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

(11) EP 1 048 909 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
19.01.2005 Bulletin 2005/03

(51) Int Cl.[7]: **F25B 43/00**, B01D 53/26

(21) Application number: **00301679.7**

(22) Date of filing: **01.03.2000**

(54) **Refrigeration dehydration filter**

Filtertrockner für Kältekreislauf

Filtre déshydrateur pour circuit frigorifique

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

(30) Priority: **26.04.1999 IT MI990874**

(43) Date of publication of application:
02.11.2000 Bulletin 2000/44

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EP-A- 0 838 642
EP-A- 0 915 307
EP-A- 0 915 308
CH-A- 342 589

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Description

[0001] The present invention relates to a refrigerant dehydrating filter according to the preamble of claim 1 and to a method of manufacturing such a filter.

[0002] It is well known that refrigeration systems need a filter to separate contaminating water from refrigerant and to trap various particles and other impurities. Dehydrating filters are known and are designed primarily to remove water from the refrigerant. As used herein, the term "refrigeration system" includes air conditioning systems and heat pumps etc and the term "refrigerant' should be understood to extend to fluids used in all these types of equipment.

[0003] Compact filters are also known in which an inlet hole into the filter and an outlet hole from the filter are found on a common base in order to present a compact design and to suit preferred applications. Alternatively, filters are known in which the inlet and outlet holes are arranged in different orientations due to their specific intended application.

[0004] European Patent Application No. 0 915 308 discloses such a filter, in which the refrigerant flows from an inlet up through desiccating material before the flow is reversed to send it down a tube to an outlet coaxial with the inlet that ends beyond the inlet. When the filter is screwed into a base connected to a condenser unit the inlet and outlet make connections with pipes defined in the base.

[0005] This design, and others in which the inlet and outlet are arranged in a different manner due to their specific type of application, make the filter easy to fit. However, this type of filter is structurally complex with a number of components, which must all be located correctly during the assembly process. This leads to assembly problems such that a filter can take a long time to construct. Additionally the various components may not be located securely, which can cause faulty seals.

[0006] European patent application 0 838 642 discloses a removable reservoir connected to a header of a condenser for a refrigeration circuit through which refrigeration fluid is passed. The reservoir is produced in the form of a replaceable cartridge provided with a connection able to cooperate with a base of conjugate shape which is fixed to the header and connected to the latter by an inlet manifold and an outlet manifold for the refrigeration fluid.

[0007] Swiss Patent No. 342,589 discloses a dehydrating filter characterised by a cylindrical reservoir, a fitting detachably installed in the top part of the reservoir and provided with inlet and outlet ports, an adapter secured in the fitting, two strainers each arranged at a distance from the top and bottom ends of the reservoir, a desiccating agent located between the two strainers, the strainers being provided with coaxial bores, and a vertical tube extending through said bores, the lower end of the tube terminating in the base of the reservoir while the upper end of the tube extends into the adapter and is tightly connected thereto. The adapter has an opening connecting a line for refrigeration fluid to the inside of the vertical tube via an inlet in the fitting, and the fitting having an outlet connected to a further line for the fluid, the whole assembly being so arranged that the fluid is able to flow through the inlet in the fitting, the opening in the adapter and down through the vertical tube, then up through the desiccating agent and finally out through the outlet in the fitting.

[0008] European patent application 0 915 307 discloses a fluid tank for an air conditioning condenser. The tank is screwed axially into a connecting base which is in turn brazed to a header box of the condenser. It contains an interchangeable axial cartridge and communicates with the header box through ducts provided in the connecting base.

[0009] According to an aspect of the present invention there is provided a refrigerant dehydration filter, comprising an external tube sealed at one end to define a return cavity; an internal tube coaxial with said external tube; a first external connection to said external tube and a second external connection to said internal tube to facilitate a transfer of refrigerant between said tubes, wherein said external tube contains desiccating material, characterised in that: said filter further comprises a filter capsule containing said desiccating material, said filter capsule being fitted within said external tube and having a coaxial tubular section through which said internal tube passes. According to another aspect of the present invention, a method for manufacturing a filter of this type is provided.

[0010] The present invention will now be described by way of example only, with reference to the accompanying drawings, of which:

Figure 1 is a longitudinal side elevation of a dehydrating filter embodying the present invention;
Figure 2 is an enlarged sectional view of part of the filter shown in *Figure 1*; and
Figure 3 is a transverse section of a portion of the filter shown in *Figure 2.*

[0011] A dehydrating filter embodying the present invention is illustrated in *Figure 1*. The filter has a hollow external casing **11**, **12** of a cylindrical shape, in two interconnecting sections. The first of said sections **11** is substantially cup-shaped and is formed from an aluminium extrusion with a relatively thick base portion **13**. Section **11** acts as a cover for a second section **12**, constituting a major portion of the device.

[0012] The second section **12** also has a cylindrical body, open at one end and designed to couple up with the first section **11** by means of soldered joint **14**. The other end of the second section **12** is restricted by a pair of coaxial sleeve sections **15**, **16** that terminate in a hole **17.** The second section **12** houses a filter capsule within its cylindrical volume. This capsule comprises a cup section **18** of cylindrical shape with an external diameter

that can fit within the internal diameter of the section of the hollow external casing **12**. The cup **18** has a coaxial tubular section **19** through which a tubular insert **20** passes.

[0013] A free annular space is provided between the external surface of the coaxial tubular section **19** and the internal surface of the cup section **18**. This annular space is filled with a desiccating material **21** located between two annular felt discs, in the form of a cylindrical sandwich but having a hole down its middle. On the other side of the felt washers there is provided at one end a drilled stopper **23**, turned towards the centre of the casing, while at the other end is the drilled base **24** of the cup section **18**.

[0014] The tubular insert **20** passes into the coaxial tubular section **19** of the cup **18** starting off as a plain tubular section and then becoming a toothed or splined section **25** that extends towards the second sleeve **16** of the second part **12** of the casing, passing into it. The outward facing spline end **25** on the tubular insert **20** has an expanded section **26** which abuts the end of the sleeve section **16** preventing the tubular insert **20** from dropping inside the second part of the casing. The end of the tubular insert **20** has an enlarged diameter **27** onto which a gasket **28** is positioned. The gasket **28** prevents the input fluid from mixing with the output fluid from the filter when it is positioned within the base **29** of a condenser in line with a fluid input channel **30** and fluid output channel **31**, as shown in *Figure 2*. A seal is also ensured due to the provision of two O-ring seals **32** mounted beyond the sleeve section **16**.

[0015] The end of the tubular insert **20** facing the inside of the casing has a locating ring or similar **33** that keeps the capsule in position with respect to the tubular insert **20**. The filter has input channels between the internal surfaces of the sleeve section **16** and the splines **25** on the tubular insert **20**. These channels lead into sleeves **15** before passing through the drilled base **24** of the bucket section **18**. Subsequently, the input fluid is admitted into the first felt washer **22**, passing through the desiccating material **21** before reaching the second felt washer **22** followed by the drilled stopper **23** and escapes into the casing **11**, **12**. The fluid moves unimpeded into the open free end of the tubular insert **20** and passing through it escapes at the other coaxial end through the seal **27**. It can be seen that the input and output channels are coaxial and therefore the filter is particularly compact and straightforward.

[0016] Locating ring **33** enables the very rapid assembly of the components of the filter. For example, the casing **11**, **12** is formed in aluminium, while tubular insert **20** is fabricated in a plastic material, such as polyamide and is relatively straightforward to manufacture, The gasket is in hydrogenated nitrile to create a seal.

[0017] During manufacture, the external cylindrical casing is obtained by extrusion with a similar process being used to produce a second section **12** that completes the casing for the filter. Next, the felt washer **22** is inserted into the cup section **18** up against the drilled base **24**. The annular space is then filled with the desiccating material **21** and the second felt washer **22** is positioned in the cup section **18** to contain the desiccating material. Finally, the drilled stopper **23** is put in place by pressing it into the cup section **18**. The capsule is therefore ready to be assembled into the complete filter.

[0018] The second section of the extruded cylindrical casing forms sleeve sections **15**, **16** in an extruded body in aluminium. External threading of this sleeve section **18** is then carried out thereby allowing the filter to be positioned into the hole **29**.

[0019] This is then followed by a greasing stage then the tubular insert **20** is located into hole **17** of the second section **12** of the casing until the widened part **26** of the splines **25** is up against the end of the sleeve section **16** which prevents the tubular insert from entering the second section **12** of the casing.

[0020] The constructed capsule is inserted into the tubular insert **20** and held in place with locating ring **33**. The casing is then assembled by soldering the two sections once they have been brought together at **14**. This is done by fitting the two sections **11**, **12** together and creating an annular solder joint.

[0021] The two O-ring seals are fitted on the external surface of the sleeve section **16**. A ring type gasket **28** is fitted on the large diameter end section **27** of the tubular insert **20**. Once the assembly is completed, an airtightness test is performed to ensure that performance can be guaranteed in use.

Claims

1. A refrigerant dehydration filter, comprising

an external tube (11,12) sealed at one end to define a return cavity;

an internal tube (20) coaxial with said external tube;

a first external connection (30) to said external tube and a second external connection (31) to said internal tube to facilitate a transfer of refrigerant between said tubes, wherein said external tube contains desiccating material (21),

characterised in that:

said filter further comprises a filter capsule (18,19,22,23) containing said desiccating material, said filter capsule being fitted within said external tube (11,12) and having a coaxial tubular section (19) through which said internal tube (20) passes.

2. A refrigerant dehydration filter according to claim 1, wherein said external tube comprises:

a first interconnecting section (11) which is substantially cup-shaped; and

a second interconnecting section (12) which connects to the first interconnecting section at one end and which houses said filter capsule.

3. A filter according to claim 1 or claim 2, wherein said external tube provides a substantially larger cross sectional area compared to the cross sectional area of said internal tube.

4. A filter according to any of claims 1 to 3, wherein an input flow is directed to said external tube (11,12) and the return flow is received from said internal tube (20).

5. A filter according to claim 1, wherein said tubes (20, 11,12) have a cylindrical cross-section.

6. A filter according to any of claims 1 to 5, wherein said internal tube (20) consists of a tubular insert having an externally splined area.

7. A filter according to claim 6, in which the external tube (11,12) is restricted at its open end by a sleeve section (16) and an outward facing splined end (25) of said tubular insert (20) has a widened end (26) that abuts the end of said sleeve section.

8. A filter according to any of claims 1 to 7, wherein said internal tube (20) consists of a tubular insert terminated with an enlarged diameter end (27) on which a gasket (28) is positioned.

9. A filter according to any of claims 1 to 8, with termination fittings of a tubular insert (20) of a casing section (12) comprising at one end a locating ring (33) positioned between said tubular insert and said capsule (18, 19, 23), with the other end (26) widened to abut the end of the sleeve section (16).

10. A filter according to any of claims 1 to 9, arranged as a sandwich within a cup section (18) with a drilled bottom end (24) assembled in sequence with an initial felt washer (22), said desiccating material (21), a second felt washer (22) and a drilled stopper (23).

11. A filter according to any of claims 1 to 10, having securing means (33) to hold the capsule (18, 19, 23) in position relative to the internal tube (20).

12. A method of manufacturing a refrigerant dehydration filter according to any of claims 1 to 10, by performing the steps of:

obtaining a hollow external casing (11, 12) and the component parts of said filter;
producing a second section (12) of this extruded casing creating sleeve sections (15, 16) with external threading to one of the sleeve sections;
performing a degreasing stage;
fitting a tubular insert (20) into a hole (17) in the second section (16) of said casing (11, 12) until the widened part (26) of splines (25) of the tubular insert abuts up against the end of the sleeve section (16);
fitting a capsule (18, 19, 22, 23) into said tubular insert (20); and
fitting a locating ring (33) of the capsule on to the tubular insert.

13. A method of manufacturing a refrigerant dehydration filter according to claim 12, wherein said method further comprises the steps of:

obtaining a capsule (18, 19, 22, 23) having cylindrical cup section (18) and a coaxial tubular section (19); and
filling the capsule with the desiccating material and locating a stopper (23) into the cup section.

Patentansprüche

1. Kältemitteldehydratisierungsfilter, der folgendes aufweist:

- ein Außenrohr (11, 12), das an dem einen Ende dicht verschlossen ist, um einen Rockfuhrungshohlraum zu bilden;
- ein Innenrohr (20), das mit dem Außenrohr koaxial ist;
- eine erste äußere Verbindung (30) mit dem Außenrohr und eine zweite äußere Verbindung (31) mit dem Innenrohr, um eine Überführung von Kältemittel zwischen den Rohren zu erleichtern, wobei das Außenrohr ein Trokkenmittel (21) enthält,

dadurch gekennzeichnet,
daß der Filter ferner eine Filterkapsel (18, 19, 22, 23) aufweist, die das Trockenmittel enthält, wobei die Filterkapsel innerhalb von dem Außenrohr (11, 12) angebracht ist und einen koaxialen rohrförmigen Bereich (19) hat, durch den das Innenrohr (20) hindurchgeht.

2. Kältemitteldehydratisierungsfilter nach Anspruch 1, wobei das Außenrohr folgendes aufweist:

- einen ersten Verbindungsbereich (11), der im wesentlichen becherförmig ist; und
- einen zweiten Verbindungsbereich (12), der an dem einen Ende mit dem ersten Verbindungsbereich (12) verbunden ist und die Filterkapsel enthält.

3. Filter nach Anspruch 1 oder 2, wobei das Außenrohr gegenüber der Querschnittsfläche des Innenrohrs eine erheblich größere Querschnittsfläche hat.

4. Filter nach einem der Ansprüche 1 bis 3, wobei eine Eingangsströmung zu dem Außenrohr (11, 12) gerichtet ist und die Rückströmung von dem Innenrohr (20) aufgenommen wird.

5. Filter nach Anspruch 1, wobei die Rohre (20, 11, 12) einen zylindrischen Querschnitt haben.

6. Filter nach einem der Ansprüche 1 bis 5, wobei das Innenrohr (20) aus einem rohrförmigen Einsatz besteht, der einen Bereich mit Außenverzahnung hat.

7. Filter nach Anspruch 6, wobei das Außenrohr (11, 12) an seinem offenen Ende von einem Hülsenbereich (16) begrenzt ist und ein nach außen weisendes verzahntes Ende (25) des rohrförmigen Einsatzes (20) ein erweitertes Ende (26) hat, das an dem Ende des Hülsenbereichs anliegt.

8. Filter nach einem der Ansprüche 1 bis 7, wobei das Innenrohr (20) aus einem rohrförmigen Einsatz besteht, der mit einem Ende (27) mit vergrößertem Durchmesser endet, an dem eine Dichtung (28) positioniert ist.

9. Filter nach einem der Ansprüche 1 bis 8, wobei Endanschlußelemente eines rohrförmigen Einsatzes (20) eines Gehäusebereichs (12) an dem einen Ende einen Positionierring (33) aufweisen, der zwischen dem rohrförmigen Einsatz und der Kapsel (18, 19, 23) positioniert ist, wobei das andere Ende (26) so erweitert ist, daß es an dem Ende des Hülsenbereichs (16) anliegt.

10. Filter nach einem der Ansprüche 1 bis 9, der als Sandwichanordnung innerhalb eines Becherbereichs (18) mit einem mit Bohrungen versehenen Bodenende (24) angeordnet ist, das der Reihe nach mit einer ersten Filzscheibe (22), dem Trokkenmittel (21), einer zweiten Filzscheibe (22) und einem mit Bohrungen versehenen Stöpsel (23) zusammengebaut ist.

11. Filter nach einem der Ansprüche 1 bis 10, der eine Befestigungseinrichtung (33) hat, um die Kapsel (18, 19, 23) relativ zu dem Innenrohr (20) in ihrer Position zu halten.

12. Verfahren zum Herstellen eines Kältemitteldehydratisierungsfilters nach einem der Ansprüche 1 bis 10 durch Ausrühren der folgenden Schritte:

- Bereitstellen eines hohlen äußeren Gehäuses (11, 12) und der Bestandteile des Filters;
- Herstellen eines zweiten Bereichs (12) dieses extrudierten Gehäuses unter Bildung von Hülsenbereichen (15, 16) mit Außengewinde an dem einen von den Hülsenbereichen;
- Durchführen eines Schmierschritts;
- Einpassen eines rohrförmigen Einsatzes (20) in ein Loch (17) in dem zweiten Bereich (16) des Gehäuses (11, 12) bis das erweiterte Teil (26) von Verzahnungen (25) des rohrförmigen Einsatzes an dem Ende des Hülsenbereichs (16) anliegt;
- Einpassen einer Kapsel (18, 19, 22, 23) in den rohrförmigen Einsatz (20); und
- Anbringen eines Positionierrings (33) der Kapsel an dem rohrförmigen Einsatz.

13. Verfahren zum Herstellen eines Kältemitteldehydratisierungsfilters nach Anspruch 12, wobei das Verfahren ferner die folgenden Schritte aufweist:

- Bereitstellen einer Kapsel (18, 19, 22, 23), die einen zylindrischen Becherbereich (18) und einen koaxialen rohrförmigen Bereich (19) hat; und
- Füllen der Kapsel mit dem Trockenmittel und Positionieren eines Stöpsels (23) in dem Becherbereich.

Revendications

1. Filtre déshydrateur de fluide réfrigérant comprenant

un tube (11, 12) extérieur scellé à une extrémité pour définir une cavité de retour ;

un tube (20) intérieur coaxial au tube extérieur ;

une première connexion (30) extérieure de connexion au tube extérieur et une deuxième connexion (31) extérieure de connexion au tube intérieur pour faciliter un transfert de fluide frigorifique entre les tubes, le tube extérieur contenant de la matière (21) de dessiccation.

caractérisé en ce que :

le filtre comprend en outre une capsule (18, 19, 22, 23) de filtre contenant la matière de dessiccation, la capsule de filtre étant adaptée dans le tube (11, 12) extérieur et ayant une section (19) tubulaire coaxiale dans laquelle passe le tube (20) intérieur.

2. Filtre déshydrateur de fluide réfrigérant, suivant la revendication 1 dans lequel le tube extérieur

comprend :

une première section (11) d'interconnexion, qui est sensiblement en forme de coupelle ; et
une deuxième section (12) d'interconnexion qui communique avec la première section d'interconnexion à une extrémité et qui loge la capsule de filtre.

3. Filtre suivant la revendication 1 ou la revendication 2, dans lequel le tube extérieur ménage une surface de section transversale sensiblement plus grande que la surface de section transversale du tube intérieur.

4. Filtre suivant l'une quelconque des revendications 1 à 3, dans lequel un courant d'entrée est envoyé dans le tube (11, 12) extérieur et le courant de retour est reçu du tube (20) intérieur.

5. Filtre suivant la revendication 1, dans lequel les tubes (20, 11, 12) ont une section cylindrique.

6. Filtre suivant l'une quelconque des revendications 1 à 5, dans lequel le tube (20) intérieur consiste en un insert tubulaire ayant une zone cannelée extérieurement.

7. Filtre suivant la revendication 6, dans lequel le tube (11, 12) extérieur est rétréci à son extrémité ouverte par une section (16) de manchon et une extrémité (26) cannelée faisant face à l'extérieur de l'insert (20) tubulaire a une extrémité élargie qui bute sur l'extrémité de la section de manchon.

8. Filtre suivant l'une quelconque des revendications 1 à 7, dans lequel le tube (20) intérieur consiste en un insert tubulaire terminé par une extrémité (27) de diamètre agrandi sur laquelle est placée une garniture (28) d'étanchéité.

9. Filtre suivant l'une quelconque des revendications 1 à 8, ayant des raccords d'extrémité d'un insert (20) tubulaire d'une section (12) de boîtier comprenant à une extrémité une bague (33) de positionnement placée entre l'insert tubulaire et la capsule (18, 19, 22, 23), tandis que l'autre extrémité (26) s'élargit pour venir buter sur l'extrémité de la section (16) de manchon.

10. Filtre suivant l'une quelconque des revendications 1 à 9, disposé sous la forme d'un sandwich dans une section (18) en coupelle avec une extrémité (24) de fond percé, assemblée en séquence avec une rondelle (22) initiale en feutre, la matière (21) de dessiccation, une seconde rondelle (22) en feutre et un arrêt (23) percé.

11. Filtre suivant l'une quelconque des revendications 1 à 10, ayant des moyens (33) de fixation pour maintenir la capsule (18, 19, 23) en position par rapport au tube (20) intérieur.

12. Procédé de fabrication d'un filtre de déshydratation de fluide réfrigérant suivant l'une quelconque des revendications 1 à 10, en effectuant les stades qui consistent :

à obtenir un boîtier (11) extérieur creux et les parties constituant le filtre ;
à produire une deuxième section de ce boîtier extrudé en créant des sections (15, 16) de manchon ayant un filetage extérieur à l'une des sections de manchon ;
à effectuer un stade de diminution;
à adapter l'insert (20) tubulaire dans un trou (17) de la deuxième section (16) du boîtier (11, 12) jusqu'à ce que la partie (26) élargie de cannelures (25) de l'insert tubulaire vienne buter sur l'extrémité de la section (16) de manchon ;
à adapter une capsule (18, 19, 22, 23) dans l'insert (20) tubulaire ;
à adapter une bague (33) de mise en position de la capsule sur l'insert tubulaire.

13. Procédé de fabrication d'un filtre de déshydratation de fluide réfrigérant, suivant la revendication 12, dans lequel le procédé consiste en outre

à obtenir une capsule (18, 19, 22, 23) ayant une section (18) cylindrique en forme de coupelle, et une section (19) tubulaire coaxiale ;
à emplir la capsule de matière de dessiccation et à mettre un arrêt dans la section en forme de coupelle.

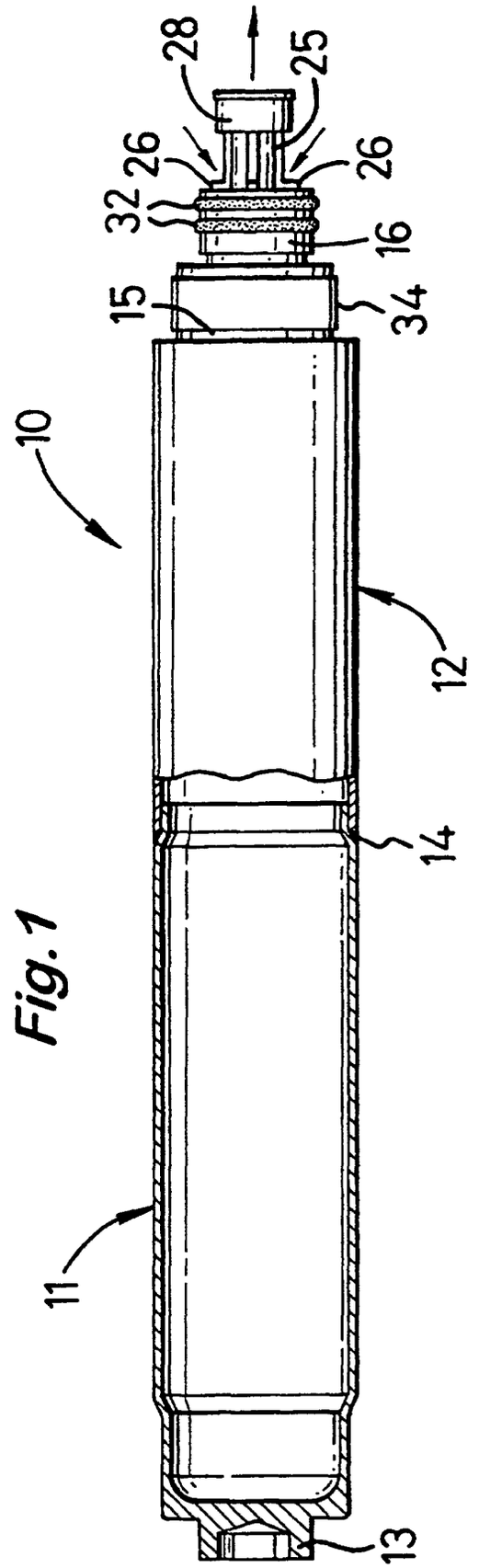


Fig.1

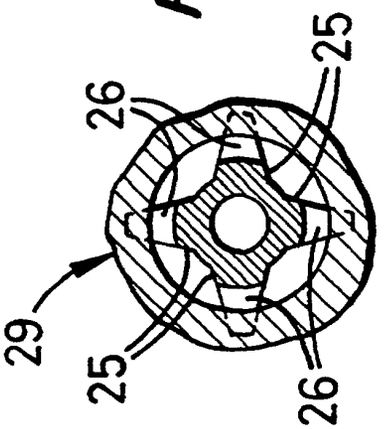


Fig.3

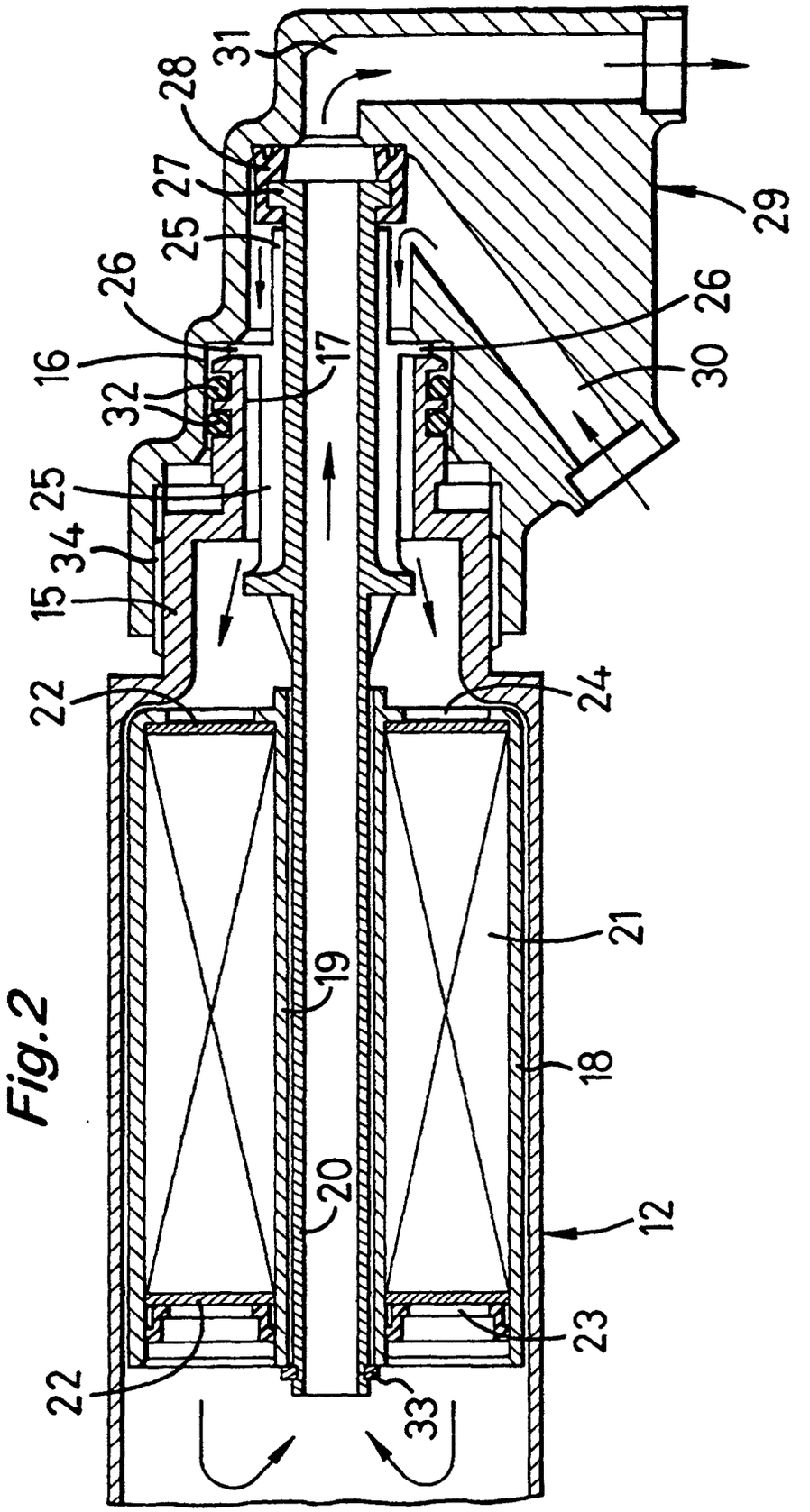


Fig.2