and the engine (1) at the upper end (13) of the filter housing comprises a set of openings (14, 15).
12. A filter unit (10) according to claims 2 and 11, wherein the opening (15) for receiving the mounting rod (3) forms part of the set of openings (14, 15) for transfer of a fluid.

13. A filter unit (10) according to any of the above claims, wherein the filter housing (11) encloses a filter chamber and wherein the filter unit (10) is arranged so as to lead the fluid to and from the filter unit (10) via the filter chamber.

5

14. A filter unit (10) according to any of the above claims, wherein the filter unit (10) is configured for filtering an engine oil.

15. Internal combustion engine (1),

10

characterized in

that it comprises a filter unit (10) according to any of the above claims.

16. Internal combustion engine (1) according to claim 15. wherein the engine (1) is provided with an engine structure (2) intended for mounting of the filter unit (10), wherein the engine structure (2) comprises a mounting rod (3) configured to be introduced through an opening (15) in the upper side (13) of the filter housing (11)..

15

17. Internal combustion engine (1) according to claim 16. wherein the mounting rod (3) is provided with mounting means (5) configured to engage with corresponding mounting means (16) on the filter unit (10).

20

18. Internal combustion engine (1) according to claim 16 or 17. wherein the mounting rod (3) is hollow and provided with one or several openings (6) in the end part and/or in the sides thereof to allow oil to flow between an inside of the filter unit (10) and an inside of the mounting rod (3) when the filter unit (10) is mounted to the mounting rod (3).

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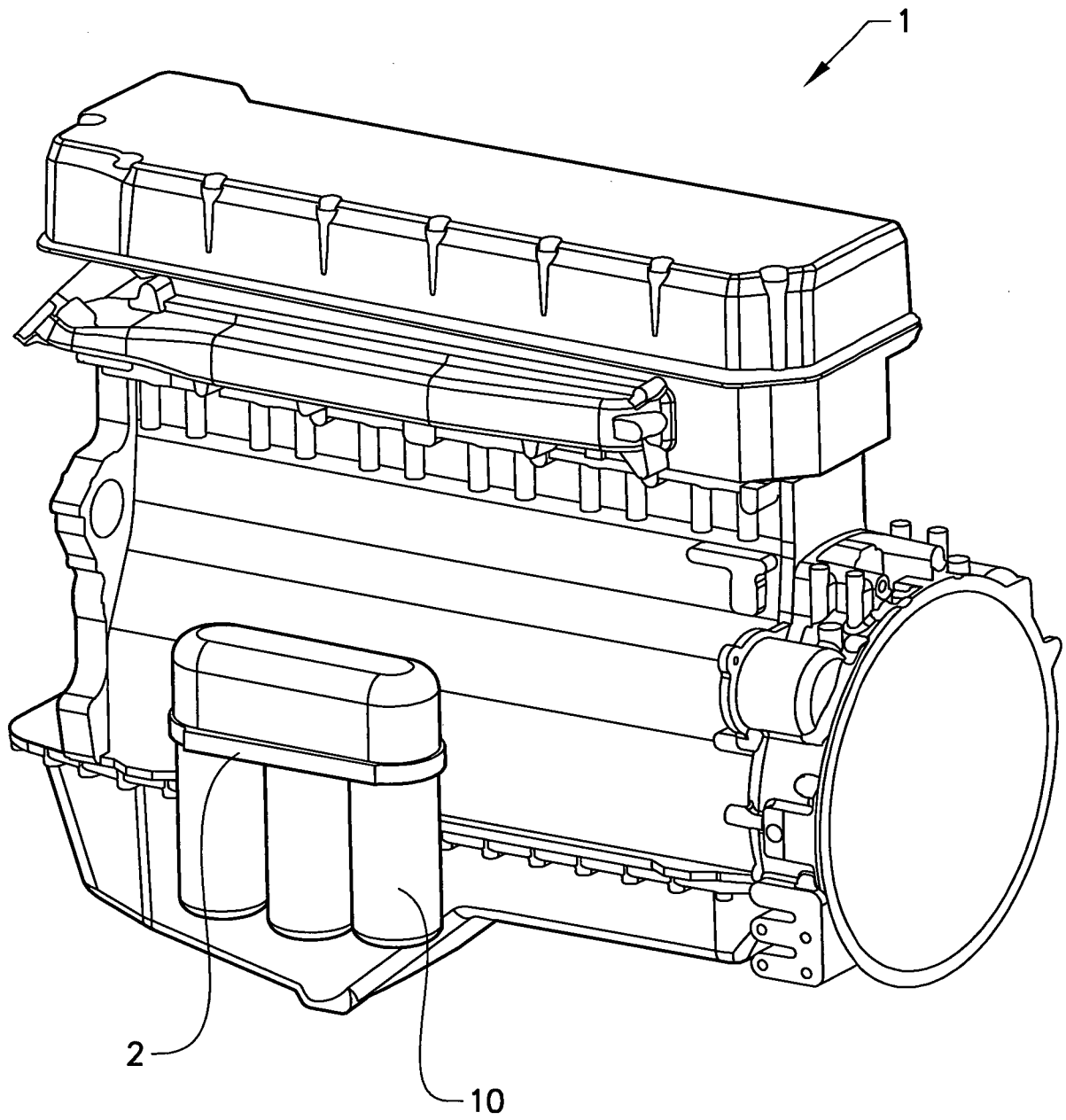
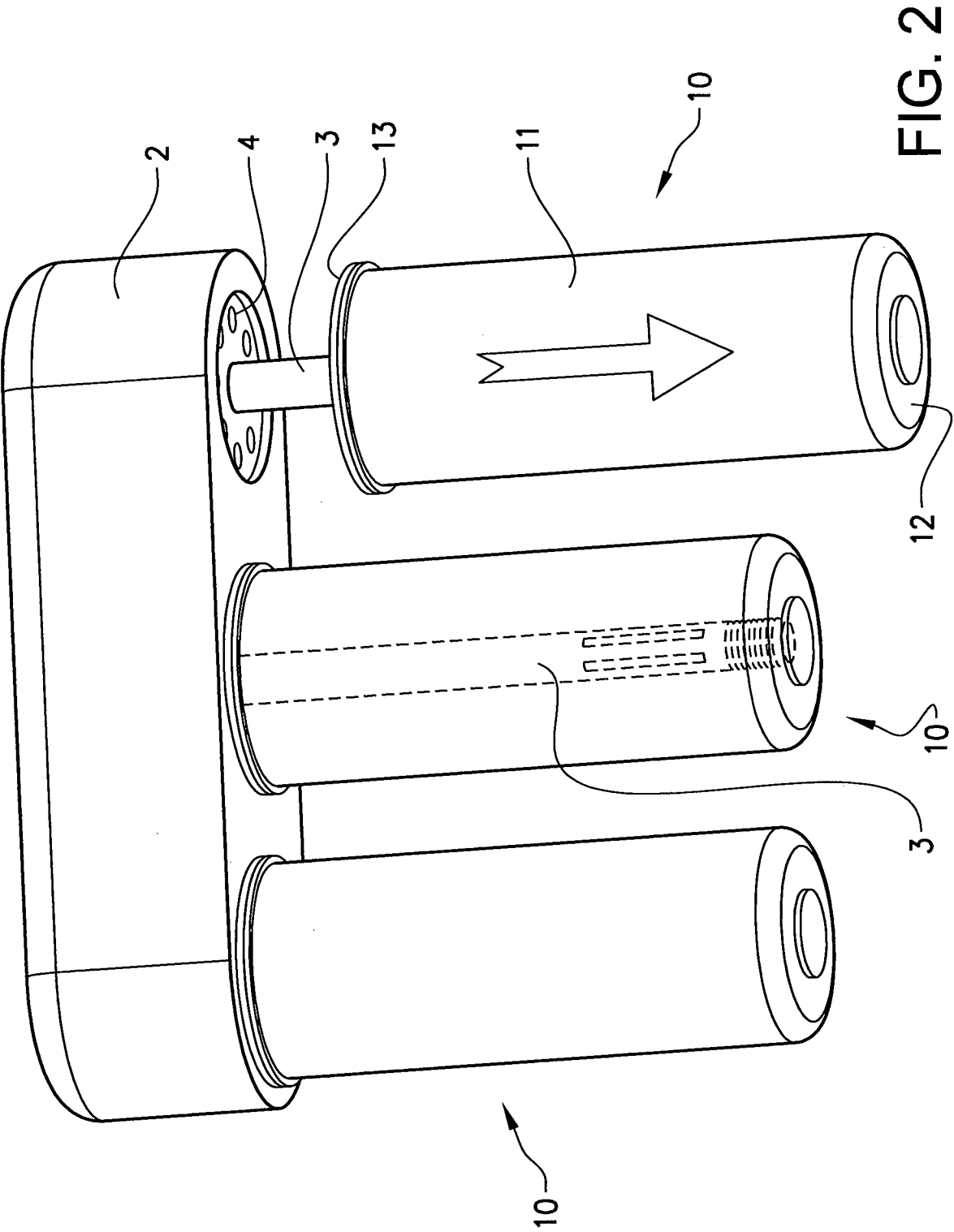
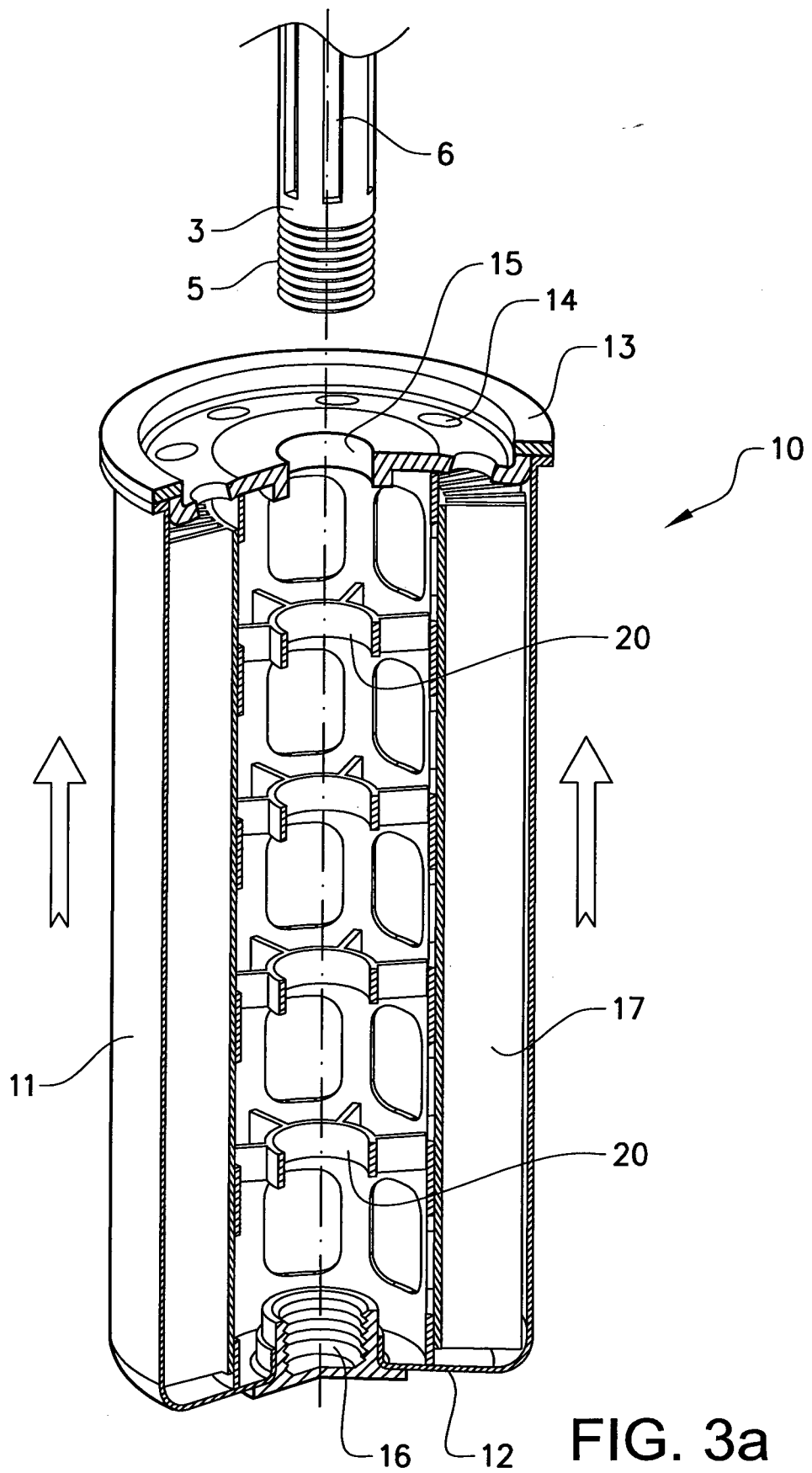


FIG. 1



3/7



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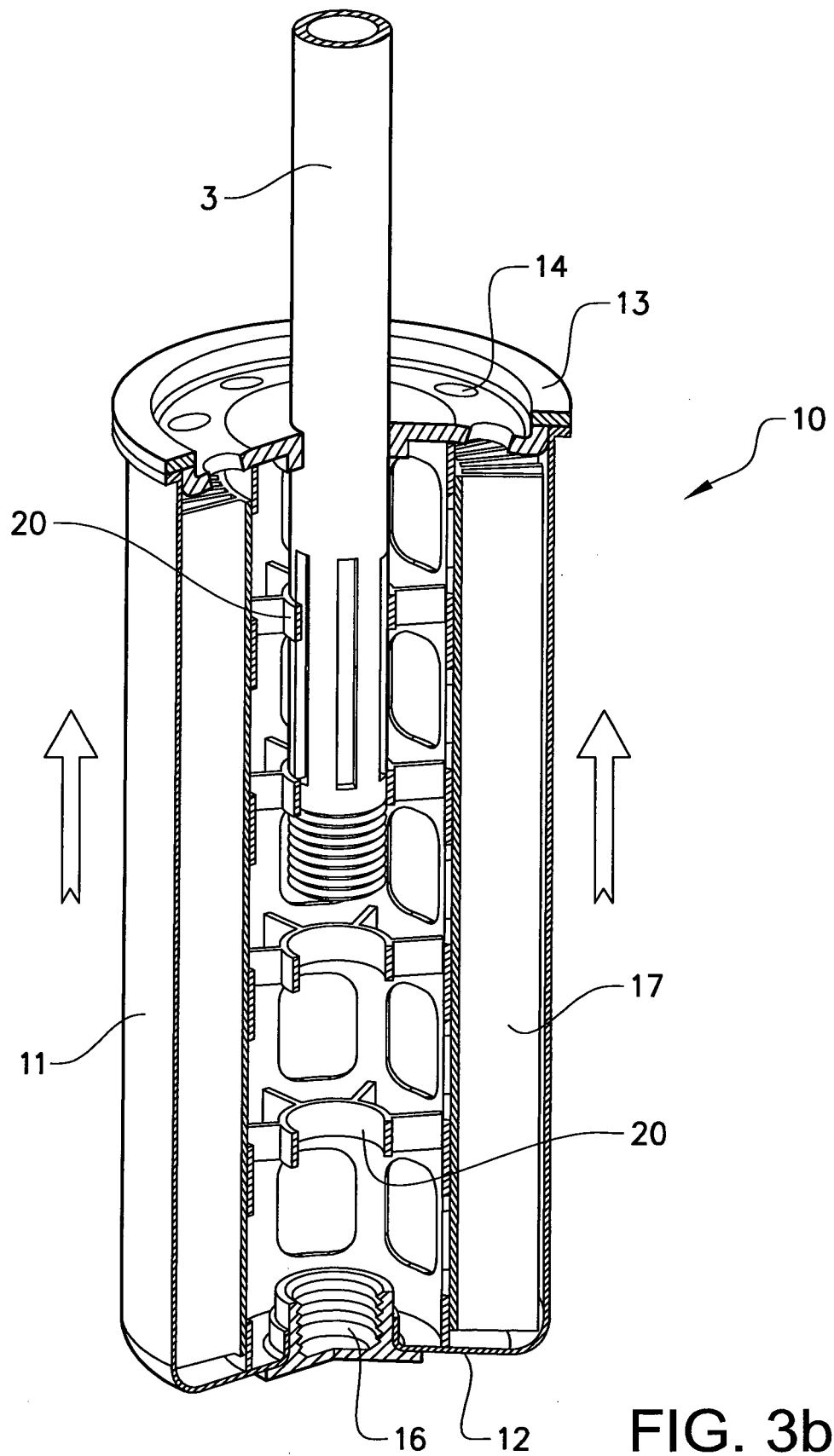
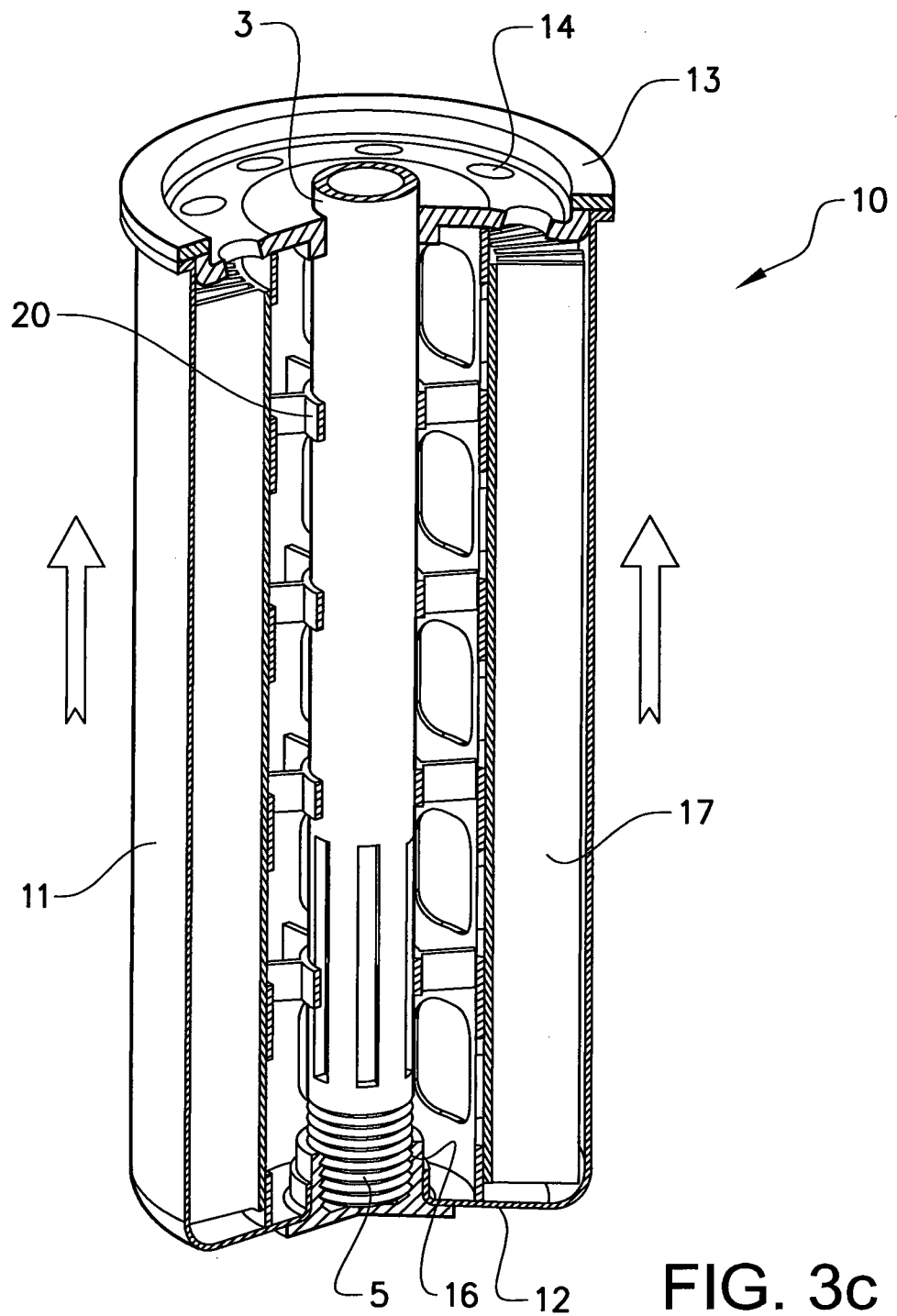


FIG. 3b

5/7



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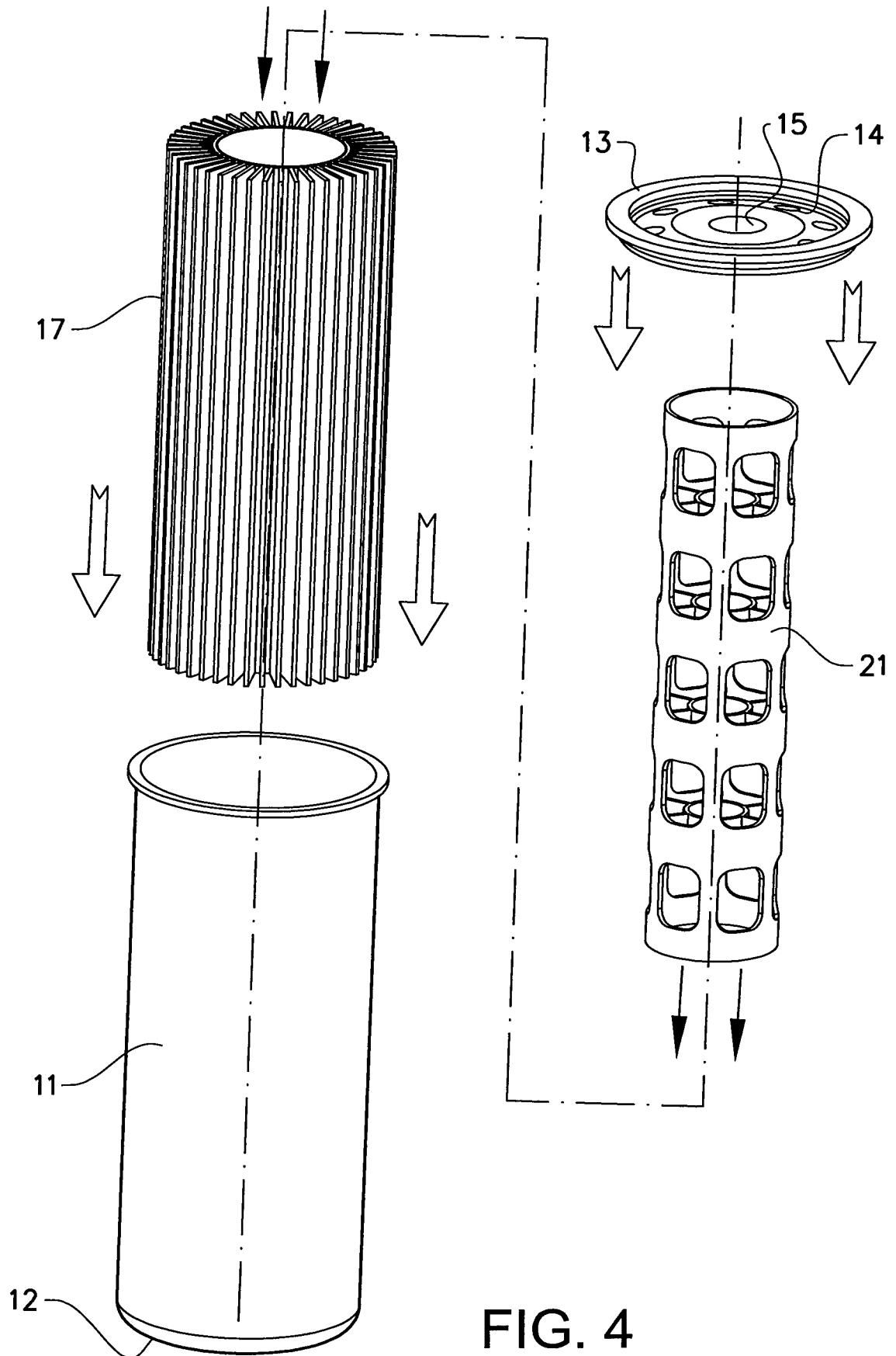


FIG. 4

7/7

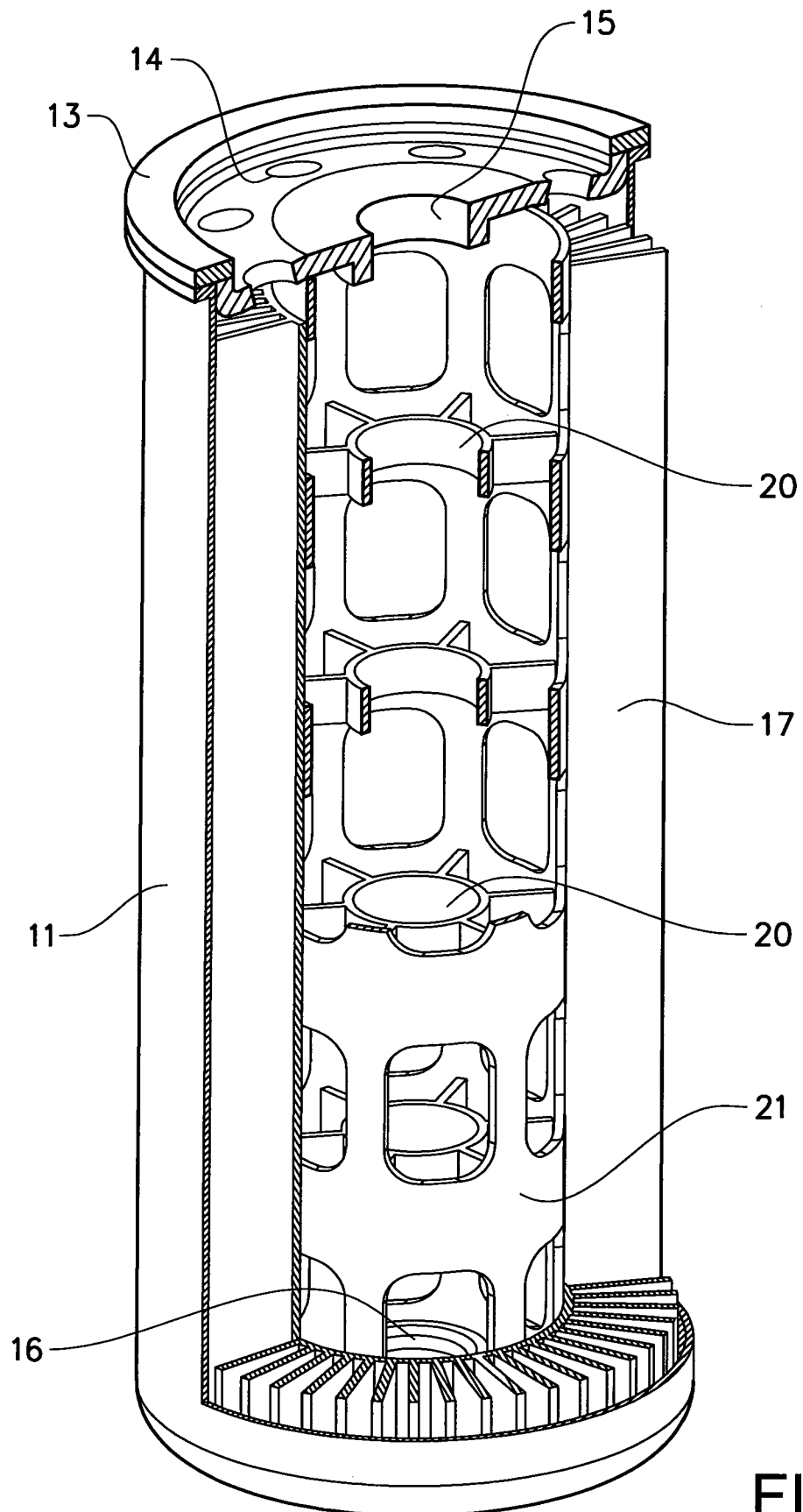


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2014/001442

A. CLASSIFICATION OF SUBJECT MATTER

INV. F01M11/03 B01D35/00 B01D35/30 B01D27/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F01M B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 013 434 A (FURROW ROGER W [US]) 7 May 1991 (1991-05-07) the whole document -----	1-18
A	DE 196 44 647 A1 (MANN & HUMMEL FILTER [DE]) 30 April 1998 (1998-04-30) the whole document -----	1-18
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A	EP 0 376 443 A2 (MITSUBISHI OIL CO [JP]) 4 July 1990 (1990-07-04) figures -----	1-18
A	WO 2011/062107 A1 (SHARP KK [JP]; TAIRA MASAHIRO) 26 May 2011 (2011-05-26) figures -----	1-18



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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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